CA IDMS™ SQL

SQL Reference Guide

Release 18.5.00, 2nd Edition

CA Technologies Product References

This document references the following CA Technologies products:

- CA IDMS™/DB
- CA IDMS™ Presspack
- CA IDMS™ SQL
- CA IDMS™ Server

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Documentation Changes

The following documentation updates were made for the 18.5.00, 2nd Edition release of this documentation:

- CA IDMS Scalar Functions (see page 124)—Updated the syntax diagram for the TRIM function.
- Third-Party Acknowledgement (see page 853)—Updated the copyright year.

The following documentation updates were made for the 18.5.00 release of this documentation:

- CA ADS, COBOL, PL/I Data Types (see page 849)—The information in this new appendix was previously available in the SQL Quick Reference Guide.
- SQL Communication Area (see page 675)—The following new subsections were added to this chapter from the SQL Quick Reference Guide:
  - COBOL/CA ADS SQLCA (see page 683)
  - PL/I SQLCA (see page 684)
  - SQLCODE and SQLCNRP Values (see page 681)

Contents

Chapter 1: Coding Considerations

This section contains the following topics:

Definitions

Most of the definitions and entities used in this guide are intuitively understood and generally used. With the introduction of SQL procedural language support it became necessary to more formally define a number of SQL routine-like objects. The following definitions are based on the definitions used in the SQL standard.

SQL-invoked routine

Specifies a routine that is allowed to be invoked only from within SQL. An SQL-invoked routine can be defined in the SQL catalog as a procedure, function, or table procedure.

SQL-invoked procedure

Specifies an SQL-invoked routine defined as a procedure in the SQL catalog.

SQL-invoked function

Specifies an SQL-invoked routine defined as a function in the SQL catalog.

SQL routine

Specifies an SQL-invoked routine whose language attribute is SQL. Because table procedures can not be written in the SQL language, an SQL routine is necessarily defined as a procedure or a function.

SQL procedure

Specifies an SQL routine defined in the SQL catalog as a procedure with language attribute SQL.

SQL function

Specifies an SQL routine defined in the SQL catalog as a function with language attribute SQL.

Using SQL Statements

You can submit SQL statements to CA IDMS by:

- Using the CA IDMS online command facility (that is, interactively)
- Using the CA IDMS batch command facility
- Embedding the statements in an application program (that is, programmatically)
- Using tools and facilities, (such as, CA IDMS Visual DBA, CA Visual Express) that submit SQL statements through CA IDMS Server

The same syntax applies no matter how you submit the statements. However, there are some statements that are only programmatic. Chapter 9, "Statements" indicates those statements that you submit only in SQL that is embedded in a program.

Statement Components

Keywords, Values, and Separators

SQL statements consist of:

- **Keywords** that:
  - Identify the action requested by the statement (for example, CREATE or SELECT)
  - Specify the type of entity (for example, TABLE or INDEX) that is the object of the requested action
  - Place qualifications on the requested action, either by themselves (for example, NOT NULL or DISTINCT) or in conjunction with user-supplied values (for example, ORDER BY EMPLOYEE_LNAME)
- **User-supplied values** that:
  - Identify specific occurrences of entities (for example, the EMPLOYEE table or user EKJ)
  - Specify data values (for example, 983 or 'Boston')
- **Separators** that separate keywords and user-supplied values from one another. A separator can be a space, a comment, a new-line character, or the end of the line.

Where Separators Are Not Required

Separators are *not* required before or after a character string literal or any of the following symbols:

*	Asterisk
:	Colon

,	Comma
=	Equal sign
¬=	Not equal sign
>=	Greater than or equal to sign
>	Greater than sign
¬>	Not greater than sign
(and)	Left and right parentheses
<=	Less than or equal to sign
<	Less than sign
¬<	Not less than sign
-	Minus sign
<>	Not equal sign
.	Period
+	Plus sign
;	Semicolon
/	Slash
||	Concatenation sign

Uppercase and Lowercase

You can use both uppercase and lowercase to enter keywords and user-supplied values in SQL statements. CA IDMS converts lowercase letters to uppercase in keywords and in user-supplied values that are not enclosed in quotation marks.

Delimiting and Continuing Statements

Statement Delimiter for the Command Facility

When you use the command facility to submit SQL statements, you must terminate each statement with a command delimiter, which is by default a semicolon (;). You can enter the command delimiter either on the same line as the rest of the statement or on a separate line. For example, the following two statements are equivalent:

```
select * from employee;

select * from employee
;
```

Continuing Statements

You can code SQL statements on one or more lines. No special character is required to indicate that a statement continues on the next line.

Embedded SQL Delimiters

When you embed SQL statements in an application program or a CA ADS process module, you must delimit each statement both at the beginning and at the end. The requirements for delimiting embedded SQL statements vary according to the program language.

Note: For more information about delimiting embedded SQL statements, see the *CA IDMS SQL Programming Guide*.

SQL Comments

How to Embed SQL Comments

You can embed an SQL comment within an SQL statement. SQL comments may be used in both interactive and embedded SQL statements.

An SQL comment:

- Begins with two consecutive hyphens (--)
- Consists of any combination of numbers, letters, spaces, and other characters
- Ends at the end of the line

Bracketed comment:

- A bracketed comment starts with the bracket introducer string '/*' and ends with the bracket terminator string '*/'.
- Bracketed comments can span multiple lines.
- The bracket introducer and terminator strings can not split over two lines.
- Can be used whenever a separator or space is allowed.
- Bracketed comments are only allowed in the routine body of an SQL-routine. They are not recognized by the command facility outside this context.

Note: When defining an SQL routine using the command facility tools OCF, IDMSBCF, or using an OCF console in CA IDMS Visual DBA, the comment introducer '/*' must not be placed in column 1, because '/*' is interpreted as an end of file on input by the command facility.

Sample SQL Comments

The following example shows SQL comments with an embedded SQL statement:

```
select
  emp_id, emp_lname, dept_id      — Columns to be selected
  from employee                  — Tables containing the data
  where dept_id = 1234;           — Selection criterion
```

Syntax Diagram Conventions

The syntax diagrams presented in this guide use the following notation conventions:

`UPPERCASE OR SPECIAL CHARACTERS`

Represents a required keyword, partial keyword, character, or symbol that must be entered completely as shown.

`lowercase`

Represents an optional keyword or partial keyword that, if used, must be entered completely as shown.

`italicized lowercase`

Represents a value that you supply.

`lowercase bold`

Represents a portion of the syntax shown in greater detail at the end of the syntax or elsewhere in the document.

◄─

Points to the default in a list of choices.

►►────────────────────

Indicates the beginning of a complete piece of syntax.

────────────────────►◄

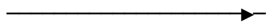
Indicates the end of a complete piece of syntax.

─────────────────────►

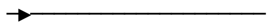
Indicates that the syntax continues on the next line.

►─────────────────────

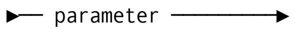
Indicates that the syntax continues on this line.



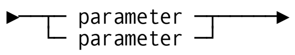
Indicates that the parameter continues on the next line.



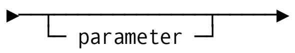
Indicates that a parameter continues on this line.



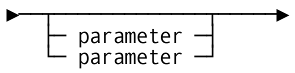
Indicates a required parameter.



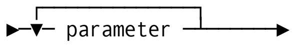
Indicates a choice of required parameters. You must select one.



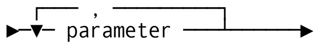
Indicates an optional parameter.



Indicates a choice of optional parameters. Select one or none.



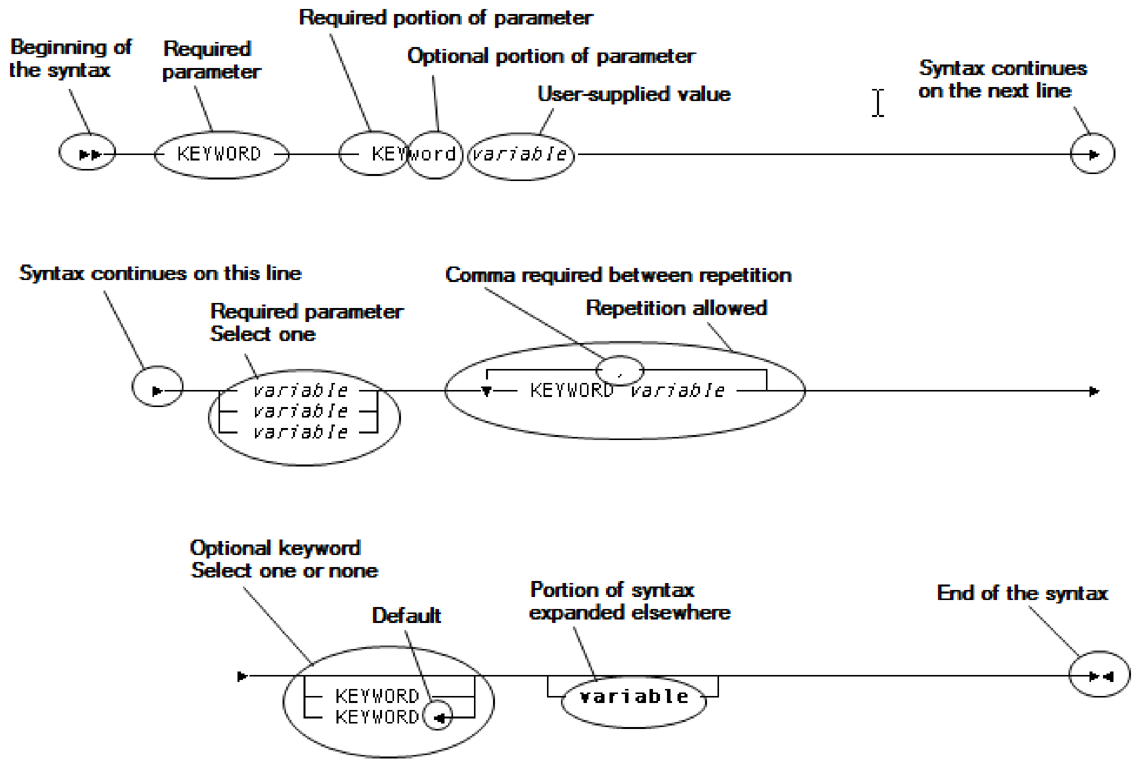
Indicates that you can repeat the parameter or specify more than one parameter.



Indicates that you must enter a comma between repetitions of the parameter.

Sample Syntax Diagram

The following sample explains how the notation conventions are used:


Beginning of the syntax
Required parameter
Required portion of parameter
Optional portion of parameter
User-supplied value
Syntax continues on the next line
KEYWORD
KEYword
variable
Syntax continues on this line
Required parameter Select one
Comma required between repetition
Repetition allowed
variable
variable
variable
KEYWORD variable
Optional keyword Select one or none
Default
Portion of syntax expanded elsewhere
End of the syntax
KEYWORD
KEYWORD
variable

Chapter 2: Identifiers

This section contains the following topics:

About Identifiers

Identifiers are the smallest lexical units used in entity names.

The following entities referenced in SQL statements have identifiers:

- Access modules
- Areas
- Columns
- Constraints
- Cursors
- Groups
- Indexes
- Keys
- Procedures
- RCMs (SQL statement modules)
- Referential constraints
- Schemas
- Segments
- Statement names
- Tables
- Table procedures
- User-defined functions
- Users
- Views

Qualifying Identifiers

Identifiers for some entities can be qualified by other identifiers. For example, table identifiers can be qualified by schema names.

Sometimes an identifier by itself does not uniquely identify an entity. For instance, a SELECT statement may include two columns with the same identifier, each from a different table. To uniquely identify each of these columns, you *must* qualify each column identifier with the associated table name or alias.

To qualify an identifier, specify the qualifier first, followed by a period (.), followed by the identifier you are qualifying. The qualified identifier in the following example identifies the EMPLOYEE table associated with the DEMOEMPL schema:

```
demoempl.employee
```

Authorization-identifier and table-name

Authorization-identifier and **table-name** are syntactic elements representing identifiers that occur in multiple SQL statements. For expanded syntax for these elements, see Expansion of Authorization-identifier and Expansion of Table-name.

Forming Identifiers

Valid characters

An identifier consists of a combination of:

- Letters (A through Z and a through z)
- Digits (0 through 9)
- At sign (@)
- Dollar sign ($)
- Pound sign (#)
- Underscore (_)

The first character of an identifier must be a letter, @, $, or #.

Maximum length

Identifiers for all entities except columns, access modules, segments, RCMs, and external names of SQL-invoked routines can be as many as 18-characters long.

Identifiers for access modules, segments, RCMs, and external names of SQL-invoked routines can be as many as eight-characters long.

An identifier for a column can be as many as 32-characters long.

Delimited Identifiers

Why delimit identifiers

You can delimit an identifier in double quotation marks to:

- **Allow the use of special characters and blanks**. An identifier enclosed in quotation marks can consist of any combination of characters. For example, the following is a valid identifier:

  ```
  "&ATM*F(0517). MA"
  ```

  To include a double quotation mark as part of the identifier itself, use two consecutive double quotation marks. For example:

  ```
  "M1K""L9&ZZ".
  ```

- **Make case significant**. When you enclose an identifier in quotation marks, CA IDMS does not convert lowercase letters to uppercase.

  Lowercase letters in quotation marks are not equal to uppercase letters or to lowercase letters that are not in quotation marks. In the example below, the identifiers on the left all identify the same table; the identifier on the right identifies a different table:

  ```
  employee                "employee"
  EMPLOYEE
  "EMPLOYEE"
  ```

Placement of quotation marks

If one or more parts of a qualified identifier require quotation marks, place the quotation marks only around the individual parts. Do not include two identifiers in one set of quotation marks. For example, both parts of the following qualified identifier require quotation marks:

```
"temp-tab-1"."Commission to Date"
```

When you calculate the length of an identifier, do not include delimiting quotation marks.

Avoiding Keywords as Identifiers

Eliminating ambiguity

You should avoid issuing an SQL statement which specifies an identifier that matches a keyword in the syntax for the statement. This eliminates potential ambiguity that could cause CA IDMS to read the statement in a way that is not meant.

If you must use a keyword as an identifier, delimit the identifier with double quotation marks as described in Delimited Identifiers.

Recognizing keywords

The syntax diagrams in this guide present keywords in roman (that is, nonitalicized) type.

For example, in the following syntax for CREATE VIEW, the keywords are CREATE VIEW, AS, and WITH CHECK OPTION:

```
►►── CREATE VIEW ─┬──────────────┬─ view-identifier ─────────────────►
                  └ schema-name. ┘

►─┬─────────────────────────────────────┬────────────────────────────►
  │         ┌──────── , ────────┐       │
  └ ( ─▼─ view-column-name ─┴─ ) ┘

►── AS query-specification ──────────────────────────────────────────►

►─┬──────────────────────────┬───────────────────────────────────────►
  └ order-by-specification ┘

►─┬─────────────────────┬────────────────────────────────────────────►◄
  └ WITH CHECK OPTION ┘
```

Delimited example identifier

If it were necessary to create a view called AS, you should identify the view as follows:

```
create view "AS" (col1, col2, col3) as (select...
```

Expansion of Authorization-identifier

The expanded parameters of authorization-identifier represent user identifiers or group identifiers in an SQL authorization statement.

Syntax

Expansion of authorization-identifier

```
►►─┬ user-identifier ─┬──────────────────────────────────────────────►◄
   └ group-identifier ┘
```

Parameters

user-identifier

Identifies a user defined to the security system.

group-identifier

Identifies a group defined to the security system.

Examples

Authorizing a User to Update a Table

In the following GRANT statement, the authorization identifier is the user identifier RES:

```
grant update
   on table employee
   to res;
```

Revoking Execute Privileges from a Group

In the following REVOKE statement, the authorization identifier is the group identifier ACCT_GRP_1:

```
revoke execute
   on access module am88pr08
   from acct_grp_1;
```

Expansion of Procedure-reference

The expanded parameters of procedure-reference represent qualified or unqualified procedure identifiers together with an optional set of parameter values.

If an SQL CALL or an SQL SELECT statement that is embedded in an application program or SQL routine contains the procedure reference, then the procedure reference also identifies the target host variables, local variables, or routine parameters into which the output parameter values return.

Syntax

Expansion of procedure-reference

```
►►─┬───────────────┬─ procedure-identifier ──────────────────────────►
   └─ schema-name. ┘

►►─┬─────────────────────────────────────────────────────────────┬─►◄
   │       ┌──────────── , ────────────┐                          │
   └─ ( ─▼─ parameter-specification ─┴─ )  ───────────────────────┘
```

Expansion of parameter-specification

```
►►─┬──────────────────────┬─ value-expression ──────────────────►◄
   └─ parameter-name ── = ┘
```

Parameters

schema-name

Specifies the schema with which the procedure identified by *procedure-identifier* is associated.

Note: For more information about using a schema name to qualify a procedure, see Identifying Entities in Schemas.

procedure-identifier

Identifies a procedure defined in the dictionary.

parameter-specification

Specifies a value assigned to a parameter of a procedure. If an SQL CALL or an SQL SELECT statement that is embedded in an application program contains the procedure and the value-expression is a host-variable, then the output value of the parameter returns into the specified host-variable. If the SQL CALL or SQL SELECT statement is embedded in an SQL routine and the value-expression is a local variable or a routine parameter then the output value of the parameter returns into the specified local variable or routine parameter.

You can use both the positional (with NO *parameter-name*) and the non-positional (with *parameter-name*) forms of parameter specification in a single procedure reference. If you use a non-positional parameter specification, then all remaining parameter specifications in the parameter list MUST be non-positional. Positional parameter specifications are assumed to correspond to the declared parameters of a procedure in the sequence of their declaration.

parameter-name

Specifies the name of a parameter associated with the procedure.

value-expression

Specifies the input value to assign to the parameter. In addition, any host-variable, local variable, or routine parameter specified as value-expression receives the output value of the parameter returned by the invoked procedure. See Expansion of Value-expression for more information.

Usage

Referencing Procedures

You can code references to SQL procedures in an SQL CALL statement.

During SQL CALL processing, CA IDMS issues a call to the corresponding routines. The output parameter values return as a result set.

You can also reference a procedure in the FROM clause of a query-specification or SELECT statement, in the same manner as references to SQL tables, views, and table procedures.

If you reference a procedure in a FROM clause, then the parameters of the procedure act as columns in an SQL table or view. You can reference them in SELECT list expressions and WHERE clauses. A procedure returns exactly one row of output or no output.

Assigning Parameter Values with the WHERE Clause

You can use the WHERE clause as an alternative method for assigning values to parameters of procedures. An expression of the form *parameter name* = *value specification* coded in the WHERE clause is considered to be equivalent to a parameter assignment using procedure reference syntax. This allows you to code procedure references without a parenthesized parameter list, just like standard table, view or table procedures references.

This method is useful particularly if you are coding SQL statements in generic SQL environments, such as CA Visual Express, which do not support the SQL CALL statement and the specification of parameters in the procedure reference.

When you use the WHERE clause to assign parameter values, you must meet the following conditions in order to assign the parameter a value:

- It must appear in an "=" comparison, not, for example, with >, <, >=. or <=.
- You can combine the "=" comparison in which the parameter appears only with other factors in the WHERE clause using an AND operator. Use of an OR operator or preceding the "=" comparison with the NOT keyword means that no value is assigned to the parameter.

Note: For more information about assignment of values to procedure parameters, see Procedure Parameters.

Examples

Qualified Procedure Reference through the CALL Statement

In the following CALL statement, the procedure reference is qualified and one parameter value is supplied as a positional parameter for the first parameter of the procedure get_bonus:

```
call emp.get_bonus (127);
```

Procedure Reference with Keyword Parameter Values

In the following CALL statement, a value is supplied for the EMP_ID parameter using keyword notation:

```
call get_bonus (emp_id=127);
```

Procedure Reference through the SELECT Statement

In the following SELECT statement, a value is supplied for the first parameter associated with the GET_BONUS procedure:

```
select * from get_bonus (7);
```

Procedure Reference through the SELECT Statement with Parameter Values Specified in the WHERE Clause;

In the following SELECT statement, parameter values are supplied through the WHERE clause. This example is identical to the example above that uses keyword notation:

```
select * from get_bonus
   where emp_id=127;
```

Note: For more information about defining procedures, see CREATE PROCEDURE and Defining and Using Procedures.

More information

Procedure Parameters (see page 631)

More information:

CREATE PROCEDURE (see page 361)
Defining and Using Procedures (see page 629)

More information

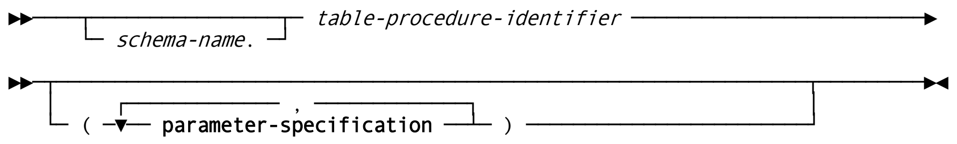
CREATE TABLE PROCEDURE (see page 387)
Defining and Using Table Procedures (see page 617)

Expansion of Table-procedure-reference

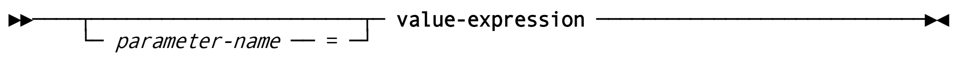
The expanded parameters of table-procedure-reference represent qualified or unqualified table procedure identifiers together with an optional set of parameter values.

Syntax

Expansion of table-procedure-reference



Expansion of parameter-specification



Parameters

schema-name

Specifies the schema with which the table procedure identified by *table-procedure-identifier* is associated.

Note: For more information about using a schema name to qualify a table procedure, see Identifying Entities in Schemas.

table-procedure-identifier

Identifies a table procedure defined in the dictionary.

parameter-specification

Assigns a value to a parameter in a table procedure reference. You can use both the positional (with NO *parameter name*) and the non-positional (with *parameter name*) forms of parameter specification in a single table procedure reference. If you use a non-positional parameter specification, all remaining parameter specifications in the parameter list MUST be non-positional. Positional parameter specifications are assumed to correspond to the declared parameters of a table procedure, in the sequence of their declaration.

parameter-name

Specifies the name of a parameter associated with the table procedure.

value-expression

Specifies the value to assign to the parameter. See Expansion of Value-expression for more information.

Usage

Referencing Table Procedures

You can code references to SQL table procedures in SQL SELECT, INSERT, UPDATE, and DELETE statements in the same manner as references to SQL tables and views. The parameters of such table procedures act as columns in an SQL table or view. You can reference them in SELECT list expressions, WHERE clauses, UPDATE statement SET clauses, and the column list of the INSERT statement. You can also reference table procedures in the SQL CALL statement. The output parameter values return as a result set.

During SQL DML processing, CA IDMS issues calls to the corresponding external routines at the same time at which it would perform database access to satisfy standard table references. This permits the simulation of SQL DML activity on external data storage structures (for example, non-SQL-defined CA IDMS databases or VSAM file systems) managed by the table procedures.

Assigning Parameter Values with the WHERE Clause

An alternative method for assigning values to parameters of table procedures is through the WHERE clause. An expression of the form *parameter name = value specification* coded in the WHERE clause is considered to be equivalent to a parameter assignment using table procedure reference syntax. This allows table procedure references to be coded without a parenthesized parameter list, just like standard table or view references.

This method is useful particularly if you are coding SQL statements in generic SQL environments, such as CA Visual Express, which do not support CA IDMS SQL extensions, such as table procedures.

When you use the WHERE clause to assign parameter values, the following conditions must be met for the parameter to be assigned a value:

- It must appear in an "=" comparison, not, for example, with >, <, >=. or <=.
- The "=" comparison in which the parameter appears can be combined only with other factors in the WHERE clause using an AND operator. Use of an OR operator or preceding the "=" comparison with the NOT keyword means that no value is assigned to the parameter.

Note: For more information about assignment of values to table procedure parameters, see Table Procedure Parameters.

Examples

Qualified Table Procedure Reference

In the following SELECT statement, the table procedure reference is qualified:

```
select * from emp.org;
```

Table Procedure Reference with Keyword Parameter Values

In the following SELECT statement, values are supplied for the EMP_ID and MGR_ID parameters using keyword notation:

```
select * from org (emp_id=127, mgr_id=7);
```

Table Procedure Reference with Positional Parameter Values

In the following SELECT statement, a value is supplied for the first parameter associated with the ORG table procedure:

```
select * from org (7);
```

Table Procedure Reference with Parameter Values Specified in the WHERE Clause

In the following SELECT statement, parameter values are supplied through the WHERE clause. This example is identical to the example above that uses keyword notation.

```
select * from org .
   where emp_id=127 and mgr_id=7;
```

Note: For more information about defining table procedures, see CREATE TABLE PROCEDURE and Defining and Using Table Procedures.

More information:

Table Procedure Parameters (see page 619)

Expansion of Table-name

The expanded parameters of table-name represent qualified or unqualified tables, views, procedures, or table procedure identifiers in an SQL statement.

Syntax

Expansion of table-name

```
►►─┬─────────────────┬─┬─ table-identifier ───────────┬────────────────────►◄
   └─ schema-name. ──┘ ├─ view-identifier ────────────┤
                       ├─ procedure-identifier ───────┤
                       └─ table-procedure-identifier ─┘
```

Parameters

schema-name

Specifies the schema with which the table, view, procedure, or table procedure identified by table-identifier, view-identifier, procedure-identifier or table-procedure-identifier is associated.

Note: For more information about using a schema name to qualify a table, view, procedure, or table procedure identifier, see Identifying Entities in Schemas. (see page 42)

table-identifier

Identifies either a base table defined in the dictionary or a temporary table defined during the current transaction.

view-identifier

Identifies a view defined in the dictionary.

procedure-identifier

Identifies a procedure defined in the dictionary.

table-procedure-identifier

Identifies a table procedure defined in the dictionary.

Examples

A Qualified Table Identifier

In the following INSERT statement, the table name is a qualified table identifier:

```
insert into demoempl.employee values (1,'John', 'Smith');
```

An Unqualified Table Identifier

In the following INSERT statement, the table name is an unqualified table identifier. If no temporary table named EMPLOYEE has been defined during the current transaction, CA IDMS assumes the table is qualified with the current schema in effect for the SQL session.

```
insert into employee values (1,'John', 'Smith');
```

More Information

- For more information about defining base tables, see CREATE TABLE, ALTER TABLE and DROP TABLE.
- For more information about defining temporary tables, see CREATE TEMPORARY TABLE.
- For more information about defining procedures, see CREATE PROCEDURE and Defining and Using Procedures.
- For more information about defining table procedures, see CREATE TABLE PROCEDURE and Defining and Using Table Procedures.
- For more information about defining views, see CREATE VIEW and DROP VIEW (see page 433).
- For more information about establishing a current schema, see SET SESSION.

More information:

ALTER TABLE (see page 290)
CREATE PROCEDURE (see page 361)
CREATE TABLE (see page 378)
CREATE TEMPORARY TABLE (see page 392)
CREATE VIEW (see page 394)
Defining and Using Table Procedures (see page 617)
DROP TABLE (see page 430)
DROP VIEW (see page 433)
SET SESSION (see page 536)

Expansion of Table-reference

The expanded parameters of table-reference represent qualified or unqualified tables, view identifiers, joined tables, or a reference to a procedure or a table procedure in an SQL statement.

Syntax

Expansion of table-reference

```
►►─┬──────────────────┬─┬─ table-identifier ─┬┬──────────────────────────────►◄
   │                  │ │                    ││
   ├─ schema-name. ───┘ └─ view-identifier ──┘│
   ├─ procedure-reference ────────────────────┤
   ├─ table-procedure-reference ──────────────┤
   ├─ joined-table ───────────────────────────┤
   └─ ( joined-table ) ───────────────────────┘
```

Parameters

schema-name

Specifies the schema with which the table or view identified by *table-identifier* or *view-identifier* is associated.

Note: For more information about using a schema name to qualify a table or view identifier, see Identifying Entities in Schemas. (see page 42)

table-identifier

Identifies either a base table defined in the dictionary or a temporary table defined during the current transaction.

view-identifier

Identifies a view defined in the dictionary.

procedure-reference

Identifies a procedure defined in the dictionary and optionally supplies parameter values to be passed to the procedure.

Note: For more information about the expansion of **procedure-reference**, see Expansion of Procedure-reference (see page 28).

table-procedure-reference

Identifies a table procedure defined in the dictionary and optionally supplies parameter values to be passed to the table procedure.

Note: For more information about the expansion of **table-procedure-reference**, see Expansion of Table-procedure-reference (see page 32).

joined-table

Identifies a table that is derived from joining two specified tables.

Note: For more information about the expansion of **joined-table**, see Expansion of Joined-table. (see page 39)

Examples

A Qualified Table Identifier

In the following SELECT statement, the table reference is a qualified table identifier:

```
select * from demoempl.employee;
```

An Unqualified Table Identifier

In the following SELECT statement, the table reference is an unqualified table identifier. If no temporary table named EMPLOYEE has been defined during the current transaction, CA IDMS assumes the table is qualified with the current schema in effect for the SQL session.

```
select * from employee;
```

Table Procedure Reference with Keyword Parameter Values

In the following SELECT statement, the table reference is a table procedure reference where values are supplied for the EMP_ID and MGR_ID parameters using keyword notation:

```
select * from org (emp_id=127, mgr_id=7);
```

More Information

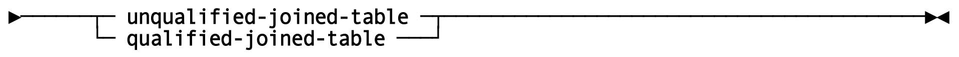
- For more information about defining base tables, see CREATE TABLE, ALTER TABLE and DROP TABLE.
- For more information about defining temporary tables, see CREATE TEMPORARY TABLE.
- For more information about defining procedures, see CREATE PROCEDURE and Defining and Using Procedures.
- For more information about defining table procedures, see CREATE TABLE PROCEDURE and Defining and Using Table Procedures.
- For more information about defining views, see CREATE VIEW and DROP VIEW.
- For more information about establishing a current schema, see SET SESSION.

Expansion of Joined-table

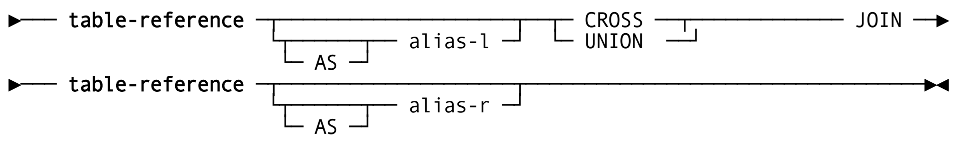
The expanded parameters of joined-table represent a table that is derived from joining two specified tables. A join operation on two tables is the result of the cross product of the two tables. A qualified join is followed by a filter operation. The cross or Cartesian product of two tables, left and right, is the result of extending each row of the left table with every row of the right table. The different types of join operations are specified through the following join types:

- CROSS
- UNION
- INNER
- LEFT OUTER
- RIGHT OUTER
- FULL OUTER

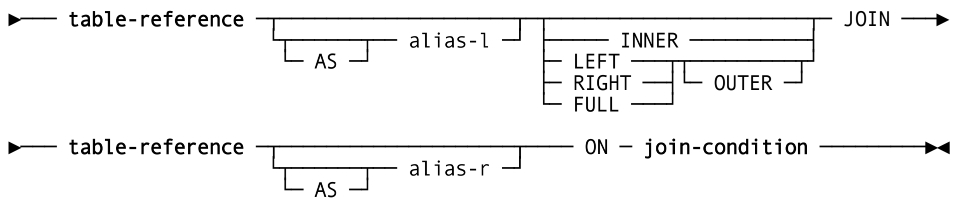
Syntax



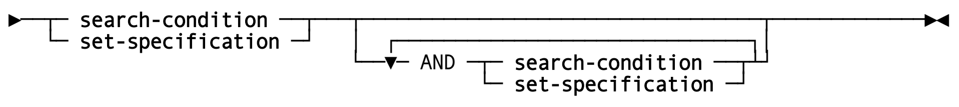
Expansion of unqualified-joined-table



Expansion of qualified-joined-table



Expansion of join-condition



Parameters

unqualified-joined-table

Specifies a *joined-table* where the join operation is a cross or union.

qualified-joined-table

Specifies a *joined-table* where the join operation is an inner, left outer, right outer, or full outer.

table-reference

Represents a table-like object. In a *joined-table* specification, a left and a right *table-reference* are required to define the left and right components of the join operation.

AS *alias-l*

Defines a new name used to identify the left table-like object within the *joined-table* specification. *Alias-l* must be a 1-through 18-character name that follows the conventions for SQL identifiers.

AS *alias-r*

Defines a new name used to identify the right table-like object within the *joined-table* specification. *Alias-r* must be a 1-through 18-character name that follows the conventions for SQL identifiers.

CROSS

Specifies a cross join. A cross join is the cross product of the left and right table.

UNION

Specifies a union join. A union join is equivalent to a full outer join where the *join-condition* always evaluates to false.

INNER

Specifies an inner join. In an inner join, the cross product of the left and right table-like objects is made, and only the rows for which *join-condition* evaluates to true are kept in the result. This is the default.

LEFT/LEFT OUTER

Specifies a left outer join. In a left outer join, the cross product of the left and right table-like objects is made, and the rows for which *join-condition* evaluates to true are kept. The result is extended with all the missing rows from the left table, and the values of the columns in the result row, derived from the right table, are set to NULL.

RIGHT/RIGHT OUTER

Specifies a right outer join. In a right outer join, the cross product of the left and right table-like objects is made, and the rows for which *join-condition* evaluates to true are kept. The result is extended with all the missing rows from the right table, and the values of the columns in the result row, derived from the left table, are set to NULL.

FULL/FULL OUTER

Specifies a full outer join. In a full outer join, the cross product of the left and right table-like objects is made, and the rows for which *join-condition* evaluates to true are kept. The result is extended with all the missing rows from the left table, and the values of the columns in the result row, derived from the right table, are set to NULL. The result is further extended with all the missing rows from the right table, and the values of the columns in the result row, derived from the left table, are set to NULL.

join-condition

Represents the truth condition for joining two table-like objects. Expanded syntax for **join-condition** appears immediately after the *joined-table* syntax. If **join-condition** contains a **set-specification** both the left and the right **table-reference** must specify base tables of a non-SQL-defined database that identify the owner and member of the non-SQL set.

Usage

- If a join type is not specified, INNER is assumed.
- Joined-tables can be nested. Evaluation is from left to right.
- It is advisable to use parenthesis when nesting joins.
- In a nested *joined-table*, only the *join-condition* of the inner most join can contain a *set-specification* because a *set-specification* requires that the left and right *table-reference* are base tables of a non-SQL-defined database.
- A *query-expression* that contains a *joined-table* is not updateable.

Examples

Selecting all Departments and Employees in Department

The following examples list all the departments and the employees of the department. The two statements give identical results.

```
select d.*, e.*
 from DEMOEMPL.DEPARTMENT d left join DEMOEMPL.EMPLOYEE e
   on  d.dept_id = e.dept_id
select d.*, e.*
 from DEMOEMPL.EMPLOYEE e  right join DEMOEMPL.DEPARTMENT d
   on  d.dept_id = e.dept_id
```

Selecting all Depts./Empls. in Dept. with or without Position

The following examples show nesting of joined tables. The two statements give identical results.

```
select d.*, e.*, p.*
    from DEMOEMPL.DEPARTMENT d left join
         (DEMOEMPL.EMPLOYEE  e left join DEMOEMPL.POSITION p
                                 on p.EMP_ID  = e.EMP_ID )
                                 on e.DEPT_ID = d.DEPT_ID;
select d.*, e.*, p.*
    from DEMOEMPL.DEPARTMENT d left join
         (DEMOEMPL.POSITION p right join DEMOEMPL.EMPLOYEE e
                                 on p.EMP_ID  = e.EMP_ID )
                                 on e.DEPT_ID = d.DEPT_ID;
```

Note: For more information about expansion of table-reference, see Expansion of Table-reference.

More information:

Expansion of Table-reference (see page 37)

Identifying Entities in Schemas

Access modules, referential constraints, tables, views, table procedures, procedures, and user-defined functions are all associated with schemas. However, when you name one of these entities in an SQL statement, specification of the schema name is optional. The schema CA IDMS uses when processing the statement depends on the following:

- Type of entity
- Presence or absence of the schema name in the entity reference
- Statement where the reference to the entity occurs
- Method you use to submit the statement to CA IDMS (for example, through the online command facility or embedded in an application program)

Resolving References to Entities in Schemas

Interactive and dynamic SQL

When compiling a statement using interactive or dynamic SQL, or when using the EXPLAIN statement to determine the access strategy to be used for an SQL statement, CA IDMS resolves references to entities in schemas as follows:

- For each entity qualified by a schema name, CA IDMS uses the named schema.
- For each unqualified table, view or table procedure in a SELECT, INSERT, UPDATE, and DELETE statement, or one of them in an EXPLAIN statement:
  - CA IDMS looks for the definition of a temporary table created during the current database transaction whose name matches the specified identifier. If a match is found, CA IDMS assumes that the reference is to the temporary table.
  - If a matching temporary table name is not found, CA IDMS uses the current schema in effect for the SQL session.
- For all other unqualified references, CA IDMS uses the current schema in effect for the SQL session

Creating or altering an access module

When creating or altering an access module, the user can change the names of schemas in table, view, table procedure, procedure, and user-defined function references in SQL data manipulation statements. The user does this by specifying one or more schema mapping rules, each of which supplies a replacement for a schema name. This facility allows a single program (and its associated RCM) to reference one set of tables when it is included in one access module, and another set of tables when it is included in another access module with different schema mapping rules.

When compiling an SQL statement during the creation or alteration of an access module, CA IDMS resolves schema names as follows:

1. For qualified references to schema entities in non-data manipulation statements, it uses the schema name specified.
2. For each qualified table, view, table procedure, procedure, or user-defined function reference in a data manipulation statement, CA IDMS uses the replacement schema name as specified in the schema mapping rules. If no replacement has been specified, it uses the schema name specified in the table, view, procedure, or user-defined function reference.
3. For unqualified references to schema entities in data description statements, it uses the schema name of the access module being created or altered.
4. For each unqualified table, view, table procedure, procedure, or user-defined function reference in a data manipulation, CA IDMS uses the replacement schema name for the NULL entry in the schema mapping rules. If no such entry is found, it uses the schema name of the access module being created or altered.
5. For all unqualified references to schema entities, CA IDMS uses the current schema associated with your SQL session.

After resolving the schema names according to the above rules, if CA IDMS cannot find the definition of a table, view, table procedure, procedure, or user-defined function referenced in a data manipulation statement, the statement remains uncompiled and a warning is issued. CA IDMS attempts to recompile the statement at runtime because the table-like object may have been created since compile time.

Automatic access module recreation

CA IDMS automatically recreates an access module at runtime if:

- CA IDMS encounters a statement that was not previously compiled
- The AUTO RECREATE option for the access module is ON and:
  - CA IDMS encounters a statement that refers to a table, view, table procedure, procedure, or user-defined function whose definition has changed since the access module was created or last altered
  - The application program has been recompiled since the access module was created or last altered

When it automatically recreates an access module, CA IDMS resolves references to schemas using the same rules as were used when the access module was created or last altered *except* in dealing with unqualified table, view, table procedure, procedure or user-defined function references in data manipulation and EXPLAIN statements:

- If the table, view, or table procedure reference is unqualified, CA IDMS first looks for the definition of a temporary table created within the current transaction whose name matches the specified table identifier. If one is found, the reference is assumed to be a reference to that temporary table.
- If no temporary table with the same name is found, then CA IDMS uses the schema mapping rules associated with the access module to resolve table, view, and table procedure references as described above in Creating or altering an access module.

Note: For more information about automatic access module re-creation, see CREATE ACCESS MODULE (see page 320) or the *CA IDMS SQL Programming Guide*.

Expansion of Cursor-name

The expanded parameters of cursor-name represent a cursor.

Syntax

Expansion of cursor-name

```
►►─┬─ static-cursor-name ──┬──────────────────────────────────────────►◄
   └─ extended-cursor-name ─┘
```

Expansion of static-cursor-name

```
►►── cursor-name ─────────────────────────────────────────────────────►◄
```

Expansion of extended-cursor-name

```
►►─┬────────────────┬──┬─ 'cursor-name' ──────┬───────────────────────►◄
   ├─── LOCAL ◄ ────┤  ├─ :host-variable ─────┤
   └─── GLOBAL ─────┘  ├─ local-variable ─────┤
                       └─ routine-parameter ──┘
```

Parameters

cursor-name

Specifies the name of the cursor as an identifier.

'*cursor-name*'

Specifies the name of the cursor as a literal whose value must conform to the rules for an identifier.

:*host-variable*

Specifies the name of the cursor as a host-variable whose value must conform to the rules for an identifier.

local-variable

Specifies the name of the cursor as a local-variable whose value must conform to the rules for an identifier.

routine-parameter

Specifies the name of the cursor as a routine-parameter whose value must conform to the rules for an identifier.

LOCAL/GLOBAL

Specifies the scope of the associated cursor name:

- LOCAL indicates that the cursor can be referenced only from within the program where it is defined.
- GLOBAL indicates that the cursor can be referenced from any program executing within the same SQL transaction.

Default: LOCAL

Usage

Static Versus Extended Cursor Names

A static cursor name is one coded as a simple identifier. The following DECLARE CURSOR statement assigns the static name "cursor1" to the cursor being defined:

```
DECLARE cursor1 CURSOR FOR select1
```

Cursors defined by a DECLARE CURSOR statement always have static names. Such cursors may either be dynamic or static, depending on whether the DECLARE CURSOR statement references a dynamically prepared SQL statement, as in the example above, or directly includes a **cursor-specification**.

An extended cursor name is one coded either as a literal, a host variable, a local-variable, or a routine-parameter. The following ALLOCATE CURSOR statement assigns the extended name "cursor1" to the cursor being defined:

```
MOVE 'cursor1' to cursor-nam
ALLOCATE :cursor-nam CURSOR FOR :statement-nam
```

Cursors created by an ALLOCATE CURSOR statement always have extended names and are always dynamic.

If a cursor is defined using a static name, it must be referenced using a static name. If it is defined using an extended name, it must be referenced using an extended name that has the same scope option as specified on the definition.

An exception to this rule occurs when identifying a cursor within a dynamically prepared UPDATE or DELETE statement.

Note: For more information about the UPDATE and DELETE statements, see UPDATE (see page 546) and DELETE. (see page 408)

Uniqueness of Cursor Names

Static and extended cursor names do not have to be unique with respect to each other. If two cursors are assigned the same value for a name, they are considered two separate cursors provided that either:

- One of the names is static while the other is extended
- Both of the names are extended, but they have different scopes, as indicated by their LOCAL/GLOBAL parameter.

Example

Example of Cursor-name

The following DECLARE CURSOR statement defines a dynamic cursor using a static cursor name of C1. It is referenced within the subsequent OPEN statement:

```
EXEC SQL
  DECLARE C1 CURSOR FOR S1
END-EXEC
EXEC SQL
  OPEN C1
END-EXEC
```

Example of Extended-cursor-name

The following ALLOCATE CURSOR statement defines a local cursor using an extended cursor name of C1. It is then referenced in the subsequent OPEN statement:

```
EXEC SQL
  ALLOCATE 'C1' CURSOR FOR 'S1'
END-EXEC
EXEC SQL
  OPEN 'C1'
END-EXEC
```

Note: Even though C1 is used as the cursor name in both of the above examples, two separate cursors are created: one with a static name of C1 and one with an extended name of C1.

Global Extended-cursor-name

The following ALLOCATE CURSOR statement defines a global cursor using an extended cursor name whose value is not known until runtime. In this case, the value 'C2' is moved to the host variable before the statement is executed and will be the name of the cursor created:

```
  move 'C2' to :cname
EXEC SQL
  ALLOCATE GLOBAL :CNAME CURSOR FOR :SNAME
END-EXEC
```

Since this is a global cursor, it can be referenced in a different program than the one where the ALLOCATE CURSOR statement appears. For example, the following OPEN statement might be contained in a different program:

```
EXEC SQL
  OPEN GLOBAL 'C2'
END-EXEC
```

Note: It does not matter that in one case the name of the cursor is supplied through a host-variable and in the other it is specified as a literal. They both refer to the global cursor C2.

More information:

Defining and Using Functions (see page 639)
Identifying Entities in Schemas (see page 42)

Expansion of Statement-name

The expanded parameters of statement-name represent a dynamically-prepared statement.

Syntax

Expansion of statement-name

```
►►─┬─ static-statement-name ───┬──────────────────────────────────────►◄
   └─ extended-statement-name ─┘
```

Expansion of static-statement-name

```
►►── statement-name ──────────────────────────────────────────────────►◄
```

Expansion of extended-statement-name

```
►►─┬─────────────┬─┬─ 'cursor-name' ──────┬──────────────────────────────►◄
   ├── LOCAL ◄ ──┤ ├─ :host-variable ─────┤
   └── GLOBAL ───┘ ├─ local-variable ─────┤
                   └─ routine-parameter ──┘
```

Parameters

statement-name

Specifies the name of the statement as an identifier.

'*statement-name*'

Specifies the name of the statement as a literal whose value must conform to the rules for an identifier.

:*host-variable*

Specifies the name of the statement as a host-variable whose value must conform to the rules for an identifier.

local-variable

Specifies the name of the statement as a local-variable whose value must conform to the rules for an identifier.

routine-parameter

Specifies the name of the statement as a routine-parameter whose value must conform to the rules for an identifier.

LOCAL/GLOBAL

Specifies the scope of the associated statement name:

- LOCAL indicates that the statement can be referenced only from within the program where it is prepared.
- GLOBAL indicates that the statement can be referenced from any program executing within the same SQL transaction.

The default is LOCAL.

Usage

Static Versus Extended Statement Names

A static statement name is one coded as a simple identifier. The following PREPARE statement assigns the static name "select1" to the statement being prepared:

```
PREPARE select1 from :select1-text
```

An extended statement name is one coded either as a literal, a host-variable, a local-variable, or a routine-parameter.

```
MOVE 'SELECT1' to statement-nam
PREPARE :statement-nam FROM :select1-text
```

If a statement is prepared using a static name, it must be referenced using a static name; similarly, if it is prepared using an extended name, it must be referenced using an extended name that has the same scope option.

Uniqueness of Statement Names

Static and extended names do not have to be unique with respect to each other. If two statements are assigned the same value for a name, they are considered two separate statements provided that either:

- One of the names is static while the other is extended.
- Both of the names are extended, but they have different scopes, as indicated by their LOCAL/GLOBAL parameter.

Example

Static-statement-name

The following PREPARE statement creates a statement using a static statement name of S1. It is referenced within the subsequent DESCRIBE statement:

```
EXEC SQL
  PREPARE S1 FROM :TEXT
END-EXEC
EXEC SQL
  DESCRIBE S1 USING DESCRIPTOR SQLDA
END-EXEC
```

Extended-statement-name

The following PREPARE statement creates a local statement using an extended statement name of S1. It is then referenced in the subsequent DESCRIBE statement:

```
EXEC SQL
  PREPARE 'S1' FROM :TEXT
END-EXEC
EXEC SQL
  DESCRIBE 'S1' USING DESCRIPTOR SQLDA
END-EXEC
```

Note: Even though S1 is used as the statement name in both of the above examples, two separate statements are created: one with a static name of S1 and one with an extended name of S1.

Global Extended-statement-name

The following PREPARE statement creates a global statement using an extended statement name whose value is not known until runtime. In this case, the value 'S2' is moved to the host variable before the statement is executed and will be the name of the statement created:

```
MOVE 'S2' TO :SNAME
EXEC SQL
  PREPARE GLOBAL :SNAME FROM :TEXT
END-EXEC
```

Since this is a global statement, it can be referenced in a different program than the one where the PREPARE statement appears. For example, the following DESCRIBE statement might be contained in a different program:

```
EXEC SQL
  DESCRIBE GLOBAL 'S2'
END-EXEC
```

Note: It does not matter that in one case the name of the statement is supplied through a host-variable and in the other it is specified as a literal. They both refer to the global statement S2.

Chapter 3: Data Types and Null Values

This section contains the following topics:

Data Types

A data type is a set of values that share processing characteristics. For example, the set of all integers is a data type. Every column, local variable, parameter, and host variable has an associated data type.

Data Types and Value Sets

The data type limits the set of values that can occur in the column, local variable, parameter, or host variable. The data type also determines the operations that can be performed on values in the column, local variable, parameter, or host variable.

You associate a data type with the following:

- A column when you define the column
- An SQL routine local variable when you define the local variable
- An SQL-invoked routine parameter when you define the parameter
- A host variable when you declare the host variable

More Information

- For more information about defining columns, see CREATE TABLE and ALTER TABLE.
- For more information about declaring host variables, see Host Variables.
- For more information about declaring local variables, see Local Variables.
- For more information about declaring routine-parameters, see Routine Parameters.

Categories of Data Types

CA IDMS supports the following data types:

Category	Data types
Approximate numeric	DOUBLE PRECISION FLOAT REAL
Binary	BINARY
Character string	CHARACTER VARCHAR (or CHAR VARYING)
Date/time	DATE TIME TIMESTAMP
Exact numeric	DECIMAL INTEGER LONGINT (or BIGINT) NUMERIC SMALLINT UNSIGNED DECIMAL UNSIGNED NUMERIC
Graphics character string	GRAPHIC VARGRAPHIC
XML data	XML

More Information

- For more information about a description of the XML data type, see XML Data Type and XML Values.
- For more information about a description of all the other data types, see Expansion of Data-type.

Determining the Data Type of a Value

The data type of a value in a column, host variable, local variable, or parameter is the data type of the column, host variable, local variable or routine parameter. For example, every value in a column with a data type of INTEGER has a data type INTEGER.

The literal used to represent a value must be appropriate for the data type of the value. For example, 983 represents a numeric value; '983' represents a character value.

Note: For more information about literals, see Literals (see page 75).

Data Types Effect on Processing

The data type of a value determines:

- Columns, local variables, parameters, and host variables to which it can be assigned
- Values with which it can be compared
- Operations where it can be used
- Results of operations where it is combined with values of other data types
- Its internal representation and storage requirements

More information:

ALTER TABLE (see page 290)
CREATE TABLE (see page 378)
Local Variables (see page 81)
Expansion of Data-type (see page 55)
Host Variables (see page 77)
Routine Parameters (see page 84)

Expansion of Data-type

The expanded parameters of data-type specify data types in an SQL data description statement.

Syntax

Expansion of data-type

```
►►─┬─ BINary ─┬────────────────────┬───────────────────────────┬──────────►◄
   │          └─ ( ── length ── ) ─┘                           │
   ├─ CHARacter ─┬────────────────────┬────────────────────────┤
   │             └─ ( ── length ── ) ─┘                        │
   ├─ DATE ────────────────────────────────────────────────────┤
   ├─ DECimal ─┬──────────────────────────────────────────┬────┤
   │           └─ ( ── precision ─┬──────────────┬─ ) ────┘    │
   │                              └─ , ── scale ─┘             │
   ├─ DOUBLE PRECISION ────────────────────────────────────────┤
   ├─ FLOAT ─┬───────────────────────┬─────────────────────────┤
   │         └─ ( ── precision ── ) ─┘                         │
   ├─ GRAPHIC ─┬────────────────────┬──────────────────────────┤
   │           └─ ( ── length ── ) ─┘                          │
   ├─ INTeger ─────────────────────────────────────────────────┤
   ├─┬─ LONGINT ─┬─────────────────────────────────────────────┤
   │ └─ BIGINT ──┘                                             │
   ├─ NUMeric ─┬──────────────────────────────────────────┬────┤
   │           └─ ( ── precision ─┬──────────────┬─ ) ────┘    │
   │                              └─ , ── scale ─┘             │
   ├─ REAL ────────────────────────────────────────────────────┤
   ├─ SMALLINT ────────────────────────────────────────────────┤
   ├─ TIME ────────────────────────────────────────────────────┤
   ├─ TIMESTAMP ───────────────────────────────────────────────┤
   ├─ UNSIGNED DECimal─┬──────────────────────────────────┬────┤
   │                   └─ ( - precision ─┬─────────────┬─ ) ┘  │
   │                                     └─ , - scale ─┘       │
   ├─ UNSIGNED NUMeric ─┬─────────────────────────────────┬────┤
   │                    └─ ( - precision ─┬─────────────┬─ ) ┘ │
   │                                      └─ , - scale ─┘      │
   ├─┬─ VARCHAR ─────────────┬─┬────────────────────┬──────────┤
   │ └─ CHARacter VARYING ───┘ └─ ( ── length ── ) ─┘          │
   └─ VARGRAPHIC ─┬────────────────────┬───────────────────────┘
                  └─ ( ── length ── ) ─┘
```

Parameters

BINARY

Identifies a set of values that are fixed-length bit strings. BINARY values are represented by hexadecimal literals (for example, X'12A5E978').

length

Specifies the number of eight-bit bytes in a BINARY value. *Length* must be an integer in the range 1 through 32,760. The default is 1.

The maximum length of a column with a data type of BINARY is limited by page size and the total length of other columns in the table.

Note: For more information about the length of a BINARY value, see CREATE TABLE. (see page 378)

CHARacter

Identifies a set of values that are fixed-length single-byte character strings. CHARACTER values are represented by character string literals (for example, 'Past due').

length

Specifies the number of bytes in a CHARACTER value. *Length* must be an integer in the range 1 through 32,760. The default is 1.

The maximum length of a column with a data type of CHARACTER is limited by page size and the total length of other columns in the table.

Note: For more information about the length of a CHARACTER value, see CREATE TABLE. (see page 378)

DATE

Identifies the set of values that represent valid dates from January 1, 0001, through December 31, 9999. DATE values are represented by character string literals (for example, '1999-07-22').

The maximum length of a DATE value is 10 bytes. Internally, the length of a DATE value is always eight bytes.

DECimal

Identifies a set of fixed-point, signed packed decimal values. DECIMAL values are represented by exact numeric literals (for example, 17.23).

The range of values included in the set is determined by the precision and scale specified for the data type. The largest possible DECIMAL value is 10^{31}-1. The smallest possible DECIMAL value is -(10^{31}-1).

precision

Specifies the number of digits in a DECIMAL value. *Precision* must be an integer in the range 1 through 56. The default is 56.

The length of a DECIMAL value is equal to the precision plus 1, divided by 2.

scale

Specifies the number of digits to the right of the decimal point in a DECIMAL value. *Scale* must be an integer in the range 0 through the precision of the DECIMAL value. The default is 0.

DOUBLE PRECISION

Identifies the set of 64-bit (long) floating-point values with a seven-bit exponent and a binary precision of 56. DOUBLE PRECISION values are represented by approximate numeric literals (for example, 0.1E-16).

The magnitude that can be represented by a *positive* DOUBLE PRECISION value ranges from approximately 5.4E-79 to approximately 7.2E+75. The magnitude that can be represented by a *negative* DOUBLE PRECISION value ranges from approximately -5.4E-79 to approximately -7.2E+75.

The length of a DOUBLE PRECISION value is eight bytes.

FLOAT

Identifies a set of floating-point values with a seven-bit exponent and a user-specified precision. FLOAT values are represented by approximate numeric literals (for example, -1.4E9).

The magnitude that can be represented by a *positive* FLOAT value ranges from approximately 5.4E-79 to approximately 7.2E+75. The magnitude that can be represented by a *negative* FLOAT value ranges from approximately -5.4E-79 to approximately -7.2E+75.

precision

Specifies the binary precision of a FLOAT value. *Precision* must be an integer in the range 1 through 56. The default is 24.

If *precision* is less than or equal to 24, the length of a FLOAT value is four bytes. If *precision* is greater than 24, the length of a FLOAT value is eight bytes.

GRAPHIC

Identifies a set of values that are fixed-length double-byte character strings. GRAPHIC values are represented by double-byte character string literals (for example, G'<####>', where < and > represent the shift-out and shift-in characters and # represents a double-byte character).

The GRAPHIC data type is a CA IDMS extension of the SQL standard.

length

Specifies the number of characters in a GRAPHIC value. The length in bytes of a GRAPHIC value is equal to the number of bytes in one character times the number of characters.

Length must be an integer in the range 1 through 16,380. The default is 1.

The maximum length of a column with a data type of GRAPHIC is limited by page size and the total length of other columns in the table.

Note: For more information about the length of a GRAPHIC value, see CREATE TABLE (see page 378).

INTeger

Identifies the set of values that are 31-bit signed integers in the range -2,147,483,648 through 2,147,483,647. INTEGER values are represented by exact numeric literals (for example, -2874).

The length of an INTEGER value is four bytes.

BIGINT (or LONGINT)

Identifies the set of values that are 63-bit signed integers in the range -9,223,372,036,854,775,808 through 9,223,372,036,854,775,807. BIGINT values are represented by exact numeric literals (for example, 2187168).

The length of a BIGINT value is eight bytes. The keyword LONGINT can be used as a synonym for BIGINT but this is a CA IDMS extension of the SQL standard.

NUMeric

Identifies a set of fixed-point, signed zoned decimal values. NUMERIC values are represented by exact numeric literals (for example, -4.7). The use of NUM as a synonym for NUMERIC is a CA IDMS extension of the SQL standard.

The range of values included in the set is determined by the precision and scale specified for the data type. The largest possible NUMERIC value is 10^{31}-1. The smallest possible NUMERIC value is -(10^{31}-1).

precision

Specifies the number of digits in a NUMERIC value. *Precision* must be an integer in the range 1 through 31. The default is 1.

The length in bytes of a NUMERIC value is equal to the precision.

scale

Specifies the number of digits to the right of the decimal point in a NUMERIC value. *Scale* must be an integer in the range 0 through the precision of the NUMERIC value. The default is 0.

REAL

Identifies the set of 32-bit (short) floating-point values with a seven-bit exponent and a binary precision of 24. REAL values are represented by approximate numeric literals (for example, 0.4E52).

The magnitude that can be represented by a *positive* REAL value ranges from approximately 5.4E-79 to approximately 7.2E+75. The magnitude that can be represented by a *negative* REAL value ranges from approximately -5.4E-79 to approximately -7.2E+75.

The length of a REAL value is four bytes.

SMALLINT

Identifies the set of values that are 15-bit signed integers in the range -32,768 through 32,767. SMALLINT values are represented by exact numeric literals (for example, 16433).

The length of a SMALLINT value is two bytes.

TIME

Identifies the set of values that represent valid times from 00.00.00 through 23.59.59.

TIME values are represented by character string literals (for example, '13.42.59').

The maximum length of a TIME value is eight bytes. Internally, the length of a TIME value is always eight bytes.

Note: A TIME value of 24.00.00 is accepted and treated as 00.00.00.

TIMESTAMP

Identifies the set of values that represent valid date/time combinations with a precision of millionths of a second. Valid dates range from January 1, 0001, through December 31, 9999. Valid times range from 00.00.00.000000 through 23.59.59.999999.

TIMESTAMP values are represented by character string literals (for example, '1999-05-02-09.46.39.738294').

The maximum length of a TIMESTAMP value is 26 bytes. Internally, the length of a TIMESTAMP value is always eight bytes.

UNSIGNED DECIMAL

Identifies a set of fixed-point, unsigned packed decimal values. UNSIGNED DECIMAL values are represented by exact numeric literals (for example, 17.23).

The range of values included in the set is determined by the precision and scale specified for the data type. The largest possible UNSIGNED DECIMAL value is 10^{31}-1. The smallest possible DECIMAL value is 0.

The UNSIGNED DECIMAL data type is a CA IDMS extension of the SQL standard.

precision

Specifies the number of digits in an UNSIGNED DECIMAL value. *Precision* must be an integer in the range 1 through 31. The default is 1.

The length of an UNSIGNED DECIMAL value is equal to the precision plus 1, divided by 2.

scale

Specifies the number of digits to the right of the decimal point in an UNSIGNED DECIMAL value. *Scale* must be an integer in the range 0 through the precision of the UNSIGNED DECIMAL value. The default is 0.

UNSIGNED NUMERIC

Identifies a set of fixed-point, unsigned zoned decimal values. UNSIGNED NUMERIC values are represented by exact numeric literals (for example, 4.7).

The range of values included in the set is determined by the precision and scale specified for the data type. The largest possible UNSIGNED NUMERIC value is 10^{31}-1. The smallest possible NUMERIC value is 0.

The UNSIGNED NUMERIC data type is a CA IDMS extension of the SQL standard.

precision

Specifies the number of digits in an UNSIGNED NUMERIC value. *Precision* must be an integer in the range 1 through 31. The default is 1.

The length in bytes of an UNSIGNED NUMERIC value is equal to the precision.

scale

Specifies the number of digits to the right of the decimal point in an UNSIGNED NUMERIC value. *Scale* must be an integer in the range 0 through the precision of the NUMERIC value. The default is 0.

VARCHAR (or CHAR VARYING)

Identifies a set of values that are variable-length single-byte character strings. VARCHAR values are represented by character string literals (for example, 'Customer address needs to be verified').

length

Specifies the maximum number of characters in a VARCHAR value. *Length* must be an integer in the range 1 through 32,758. The default is 1.

The length of a VARCHAR value is the number of characters in the value. The number of bytes reserved for a VARCHAR value is always the same; the maximum length, plus 2 regardless of the length of the VARCHAR value. A VARCHAR value is preceded by a 2-byte binary length of the value.

The maximum length of a column with a data type of VARCHAR is limited by page size, the total length of other columns in the table, and other factors.

Note: For more information about the length of a VARCHAR value, see CREATE TABLE. (see page 378)

VARGRAPHIC

Identifies a set of values that are variable-length double-byte character strings. VARGRAPHIC values are represented by double-byte character string literals (for example, G'<####>', where < and > represent the shift-out and shift-in characters and # represents a double-byte character).

The VARGRAPHIC data type is a CA IDMS extension of the SQL standard.

length

Specifies the maximum number of characters in a VARGRAPHIC value. *Length* must be an integer in the range 1 through 16,379. The default is 1.

The length of a VARGRAPHIC value is the number of characters in the value. The numbeCREATE TABLEr of bytes reserved for a VARGRAPHIC value is the maximum length times the number of bytes for one character, plus 2. A VARGRAPHIC value is preceded by a 2-byte binary length of the value.

The maximum length of a column with a data type of VARGRAPHIC is limited by page size and the total length of other columns in the table.

Note: For more information about the length of a VARGRAPHIC value, see CREATE TABLE. (see page 378)

Usage

Graphics Data

The use of graphics data requires the installation of CA IDMS DBCS.

Example

Defining Table Columns

The following CREATE TABLE statement creates a table with ten columns. Each column is associated with a data type. The data type specification determines the set of values that can occur in the column.

```
create table job
   (job_id          integer        not null,
   job_title        character(20)  not null,
   job_desc_line_1  varchar(60),
   job_desc_line_2  varchar(60),
   min_rate         decimal(8,2),
   max_rate         decimal(8,2),
   salary_ind       character(1),
   num_of_positions smallint,
   num_open         smallint,
   eff_date         date);
```

Representation of Date/Time Values

Values whose data types are DATE, TIME, or TIMESTAMP are represented internally as binary numbers and externally as character strings.

Internal Representation

Date/time values are represented internally by 64-bit binary numbers. The bits, numbered from the left starting with 0, have the following meaning:

Bits	**Meaning**
Bits 0 through 26	Number of days since January 1, 0001
Bits 27 through 43	Number of seconds in the day since midnight
Bits 44 through 63	Number of microseconds since the last second

External Representations

Date/time Representations

CA IDMS provides four standard external representations for a date/time value:

- International Standards Organization (ISO)
- IBM USA standard (USA)
- IBM European standard (EUR)
- Japanese Industrial Standard Christian Era (JIS)

You can reference the abbreviation associated with the external representation (for example, ISO) when you use the CHAR function.

Note: For more information about the CHAR function, see CA IDMS Scalar Functions. (see page 124)

Date Values

The external representation of a date value is a character string which begins with a digit and must be at least five characters. The representation of a date value can:

- Omit leading zeros from the month, day, and year portions
- Include trailing blanks

The following table describes the external representations of a date value:

Standard	Format	Example
ISO	*yyyy-mm-dd*	1990-12-15
USA	*mm/dd/yyyy*	12/15/1990
EUR	*dd.mm.yyyy*	15.12.1990
JIS	*yyyy-mm-dd*	1990-12-15

External Representations of Time Values

The external representation of a time value is a character string which begins with a digit and must be at least five characters. The representation of a time value may omit a leading zero from the hours, minutes, and seconds portions and may include trailing blanks.

The following table describes the external representations of a time value:

Standard	Format	Example
ISO	*hh*.*mm*.*ss*	16.43.17
USA	*hh*:*mm* AM *hh*:*mm* PM	4:43 PM
EUR	*hh*.*mm*.*ss*	16.43.17
JIS	*hh*:*mm*:*ss*	16:43:17

External Representations of Timestamps

The external representation of a timestamp is a character string which begins with a digit and must be at least 11 characters. The timestamp format is:

yyyy-mm-dd-hh.mm.ss.nnnnnn

With the representation of a timestamp value may:

- Omit leading zeros from the year, month, day, hours, minutes, and second portions
- Truncate or omit microseconds entirely (any digit of microseconds that is omitted is assumed to be zero)
- Include trailing blanks

Entering and Retrieving Date/Time Values

When you enter date/time values into the database or use them in predicates, you can use any of the formats documented above. CA IDMS determines the format by examining the value.

When you retrieve date/time values from the database, the format in which the value is retrieved depends on how the SQL statement is issued:

- If the statement is embedded in a program, the format is determined by the DATE and TIME precompiler options, if specified, or by the installation default.
- If the statement is submitted through the Command Facility, all date/time values are returned in ISO format.

Note: For more information about precompiler options, see the *CA IDMS SQL Programming Guide*.

Comparison, Assignment, Arithmetic, and Concatenation Operations

The data type, length, and magnitude of a value determine how CA IDMS handles the value during comparison, assignment, arithmetic, and concatenation operations. The same factors also affect the outcome of these operations.

For example:

- Padding can occur during comparisons of values of unequal length.
- Overflow occurs when the magnitude of a numeric value is greater than the largest magnitude represented by the data type of the construct to which the value is assigned.
- Underflow occurs when the magnitude of an approximate numeric value is smaller than the smallest magnitude represented by the data type of the construct to which the value is assigned.
- Truncation can occur when a binary, graphic, or character value is assigned to a construct that is not big enough to hold the value.
- Rounding can occur as a result of truncation during assignment and arithmetic operations.

Binary Values

Comparison

Binary values can be compared to the following:

- Other binary values. When comparing binary values of different lengths, CA IDMS pads the shorter value with binary zeros on the right to make the lengths equal.
- Date/time values. Provided the binary value has a length of 8.
- Character values. If the binary and character values are of different lengths, CA IDMS pads the shorter value with spaces on the right to make the lengths equal.

Assignment

Binary values can be assigned to the following:

- Binary constructs (for example, a column with a data type of BINARY):
  - If the binary value is shorter than the construct, CA IDMS pads the value with binary zeros on the right to make the value as long as the construct.
  - If the binary value is longer than the construct and the construct is a column (for example, in an INSERT or UPDATE operation), CA IDMS truncates the value on the right if the portion to be truncated contains only binary zeros. If nonzero bits would be truncated, CA IDMS generates an exception and no assignment occurs.
  - If the binary value is longer than the construct and the construct is a host variable (for example, in a FETCH or SELECT operation), CA IDMS truncates the value on the right.
- Date/time constructs (for example, a column with a data type of TIMESTAMP), provided the binary value has a length of 8 and conforms to the internal representation of a valid date/time value.
- Character constructs (for example, a column with a data type of CHARACTER). The rules for assigning a binary value to a character construct are the same as those for assigning a character value to a character construct. If padding is necessary, it is done with blanks instead of binary zeros.

Arithmetic

You cannot use binary values in arithmetic operations.

Concatenation

Binary values can be concatenated with other binary values and with character values. For the purposes of concatenation, binary values are treated as character values, and the result of a concatenation operation is a character value.

Character Values

Comparison

Character values can be compared to the following:

- Other character values. When comparing character values of different lengths, CA IDMS pads the shorter value with blanks on the right to make the lengths equal.
- Date/time values, provided the character value has the format of a date/time value of the same data type as the date/time value used in the comparison.
- Binary values. The binary value is treated as a character value and padded with blanks, if necessary, before the comparison is made.

Assignment

Character values can be assigned to the following:

- Character constructs (for example, a column with a data type of CHARACTER or VARCHAR). If the character value is:
  - Shorter than the construct, and the construct has a data type of CHARACTER, CA IDMS pads the value with blanks on the right to make the value as long as the construct. If the construct has a data type of VARCHAR, no padding takes place.
  - Longer than the construct and the construct is a column (for example, in an INSERT or UPDATE operation), CA IDMS truncates the value on the right if all the characters to be truncated are blanks. If nonblank characters would be truncated, CA IDMS generates an exception and no assignment occurs.
  - Longer than the construct and the construct is a host variable, a local variable, or a parameter (for example, in a FETCH, SELECT, or a SET operation), CA IDMS truncates the value on the right and an SQL warning condition is issued.
- Date/time constructs (for example, a column with a data type of TIMESTAMP), provided the character value has the format of a date/time value of the same data type as the construct to which the value is being assigned.
- Binary constructs (for example, a column with a data type of BINARY). The rules for assigning a character value to a binary construct are identical to those for assigning a binary value to a binary construct. If padding is necessary, it is done with binary zeros instead of blanks.

Arithmetic

You cannot use character values in arithmetic operations.

Concatenation

Character values can be concatenated with other character values.

If one value in the concatenation:

- Has a data type of VARCHAR, the result has a data type of VARCHAR. Otherwise, the result has a data type of CHARACTER.
- Is null, the result is null. Otherwise, the length of the result is the sum of the lengths of the two values that are concatenated. The length of the result cannot exceed 32,760.

A character value and a binary value can be concatenated. The binary value is treated as a character value for the purpose of concatenation.

Date/time Values

Comparison

Date/time values can be compared to:

- Other date/time values of the same data type
- Binary values, provided the binary value has a length of 8
- Character values, provided the character value has the format of a date/time value of the same data type as the date/time value used in the comparison

Assignment

Date/time values can be assigned to the following:

- Date/time constructs of the same data type. For example, a value with a data type of TIMESTAMP can be assigned to a column with a data type of TIMESTAMP.
- Binary constructs with a length of 8.
- Character constructs long enough to contain the date/time value

  If the date/time value is:

  - Shorter than the character construct, CA IDMS pads the value with blanks on the right to make the value as long as the construct
  - Longer than the character construct, CA IDMS generates an exception and does not perform the assignment

Arithmetic

You can use date/time values only in addition and subtraction. Special rules govern date/time arithmetic.

Note: For information about date/time arithmetic, see Date/time Arithmetic. (see page 110)

Concatenation

You can concatenate a date value and a time value using the TIMESTAMP function.

Note: For more information about the TIMESTAMP function, see CA IDMS Scalar Functions (see page 124).

Graphics Character Values

Comparison

Graphics character values can be compared to other graphics character values. When comparing graphics character values of different lengths, CA IDMS pads the shorter value with double-byte blank characters on the right to make the lengths equal.

Assignment

Graphics character values can be assigned to graphics character constructs (for example, to a column with a data type of GRAPHIC or VARGRAPHIC): If the graphics character value is:

- Shorter than the construct, and the construct has a data type of GRAPHIC, CA IDMS pads the value with double-byte blank characters on the right to make the value as long as the construct. If the construct has a data type of VARGRAPHIC, no padding takes place.
- Longer than the construct and the construct is a column (for example, in an INSERT or UPDATE operation), CA IDMS truncates the value on the right if the portion to be truncated contains only double-byte blank characters. If nonblank characters would be truncated, CA IDMS generates an exception and no truncation occurs.
- Longer than the construct and the construct is a host variable (for example, in a FETCH or SELECT operation), CA IDMS truncates the value on the right.

Arithmetic

You cannot use graphics character values in arithmetic operations.

Concatenation

Graphics character values can be concatenated with other graphics character values.

If one of the values has a data type of VARGRAPHIC, the result has a data type of VARGRAPHIC. Otherwise, the result has a data type of GRAPHIC.

If one value in the concatenation is null, the result is null. Otherwise, the length of the result is the sum of the lengths of the two values that are concatenated. The length of the result cannot exceed 32,760.

Usage

The use of graphics data requires the installation of CA IDMS DBCS.

Numeric Values

Comparison

Numeric values can be compared only to other numeric values.

Assignment

Numeric values can be assigned only to numeric constructs (for example, to a column with a data type of DECIMAL).

When assigning a value of one numeric data type to a construct of a different numeric data type, CA IDMS converts the value to the data type of the construct:

- If the conversion results in overflow or underflow, CA IDMS generates an exception and does not perform the assignment.
- If the conversion results in the loss of digits to the right of the decimal point in an exact numeric value or least significant digits in the mantissa of an approximate numeric value, CA IDMS rounds the value and does not generate an exception.

Arithmetic

You can use values of all numeric data types (both approximate and exact) in arithmetic operations. Additionally, a single arithmetic expression can include values of more than one numeric data type.

Data Type Conversion for Comparison and Arithmetic

When a comparison or arithmetic operation involves two values of different numeric data types, CA IDMS determines which data type has higher precedence. CA IDMS then converts both values to a common data type based on the data type of higher precedence:

	Data type of highest precedence	Common data type for conversion
Highest	DOUBLE PRECISION FLOAT REAL	DOUBLE PRECISION
	DECIMAL NUMERIC	DECIMAL
	LONGINT	LONGINT

	Data type of highest precedence	Common data type for conversion
Lowest	INTEGER SMALLINT	INTEGER

Precision of the Result

The precision of the result of comparison or arithmetic operation when a conversion involves a decimal data type is:

- The maximum number of digits to the left of the decimal in the source operands plus the result scale plus 1, if the operation is addition or subtraction (The result scale is the maximum of the source scales)

  For example, the precision of the result of 45673 + 5.398 is 9.

- The sum of the precision of the first value and the second value, if the operation is multiplication or division

  For example, the precision of the result of 45 x 367 is 5.

Examples of Data Type Conversion

For example, to add a NUMERIC value to an INTEGER value, CA IDMS converts both values to DECIMAL. To compare a FLOAT value to a REAL value, CA IDMS converts both values to DOUBLE PRECISION.

Null Values

A null value is a placeholder that indicates the absence of a value. Null values exist for all data types. The null value of a given data type is different from all non-null values of the same data type.

By default, any column can contain null values. You can use either the NOT NULL or the CHECK parameter in a column definition to disallow null values in the column.

Parameters and local variable of SQL-invoked routines can always contain null values. However, it is possible to define initial values.

Host variables can also represent null values. You use an indicator variable with a host variable to indicate whether the host variable represents a null value.

How You Specify a Null Value

You use the keyword NULL to indicate a null value. For example, the following INSERT statement inserts a new row into the DEPARTMENT table. The department number and name and the division code are known, but the department head has not been appointed yet. A null value is used as a placeholder in the DEPT_HEAD_ID column.

```
insert into department
   (dept_id, dept_name, div_code, dept_head_id)
   values (4040, 'Audit', 'D09', null);
```

Null Values in Comparison and Arithmetic Operations

Null values have the following effect in comparison and arithmetic operations:

- The result of a **comparison operation** involving one or more null values is always unknown
- The result of an **arithmetic operation** involving one or more null values is always a null value

Null Values in Sort Operations

In a sort operation, a null value is a high value. Thus, a null is placed at the end of an ascending sort sequence.

More Information

- For more information about defining columns, see CREATE TABLE or CREATE TEMPORARY TABLE.
- For more information about CREATE FUNCTION, CREATE PROCEDURE, and compound statements, see Statements.
- For more information about indicator variables, see Indicator Variables.

More information:

CREATE FUNCTION (see page 341)
CREATE PROCEDURE (see page 361)
CREATE TABLE (see page 378)
CREATE TEMPORARY TABLE (see page 392)
Statements (see page 249)

Chapter 4: Values and Value Expressions

This section contains the following topics:

Literals

A literal directly represents a specific value. CA IDMS uses several types of literals. Each type of literal represents values of one or more data types. For example, a character string literal represents either a CHARACTER value or a VARCHAR value.

Note: For more information about data types, see Values and Value Expressions.

More information:

Values and Value Expressions (see page 75)

Expansion of Literal

The expanded parameters of literal represent specific data values in an SQL statement.

Syntax

Expansion of literal

```
►►─┬─ 'character-string-literal' ────────────────────────────────────────►◄
   ├─ G'double-byte-character-string-literal' ─┤
   ├─ X'hexadecimal-literal' ──────────────────┤
   ├─ exact-numeric-literal ───────────────────┤
   └─ approximate-numeric-literal ─────────────┘
```

Parameters

'*character-string-literal*'

Represents a character value as a string of single-byte characters (for example, '79 High Street').

A character string literal can consist of any combination of letters, digits, and special characters (including blanks). Lowercase letters are not equal to uppercase letters in a character string literal (for example, 'Boston' is not equal to 'BOSTON').

Character string literals must be enclosed in single quotation marks. To include a single quotation mark as part of the character string itself, code two consecutive single quotation marks (for example, 'Carol''s job').

G'*double-byte-character-string-literal*'

Represents a character value as a string of double-byte characters. Within a double-byte character string literal, a sequence of one or more double-byte characters must be preceded by the shift-out character and followed by the shift-in character (for example, G'<####>', where < and > represent the shift-out and shift-in characters and # represents a double-byte character). The shift characters are not part of the data value.

A double-byte character string literal can consist of any combination of characters in the double-byte character set (including the double-byte blank character). The entire sequence of characters, including the shift-out and shift-in characters, must be enclosed in single quotation marks.

Note: Certain hardware configurations do not require the use of shift characters in double-byte character string literals.

Note: 'SQL Standard Compatibility'. Double-byte character string literals are a CA IDMS extension of the SQL standard.

X'*hexadecimal-literal*'

Represents a binary value as a sequence of an even number of hexadecimal digits (for example, X'01F27A'). Hexadecimal literals must be enclosed in single quotation marks.

Case is not significant in hexadecimal literals. You can use either uppercase or lowercase for the digits A through F.

exact-numeric-literal

Represents a signed or unsigned fixed-point decimal number. The decimal point in an exact numeric literal can be either explicit (for example, 39523.142) or implicit after the rightmost digit (for example, -2834).

approximate-numeric-literal

Represents a floating point number. Approximate numeric literals have the form *mantissa*E*exponent* (for example, 3.45E-2), where:

- **Mantissa** is an exact numeric literal
- **Exponent** is a signed or unsigned integer

Example

Specifying Values for a New Row

The INSERT statement below inserts a new row into the COVERAGE table. The values in the row are represented by the following types of literals: character string (first column), exact numeric (second and fourth columns), and date (third column).

```
insert into coverage (plan_code, emp_id, selection_date, num_dependents)
   values ('002', 2538, '1989-05-11', 3);
```

Host Variables

A host variable is a variable that is referenced in an SQL statement embedded in an application program. You use host variables to:

- Make data in the CA IDMS database available for processing by an application program
- Make data from sources other than the database (for example, from a sequential file) available for processing by SQL statements

Host variables are not used in SQL statements submitted through the command facility.

Note: An INTO clause is required for SQL SELECT statements embedded in host programs.

Indicator Variables

An indicator variable is a host variable used to indicate whether the value in another host variable represents a null or truncated value. The use of indicator variables is optional. You can reference a host variable in an SQL statement with or without naming an associated indicator variable. However, if a SELECT or FETCH statement causes a null value to be assigned to a host variable without an associated indicator variable, CA IDMS returns an error.

Indicator Variable Values

When assigning a value to a host variable, CA IDMS sets the associated indicator variable as follows:

Indicator variable	Meaning
-1	The value assigned to the host variable was null. The contents of the host variable are unchanged.
0	The host variable contains a non-null value that has not been truncated.
1 or greater	The host variable contains a truncated value. The value in the indicator variable is the length in bytes of the original untruncated value.

Declaring Host Variables

Before you execute an SQL statement that references a host variable, you must declare the variable to CA IDMS:

- **Explicitly** in an SQL declaration section
- **Implicitly** with an INCLUDE statement

A single application program can include both explicit and implicit host variable declarations.

Note: For more information about using the INCLUDE statement to declare host variables, see INCLUDE. (see page 479)

SQL Declaration Section

In an explicit host variable declaration, you specify the name and data type of the variable. Depending on the program language, additional information about the variable may also be required (for example, the COBOL level number).

Host variable names must conform to language-specific rules for forming variable names.

Note: For more information about language-specific instructions for declaring host variables in an SQL declaration section, see the *CA IDMS SQL Programming Guide*.

More information:

INCLUDE (see page 479)

Expansion of Host-variable

The expanded parameters of host-variable identify declared program variables.

Syntax

Expansion of host-variable

```
►►─── :host-variable-name ─┬───────────────────────────────────────┬──────────►◄
                           └─ indicator :indicator-variable-name ─┘
```

Parameters

:*host-variable-name*

Identifies the name of a host variable previously declared to the program.

indicator :*indicator-variable*

Identifies the name of a host variable previously declared to the program to serve as an indicator variable.

Indicator-variable must reference a variable that was declared with a numeric data type.

Usage

A Colon Must Precede the Variable Name

When you reference a host variable in an SQL statement, you must precede the variable name with a colon (:).

No Comma Between Host and Indicator Variables

There is no required separator between a host variable and its associated indicator variable when they are referenced in an SQL statement. The only valid separator is the optional keyword **indicator**.

Non-bulk Structure in COBOL

In certain SQL statements embedded in a COBOL application program, **host-variable** may refer to a non-bulk structure defined in the host program.

Note: For more information about commas as separators, see the *CA IDMS SQL Programming Guide*.

Example

The following SELECT statement retrieves data into host variables. BIRTH-DATE-I is an indicator variable that is associated with BIRTH-DATE-HOST because the BIRTH_DATE column may contain null values.

```
EXEC SQL
   SELECT DEPT_ID, DEPT_NAME, EMP_ID
      INTO :DEPT-ID-HOST,
           :DEPT-NAME-HOST,
           :EMP-ID-HOST,
           :BIRTH-DATE-HOST :BIRTH-DATE-I
      FROM DEPARTMENT D, EMPLOYEE E
      WHERE D.DEPT_ID = E.DEPT_ID
END-EXEC
```

Local Variables

A local variable is a variable that is defined in an SQL routine. You use local variables to temporarily store and retrieve values as needed in the logic of the routine. Local variables are used for such things as:

- Retrieving data from a CA IDMS database by specifying them on the INTO clause of a SELECT statement
- Passing data to and from other SQL-invoked routines by specifying them as arguments on the routine invocation
- Holding computational values by specifying them as a target of a SET statement or as values within expressions.

Local variables can only be referenced within the body of the SQL routine in which they are defined.

Declaring Local Variables

A local variable is defined by a **variable-declaration** statement that is included in a compound statement within an SQL routine body. The declaration of a local variable consists of the specification of its name, data type, and optionally its initial value.

Note: For more information about declaring local variables, see Compound Statement. (see page 566)

More information:

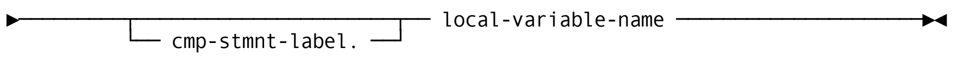
Compound Statement (see page 566)

Expansion of Local-variable

The expanded parameters of local-variable identify program variables declared in a compound statement.

Syntax

Expansion of local-variable



Parameters

cmp-stmnt-label

Specifies the label of the compound statement that contains the definition of **local-variable**.

local-variable-name

Identifies the local variable of an SQL routine.

Usage

Referencing Local Variables

A local variable can only be referenced from within the compound statement that contains its declaration or from within a compound statement contained in the compound statement that contains its declaration.

Avoiding Ambiguous References

The name of a local variable of an SQL routine can be the same as the name of another local variable, a routine parameter, a column, or another schema-defined entity such as a table. To avoid ambiguity when referencing these objects, qualification can be used as follows:

- A local variable can be qualified with the label of the compound statement in which it is declared.
- A routine parameter can be qualified with its associated schema and routine name.
- A column can be qualified with its schema and table name.
- Other schema-defined objects can be qualified with the name of the schema in which they are defined.

Resolving Ambiguous References

If a name is not qualified and more than one object has the specified name, CA IDMS uses the following precedence rules to resolve the ambiguous reference:

- If a local variable with a matching name has been declared within the compound statement in which the reference occurs, the reference is to the local variable. If more than one such variable is declared, the reference is to the variable declared in the innermost compound statement containing the reference.
- If a parameter of the routine in which the reference occurs has a matching name, the reference is to the routine parameter.
- Otherwise, the reference is treated as a reference to a schema-defined object.

  Note: For more information about how such a reference is resolved, see Resolving References to Entities in Schemas.

In the SQL standard, an unqualified reference would be to the object with innermost scope.

Example

In the following SQL procedure, two local variables, FNAME and LNAME are defined. The references are qualified in the SELECT statement with the label of the compound statement that holds the definition of the local variables. The SET statement uses unqualified references.

```
set options command delimiter '++';
create procedure SQLROUT.LOCALVAR
  ( TITLE     varchar(10) with default
  , P_EMP_ID  NUMERIC(4)
  , P_NAME    varchar(25)
  )
    external name LOCALVAR language SQL
L_MAIN: begin not atomic
 /*
** Count number of employees with equal Firstname using REPEAT
*/
 declare FNAME   char(20);
 declare LNAME   varchar(20);

 select EMP_FNAME, EMP_LNAME
   into L_MAIN.FNAME, L_MAIN.LNAME
   from DEMOEMPL.EMPLOYEE
  where EMP_ID = P_EMP_ID;

  set P_NAME = FNAME || LNAME;
end L_MAIN
++
*+ TITLE       P_EMP_ID  P_NAME
call SQLROUT.LOCALVAR('LOCALVAR',2010)++
*+

*+ -----       --------  -------------
*+ LOCALVAR    2010      Cora    Parke
```

Routine Parameters

A routine parameter is a parameter of an SQL routine. You use routine parameters to perform the following:

- Pass values to and from the SQL routine
- Store and retrieve values as needed by the routine logic
- Pass values to other SQL-invoked routines

Routine parameters can only be referenced within the body of the SQL routine in which they are defined.

Defining Routine Parameters

A routine parameter is defined through a **parameter-definition** clause of the CREATE PROCEDURE or CREATE FUNCTION statements. The definition includes the specification of the name, the data type and optional WITH DEFAULT attribute.

Note: For more information about defining routine parameters, see CREATE PROCEDURE (see page 361) and CREATE FUNCTION. (see page 341)

More information:

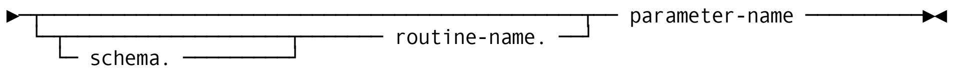
CREATE FUNCTION (see page 341)
CREATE PROCEDURE (see page 361)

Expansion of Routine-parameter

The expanded parameters of routine-parameter identify routine parameters of an SQL routine.

Syntax

Expansion of routine-parameter



Parameters

schema

Specifies the schema with which the SQL routine identified by *routine-name* is associated.

routine-name

Specifies the name of the SQL routine in which the routine parameter identified by **routine-parameter** is defined.

parameter-name

Identifies a parameter of an SQL routine.

Usage

Referencing Routine Parameters

Routine parameters can only be referenced within the body of the SQL routine in which they are defined. A routine parameter is global to the SQL routine. It can be referenced anywhere in the body of the routine.

Avoiding Ambiguous References

The name of a routine parameter can be the same as the name of a local variable, a column, or another schema-defined entity such as a table. To avoid ambiguity when referencing these objects, qualification can be used as follows:

- A local variable can be qualified with the label of the compound statement in which it is declared.
- A routine parameter can be qualified with its associated schema and routine name.
- A column can be qualified with its schema and table name.
- Other schema-defined objects can be qualified with the name of the schema in which they are defined.

Resolving Ambiguous References

If a name is not qualified and more than one object has the specified name, CA IDMS uses the following precedence rules to resolve the ambiguous reference:

- If a local variable with a matching name has been declared within the compound statement in which the reference occurs, the reference is to the local variable. If more than one such variable is declared, the reference is to the variable declared in the innermost compound statement containing the reference.
- If a parameter of the routine in which the reference occurs has a matching name, the reference is to the routine parameter.
- Otherwise, the reference is treated as a reference to a schema-defined object. For information about how such a reference is resolved, see Resolving References to Entities in Schemas.

Note: In the SQL standard, an unqualified reference would be to the object with innermost scope.

Example

In the following SQL procedure, three routine parameters, TITLE, P_EMP_ID, and P_LAST_NAME are defined. The references to P_EMP_ID and P_LAST_NAME in the SELECT statement are qualified. The SET statement uses an unqualified reference to TITLE.

```
set options command delimiter '++';
create procedure SQLROUT.GETLNAME
  ( TITLE     varchar(10) with default
  , P_EMP_ID  NUMERIC(4)
  , P_LAST_NAME    varchar(25)
  )
    external name GETLNAME language SQL
L_MAIN: begin not atomic

 select EMP_FNAME
   into SQLROUT.GETLNAME.P_LAST_NAME
   from DEMOEMPL.EMPLOYEE
  where EMP_ID = GETLNAME.P_EMP_ID;

  set TITLE = 'Success';
end L_MAIN
++

call SQLROUT.GETLNAME  ('?',2010)++
*+
*+ TITL:EP_EMP_ID   P_LAST_NAME
*+ -----       --------   -----------
*+ Success         2010   Cora
```

Dynamic Parameters

A dynamic parameter is a value supplied during the execution of a dynamic SQL statement. It allows a statement, such as an UPDATE or INSERT statement, to be prepared once but executed multiple times with different input values for each execution. It also allows a SELECT statement to be prepared once but be used with different selection criteria to retrieve different rows.

Using Dynamic Parameters

You indicate the presence of a dynamic parameter by specifying a dynamic parameter marker within the text of the SQL statement being prepared. A dynamic parameter marker is the question mark ("?") symbol. It can be specified anywhere that an input host variable can be specified, except as noted below.

When executing an SQL statement that contains one or more dynamic parameter markers, you supply values to be substituted in place of the markers through the USING clause on the EXECUTE statement. If the prepared SQL statement is a SELECT, the substitution values are supplied through the USING clause on the OPEN statement.

Parameter Data Types

When a statement containing a dynamic parameter marker is prepared, CA IDMS infers the data type of the substitution value by examining the context where the dynamic parameter marker appears. You may use the DESCRIBE statement (or the DESCRIBE option on the PREPARE statement) to determine the assumptions that CA IDMS has made about the data types of the dynamic parameters.

The data types of the actual substitution values do not need to be the same as those assumed by CA IDMS. However, they must be compatible with respect to the assignment operator. That is, the value passed at the time the statement is executed must be capable of being assigned to a variable of the data type assumed by CA IDMS.

Note: For more information about the assignment operation, see Comparison, Assignment, Arithmetic, and Concatenation Operations. (see page 66)

The following table outlines how CA IDMS infers the data type of a dynamic parameter from the context in which it is used.

Context	**data type of dynamic parameter**
Date-time value expressions	
? + date or date + ?	Date duration (DECIMAL(8,0))
? + time or time + ?	Time duration (DECIMAL(6,0))
? + timestamp or timestamp + ?	Time duration (DECIMAL(6,0))
date - ?	Date duration (DECIMAL(8,0))
time - ?	Time duration (DECIMAL(6,0))
timestamp - ?	Time duration (DECIMAL(6,0))
? - date	DATE
? - time	TIME

Context	**data type of dynamic parameter**
? + labeled duration or ? - labeled duration	DATE if duration is DAY, MONTH, YEAR; TIME if duration is HOUR, MINUTE, SECOND
v + ? DAY/MONTH/YEAR/ HOUR/MINUTE/SECOND	DECIMAL(31,6)
Other value expressions	
? arithmetic-operator *v* or *v* arithmetic-operator ?	Same as *v*
? || *v* or *v* || ?	VARCHAR (256)
Scalar functions	
CAST (? AS **data-type**)	**data-type**
CHAR_LENGTH (?)	VARCHAR (256)
CHARACTER_LENGTH (?)	VARCHAR (256)
COALESCE (*v*,...?,...)	Same as *v* (The first entry in the list cannot be a dynamic parameter)
CONCAT (?,?)	First and second VARCHAR (256)
CONVERT(?, data-type)	data-type
FLOAT (?)	DOUBLE PRECISION
HEX (?)	VARCHAR (256)
IFNULL(v,?)	Same as v (The first entry in the list cannot be a dynamic parameter)
INTEGER (?)	INTEGER
LCASE(?)	VARCHAR (256)
LEFT (?, ?)	First is VARCHAR (256); second is INTEGER
LENGTH (?)	VARCHAR (256)
LOCATE (?, ?, ?)	First and second are VARCHAR (256); third is INTEGER
LOWER (?)	VARCHAR (256)
LTRIM (?)	VARCHAR (256)
POSITION (? IN ?)	Both are VARCHAR (256)
PROFILE (?)	VARCHAR (256)
RTRIM (?)	VARCHAR (256)

Context	data type of dynamic parameter
SUBSTR (?, ?, ?) or SUBSTRING (? FROM ? FOR ?)	First is VARCHAR (256); second and third are INTEGER
TRIM (? FROM ?)	Both are VARCHAR (256)
UCASE (?)	VARCHAR (256)
UPPER (?)	VARCHAR (256)
VALUE (*v*,...,?,...)	Same as *v* (The first entry in the list cannot be a dynamic parameter)
VARGRAPHIC (?)	VARCHAR (256)
Predicates	
? comparison-operator *v* or *v* comparison-operator ?	Same as *v*
? LIKE ? ESCAPE ?	All are VARCHAR (256)
? BETWEEN *v1* AND *v2*	Same as *v1*
v BETWEEN ? AND ?	Both same as *v*
v1 IN (*v2*,...,?,...)	Same as *v1*
? IN (*v1*, *v2*, ...)	Same as *v1*
? comparison-operator ANY/ALL (subquery)	Same data type as result of subquery.
? comparison-operator (subquery)	Same data type as result of subquery.
Update values	
UPDATE ... SET *column* = ?	Same as *column*.
INSERT ... VALUES (...,?,...)	Same as target column.

Note: Dynamic parameters are always nullable.

Data Type Conversion Considerations

CA IDMS uses the rules in the previous table to infer a data type for a dynamic parameter. The actual value of the parameter may have a different data type provided the two are compatible with regard to the assignment operator. However, in certain cases, compatibility may not be sufficient. For example, if you wish to supply a very long character string as an input value and CA IDMS has inferred a data type of VARCHAR(256), the input value is truncated to a length of 256. To circumvent this, you can use the CAST function to override the default data type, as in the next example:

```
UPDATE MY.TEXT
  SET STRING =
    CHAR(CURRENT TIMESTAMP) || '**' || CAST (? AS VARCHAR(1000))
  WHERE ...
```

As an operand of a concatenate symbol, CA IDMS would normally assign VARCHAR (256) as the data type for the dynamic parameter. However, by using a CAST function, the parameter is instead assigned a data type of VARCHAR (1000).

Restrictions in the Use of Dynamic Parameters

Dynamic parameter markers may not be used in the following contexts:

- Following a unary + or - operator
- By itself as an entry in the *select-list* of a query expression
- As both operands of a dyadic operator (except for the concatenation operator)
- As the first entry in the operand list of the COALESCE and VALUE functions
- As both the first and second or first and third operands of a BETWEEN predicate
- As both the first operand and any entry in the second operand of the IN predicate
- As the operand in the following functions: CHAR, DATE, DAY, DAYS, DECIMAL, DIGITS, MINUTE, MONTH, MICROSECOND, OCTET_LENGTH, SECOND, TIME, TIMESTAMP, YEAR

Note: The CAST function may be used to assign a data type to a parameter that otherwise would not be allowed within the desired context. For example, if you want to use a dynamic parameter as the first operand in the VALUE function, you may embed the parameter in a CAST function to assign a default data type.

Statement Options

For more information, refer to the options that make use of dynamic parameters on the following statements:

- DESCRIBE
- EXECUTE
- OPEN
- PREPARE

Expansion of Dynamic-parameter-marker

The expanded parameters of dynamic-parameter-marker indicate the use of a dynamic parameter.

Syntax

Expansion of dynamic-parameter-marker

```
▶▶— ? ————————————————————————————————————————————————▶◀
```

Parameters

?

Indicates that a dynamic parameter is used to supply a value when the statement is executed.

Usage

Dynamic SQL Only

Dynamic parameter markers may appear only within the text of an SQL statement which is compiled dynamically using the PREPARE statement. They may not be used in statements compiled through an EXECUTE IMMEDIATE statement nor in statements embedded in a host application program.

Note: For more information about the use of dynamic parameters, see Dynamic Parameters.

Example

The following INSERT statement contains dynamic parameter markers to indicate that values for the associated dynamic parameters are supplied when the statement is executed. The EXECUTE statement that follows, supplies those values through the use of host variables.

```
insert into coverage (plan_code, emp_id, selection_date,
    num_dependents)
    values (?, ?, current date, ?)

execute dyninsert using
    :wk-plan, :wk-emp, :wk-deps indicator :wk-deps-i
```

Special Registers

A special register is a system-supplied variable defined by CA IDMS. At any given time, the value of a special register depends upon the context of the current user session.

Usage

You use special registers in place of literals primarily in SQL data manipulation statements. For example, in the following SELECT statement, the special register CURRENT DATE specifies the end of a range of dates used as a selection criterion:

```
select emp_id, emp_lname
   from employee
   where start_date between '1989-01-01' and current date;
```

Expansion of Special-register

The expanded parameters of special-register identify system-supplied variables whose value is determined when the SQL statement in which they appear is executed.

Syntax

Expansion of special-register

```
►►─┬─ USER ─────────────────┬──────────────────────────────────────────────────►◄
   ├─ GROUP ────────────────┤
   ├─ CURRENT DATE ─────────┤
   ├─ CURRENT TIME ─────────┤
   ├─ CURRENT TIMESTAMP ────┤
   ├─ CURRENT TIMEZONE ─────┤
   ├─ CURRENT DATABASE ─────┤
   ├─ CURRENT SCHEMA ───────┤
   └─ CURRENT SQLID ────────┘
```

Note: SQL Standard Compatibility. All special registers except USER are CA IDMS extensions of the SQL standard.

Parameters

USER

Contains the authorization identifier of the user executing the SQL session.

This value is established when the user signs on to the teleprocessing monitor or when the batch application is started by the operating system.

If no user has been established, the value of USER is blanks.

GROUP

Contains the default group identifier associated with the executing user as defined to the security facility.

If no user has been established or if the user has not been assigned a default group, the value of GROUP is blank.

CURRENT DATE

Contains the current date when the SQL statement is executed.

CURRENT TIME

Contains the current time when the SQL statement is executed.

CURRENT TIMESTAMP

Contains the current date and time when the SQL statement is executed with a precision of millionths of a second.

CURRENT TIMEZONE

Contains the difference between current time and Greenwich Mean Time expressed as a time duration.

This value is calculated from operating system values.

CURRENT DATABASE

Contains the name of the database to which the SQL session is connected.

CURRENT SCHEMA

Contains the current schema identifier associated with the SQL session.

This value is established in the CURRENT SCHEMA parameter of a SET SESSION statement. If the SET SESSION statement has not been issued, it is the value of the SCHEMA profile variable associated with the user session.

If no value has been established, the value of CURRENT SCHEMA is blanks.

CURRENT SQLID

Is a synonym for CURRENT SCHEMA.

Usage

Values in CURRENT DATE, TIME, and TIMESTAMP

All occurrences of CURRENT DATE, CURRENT TIME, and CURRENT TIMESTAMP appearing within a single SQL statement are effectively evaluated at the same time.

Data Types and Equivalent Scalar Functions of Special Register Variables

This table gives the data types of CA IDMS special registers and the equivalent scalar function invocation:

Special register	Data type	Equivalent Scalar Function
USER	CHARACTER(18)	USER()
GROUP	CHARACTER(18)	
CURRENT DATE	DATE	CURDATE()
CURRENT TIME	TIME	CURTIME()
CURRENT TIMESTAMP	TIMESTAMP	NOW()
CURRENT TIMEZONE	DECIMAL (6,0)	
CURRENT SCHEMA	CHARACTER (18)	
CURRENT SQLID	CHARACTER (18)	
CURRENT DATABASE	CHARACTER (8)	DATABASE()

ROWID Pseudo-column

A pseudo-column is a column automatically associated by CA IDMS with each table or view. Pseudo-columns are not part of the definition of a table or a view and thus do not show up as rows from the SYSTEM.COLUMN catalog table, nor will they be part of a SELECT * list.

ROWID has a special data type TID (Tuple ID) with a fixed length of 8 bytes. For any practical considerations, the TID data type can be considered equivalent to BIN(8). The ROWID contains information about the storage location of the row in the database. Internally the ROWID is made up of the DBKEY of the underlying database record (first 4 bytes). The last 4 bytes are currently ignored, but may be used in the future.

The value of ROWID is unique for each row of a base table; however, you cannot consider it to be a table's primary key because its value can change over the lifetime of the database. This could happen, for example, after an UNLOAD/RELOAD operation.

The ROWID provides unique access and the fastest access to a row of a table, no matter if the table is SQL- or non-SQL-defined.

The ROWID value is not persistent for the life of the database, but it never changes within a transaction or other controlled processes, if the row is not deleted, of course.

The value of ROWID can be null (for example, as the result of an outer join operation).

A ROWID pseudo-column cannot be updated or inserted.

Views also have an associated ROWID pseudo-column. The value of a view's ROWID is the ROWID of the first base table in the decomposition of the view from left to right. The ROWID values of a view are not necessarily unique.

The ROWID pseudo-column is a CA IDMS extension of the SQL standard.

When to Use ROWID

Although ROWID can be used for SQL-defined tables, it is most useful for updating non-SQL-defined databases. Since such databases tend to have record types with no primary or foreign keys, identifying a specific row to be updated or deleted is often difficult. For such record types, it was often necessary to implement a table procedure to perform the update or deletion. The presence of ROWID pseudo-column makes the table procedure unnecessary, because it uniquely identifies each row of any non-SQL-defined table.

Expansion of rowid-pseudo-column

The expanded parameters of rowid-pseudo-column request the ROWID values to be determined when the SQL statement in which they appear is executed.

Syntax

Expansion of rowid-pseudo-column

```
►►─┬──────────────────────────────────────────┬─── ROWID ──────────────►◄
   ├──┬──────────────────┬┬─ table-identifier. ─┤│
   │  └ schema-name. ────┘└─ view-identifier. ──┘│
   └──────────────── alias. ─────────────────────┘
```

Parameters

schema-name

Specifies the schema with which the table or view identified by table-identifier or view-identifier is associated.

Note: For more information about using a schema name to qualify a table or view identifier, see Identifying Entities in Schemas.

table-identifier

Identifies a base table defined in the dictionary.

view-identifier

Identifies a view defined in the dictionary.

alias

Specifies the alias associated with the table or view to which the ROWID pseudo-column refers. The alias must be defined in the FROM parameter of the subquery, query specification, or SELECT statement that includes the ROWID.

Usage

Because the pseudo-column ROWID obviously becomes easily ambiguous when multiple tables or views are involved in an SQL statement, qualification is required in most, but the simplest statements.

Note: ROWID can generally also be used for tables associated with native VSAM files. However for KSDS native VSAM files ROWID cannot be used to directly access a KSDS record.

Examples

Using ROWID in a Simple SELECT Statement

```
SELECT ROWID, OFFICE_CODE_0450, OFFICE_CITY_0450
  FROM EMPSCHM.OFFICE;
*+
*+     ROWID     OFFICE_CODE_0450  OFFICE_CITY_0450
*+     --------  ----------------  ----------------
*+   X'01259701'  002               BOSTON
*+   X'0125A001'  001               SPRINGFIELD
*+   X'0125A301'  005               GLASSTER
*+   X'0125A601'  012               CAMBRIDGE
*+   X'0125A901'  008               WESTON
```

The values of ROWID are displayed as hexadecimal values, which in this case are also the values of the DBKEY for the OFFICE record in the non-SQL-defined schema EMPSCHM VERSION 100 of the demo employee database.

Using ROWID in the WHERE clause of a Searched UPDATE Statement

```
UPDATE EMPSCHM.EMPLOYEE SET EMP_CITY = 'BRUSSELS'
  WHERE ROWID = X'0124FF01';
```

The column EMP_CITY of the EMPLOYEE record in the non-SQL schema EMPSCHM VERSION 100 is updated for the record whose DBKEY is X'0124FF01'.

Using ROWID in a JOIN of a Base Table and a View

Both examples use DEFJE01.EMPLOYEEV which is defined as follows:

```
CREATE VIEW DEFJE01.EMPLOYEEV
    AS SELECT * FROM EMPSCHM.EMPLOYEE;
```

In the first example DEFJE01.EMPOFFV is defined as follows:

```
CREATE VIEW DEFJE01.EMPOFFV
 AS SELECT EV.*, O.*
  FROM EMPSCHM.OFFICE O, DEFJE01.EMPLOYEEV EV
 WHERE "OFFICE-EMPLOYEE";
```

The returned ROWID for the view is the ROWID of the EMPSCHM.OFFICE base table:

```
SELECT EOV.ROWID, D.ROWID, D.*, EMP_ID, OFFICE_CODE_0450
  FROM DEFJE01.EMPOFFV EOV, EMPSCHM.DEPARTMENT D
 WHERE "DEPT-EMPLOYEE" AND EMP_ID < 5;
*+
*+     ROWID         ROWID     DEPT_ID_0410
*+     --------      --------  ------------
*+  X'0125A001'   X'0125BD01'          100
*+  X'0125A001'   X'0125BC01'         3100
*+  X'0125A001'   X'0125AB01'         3200
*+
*+ DEPT_NAME_0410            DEPT_HEAD_ID_0410  EMP_ID
*+ ----------                -----------------  ------
*+ EXECUTIVE ADMINISTRATION                 30       1
*+ INTERNAL SOFTWARE                         3       3
*+ COMPUTER OPERATIONS                       4       4
*+
*+ OFFICE_CODE_0450
*+ ----------------
*+ 001
*+ 001
*+ 001
```

In the second example, DEFJE01.EMPOFFV is defined as follows:

```
CREATE VIEW DEFJE01.EMPOFFV
 AS SELECT EV.*, O.*
  FROM DEFJE01.EMPLOYEEV EV, EMPSCHM.OFFICE O
 WHERE "OFFICE-EMPLOYEE";
```

The returned ROWID for the view is the ROWID of the EMPSCHM.EMPLOYEE base table, which is the first base table in the view EMPLOYEEV.

```
SELECT EOV.ROWID, D.ROWID, D.*, EMP_ID, OFFICE_CODE_0450
  FROM DEFJE01.EMPOFFV EOV, EMPSCHM.DEPARTMENT D
 WHERE "DEPT-EMPLOYEE" AND EMP_ID < 5;
*+
*+  ROWID         ROWID     DEPT_ID_0410
*+  --------      --------  ------------
*+  X'01252801'   X'0125BD01'           100
*+  X'01253B01'   X'0125BC01'          3100
*+  X'01255301'   X'0125AB01'          3200
*+
*+  DEPT_NAME_0410           DEPT_HEAD_ID_0410  EMP_ID
*+  --------------           -----------------  ------
*+ EXECUTIVE ADMINISTRATION                30       1
*+ INTERNAL SOFTWARE                        3       3
*+ COMPUTER OPERATIONS                      4       4
*+
*+ OFFICE_CODE_0450
*+ ----------------
*+ 001
*+ 001
*+ 001
```

Searched Update of Records Without Primary Key

This example updates all the COVERAGE records of the employee with EMP_ID=23:

```
UPDATE EMPSCHM.COVERAGE C
  SET SELECTION_YEAR_0400 = 20
 WHERE C.ROWID IN (
           SELECT CI.ROWID
             FROM EMPSCHM.EMPLOYEE E, EMPSCHM.COVERAGE CI
            WHERE "EMP-COVERAGE"
              AND EMP_ID = 23);
*+ Status = 0        SQLSTATE = 00000
*+ 2 rows processed
```

Searched Delete of Records Without Primary Key

This example deletes all the COVERAGE records of the employee with EMP_ID=23:

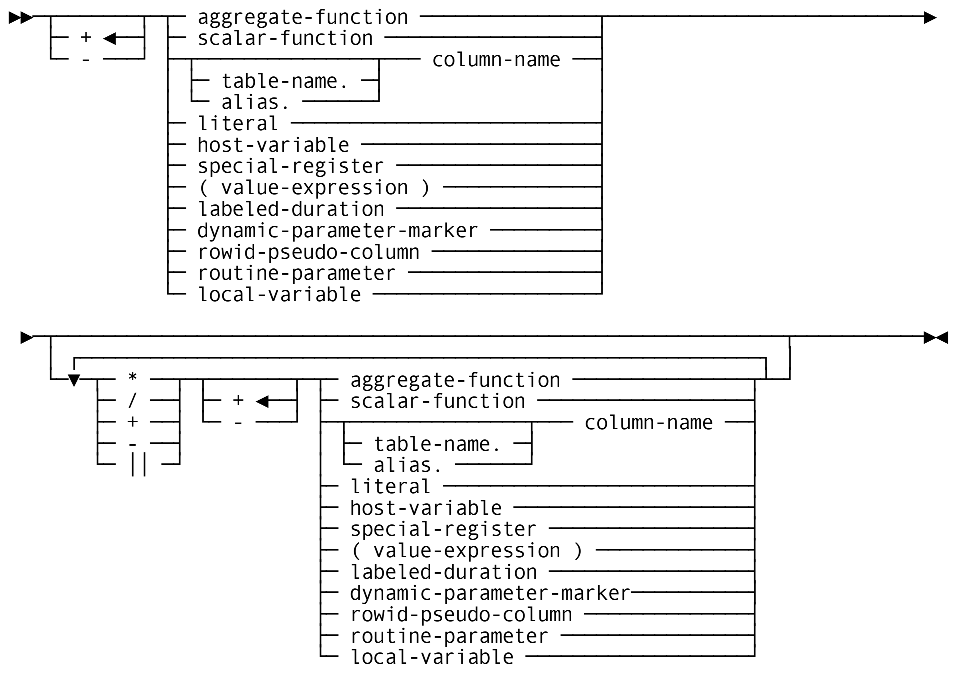
```
DELETE FROM EMPSCHM.COVERAGE C
 WHERE C.ROWID IN (
       SELECT CI.ROWID
         FROM EMPSCHM.EMPLOYEE E, EMPSCHM.COVERAGE CI
        WHERE "EMP-COVERAGE"
          AND EMP_ID = 23);
*+ Status = 0        SQLSTATE = 00000
*+ 2 rows processed
```

Expansion of Value-expression

The expanded parameters of value-expression represent a single data value or a set of one or more data values in an SQL statement.

Syntax

Expansion of value-expression



Parameters

+, -

Specifies the unary arithmetic operation to be performed on the operand that follows:

- **+** leaves the sign of the operand unchanged. A positive value remains positive. A negative value remains negative.
- **-** reverses the sign of the operand. A positive value becomes negative. A negative value becomes positive.

The default is +.

You can specify unary arithmetic operators with numeric operands only.

aggregate-function

Specifies an aggregate function to be used as an operand in the value expression. For expanded **aggregate-function** syntax, see Aggregate-function.

scalar-function

Specifies a scalar function to be used as an operand in the value expression. For expanded **scalar-function** syntax, see Expansion of Scalar-function.

column-name

Specifies a column to be used as an operand in the value expression. The expression is evaluated once for each value in the named column.

table-name.

Specifies the table, view, procedure or table procedure that includes the named column. For expanded **table-name** syntax, see Expansion of Table-name.

***alias*.**

Specifies the alias associated with the table, view, procedure or table procedure that includes the named column. The alias must be defined in the FROM parameter of the subquery, query specification, or SELECT statement that includes the value expression.

literal

Specifies a literal to be used as a single operand in the value expression. For expanded **literal** syntax, see Expansion of Literal.

host-variable

Specifies a host variable to be used as a single operand in the value expression. For expanded **host-variable** syntax, see Expansion of Host-variable.

special-register

Specifies a special register to be used as a single operand in the value expression. For expanded **special-register** syntax, see Expansion of Special-register.

(value-expression)

Specifies another value expression to be used as a single operand in the value expression. To be manipulated as a single operand, the value expression must be enclosed in parentheses.

labeled-duration

Specifies a labeled duration to be used as an operand in the value expression. For expanded **labeled-duration** syntax, see Expansion of Labeled-duration.

dynamic-parameter-marker

Specifies a dynamic parameter to be used as a single operand in the value expression. For expanded **dynamic-parameter-marker** syntax, see Expansion of Dynamic-parameter-marker.

rowid-pseudo-column

Requests the ROWID value to be determined when the SQL statement in which it appears is executed.

routine-parameter

Specifies a routine parameter to be used as a single operand in the value expression.

Note: For more information about expanded **routine-parameter** syntax, see Expansion of Routine-parameter.

local-variable

Specifies a local variable to be used as a single operand in the value expression.

Note: For more information about expanded **local-variable**, see Local Variables. (see page 81)

***, /, +, -, ||**

Specifies the binary arithmetic operation or concatenation operation to be performed on the operands preceding and following the operator.

Binary arithmetic operators are:

- ***** multiplies the first operand by the second operand
- **/** divides the first operand by the second operand
- **+** adds the second operand to the first operand
- **-** subtracts the second operand from the first operand

You can specify binary arithmetic operators with numeric operands only.

The concatenation operator is:

- || concatenates the second operand to the first operand

You can specify the concatenation operator with binary operands, character operands, or graphics operands.

Usage

Order of Evaluation

After evaluating the individual operands, CA IDMS performs the operations in a value expression in the following order:

1. Unary operations from left to right.
2. Multiplication and division from left to right.
3. Addition and subtraction from left to right.

You can use parentheses to override the default order of evaluation. Operations in parentheses are performed first.

For example, the result of the following value expression is 19:

```
10 * 2 - 1
```

When the subtraction operation is enclosed in parentheses, the result of the expression is 10:

```
10 * (2 - 1)
```

Unary Operators With Signed Numeric Literals

If the operand following a unary operator is a numeric literal that includes a plus or minus sign, the literal must be enclosed in parentheses.

Null Values in a Value Expression

If the value of any of the operands in a value expression is null, the result of the expression is a null value.

Data Type of the Result

The data type of the result of a value expression with one operand is the data type of the operand.

The data type of the result of a numeric value expression with multiple operands is the common data type corresponding to the data type of highest precedence in the expression, as determined by the rules for data type conversion in arithmetic operations.

This table shows the data type of the result of a concatenation operation for each allowable combination of operands:

Operand	Operand	Result
CHARACTER	CHARACTER	CHARACTER
CHARACTER	VARCHAR	VARCHAR
VARCHAR	VARCHAR	VARCHAR
BINARY	BINARY	CHARACTER
BINARY	CHARACTER	CHARACTER
BINARY	VARCHAR	CHARACTER
GRAPHIC	GRAPHIC	GRAPHIC
GRAPHIC	VARGRAPHIC	GRAPHIC
VARGRAPHIC	VARGRAPHIC	VARGRAPHIC

Note: For more information about data type conversion, see Comparison, Assignment, Arithmetic, and Concatenation Operations.

Examples

A Single Operand

In the SELECT statement below, the value expressions that identify the data to be selected each consist of a single operand. The first is a column, and the second two are aggregate functions.

```
select proj_leader_id, count(proj_id), avg(est_man_hours)
   from project
   group by proj_leader_id;
```

Multiple Operands

In the UPDATE statement below, the value expression that specifies the new value for SALARY_AMOUNT includes multiple operands. CA IDMS computes the new value by multiplying the value in the SALARY_AMOUNT column by .06, adding the result to the original value in SALARY_AMOUNT, and then adding the value in :MERIT_AMT to the result of the first addition.

```
EXEC SQL
UPDATE POSITION
   SET SALARY_AMOUNT = SALARY_AMOUNT + (SALARY_AMOUNT * .06)
                       + :MERIT_AMT
   WHERE EMP_ID = :EMPLOYEE-ID
END-EXEC
```

Durations

A duration is a value that represents a time interval. There are three kinds of duration:

- Labeled duration
- Date duration
- Time duration

Labeled Durations

A labeled duration represents a specific unit of time as expressed by a value expression followed by a duration keyword. Labeled duration appears in syntax as **labeled-duration**. For expanded **labeled-duration** syntax, see Expansion of Labeled-duration.

These are examples of labeled durations:

- 10 MINUTES
- :HV-INPUT YEARS
- SUM (HOURS_WORKED) HOURS

Date Duration

A date duration is a value of data type DECIMAL(8,0) that represents an interval of years, months, and days. The value must have the format *yyyymmdd* where *yyyy* represents the number of years, *mm* the number of months, and *dd* the number of days.

For example, the date duration 41027 represents 4 years, 10 months, and 27 days.

Time Duration

A time duration is a value of data type DECIMAL(6,0) that represents an interval of hours, minutes, and seconds. The value must have the format *hhmmss* where *hh* represents the number of hours, *mm* the number of minutes, and *ss* the number of seconds.

For example, the time duration 173306 represents 17 hours, 33 minutes, and 6 seconds.

Expansion of Labeled-duration

The expanded parameters of labeled-duration specify an interval of time in a unit of measure ranging from microseconds to years.

Syntax

Expansion of labeled-duration

```
►►─┬─ aggregate-function ──────────────────┬── YEAR ─────┬──────────────────►◄
   ├──────────────────┬── column-name ─┤   ├─ YEARS ────┤
   │ ├─ table-name. ─┤                 │   ├─ MONTH ────┤
   │ └─ alias. ──────┘                 │   ├─ MONTHS ───┤
   ├─ literal ─────────────────────────┤   ├─ DAY ──────┤
   ├─ host-variable ───────────────────┤   ├─ DAYS ─────┤
   ├─ value-expression ────────────────┤   ├─ HOUR ─────┤
   └─ dynamic-parameter-marker ────────┘   ├─ HOURS ────┤
                                           ├─ MINUTE ───┤
                                           ├─ MINUTES ──┤
                                           ├─ SECOND ───┤
                                           ├─ SECONDS ──┤
                                           ├─ MICROSECOND ─┤
                                           └─ MICROSECONDS ┘
```

Parameters

aggregate-function

Specifies the aggregate function that represents the value in the labeled duration. For expanded **aggregate-function** syntax, see Aggregate-function.

column-name

Specifies the column that represents the value in the labeled duration.

table-name.

Specifies the table, view, procedure or table procedure that includes the named column. For expanded **table-name** syntax, see Expansion of Table-name.

***alias*.**

Specifies the alias for the table, view, procedure or table procedure that includes the named column.

literal

Specifies the literal that represents the value in the labeled duration. For expanded **literal** syntax, see Expansion of Literal.

host-variable

Specifies the host variable that contains the value in the labeled duration. For expanded **host-variable** syntax, see Expansion of Host-variable.

value-expression

Specifies the value expression that represents the value in the labeled duration. For expanded **value-expression** syntax, see Expansion of Value-expression.

dynamic-parameter-marker

Specifies that the value in the labeled-duration statement is supplied as a dynamic parameter. For expanded **dynamic-parameter-marker** syntax, see Expansion of Dynamic-parameter-marker.

YEAR / YEARS

Indicates that the unit of measure of the duration is years.

MONTH / MONTHS

Indicates that the unit of measure of the duration is months.

DAY / DAYS

Indicates that the unit of measure of the duration is days.

HOUR / HOURS

Indicates that the unit of measure of the duration is hours.

MINUTE / MINUTES

Indicates that the unit of measure of the duration is minutes.

SECOND / SECONDS

Indicates that the unit of measure of the duration is seconds.

MICROSECOND / MICROSECONDS

Indicates that the unit of measure of the duration is microseconds.

Date/time Arithmetic

The only arithmetic operations that can be performed on date/time values are addition and subtraction.

Date/time Addition

If a date/time value is the operand of addition, the other operand must be a duration. These rules govern the use of the addition operator with date/time values:

- If one operand is a date, the other operand must be a date duration or labeled duration of years, months, or days
- If one operand is a time, the other operand must be a time duration or a labeled duration of hours, minutes, or seconds
- If one operand is a timestamp, the other operand must be a duration

Date/time Subtraction

The rules for the use of the subtraction operator on date/time values differ from those for addition. The tables below describe the rules for using the subtraction operator with date/time values.

Note: The second operand cannot be a timestamp.

First Operand Rules

If the first operand is	The second operand must be
A date	■ A date ■ A date duration ■ A string representation of a date ■ A labeled duration of years, months or days
A time	■ A time ■ A time duration ■ A string representation of a time ■ A labeled duration of hours, minutes, or seconds
A timestamp	A duration

Second Operand Rules

If the second operand is	The first operand must be
A date	■ A date ■ A string representation of a date
A time	■ A time ■ A string representation of a time

Date Arithmetic

Dates can be subtracted, incremented, or decremented.

Subtracting Dates

The result of subtracting one date from another date is a date duration in the form *yyyymmdd* that specifies the number of years, months, and days between the two dates. The data type of the result is DECIMAL(8,0).

In the expression D1 - D2, where D1 and D2 are date values:

```
If D1 is greater than or equal to D2,
D2 is subtracted from D1

If D1 is less than D2,
D1 is subtracted from D2, and the sign of the result is made negative
```

Date Subtraction Procedures

These are the procedures used to obtain a result R in the expression R = D1 - D2 where D1 and D2 are date values:

```
If DAY(D2) < = DAY(D1),
then DAY(R) = DAY(D1) - DAY(D2).

If DAY(D2) > DAY(D1),
then DAY(R) = N + DAY(D1) - DAY(D2)
where N = the last day of MONTH(D2).
MONTH(D2) is then incremented by 1.

If MONTH(D2) < = MONTH(D1),
then MONTH(R) = MONTH(D1) - MONTH(D2).

If MONTH(D2) > MONTH(D1),
then MONTH(R) = 12 + MONTH(D1) - MONTH(D2).
YEAR(D2) is then incremented by 1.

YEAR(R) = YEAR(D1) - YEAR(D2).
```

Example of Subtracting Dates

The result of DATE('12/31/2000') - DATE('8/10/1999') is 10421, representing a duration of 1 year, 4 months, and 21 days.

Arithmetic with a Date and a Duration

What You Can Do

The result of adding a duration to a date or subtracting a duration from a date is a date. The result must fall in the range of dates from January 1, 0001 to December 31, 9999.

:warning. If an invalid date is calculated during an UPDATE STATEMENT, the target column remains unchanged. An invalid date can be calculated during "Operations with a Duration of Years" or "Operations with a Duration or Months."

Operations with a Duration of Years

Adding or subtracting a duration of years affects the year of the resulting date but does not affect the month or day unless the result is February 29 of a non-leap year. In this case, the day portion is set to 28. When this adjustment is required, a warning message is issued.

For example, the result of DATE('5/1/1998') + 3 YEARS is '5/1/2001'.

Operations with a Duration of Months

Adding or subtracting a duration of months affects the month and potentially the year of the resulting date. The day portion of the date is unchanged unless the result is an invalid date, such as June 31. When an invalid date is calculated, CA IDMS returns a warning message. If the invalid date is calculated during a SELECT statement, the date is set to the last day of the month.

For example, the result of DATE ('10/31/2001') - 1 MONTH is '9/30/2001'.

Operations with a Duration of Days

Adding or subtracting a duration of days affects the day of the resulting date and potentially the month and year.

For example, the result of DATE ('12/15/2000') + 45 DAYS is '1/29/2001'.

Operations with Date Durations

Date durations of data type DECIMAL (8,0) in the form *yyyymmdd* may also be added to and subtracted from dates. The date duration may be a positive or negative value.

The result is a date that has been incremented or decremented by the specified number of years, months, and days, respectively. Thus, D1 + N, where N is a positive date duration, is equivalent to this expression:

```
D1 + YEAR(N) YEARS + MONTH(N) MONTHS + DAY(N) DAYS
```

For example, the result of DATE('4/13/2001') + 101 is '5/14/2001'.

Note: Leading zeros are dropped. Therefore, 101 is the same as 00000101.

Reversing Operations with Date Durations

If you add duration 100 (one month) to date D1, obtaining result R, R - 100 may not necessarily equal D1 because the operation D1 + 100 may require an end-of-the-month adjustment. For example:

```
DATE('8/31/2001') + 100 = '9/30/2001'
```

However:

```
DATE('9/30/2001') - 100 = '8/30/2001'
```

Time Arithmetic

Times can be subtracted, incremented, or decremented.

Subtracting Times

The result of subtracting one time (T2) from another (T1) is a time duration in the form *hhmmss* that specifies the number of hours, minutes, and seconds between the two times. The data type of the result is DECIMAL (6,0).

In the expression T1 - T2, where T1 and T2 are time values:

```
If T1 is greater than or equal to T2,
T2 is subtracted from T1

If T1 is less than T2,
T1 is subtracted from T2, and the sign of the result is made negative
```

Time Subtraction Procedures

These are the procedures used to obtain a result R in the expression R = T1 - T2 where T1 and T2 are time values:

```
SECOND(T2) < = SECOND(T1),
then SECOND(R) = SECOND(T1) - SECOND(T2).

If SECOND(T2) > SECOND(T1),
then SECOND(R) = 60 + SECOND(T1) - SECOND(T2).
MINUTE(D2) is then incremented by 1.

If MINUTE(T2) < = MINUTE(T1),
then MINUTE(R) = MINUTE(T1) - MINUTE(T2).

If MINUTE(T2) > MINUTE(T1),
then MINUTE(R) = 60 + MINUTE(T1) - MINUTE(T2).
HOUR(T2) is then incremented by 1.

HOUR(R) = HOUR(T1) - HOUR(T2).
```

For example, the result of TIME ('16:43:17') - TIME('14:30:00') is 21317, representing a duration of 2 hours, 13 minutes and 17 seconds.

Arithmetic with a Duration and a Time

What is the Result?

The result of adding a duration to a time, or of subtracting a duration from a time, is a time.

Operations With a Duration of Hours

Adding or subtracting a duration of hours affects the hours of the resulting time. The minutes and seconds are unchanged.

For example, the result of TIME ('16:43:17') + 3 HOURS is '19:43:17'.

Operations With a Duration of Minutes

Adding or subtracting a duration of minutes affects the minutes and potentially the hours of the resulting time. The second's portion of the time is unchanged.

For example, the result of TIME ('16:43:17') + 30 MINUTES is '17:13:17'.

Operations With a Duration of Seconds

Adding or subtracting a duration of seconds affects the seconds and potentially the minutes and hours of the resulting time.

For example, the result of TIME ('16:43:17') + 51 SECONDS is '16:44:08'.

Note: In arithmetic with a time and a duration, overflow or underflow ofhours is discarded.

Operations With Time Durations

Time durations of a data type DECIMAL(6,0) may also be added to and subtracted from times. The time duration may be a positive or negative value.

The result is a time that has been incremented or decremented by the specified number of hours, minutes, and seconds, respectively. Thus, T1 + N, where N is a positive time duration, is equivalent to this expression:

```
T1 + HOUR(N) HOURS + MINUTE(N) MINUTES + SECONDS(N) SECONDS
```

For example, the result of TIME ('16:43:17') + 32114 is '20:08:31'.

Timestamp Arithmetic

Timestamps can be incremented, or decremented. The result of adding a duration to a timestamp, or of subtracting a duration from a timestamp, is a timestamp.

Timestamp arithmetic is performed as described for date and time arithmetic except that an overflow or underflow of hours is carried into the date part of the result.

Precedence of Operations

Expressions within parentheses are evaluated first. When the order of evaluation is not specified by parentheses:

- Prefix operators are applied before multiplication and division
- Multiplication and division are applied before addition and subtraction
- Operators at the same precedence level are applied from left to right

Expansion of XML-value-expression

The expanded parameters of XML-value-expression specify XML values.

Note: For more information about XML values, see XML Data Type and XML Values.

Syntax

Expansion of XML-value-expression

```
►──────┬── XML-value-function ──┬─────────────────────────────►◄
       └── subquery ────────────┘
```

Parameters

XML-value-function

Specifies an **XML-value-function** that returns an XML value. See Expansion of XML-value-function, for more information.

subquery

Specifies a **subquery** that must return a single XML value or the NULL value. See Subqueries, for more information.

Chapter 5: Functions

This section contains the following topics:

Aggregate-function

An aggregate function is a function whose argument includes one or more columns and which operates on one or more rows. The result of an aggregate function is a single value. This value is derived from the sets of values in the columns named in the argument.

The set of values is derived from the result table or from each group of results if the associated query contains a GROUP BY.

Expansion of Aggregate-function

The expanded parameters of aggregate-function represent an aggregate function in an SQL statement.

Syntax

Expansion of aggregate-function

```
►►─┬─┬─ AVG ─┬─ ( ─┬─┬──────────────┬─┬──────────────┬─ column-name ─┬─ ) ─┬─►◄
   │ ├─ MAX ─┤     │ └─ DISTINCT ─┘ ├─ table-name. ─┤               │     │
   │ ├─ MIN ─┤     │                └─ alias. ──────┘               │     │
   │ └─ SUM ─┘     └─ all value-expression ─────────────────────────┘     │
   └─ COUNT ( ─┬─ * ─────────────────────────────────────────── ) ────────┘
               └─┬──────────────┬─┬──────────────┬─ column-name ─┘
                 └─ DISTINCT ─┘ ├─ table-name. ─┤
                                └─ alias. ──────┘
```

Parameters

AVG

Computes the arithmetic mean of the non-null values specified by the argument.

If no rows are found for the function, or if all rows found contain null values, the result of the function is null.

MAX

Finds the largest of the non-null values specified by the argument.

If no rows are found for the function, or if all rows found contain null values, the result of the function is null.

MIN

Finds the smallest of the non-null values specified by the argument.

If no rows are found for the function, or if all rows found contain null values, the result of the function is null.

SUM

Computes the total of the non-null values specified by the argument.

If no rows are found for the function, or if all rows found contain null values, the result of the function is null.

DISTINCT

Directs CA IDMS to exclude both duplicate values and null values from the set of values identified by *column-name* before evaluating the function.

If you do not specify DISTINCT, CA IDMS excludes only null values.

column-name

Specifies the set of values in the named column. CA IDMS excludes null values from the set before evaluating the function.

For AVG and SUM, the named column must have an approximate or exact numeric data type.

table-name

Specifies the table, view, procedure or table procedure that includes the named column. For expanded **table-name** syntax, see Expansion of Table-name.

alias

Specifies the alias associated with the table, view, procedure or table procedure that includes the named column. The alias must be defined in the FROM parameter of the subquery, query specification, or SELECT statement that includes the aggregate function.

all value-expression

Specifies the set of values derived from the evaluation of a value expression. Null values are excluded from the set before the function is evaluated.

When used as the argument of an aggregate function, **value-expression**:

- Must include at least one column reference
- Cannot include another aggregate function (that is, you cannot nest aggregate functions)
- Cannot include both arithmetic operators and outer references

  Note: For more information about outer references, see Subqueries. (see page 238)

For AVG and SUM, the values in the set must have an approximate or exact numeric data type.

The keyword ALL is optional and does not affect the evaluation of the function. For expanded **value-expression** syntax, see Expansion of Value-expression.

COUNT

Counts the number of rows where the column identified by the argument contains non-null values.

If no rows are found for the function, or if all rows found contain null values, the result of the function is 0.

*****

Counts the rows in the requested grouping, if any, of the result table.

Usage

The DISTINCT and ALL Parameters with MAX and MIN

When the argument of the MAX or MIN function is a single column, the result of the function is the same whether you use the DISTINCT parameter. However, CA IDMS evaluates the function more efficiently when you omit DISTINCT.

Aggregate Functions with Grouped Tables

When used in a subquery, query-specification, or SELECT statement that includes the GROUP BY parameter, aggregate functions are evaluated once for each group in the table.

If there is no GROUP BY parameter, aggregate functions are evaluated once for the entire result table.

Data Types of Function Results

Function	Data type of the value returned
AVG	Determined by the rules for data type conversion in arithmetic operations
COUNT	INTEGER
MAX	Same as the data type of the values specified by the argument
MIN	Same as the data type of the values specified by the argument
SUM	Determined by the rules for data type conversion in arithmetic operations

Note: For more information about data type conversion, see Comparison, Assignment, Arithmetic, and Concatenation Operations. (see page 66)

Examples

Finding an Average

The following SELECT statement returns the average number of days employees took as vacation time or sick time in the 1989 fiscal year:

```
select avg(vac_taken + sick_taken)
   from benefits
   where fiscal_year = '89';
```

Counting Rows that Satisfy a Condition

The following SELECT statement counts the insurance plans not currently used by any employees:

```
select count(*)
   from insurance_plan
   where plan_code not in
      (select plan_code
         from coverage);
```

Counting Rows in Table Groupings

The following SELECT statement counts the number of different jobs in each department:

```
select d.dept_id, d.dept_name, count(distinct p.job_id)
   from department d, employee e, position p
   where d.dept_id = e.dept_id
      and e.emp_id = p.emp_id
   group by d.dept_id, d.dept_name;
```

Selecting the Largest Value

The following SELECT statement identifies the jobs that have the largest number of positions open:

```
select job_id, job_title, num_open
   from job
   where num_open =
      (select max(num_open)
         from job);
```

More Information

- For more information about subqueries and query specifications, see Query Specifications, Subqueries, Query Expressions, and Cursor Specifications.
- For more information about the SELECT statement, see SELECT.

More Information:

Query Specifications, Subqueries, Query Expressions, and Cursor Specifications (see page 231)
SELECT (see page 518)

Scalar Function

A scalar function is a function that operates on 0 or more value expressions and returns a single value. This value is derived from the expression or expressions named in the function arguments.

Scalar functions can be user-defined or built-in. User-defined functions are defined using a CREATE FUNCTION statement. Built-in functions are known to the DBMS but are not explicitly defined. All built-in functions are provided as part of CA IDMS SQL. During the installation of CA IDMS, a large number of generally useful user-defined functions is defined into the SYSCA schema. For detailed descriptions of the CA-supplied scalar functions, see CA IDMS Scalar Functions.

Expansion of Scalar-function

A scalar function operates on 0 or more value expressions, resulting in a single value.

Syntax

Expansion of scalar-function

```
►►──┬──user-defined-function ──────────────┬──────────────────────────────►◄
    ├─ ABS-function ───────────────────────┤
    ├─ ACOS-function ──────────────────────┤
    ├─ ASIN-function ──────────────────────┤
    ├─ ATAN-function ──────────────────────┤
    ├─ ATAN2-function ─────────────────────┤
    ├─ CAST-function ──────────────────────┤
    ├─ CEIL-function ──────────────────────┤
    ├─ CEILING-function ───────────────────┤
    ├─ CHAR-function ──────────────────────┤
    ├─ CHAR_LENGTH-function ───────────────┤
    ├─ CHARACTER_LENGTH-function ──────────┤
    ├─ COALESCE-function ──────────────────┤
    ├─ CONCAT-function ────────────────────┤
    ├─ CONVERT-function ───────────────────┤
    ├─ COS-function ───────────────────────┤
    ├─ COSH-function ──────────────────────┤
    ├─ COT-function ───────────────────────┤
    ├─ CURDATE-function ───────────────────┤
    ├─ CURTIME-function ───────────────────┤
    ├─ DATABASE-function ──────────────────┤
    ├─ DATE-function ──────────────────────┤
    ├─ DAY-function ───────────────────────┤
    ├─ DAYNAME-function ───────────────────┤
    ├─ DAYOFMONTH-function ────────────────┤
    ├─ DAYOFWEEK-function ─────────────────┤
    ├─ DAYOFYEAR-function ─────────────────┤
    ├─ DAYS-function ──────────────────────┤
    ├─ DECIMAL-function ───────────────────┤
    ├─ DEGREES-function ───────────────────┤
    ├─ DIGITS-function ────────────────────┤
    ├─ EXP-function ───────────────────────┤
    ├─ FLOAT-function ─────────────────────┤
    ├─ FLOOR-function ─────────────────────┤
    ├─ HEX-function ───────────────────────┤
    ├─ HOUR-function ──────────────────────┤
    ├─ IFNULL-function ────────────────────┤
    ├─ INSERT-function ────────────────────┤
    ├─ INTEGER-function────────────────────┤
    ├─ LCASE-function  ────────────────────┤
    ├─ LEFT-function   ────────────────────┤
    ├─ LENGTH-function ────────────────────┤
    ├─ LOCATE-function ────────────────────┤
    ├─ LOG-function    ────────────────────┤
    ├─ LOG10-function  ────────────────────┤
    ├─ LOWER-function  ────────────────────┤
    ├─ LTRIM-function  ────────────────────┤
    ├─ MICROSECOND-function────────────────┤
    ├─ MINUTE-function─────────────────────┤
    ├─ MOD-function    ────────────────────┤
    ├─ MONTH-function ─────────────────────┤
    ├─ MONTHNAME-function ─────────────────┤
    ├─ NOW-function ───────────────────────┤
    ├─ OCTET_LENGTH-function ──────────────┤
    ├─ PI-function ────────────────────────┤
    ├─ POSITION-function  ─────────────────┤
    ├─ POWER-function  ────────────────────┤
    ├─ PROFILE-function────────────────────┤
    ├─ QUARTER-function────────────────────┤
    ├─ RADIANS-function──────────────────────────┤
    ├─ RAND-function─────────────────────────────┤
    ├─ REPEAT-function───────────────────────────┤
    ├─ REPLACE-function──────────────────────────┤
    ├─ RIGHT-function  ──────────────────────────┤
    ├─ ROUND-function  ──────────────────────────┤
    ├─ RTRIM-function  ──────────────────────────┤
    ├─ SECOND-function ──────────────────────────┤
    ├─ SIGN-function   ──────────────────────────┤
    ├─ SIN-function    ──────────────────────────┤
    ├─ SINH-function   ──────────────────────────┤
    ├─ SPACE-function  ──────────────────────────┤
    ├─ SQRT-function   ──────────────────────────┤
    ├─ SUBSTR-function ──────────────────────────┤
    ├─ SUBSTRING-function ───────────────────────┤
    ├─ TAN-function ─────────────────────────────┤
    ├─ TANH-function ────────────────────────────┤
    ├─ TIME-function ────────────────────────────┤
    ├─ TIMESTAMP-function ───────────────────────┤
    ├─ TRIM-function ────────────────────────────┤
    ├─ TRUNCATE-function─────────────────────────┤
    ├─ UCASE-function ───────────────────────────┤
    ├─ UPPER-function ───────────────────────────┤
    ├─ USER-function ────────────────────────────┤
    ├─ VALUE-function ───────────────────────────┤
    ├─ VARGRAPHIC-function───────────────────────┤
    ├─ WEEK-function ────────────────────────────┤
    ├─ XMLPOINTER-function───────────────────────┤
    ├─ XMLSERIALIZE-function─────────────────────┤
    └─ YEAR-function ────────────────────────────┘
```

Parameters

user-defined-function

Specifies to invoke a user-defined function. See Expansion of User-defined-function, for more information about expanded user-defined-function syntax.

The remaining parameters are used to invoke a CA IDMS scalar function.

Note: For more information about the CA-supplied scalar functions, see CA IDMS Scalar Functions (see page 124).

Usage

Built-in Versus User-Defined Functions

The scalar functions that are provided by CA IDMS are implemented as built-in functions or user-defined functions. Built-in functions are not defined in the dictionary. The user-defined functions provided by CA IDMS are defined in the SYSCA schema during installation.

How a function is implemented is significant for two reasons:

- User-defined functions cannot be referenced in a table's check constraint
- The number of user-defined functions that can be referenced in an SQL statement is limited

Note: For more information about how to determine the implementation of a CA IDMS supplied scalar function, see CA IDMS Scalar Functions (see page 124).

More information:

CA IDMS Scalar Functions (see page 124)

CA IDMS Scalar Functions

This section describes the scalar functions provided by CA IDMS including their purpose, syntax, parameters, usage considerations, and examples.

ABS-function

Syntax

```
►►─ ABS ( value-expression ) ────────►◄
```

ABS returns the absolute value of the value-expression, which must have a numeric data type.

The result has the same data type as the value-expression. If the value-expression is null, the result is the null value. If a data error occurs, an exception is raised.

Example The following statement returns 125:

```
SELECT ABS(-125)
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

ACOS-function

Syntax

```
►►─ ACOS ( value-expression ) ────────►◄
```

ACOS returns the arccosine of the value-expression as an angle expressed in radians. ACOS is the inverse function of the COS function.

The **value-expression** must be of any numeric data type and must have a value in the range of -1 to 1. It is converted to a double precision floating-point number for processing by this function.

The result of the function is a double precision floating-point number. If the value-expression is null, the result is the null value. If a data error occurs, an exception is raised.

Example

The following statement returns 7.9539883018414370E-01:

```
SELECT ACOS(0.7)
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

ASIN-function

Syntax

```
►►─ ASIN ( value-expression ) ────────►◄
```

ASIN returns the arcsine of the value-expression as an angle expressed in radians ASIN is the inverse function of the SIN function.

The **value-expression** must be of any numeric type and must have a value in the range of -1 to 1. It is converted to a double precision floating-point number for processing by this function.

The result of the function is a double precision floating-point number. If the value-expression is null, the result is the null value. If a data error occurs, an exception is raised.

Example The following statement returns 1.5707963267948966E+00:

```
SELECT ASIN(1)
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

ATAN-function

Syntax

```
►►─ ATAN ( value-expression ) ────────►◄
```

ATAN returns the arctangent of the value-expression as an angle expressed in radians. ATAN is the inverse function of the TAN function.

The **value-expression** must be of any numeric data type. It is converted to a double precision floating-point number for processing by this function.

The result of the function is a double precision floating-point number. If the value-expression is null, the result is the null value. If a data error occurs, an exception is raised.

Example The following statement returns 1.2490457723982544E+00

```
SELECT ATAN(3)
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

ATAN2-function

Syntax

```
►►─ ATAN2 ( value-expression1, value-expression2 ) ────────►◄
```

Parameters

value-expression1

Specifies a numeric value-expression. See Expansion of Value-expression.

value-expression2

Specifies a numeric value-expression. See Expansion of Value-expression.

ATAN2 returns the arctangent of x and y coordinates, given by value-expression1 and value-expression2 respectively, as an angle expressed in radians.

Both value-expressions must be of any numeric data type and cannot both be 0. They are converted to double precision floating-point numbers for processing by this function.

The result of the function is a double precision floating-point number. If the value-expression is null, the result is the null value. If a data error occurs, an exception is raised.

Example: The following statement returns 1.2490457723982544E+00

```
SELECT ATAN2(1,3)
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

CAST-function

Syntax

```
►►── CAST ( ─┬─ value-expression ─┬─ AS data-type ) ────►◄
             └─ NULL ─────────────┘
```

The CAST function forces conversion of the **value-expression** to a specified data type.

CAST allows:

- All conversions that can be made without the CAST function
- A **numeric value to character value** conversion, which creates a display version of the numeric data type and follows truncation rules for the numeric data type

When an *approximate* numeric value is cast to a character value, the value is converted to an external floating point representation. Trailing zeros removed from the mantissa except in the first place to the right of the decimal point.

The maximum number of digits in the mantissa is 6 for a REAL value and 13 for a DOUBLE PRECISION value. The exponent is an integer value with at least one digit. A negative value in either the mantissa or the exponent is preceded by a sign character.

These are examples of casting REAL data values to character values:

REAL data value	Character value through CAST
1.0098999E+02	1.009899E2
1.9899997E+00	1.989999E0
0.0000000E+00	0.0E0
9.9999964E-02	9.999996E-2

When an *exact* numeric value is cast to a character value, the numeric value is left-justified, with leading zeros removed except in the first place to the left of the decimal point and trailing zeros removed except in the first place to the right of the decimal point. Negative values are preceded by a sign character.

These are examples of casting exact numeric values:

Exact numeric value	Character value through CAST
001234.56	1234.56
00.123456	0.123456
-6.7000	-6.7
666.0000	666.0
666	666

A character value to numeric value conversion extracts the numeric value from the string in either decimal or floating point notation. The character value can have leading or trailing blanks but cannot have extraneous characters (for example, more than one sign or more than one decimal point).

A **character value to graphics value** conversion converts the character string to its DBCS equivalent and truncates or pads the result to conform to the length in the data type specification.

Note: For more information about assignment rules in conversions, see Comparison, Assignment, Arithmetic, and Concatenation Operations. (see page 66)

Parameters

NULL

Forces conversion of a null value to a specified data type.

AS data-type

Identifies the data type to which the **value-expression** or null value is to be converted. Expansion of **data-type** is presented under Expansion of Data-type.

CEIL or CEILING-function

Syntax

```
►►─┬─ CEIL ────┬─ (value-expression) ───►◄
   └─ CEILING ─┘
```

CEILING returns the smallest integer value that is greater than or equal to the value-expression. CEIL and CEILING are identical.

The **value-expression** must be of any numeric data type.

The result of the function has the same data type as the value-expression except that the scale is 0 if the value-expression is of type (UNSIGNED) DECIMAL or (UNSIGNED) NUMERIC. For example, a value-expression with a data type of NUMERIC(3,2) results in NUMERIC(3,0). If the value-expression is null, the result is the null value. If a data error occurs, an exception is raised.

Example

The following statement returns: 13   2.0000000000000000E+00   -12

```
SELECT CEILING(12.55), CEILING(123.1E-2), CEILING (-12.55)
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

CHAR-function

Syntax

```
►►─ CHAR ( value-expression ─┬─────────────────────────────┬─ ) ─►◄
                             ├─ , ── ISO ──────────────────┤
                             ├─ , ── USA ──────────────────┤
                             ├─ , ── EUR ──────────────────┤
                             ├─ , ── JIS ──────────────────┤
                             └─ , ── exact-numeric-literal ┘
```

CHAR obtains a character string representation from the value in value-expression. The syntax and semantics for the CHAR function depends on the data type of **value-expression**.

- Data type of value-expression is an exact numeric data: INTEGER, SMALLINT, OR LONGINT.
- CHAR returns a fixed-length character string representation of the exact numeric value of value-expression. Specifying a second parameter is not allowed. The result is left-justified and contains *n* characters corresponding to the digits of the value of value-expression with a preceding minus sign if the value-expression is negative. The length of the returned string depends on the data type of value-expression. A SMALLINT data type has a result length of 6. An INTEGER has a result length of 11 and a LONGINT has a result length of 20.
- Example:

```
SELECT CHAR(FIXLENGTH), LENGTH(CHAR(FIXLENGTH)) AS LEN_SMALLINT
       , CHAR(NUMROWS) , LENGTH(CHAR(NUMROWS))   AS LEN_INTEGER
FROM SYSTEM.TABLE WHERE NAME = 'TABLE';

*+ CHAR(FUNCTION)  LEN_SMALLINT  CHAR(FUNCTION)  LEN_INTEGER
*+ --------------  ------------  --------------  -----------
*+ 256                        6  33                       11
*+ 0                          6  0                        11
```

- Data type of value-expression is a fixed point, packed or zoned decimal: (UNSIGNED) DECIMAL, (UNSIGNED) NUMERIC.
- CHAR returns a fixed-length character string representation of the value of value-expression. Specifying a second parameter is not allowed. If value-expression has a precision of p and a scale of s, the result contains p+2 characters as follows: a blank or minus sign, depending on the sign of value-expression, p-s digits followed by a period and finally s digits. The result is left-justified.

- Example:

```
SELECT VAC_TIME, CHAR(-VAC_TIME)
     , LENGTH(CHAR(VAC_TIME))
  FROM DEMOEMPL.EMP_VACATION WHERE VAC_TIME > 300
*+
*+               VAC_TIME  CHAR(FUNCTION)          (CONST)
*+               --------  --------------           -------
*+                 340.00  -340.0                        33
*+                 396.00  -396.0                        33
*+                 484.00  -484.0                        33
*+
```

- Data type of value-expression is a floating-point data type: REAL, FLOAT or DOUBLE PRECISION
- CHAR returns a fixed-length character string representation of the floating point value of value-expression. Specifying a second parameter is not allowed. The result is left justified and contains 24 characters.
- Example:

```
SELECT AVGROWLENGTH, CHAR(AVGROWLENGTH)
       ,  LENGTH(CHAR(AVGROWLENGTH)) AS L24
  FROM SYSTEM.TABLE WHERE NAME = 'TABLE';
*+
*+   AVGROWLENGTH  CHAR(FUNCTION)               L24
*+   ------------  --------------               ---
*+   2.5600000E+02  2.56E2                        24
*+   0.0000000E+00  0.0E0                         24
```

- Data type of value-expression is a character data type CHAR, VARCHAR.
- CHAR returns a fixed-length character string representation of the value of value-expression. An exact-numeric-literal can be specified as a second parameter, in which case it defines the length of the result. The value of exact-numeric-literal must be in the range 0-255. If the length of value-expression is lower than exact-numeric-literal the result will be padded with blanks on the right, else if the length is larger, truncation will occur and, if nonblank characters are truncated, a warning message is issued.

- Example:

```
SELECT CHAR(NAME,4), LENGTH(CHAR(NAME, 4)) AS LEN
  FROM SYSTEM.TABLE WHERE NAME = 'TABLE';
*+ DB001043 T375 C1M322: String truncation
*+ DB001043 T375 C1M322: String truncation
*+
*+ CHAR(FUNCTION)     LEN
*+ --------------     ---
*+ TABL                 4
*+ TABL                 4
```

- Data type of value-expression is DATE, TIME, or TIMESTAMP.

If no format (ISO, USA, EUR, JIS) is specified for the character string, the result is returned in ISO format or, if the SQL statement is embedded in a program, the format specified in a precompiler option.

Note: For information about specifying precompiler options, see the *CA IDMS SQL Programming Guide*.

Parameters

ISO

Specifies that the format of the result should comply with the standard of the International Standards Organization (ISO). Formats used when ISO is specified are:

Data type	Format	Example
DATE	*yyyy-mm-dd*	1990-12-15
TIME	*hh.mm.ss*	16.43.17
TIMESTAMP	*yyyy-mm-dd-hh.mm.ss.nnnnnn*	1990-12-15-16.43.17.123456

USA

Specifies that the format of the result should comply with the standard of the IBM USA standard. Formats used when USA is specified are:

Data type	Format	Example
DATE	*mm/dd/yyyy*	12/15/1990
TIME	*hh*:*mm* AM *hh*:*mm* PM	4:43 PM
TIMESTAMP	*yyyy-mm-dd-hh.mm.ss.nnnnnn*	1990-12-15-16.43.17.123456

EUR

Specifies that the format of the result should comply with the standard of the IBM European standard. Formats used when EUR is specified are:

Data type	Format	Example
DATE	*dd.mm.yyyy*	15.12.1990
TIME	*hh.mm.ss*	16.43.17
TIMESTAMP	*yyyy-mm-dd-hh.mm.ss.nnnnnn*	1990-12-15-16.43.17.123456

JIS

Specifies that the format of the result should comply with the standard of the Japanese Industrial Standard Christian Era. Formats used when JIS is specified are:

Data type	Format	Example
DATE	*yyyy-mm-dd*	1990-12-15
TIME	*hh:mm:ss*	16:43:17
TIMESTAMP	*yyyy-mm-dd-hh.mm.ss.nnnnnn*	1990-12-15-16.43.17.123456

CHAR_LENGTH or CHARACTER_LENGTH-functions

Syntax

```
►►─┬─ CHAR_LENGTH ──────┬─ ( value-expression ) ─────►◄
   └─ CHARACTER_LENGTH ─┘
```

CHAR_LENGTH (or CHARACTER_LENGTH) obtains the length of the value in **value-expression**.

The result of the CHAR_LENGTH (or CHARACTER_LENGTH) function is an integer.

The length of a value depends on its data type:

Data type	Length
BINARY	The number of bytes which contain the value
CHARACTER VARCHAR	The actual number of characters in the string, including blanks
GRAPHIC VARGRAPHIC	The number of DBCS characters

COALESCE-function

The COALESCE scalar function is identical to the VALUE scalar function, so they are listed together. See VALUE or COALESCE-function for more information.

CONCAT-function

Syntax

```
▶▶─ CONCAT ( value-expression1, value-expression2 ) ─────────▶◀
```

Parameters

value-expression1

Specifies a character string value-expression. See Expansion of Value-expression for more information.

value-expression2

Specifies a character string value-expression. See Expansion of Value-expression for more information.

CONCAT (value-expression1, value-expression2) is equivalent to value-expression1 || value-expression2. '||' is the concatenation operator and concatenates the value-expression2 to value-expression1.

value-expression1 and value-expression2 can be of BINARY, CHARACTER, VARCHAR, GRAPHICS, or VARGRAPHIC data type.

If any of the value-expressions are null, the result is the null value.

Example

The following statement returns 'A1B2C3':

```
SELECT  CONCAT(CONCAT('A1', 'B2'), 'C3')
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

CONVERT-function

Syntax

```
▶▶─ CONVERT ( value-expression, data-type ) ─────────▶◀
```

CONVERT is semantically equivalent with CAST. See CAST-function for more information.

Example

The following statement returns 1.1999999999999999E+00:

```
SELECT CONVERT (1.2, DOUBLE PRECISION)
        FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

COS-function

Syntax

```
►►─ COS ( value-expression ) ────────►◄
```

COS returns the cosine of the value-expression, which must be an angle expressed in radians. COS is the inverse function of the ACOS function.

The **value-expression** must be of any numeric data type. It is converted to a double precision floating-point number for processing by this function.

The result of the function is a double precision floating-point number. If the value-expression is null, the result is the null value. If a data error occurs, an exception is raised.

Example

The following statement returns 7.0000000000000037E-01

```
SELECT  COS(7.9539883018414370E-01 )
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

COSH-function

Syntax

```
►►─ COSH( value-expression ) ────────►◄
```

COSH returns the hyperbolic cosine of the value-expression, which must be an angle expressed in radians.

The **value-expression** must be of any numeric data type. It is converted to a double precision floating-point number for processing by this function.

The result of the function is a double precision floating-point number. If the value-expression is null, the result is the null value. If a data error occurs, an exception is raised.

Example

The following statement returns 1.5430806348152437E+00:

```
SELECT  COSH (1)
     FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

COT-function

Syntax

```
►►─ COT ( value-expression ) ────────►◄
```

COT returns the cotangent of the value-expression, which must be an angle expressed in radians.

The **value-expression** must be of any numeric data type. It is converted to a double precision floating-point number for processing by this function.

The result of the function is a double precision floating-point number. If the value-expression is null, the result is the null value. If a data error occurs, an exception is raised.

Example

The following statement returns 1.0000000000000000E+00:

```
SELECT COT(PI() / 4)
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

CURDATE-function

Syntax

```
►►─ CURDATE () ────────►◄
```

CURDATE is equivalent to the special-register CURRENT DATE. See Expansion of Special-register for more information.

Example

The following statement returns the current date two times:

```
SELECT CURDATE(), CURRENT DATE
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

CURTIME-function

Syntax

```
▶▶─ CURTIME () ────────▶◀
```

CURTIME is equivalent to the special-register CURRENT TIME. See Expansion of Special-register for more information.

Example

The following statement returns the current time two times:

```
SELECT CURTIME() , CURRENT TIME
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

DATABASE-function

Syntax

```
▶▶─ DATABASE () ────────▶◀
```

DATABASE is equivalent to the special-register CURRENT DATABASE. See Expansion of Special-register for more information.

Example

The following statement returns the current database 'SYSDICT':

```
SELECT DATABASE()
 FROM SYSTEM.SCHEMA WHERE NAME='SYSTEM';
```

DATE-function

Syntax

```
▶▶─ DATE ( value-expression ) ────────▶◀
```

DATE obtains the date from the value in **value-expression**.

The result of the DATE function depends on the type of value in **value-expression**:

Value-expression	Result
TIMESTAMP value	The date part of the timestamp
DATE value	The date
Numeric value	The date that is *n*-1 days after January 1, 0001, where *n* is the number that would result if the INTEGER function were applied to **value-expression**
Character string in the form *yyyynnn* where *yyyy* denotes a year and *nnn* is in the range 001 to 366 denoting a day of that year	The date represented by the character string

DAY or DAYOFMONTH-function

Syntax

```
►►─┬─ DAY ────────┬─ ( value-expression ) ──────────►◄
   └─ DAYOFMONTH ─┘
```

DAY obtains the day part of the value in **value-expression**.

Value-expression must be a date, timestamp, or date duration.

The result of the DAY function is an integer, as shown in the next table.

Value-expression	Result
TIMESTAMP value	1 to 31 (the day part of the timestamp)
DATE value	1 to 31 (the day part of the date)
Date duration	The day part of the value (an integer in the range -99 to 99 with the same sign as **value-expression** if the result is not 0)

Example

The following statement returns 25:

```
SELECT DAYOFMONTH ('2002-12-25')
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

DAYNAME-function

Syntax

```
►►─ DAYNAME ( value-expression ) ────────►◄
```

DAYNAME returns a character string containing the English name of the day specified by value-expression.

value-expression must be a DATE or TIMESTAMP data type or must be a CHARACTER or VARCHAR data type and represent a valid string representation of a date or timestamp.

The result is of CHARACTER(12) data type.

The result is null if value-expression is null.

Example

The following statement returns the names of all days from now to now + 6 days "Tuesday Wednesday Thursday Friday Saturday Sunday Monday:"

```
SELECT  DAYNAME(NOW() + 0 DAY),
          DAYNAME(NOW() + 1 DAY),
          DAYNAME(NOW() + 2 DAY),
          DAYNAME(NOW() + 3 DAY),
          DAYNAME(NOW() + 4 DAY),
          DAYNAME(NOW() + 5 DAY),
          DAYNAME(NOW() + 6 DAY)
FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

DAYOFWEEK-function

Syntax

```
►►─ DAYOFWEEK ( value-expression ) ────────►◄
```

DAYOFWEEK returns the day of the week where 1 is Sunday and 7 is Saturday.

value-expression must be a DATE or TIMESTAMP data type or must be a CHARACTER or VARCHAR data type and represent a valid string representation of a date or timestamp.

The result is an INTEGER data type.

The result is null if value-expression is null.

Example

The following statement returns 4, which represents Wednesday:

```
SELECT DAYOFWEEK ('2002-12-25')
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

DAYOFYEAR-function

Syntax

```
►►─ DAYOFYEAR ( value-expression ) ────────►◄
```

DAYOFYEAR returns the day of the year where 1 is January 1.

value-expression must be a DATE or TIMESTAMP data type or must be a CHARACTER or VARCHAR data type and represent a valid string representation of a date or timestamp.

The result is an INTEGER data type and in the range of 1 to 366.

The result is null if value-expression is null.

Example

The following statement returns 365:

```
SELECT DAYOFYEAR ('2002-12-31')
        FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

DAYS-function

Syntax

```
►►─ DAYS ( value-expression ) ────────►◄
```

DAYS obtains an integer representation of the date in **value-expression**.

Value-expression must be a date, timestamp, or valid character string representation of a date.

The result of the DAYS function is *d* + 1 days from January 1, 0001, where *d* is the date that would result if the DATE function were applied to **value-expression**.

DECIMAL-function

Syntax

```
►►─ DECIMAL ( value-expression ─┬───────────────────────────────────┬─►◄
                                 └─ , ── precision ─┬──────────────┬─┘
                                                    └─ , ─ scale ──┘
```

DECIMAL obtains a decimal representation of the value in **value-expression**.

Value-expression must be numeric.

The result of the DECIMAL function is a decimal number. The following table shows the default precision and scale of the result if *precision* is not specified.

Value-expression data type	Default precision	Default scale
LONGINT	19	0
INTEGER	10	0
SMALLINT	5	0
Other numeric data types	Same as value-expression	Same as value-expression

Parameters

precision

Specifies the number of digits in the result. *Precision* must be an integer in the range of 1 to 31.

scale

Specifies the number of digits to the right of the decimal point in the result. *Scale* must be an integer in the range of 0 to the value of *precision*.

DEGREES-function

Syntax

```
►►─ DEGREES ( value-expression ) ────────►◄
```

DEGREES returns the number of degrees calculated from the value-expression expressed in radians. The **value-expression** must be of any numeric data type. It is converted to a double precision floating-point number for processing by this function.

The result of the function is a double precision floating-point number.

If the value-expression is null, the result is the null value. If a data error occurs, an exception is raised.

Example

The following statement returns 8.9999999999999985E+01:

```
SELECT DEGREES(PI() / 2)
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

DIGITS-function

Syntax

```
►►─ DIGITS  ( value-expression ) ───────►◄
```

DIGITS obtains a character string representation of the value in **value-expression**.

Value-expression must be an integer or decimal number.

The result of the DIGITS function is a fixed-length string of digits that represents the absolute value of **value-expression** and ignores scale. Thus, the result has no sign and no decimal point. The result includes leading zeros.

The length of the result is:

- 5 if **value-expression** has a data type of SMALLINT
- 10 if **value-expression** has a data type of INTEGER
- 19 if **value-expression** has a data type of LONGINT
- The precision of **value-expression** if it contains a decimal number

EXP-function

Syntax

```
►►─ EXP ( value-expression ) ───────►◄
```

EXP returns a value that is calculated as the base of the natural logarithm (e), raised to a power specified by the value-expression. EXP is the inverse function of LOG.

The **value-expression** must be of any numeric data type. It is converted to a double precision floating-point number for processing by this function.

The result of the function is a double precision floating-point number. If the value-expression is null, the result is the null value. If a data error occurs, an exception is raised.

Example

The following statement returns 2.7182818284590451E+00:

```
SELECT   EXP (1)
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

FLOAT-function

Syntax

```
►►─ FLOAT ( value-expression ) ─────────►◄
```

FLOAT obtains a floating-point representation of the value in **value-expression**.

Value-expression must be a number.

The result of the FLOAT function is a double precision floating-point number. It is the same number that would result if **value-expression** were assigned to a column with a data type of DOUBLE PRECISION.

FLOOR-function

Syntax

```
►►─ FLOOR ( value-expression ) ─────────►◄
```

FLOOR returns the largest integer value that is less than or equal to the value-expression.

The **value-expression** must be of any numeric data type.

The result of the function has the same data type as the value-expression except that the scale is 0 if the value-expression is of type (UNSIGNED) DECIMAL or (UNSIGNED) NUMERIC. For example, a value-expression with a data type of NUMERIC (3,2) results in NUMERIC(3,0). If the value-expression is null, the result is the null value. If a data error occurs, an exception is raised.

Example

The following statement returns 12   1.0000000000000000E+00   -13

```
SELECT FLOOR  (12.55), FLOOR  (123.1E-2), FLOOR   (-12.55)
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

HEX-function

Syntax

```
►►─ HEX ( value-expression ) ─────────►◄
```

HEX obtains a hexadecimal representation of the value in **value-expression**.

The result of the HEX function is a character string of hexadecimal digits. The resulting value and length of the result field depend on the data-type of value-expression. For a character operand, the first two digits represent the first byte of value-expression, the next two digits represent the second byte of value-expression, and so on.

The length of the result is limited to 32,767 digits.

If value-expression is a numeric character string, its length will vary as noted below. If it is neither a numeric nor a graphic character string, the length of the result is twice the length of value-expression (as defined by the length function) or twice the maximum length of a varying-length string. If value-expression is a graphic character string, the length of the result is four times the length of value-expression (four times the maximum length of a varying-length string)

If value-expression is a fixed-length string, and the length of the result is less than 255, the result is a fixed-length string. Otherwise, the result is a varying-length string with a maximum length equal to:

- Twice the fixed or maximum length.
- Four times the fixed or maximum length

If value-expression is some kind of numeric data-type, the length of the resulting character string depends on the data-type in the following way:

- BINARY—twice the length of value-expression.
- (UNSIGNED) DECIMAL—twice the length of the (UNSIGNED) DECIMAL value (The length of an (UNSIGNED) DECIMAL value is equal to precision plus 1, divided by 2).
- DOUBLE PRECISION—twice the length of the DOUBLE PRECISION value (16 bytes, for example).
- FLOAT—twice the length of the FLOAT value (If precision is less than or equal to 24, the length of a FLOAT value is 4 bytes. If precision is greater than 24, the length of a FLOAT value is 8 bytes).
- SMALLINT—twice the length of a SMALLINT value (4 bytes, for example).
- INTEGER—twice the length of an INTEGER value (8 bytes, for example).
- LONGINT/BIGINT—twice the length of a LONGINT/BIGINT value (16 bytes, for example).
- (UNSIGNED) NUMERIC—twice the length of the (UNSIGNED) NUMERIC value (The length of an (UNSIGNED) NUMERIC value is equal to the precision).
- REAL—twice the length of the REAL value (8 bytes, for example).

If value-expression is a numeric constant, the following rules apply:

- If the value-expression is less than or equal to the maximum positive number that can be stored in a fullword (2147483647), the result will always be an 8 character hex string

  Example: HEX(2147483647) will display as 7FFFFFFF

- All other numeric constants will be displayed as packed decimal, like for the DECIMAL data-type

  Example: HEX(2147483648) will display as 02147483648C

Note: Since HEX(00000000) will return 00000000, it will never match a value of HEX(decimal-field), even if the value of that decimal field is 0. In this case, one should use the CAST on the numeric constant so that the value types are consistent

Example: Suppose the decimal-field is defined as DECIMAL(8) and contains 0, the following WHERE clause will include the row in the result table:

```
SELECT decimal-field, HEX(decimal-field) FROM rec-name
WHERE HEX(decimal-field) = HEX(CAST(0 AS DECIMAL(8)));
```

HOUR-function

Syntax

```
►►─ HOUR  ( value-expression ) ─────────►◄
```

HOUR obtains the hours part of the value in **value-expression**.

Value-expression must be a time, timestamp, or time duration

The result of the HOUR function is an integer, as shown in the following table.

Value-expression	Result
TIMESTAMP value	0 to 24 (the hours part of the timestamp)
TIME value	0 to 24 (the hours part of the time)
Time duration	The time part of the value (an integer in the range -99 to 99 with the same sign as **value-expression** if the result is not 0)

IFNULL-function

Syntax

```
►►─ IFNULL ( value-expression1, value-expression2 ) ─────────►◄
```

Parameters

value-expression1

Specifies a value-expression. See Expansion of Value-expression.

value-expression2

Specifies a value-expression. See Expansion of Value-expression.

IFNULL returns the first value-expression that is not null. IFNULL is similar to the VALUE and COALESCE scalar functions with the exception that IFNULL is limited to only two value-expressions instead of multiple value-expressions.

Note: For more information, see VALUE or COALESCE-function.

Example

The following statement will show '**NULL**' for any row with a null value for SEGMENT, otherwise the name of the segment will be shown:

```
SELECT SCHEMA, NAME, IFNULL (SEGMENT, '**NULL**')
        FROM SYSTEM.TABLE
```

INSERT-function

Syntax

```
►►─ INSERT ( value-expression1, start, length, value-expression2 ) ─────────►◄
```

Parameters

value-expression1

Specifies a character string value-expression. See Expansion of Value-expression.

value-expression2

Specifies a character string value-expression. See Expansion of Value-expression.

start

Specifies a numeric value-expression. See Expansion of Value-expression.

length

Specifies a numeric value-expression. See Expansion of Value-expression.

INSERT returns a string constructed from **value-expression1**, where beginning at **start**, **length** characters have been deleted and **value-expression2** has been inserted.

value-expression1 specifies the source string and must be a CHARACTER or VARCHAR data type. If the length **of value-expression1** is 0, the result the null value.

Start must be of any numeric data type, but only the integer part is considered. The integer part of **start** specifies the starting point within **value-expression1** where the deletion of characters and the insertion of **value-expression2** is to begin. The integer part of **start** must be in the range of 1 to the length of **value-expression1** plus one.

Length must be of any numeric data type, but only the integer part is considered. The integer part of **length** specifies the number of characters that are to be deleted from **value-expression1**, starting at start. The integer part of **length** must be in the range of 0 to the length of **value-expression1**.

value-expression2 specifies the string to be inserted into **value-expression1**, starting at **start**. The string to be inserted must be a CHARACTER or VARCHAR data type.

The result is always of VARCHAR data type.

The length of the result is given by the following formula:

```
 LENGTH(value-expression1) + LENGTH(value-expression2)
-  min(length,  LENGTH(value-expression1) - start + 1)
```

If both start and length are constants, the maximum length of the result is calculated during compilation of the INSERT invocation using the above formula, otherwise the maximum length is 8000.

The result is null if either **value-expression1** or **value-expression2** is null. If the insert cannot be done, because of invalid parameters, an exception is raised.

Example 1

The following statement appends the string 'DEF' to the string 'ABC' giving 'ABCDEF':

```
SELECT INSERT ('ABC', 4  , 0,'DEF')
                     FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

Because both the start and length parameters of the INSERT function are constants, the maximum length of the result VARCHAR string is 6.

Example 2

The following statement prefixes the string 'DEF' with the string 'ABC' giving 'ABCDEF':

```
SELECT SUBSTR(INSERT ('DEF', 1 * 1 , 0,'ABC'), 1, 20)
        FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

Because the start position is not a constant, but an expression, the maximum length of the result VARCHAR string of INSERT is 8000. The SUBSTR function is used to limit the final result to 20 characters.

Example 3

The following statement replaces the character at position 3 in string 'ABCDEF' with the string 'XYZ' returning 'ABXYZDEF':

```
SELECT INSERT ('ABCDEF',3  , 1,'XYZ')
        FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

Because both the start and length parameters of the INSERT function are constants, the maximum length of the result VARCHAR string is 8.

INTEGER-function

Syntax

```
►►─ INTEGER ( value-expression ) ─────────►◄
```

INTEGER obtains an integer representation of the value in **value-expression**.

Value-expression must be a number. The whole number part of **value-expression** must be in the range of integers.

The result of the INTEGER function is the same number that would result if **value-expression** were assigned to a column with a data type of INTEGER.

LEFT-function

Syntax

```
►►─ LEFT  ( value-expression, length ) ──────────►◄
```

Parameters

value-expression

Specifies a character string value-expression. See Expansion of Value-expression.

length

Specifies a numeric value-expression. See Expansion of Value-expression.

LEFT obtains a substring of the value in **value-expression**, starting with character position 1.

Value-expression must be a character or graphics string.

The result of the LEFT function is a character string when **value-expression** is a character string; the result is a graphics string when **value-expression** is a graphics string.

Length is a value expression that must be an integer not less than 1, and must not exceed the length of the string in **value-expression**. (The length of a value with a data type of VARCHAR or VARGRAPHIC is its maximum length.)

If the substring is less than the specified length, CA IDMS pads the result with blanks.

If *length* is not specified, the substring begins at *start* and ends at the end of the string.

If *length* is null, the result of the function is null.

LEFT (**value-expression**, *length*) is equivalent to SUBSTR (**value-expression**, 1, *length*).

LENGTH-function

Syntax

```
►►─ LENGTH ( value-expression ) ──────────►◄
```

LENGTH obtains the length of the value in **value-expression**.

The result of the LENGTH function is an integer.

The length of a value depends on its data type, as shown in the following table.

Data type	Length
DOUBLE PRECISION	8 bytes

Data type	Length
FLOAT	4 bytes if precision <= 24 8 bytes if precision > 24
REAL	4 bytes
BINARY	The number of bytes containing the value
CHARACTER VARCHAR	The actual number of characters in the string, including blanks
DATE	10 bytes
TIME	8 bytes
TIMESTAMP	26 bytes
DECIMAL	The number of bytes containing the value
INTEGER	4 bytes
LONGINT	8 bytes
NUMERIC	The number of bytes containing the value
SMALLINT	2 bytes
UNSIGNED DECIMAL	The number of bytes containing the value
UNSIGNED NUMERIC	The number of bytes containing the value
GRAPHIC VARGRAPHIC	The number of DBCS characters

LOCATE-function

Syntax

```
►►─ LOCATE ( value-expression1, value-expression2 ─┬─────────────┬─── ) ───►◄
                                                   └ , ─ start ──┘
```

Parameters

value-expression1

Specifies a character string value-expression. See Expansion of Value-expression.

value-expression2

Specifies a character string value-expression. See Expansion of Value-expression.

start

Specifies a numeric value-expression. See Expansion of Value-expression.

LOCATE returns an integer value representing the location of the first value expression within the second value expression. The value expressions must each be either CHARACTER or VARCHAR. If the first value expression does not appear in the second value expression, the result of LOCATE is 0. Otherwise, the result of LOCATE is the byte position of the first matching character within the second string.

Start specifies the character position within the second value-expression at which the search for the first value-expression is to start.

Start is a value-expression that must be an integer not greater than the length of the string in the **value-expression2**.

LOG-function

Syntax

```
►►─ LOG ( value-expression ) ─────────►◄
```

LOG returns a value that is calculated as the natural logarithm of value-expression. LOG is the inverse function of EXP.

The **value-expression** must be of any numeric data type. It is converted to a double precision floating-point number for processing by this function.

The result of the function is a double precision floating-point number. If the value-expression is null, the result is the null value. If a data error occurs, an exception is raised.

Example

The following statement returns 1.0986122886681095E+00:

```
SELECT LOG (3)
  FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM'
```

LOG10-function

Syntax

```
►►─ LOG10 ( value-expression ) ──────────►◄
```

LOG10 returns a value that is calculated as the base 10 logarithm of value-expression.

The **value-expression** must be of any numeric data type. It is converted to a double precision floating-point number for processing by this function.

The result of the function is a double precision floating-point number. If the value-expression is null, the result is the null value. If a data error occurs, an exception is issued.

Example

The following statement returns 3.0000000000000000E+00:

```
SELECT LOG (1000)
  FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM'
```

LOWER or LCASE-function

Syntax

```
►►─┬─ LOWER ─┬─ ( value-expression ) ──────────►◄
   └─ LCASE ─┘
```

LOWER operates on CHARACTER or VARCHAR value-expressions. The result is a string of equal length where all upper case characters have been folded into lower case.

Example

The following statement returns 'joe carpenter':

```
SELECT LCASE('JOE CARPENTER')
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

LTRIM-function

Syntax

```
►►─ LTRIM  ( value-expression ) ──────────►◄
```

LTRIM removes leading blanks from value-expression.

Value-expression must be a character string. It is the equivalent of TRIM (*leading* FROM **value-expression**).

MICROSECOND-function

Syntax

```
▶▶─ MICROSECOND  ( value-expression ) ──────────▶◀
```

MICROSECOND obtains the microsecond part of the value in **value-expression**.

Value-expression must be a timestamp.

The result of the MICROSECOND function is an integer in the range 0 to 999999, representing the microsecond part of the timestamp.

MINUTE-function

Syntax

```
▶▶─ MINUTE ( value-expression ) ──────────▶◀
```

MINUTE obtains the minutes part of the value in **value-expression**.

Value-expression must be a time, timestamp, or time duration.

The result of the MINUTE function is an integer, as shown in the following table.

Value-expression	Result
TIMESTAMP value	0 to 59 (the minutes part of the timestamp)
TIME value	0 to 59 (the minutes part of the time)
Time duration	The minute part of the value (an integer in the range -99 to 99 with the same sign as **value-expression** if the result is not 0)

MOD-function

Syntax

```
▶▶─ MOD ( value-expression1, value-expression2 ) ──────────▶◀
```

Parameters

value-expression1

Specifies a numeric value-expression. See Expansion of Value-expression.

value-expression2

Specifies a numeric value-expression. See Expansion of Value-expression.

MOD returns the remainder of dividing value-expression1 by value-expression2 using the formula:

```
MOD(v1, v2) = v1 - Truncated_Integer(v1/v2) * v2
```

with Truncated_Integer(v1 / v2) the truncated integer result of the division.

Both value-expressions must be of any numeric data type. The second value-expression cannot be zero.

If the value-expression is null, the result is the null value. If a data error occurs, an exception is issued.

The data type of the result follows these rules:

- If both value-expressions are INTEGER or SMALLINT, the data type of the result is INTEGER.
- If one of the value-expressions is LONGINT, and the other is INTEGER, SMALLINT, or LONGINT, the data type of the result is also LONGINT.
- If one value-expression is an INTEGER, SMALLINT, or LONGINT and the other is an (UNSIGNED) DECIMAL or (UNSIGNED) NUMERIC, the data type of the result is (UNSIGNED) DECIMAL or (UNSIGNED) NUMERIC with the same precision and scale as the (UNSIGNED) DECIMAL or (UNSIGNED) NUMERIC value-expression.
- If both value-expressions are (UNSIGNED) DECIMAL or (UNSIGNED) NUMERIC, the data type of the result is equal to the data type of value-expression1. The precision and scale of the result are given by the following formulas:

  ```
  Prec. result = min(prec.1-scale.1, prec.2-scale.2 ) + max(scale.1, scale.2)

     Scale.result =  max(scale1, scale2)
  ```

- If either value-expression is a floating-point number, REAL, FLOAT, or DOUBLE PRECISION, the data type of the result is double precision floating-point.

The processing of this function is always done in floating-point. Both value-expressions are converted to double precision floating-point numbers.

Example 1

The following statement returns 1:

```
SELECT MOD(10, 3    )
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

Example 2

The following statement returns 1.0000000000000000E+00:

```
SELECT MOD(10E0, 3    )
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

Example 3

The following statement returns 1.0:

```
SELECT MOD(10.0, 3    )
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

Example 4

The following statement returns 1.00:

```
SELECT MOD(10.00  , 3    )
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

MONTH-function

Syntax

```
►►─ MONTH ( value-expression ) ─────────►◄
```

MONTH obtains the month part of the value in **value-expression**.

Value-expression must be a date, timestamp, or date duration.

The result of the MONTH function is an integer, as shown in the following table.

Value-expression	Result
TIMESTAMP value	1 to 12 (the month part of the timestamp)
DATE value	1 to 12 (the month part of the date)
Date duration	The date part of the value (an integer in the range -99 to 99 with the same sign as **value-expression** if the result is not 0)

MONTHNAME-function

Syntax

```
▶▶─ MONTHNAME ( value-expression ) ───────────▶◀
```

MONTHNAME returns a character string containing the English name of the month specified by value-expression.

value-expression must be a DATE or TIMESTAMP data type or must be a CHARACTER or VARCHAR data type and represent a valid string representation of a date or timestamp.

The result is of CHARACTER(12) data type.

The result is null if value-expression is null.

Example

The following statement returns the names of all months from now to now + 11 months "January February March April May June July August September October November December:"

```
SELECT   MONTHNAME(NOW() + 0  MONTH),
         MONTHNAME(NOW() + 1  MONTH),
         MONTHNAME(NOW() + 2  MONTH),
         MONTHNAME(NOW() + 3  MONTH),
         MONTHNAME(NOW() + 4  MONTH),
         MONTHNAME(NOW() + 5  MONTH),
         MONTHNAME(NOW() + 6  MONTH),
         MONTHNAME(NOW() + 7  MONTH),
         MONTHNAME(NOW() + 8  MONTH),
         MONTHNAME(NOW() + 9  MONTH),
         MONTHNAME(NOW() + 10 MONTH),
         MONTHNAME(NOW() + 11 MONTH),
         MONTHNAME(NOW() + 12 MONTH)
FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM'
```

NOW-function

Syntax

```
▶▶─ NOW ( ) ───────────▶◀
```

NOW is equivalent to the special-register CURRENT TIMESTAMP. See Expansion of Special-register for more information.

Example

The following statement returns the current date and time two times:

```
SELECT NOW(), CURRENT TIMESTAMP
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

OCTET_LENGTH-function

Syntax

```
►►─ OCTET_LENGTH ( value-expression ) ────────►◄
```

OCTET_LENGTH obtains the length in bytes of the value in **value-expression**.

The result of the OCTET_LENGTH function is an integer.

The length of a value depends on its data type:

Data type	Length
DOUBLE PRECISION	8
FLOAT	4 if precision <= 24 8 if precision > 24
REAL	4
BINARY	The number of bytes which contain the value
CHARACTER VARCHAR	The actual number of bytes in the string, including blanks
DATE	10
TIME	8
TIMESTAMP	26
DECIMAL	The number of bytes which contain the value
INTEGER	4
LONGINT	8
NUMERIC	The number of bytes which contain the value
SMALLINT	2
UNSIGNED DECIMAL	The number of bytes which contain the value

Data type	Length
UNSIGNED NUMERIC	The number of bytes which contain the value
GRAPHIC VARGRAPHIC	Two times the number of DBCS characters

PI-function

Syntax

```
►►─ PI ( ) ──────────────────►◄
```

PI returns the constant value of pi as a floating point value. The value returned is 3.141592653589793238.

Example

The following statement returns 3.1415926535897933E+00:

```
SELECT PI()
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

POSITION-function

Syntax

```
►►─ POSITION ( value-expression IN value-expression ) ──────────►◄
```

POSITION returns an integer value representing the location of the first value expression within the second value expression. The value expressions must each be either CHARACTER or VARCHAR. If the first value expression does not appear in the second value expression, the result of POSITION is 0. Otherwise, the result of POSITION is the byte position of the first matching character within the second string.

It is the equivalent of LOCATE (**value-expression, value-expression**, 1).

POWER-function

Syntax

```
►►─ POWER ( value-expression1, value-expression2 ) ──────────►◄
```

Parameters

value-expression1

Specifies a numeric value-expression. See Expansion of Value-expression.

value-expression2

Specifies a numeric value-expression. See Expansion of Value-expression.

POWER returns the value of value-expression1 to the power of value-expression2.

The data types of value-expression1 and value-expression2 must be numeric data types. The internal processing of this function is done using double precision floating-point arithmetic.

The data type of the result of the function depends on the data types of value-expression1 and value-expression2:

The result is of INTEGER type if value-expression1 and value-expression2 are SMALLINT or INTEGER. The result is LONGINT if one of the value-expressions is LONGINT and the other LONGINT, INTEGER or SMALLINT, otherwise, the result is DOUBLE PRECISION.

The result is null if either **value-expression1** or **value-expression2** is null. If the calculation resulted in a data error, an exception is raised.

Example 1

The following statement returns the value 625:

```
SELECT POWER(25,2)
   FROM SYSTEM.TABLE WHERE NAME = 'SCHEMA'
```

Example 2

The following SELECT returns the value 6.2500000000000000E+02:

```
SELECT POWER(25.0,2)
   FROM SYSTEM.TABLE WHERE NAME = 'SCHEMA'
```

PROFILE-function

Syntax

```
►►─ PROFILE ( value-expression ) ─────────►◄
```

PROFILE obtains the value associated with an attribute of the current user session.

Value-expression must be a character string.

The result of the PROFILE function is a CHARACTER value with a length of 32. If **value-expression** does not correspond to an attribute keyword for the session, the function returns a null value.

Note: For more information about attributes of a user session, see the discussion of system profiles in *CA IDMS System Tasks and Operator Commands Guide*.

QUARTER-function

Syntax

```
►►─ QUARTER ( value-expression ) ─────────►◄
```

QUARTER returns the quarter of the year in which the date, specified by **value-expression**, occurs.

value-expression must be a DATE or TIMESTAMP data type or must be a CHARACTER or VARCHAR data type and represent a valid string representation of a date or timestamp.

The result is an INTEGER data type and is in the range of 1 to 4.

The result is null if value-expression is null.

Example

The following statement returns 4 because December is in the last quarter of the year:

```
SELECT QUARTER('2002-12-31')
        FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM'
```

RADIANS-function

Syntax

```
►►─ RADIANS ( value-expression ) ─────────►◄
```

RADIANS returns the number of radians corresponding to the number of degrees specified by **value-expression**.

The **value-expression** must be of any numeric data type. It is converted to a double precision floating-point number for processing by this function.

The result of the function is a double precision floating-point number.

If the value-expression is null, the result is the null value. If a data error occurs, an exception is raised.

Example

The following statement returns 3.1415926535897931E+00, which is an approximate value of PI:

```
SELECT RADIANS(180)
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

RAND-function

Syntax

```
►►─ RAND (┬────────────────┬) ─────────►◄
          └ value-expression ┘
```

RAND returns a random floating-point value between 0 and 1. **value-expression** is optional and specifies a seed value. If no seed value is specified, 1 will be used as seed value.

If specified, the **value-expression** must be of any numeric data type. It is converted to an INTEGER number for processing by this function.

The result of the function is a double precision floating-point number.

If a data error occurs, an exception is raised.

Within the context of an IDMS task, the optional seed value is only evaluated once during the very first call of the random generator with a seed value. The series of generated random numbers will be equal for equal seed values when executed under different IDMS tasks.

Example

The following statement returns random floating-point numbers between 0 and 1:

```
SELECT RAND (200), RAND()
   FROM SYSTEM.SCHEMA;-- WHERE NAME = 'SYSTEM';
```

REPEAT-function

Syntax

```
▶▶─ REPEAT ( value-expression, count ) ──────────▶◀
```

REPEAT returns a string constructed as count times value-expression repeated.

Parameters

value-expression

Specifies the string to be repeated and must be a CHARACTER or CHAR data type.

count

Specifies an expression of any numeric data type, but only the integer part is considered. The integer part of **count** specifies the number of times to repeat **value-expression**.

The result of the function is VARCHAR.

The length of the result is the length of **expression** times **count**. If the actual length of the result string exceeds the maximum for the return type, an error occurs.

If count is a constant, the maximum length of the result is calculated during compilation of the REPEAT function invocation, otherwise the maximum is 16000.

The result is null if either **value-expression** or **count** is null. If the repeat cannot be done because of invalid parameters, an exception is raised.

Example 1

The following statement returns 'ABCDABCDABCDABCD':

```
SELECT REPEAT('ABCD', 4)
       FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

Example 2

The following statement returns a string with length 0:

```
SELECT REPEAT('ABCD', 0)
       FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

Example 3

The following statement returns <null> because count is negative:

```
SELECT REPEAT('ABCD', -2)
       FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

REPLACE-function

Syntax

```
►►─ REPLACE ( value-expression1, value-expression2, value-expression3 ) ──────►◄
```

Parameters

value-expression1

Specifies a character string value-expression. See Expansion of Value-expression.

value-expression2

Specifies a character string value-expression. See Expansion of Value-expression.

value-expression3

Specifies a character string value expression. See Expansion of Value-expression.

REPLACE replaces all occurrences of **value-expression2** in **value-expression1** with **value-expression3**. If **value-expression2** was not found in **value-expression1**, **value-expression1** is returned unchanged.

value-expression1 is a non-null expression that specifies the source string.

value-expression2 is a non-null expression that specifies the string to be replaced in the source string.

value-expression3 is an expression that specifies the replacement string. A null value will cause **value-expression1** to be returned unchanged. The arguments must all have data types that are compatible with VARCHAR, that is CHARACTER or VARCHAR. The actual length of each string must be less than or equal to 8000. The data type of the result is VARCHAR and the resulting length must be less than or equal to 8000. The length of the result is given by the following formula, where n is the number of occurrences of value-expression2 in value-expression1:

```
   LENGTH(value-expression1)
+  (n * (LENGTH(value-expression3)  - LENGTH(value-expression2)))
```

The result is null if either **value-expression1**, **value-expression2**, **or value-expression3** is null. If the replace cannot be done because of invalid parameters, that is, in case one or more of the lengths exceed the limit, an exception is raised.

Example 1

In this example, the result is '$$$$123.0$$$$99'.

Replace all characters '*' in the string '**123.0**99' with '$$'.

```
SELECT REPLACE('**123.0**99', '*', '$$')
 FROM SYSTEM.SCHEMA WHERE NAME ='SYSTEM'
```

Example 2

List the departments of the EMPSCHM.DEPARTMENT table in alphabetical order, but ignore any spaces when sorting. The REPLACE function removes all spaces in the SORT_NAME column of the result.

```
SELECT *, REPLACE (DEPT_NAME_0410, ' ', '') SORT_NAME
   FROM EMPSCHM.DEPARTMENT
   ORDER BY SORT_NAME;
```

Example 3

In this example, the result is 'LOTS OF **FOO**LISH TALK'.

Replace string 'FOO' in the string 'LOTS OF FOOLISH TALK' with '**FOO**'.

```
SELECT REPLACE('LOTS OF FOOLISH TALK', 'FOO', '**FOO**')
     FROM SYSTEM.SCHEMA WHERE NAME ='SYSTEM'
```

RIGHT-function

Syntax

```
►►─ RIGHT ( value-expression, count ) ─────────►◄
```

RIGHT returns a string constructed from the specified number of rightmost **count** characters of **value-expression**.

Parameters

value-expression

Specifies the string from which the result is constructed and must be a CHARACTER or VARCHAR data type.

count

Specifies of any numeric data type, but only the integer part is considered. The integer part of **count** specifies the length of the result. The integer part of **count** must be an integer between 0 and n, where n is the length of **value-expression**.

The result is null if either **value-expression1** or **count** is null. If **count** is larger than the length of value-expression1, or if an error occurs, an exception is raised.

Example 1

The following statement returns the string 'CD':

```
SELECT RIGHT ('ABCD', 2 )
        FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

Example 2

The following statement returns a string with length 0:

```
SELECT RIGHT ('ABCD', 0 )
        FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

ROUND-function

Syntax

```
►►─ ROUND ( value-expression1, value-expression2 ) ─────────►◄
```

Parameters

value-expression1

Specifies a numeric value-expression. See Expansion of Value-expression.

value-expression2

Specifies a numeric value-expression. See Expansion of Value-expression.

ROUND returns **value-expression1** rounded to **value-expression2** places to the right of the decimal point if **value-expression2** is positive, or, to the left of the decimal point if **value-expression2** is zero or negative.

The **value-expression1** must be of any numeric data type.

The **value-expression2** must be of any numeric data type but will be converted internally to INTEGER. The integer value of **value-expression2** specifies the number of places to the right of the decimal point for the result if **value-expression2** is not negative. If **value-expression2** is negative, **value-expression1** is rounded to 1 + the absolute integer value of **value-expression2** number of places to the left of the decimal point. If the absolute integer value of **value-expression2** is larger than the number of digits to the left of the decimal point, the result is 0.

If **value-expression1** is positive, rounding is to the next higher positive number. If **value-expression1** is negative, rounding is to the next lower negative number.

The result of the function has the same data type and attributes as the **value-expression1** except that the precision is increased by one if the value-expression is of (UNSIGNED) DECIMAL or (UNSIGNED) NUMERIC data type and the precision is less than 31.

If any of the value-expressions are null, the result is the null value. If a data error occurs, an exception is raised.

Example 1

The following statement returns 627.46380 627.46400 627.46000 50000 627.00000 630.00000 600.00000: 1000.00000 0.00000:

```
SELECT  ROUND(627.46381, 4) ,
           ROUND(627.46381, 3) ,
           ROUND(627.46381, 2) ,
           ROUND(627.46381, 1) ,
           ROUND(627.46381, 0) ,
           ROUND(627.46381,-1) ,
           ROUND(627.46381,-2) ,
           ROUND(627.46381,-3) ,
           ROUND(627.46381,-4)
FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

Example 2

The following statement returns -627.46380 -627.46400 -627.46000 -627.50000 -627.00000 -630.00000 -600.00000 :

```
SELECT  ROUND(-627.46381, 4) ,
           ROUND(-627.46381, 3) ,
           ROUND(-627.46381, 2) ,
           ROUND(-627.46381, 1) ,
           ROUND(-627.46381, 0) ,
           ROUND(-627.46381,-1) ,
           ROUND(-627.46381,-2)
FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

RTRIM-function

Syntax

```
►►─ RTRIM ( value-expression ) ──────────►◄
```

RTRIM removes trailing blanks from value-expression. **Value-expression** must be a character string. It is the equivalent of TRIM (*trailing* FROM **value-expression**).

SECOND-function

Syntax

```
►►─ SECOND ( value-expression ) ──────────►◄
```

SECOND obtains the seconds part of the value in **value-expression**.

Value-expression must be a time, timestamp, or time duration.

The result of the SECOND function is an integer, as shown in the following table.

Value-expression	Result
TIMESTAMP value	0 to 59 (the seconds part of the timestamp)
TIME value	0 to 59 (the seconds part of the time)
Time duration	The time part of the value (an integer in the range -99 to 99 with the same sign as **value-expression** if the result is not 0)

SIGN-function

Syntax

```
►►─ SIGN ( value-expression ) ──────────►◄
```

SIGN returns an indicator of the sign of **value-expression**. The possible values for the indicator are:

- -1 if value-expression is less than zero
- 0 if value-expression is zero
- 1 if value-expression is greater than zero

value-expression must be of any numeric data type except (UNSIGNED) DECIMAL or (UNSIGNED) NUMERIC with a scale and precision of 31. The data type and attributes of the result of the function are the same as the value-expression except when the value-expression is (UNSIGNED) DECIMAL or (UNSIGNED) NUMERIC. The precision is incremented if the value-expression's precision and scale are equal. This is to allow for the return values of the function.

If the value-expression is null, the result is the null value. If a data error occurs, an exception is raised.

Example

The following statement returns -1 0 1:

```
SELECT SIGN (1 - 10), SIGN ( 0), SIGN (1 +10)
    FROM SYSTEM.TABLE WHERE NAME = 'SYSTEM'
```

SIN-function

Syntax

```
►►─ SIN ( value-expression ) ─────────►◄
```

SIN returns the sine of the **value-expression**, which must be an angle expressed in radians. SIN is the inverse function of the ASIN function.

The value-expression must be of any numeric data type. It is converted to a double precision floating-point number for processing by this function.

The result of the function is a double precision floating-point number. If the value-expression is null, the result is the null value. If a data error occurs, an exception is raised.

Example

The following statement returns 1.0000000000000000E+00:

```
SELECT  SIN( PI() / 2)
    FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

SINH-function

Syntax

```
►►─ SINH ( value-expression ) ──────────►◄
```

SINH returns the hyperbolic sine of the **value-expression**, which must be an angle expressed in radians.

The **value-expression** must be of any numeric data type. It is converted to a double precision floating-point number for processing by this function.

The result of the function is a double precision floating-point number. If the value-expression is null, the result is the null value. If a data error occurs, an exception is raised.

Example

The following statement returns 1.1548739357257750E+01:

```
SELECT  SIN( PI())
     FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

SPACE-function

Syntax

```
►►─ SPACE ( value-expression ) ──────────►◄
```

SPACE returns a character string that consists of **value-expression** number of blanks. **value-expression** is of any numeric data type, but only the integer part is considered. The integer part specifies the number of blanks that makes up the result, and it must be between 0 and 30000.

The result is of VARCHAR data type. The length of the result is the integer part of value-expression.

If value-expression is a constant, the maximum length of the result is calculated during compilation of the SPACE function invocation, otherwise the maximum is 30000.

The result is null if value-expression is null. An error occurs if value-expression is larger than 30000.

Example

The following statement returns 10 blanks:

```
SELECT SPACE (10)
        FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

SQRT-function

Syntax

```
►►─ SQRT ( value-expression ) ──────────►◄
```

SQRT returns the square root of the **value-expression**. The **value-expression** must be of any numeric data type. It is converted to a double precision floating-point number for processing by this function.

The result of the function is a double precision floating-point number. If the value-expression is null, the result is the null value. If a data error occurs, an exception is raised.

Example 1

The following statement returns 4.0000000000000000E+00:

```
SELECT  SQRT(16)
    FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

Example 2

The following statement returns <null> because the square root of a negative number does not exist:

```
SELECT  SQRT(-16)
    FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

SUBSTR or SUBSTRING-function

Syntax

```
►►┬ SUBSTR ────┬( value-expression,start ─┬─────────────────┬──────────►◄
  └ SUBSTRING ─┘                          └─ , ── length ─┘

►►─ SUBSTRING ( value-expression FROM start ─┬────────────────┬) ───►◄
                                             └── FOR length ──┘
```

SUBSTR or SUBSTRING obtains a substring of the value in **value-expression**.

Value-expression must be a character or graphics string.

The result of the SUBSTR function is a character string when **value-expression** is a character string; the result is a graphics string when **value-expression** is a graphics string.

Parameters

start

Specifies the position of the first character of the result.

Start is a value expression that must be an integer less than or equal to the length of the string in **value-expression**.

If *start* is null, the result of the function is null.

length

Specifies the length of the result.

Length is a value expression that must be an integer not less than one. The sum of *length* and *start* must not exceed 1 + the length of the string in **value-expression**. (The length of a value with a data type of VARCHAR or VARGRAPHIC is its maximum length.)

If the substring is less than the specified length, CA IDMS pads the result with blanks.

If *length* is not specified, the substring begins at *start* and ends at the end of the string.

If *length* is null, the result of the function is null.

TAN-function

Syntax

```
►►─ TAN ( value-expression ) ────────►◄
```

TAN returns the tangent of the **value-expression**, which must be an angle expressed in radians. TAN is the inverse function of the ATAN function.

The **value-expression** must be of any numeric data type. It is converted to a double precision floating-point number for processing by this function.

The result of the function is a double precision floating-point number. If the value-expression is null, the result is the null value. If a data error occurs, an exception is raised.

Example

The following statement returns 1.0000000000000000E+00:

```
SELECT  TAN ( PI()/4 )
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

TANH-function

Syntax

```
►►─ TANH ( value-expression ) ──────────►◄
```

TANH returns the hyperbolic tangent of the **value-expression**, which must be an angle expressed in radians.

The value-expression must be of any numeric data type. It is converted to a double precision floating-point number for processing by this function.

The result of the function is a double precision floating-point number. If the value-expression is null, the result is the null value. If a data error occurs, an exception is raised.

Example

The following statement returns 6.5579420263267255E-01:

```
SELECT  TANH ( PI()/4 )
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

TIME-function

Syntax

```
►►─ TIME ( value-expression ) ──────────►◄
```

TIME obtains the time from the value in **value-expression**.

Value-expression must be a timestamp, time, or character string.

The result of the TIME function is a time:

Value-expression	**Result**
TIMESTAMP value	The time part of the timestamp
TIME value	That time
CHARACTER value in a valid time format	The time represented by the character string

TIMESTAMP-function

Syntax

```
►►─ TIMESTAMP (┬ value-expression ────────┬) ──────────►◄
               └─ , ─ value-expression────┘
```

TIMESTAMP obtains a timestamp from a value or pair of values.

If *one* value expression is specified, it must be:

- A value with the TIMESTAMP data type
- A valid character string representation of a timestamp
- An eight-character string in the form of a System/370 Store Clock value
- A 14-character string in the form *yyyymmddhhnnss* where *yyyy* is the year, *mm* is the month, *dd* is the day, *hh* is the hour, *nn* is the minutes, and *ss* is the seconds

  Note: A timestamp represented by a 14-character string has a microsecond part of zero. The interpretation of an eight-character string is a timestamp, as discussed under Store Clock value in *IBM System/370 Principles of Operations*.

If *two* value expressions are specified, the first **value-expression** must be a date or valid character string representation of a date, and the second **value-expression** must be a time or valid character string representation of a time.

The result of the function is a value with the TIMESTAMP data type:

- If two value expressions are specified, the result is a timestamp with the date specified in the first value and the time specified in the second value
- If one value expression is specified and it is a character string, the result is the timestamp represented by the character string

TRIM-function

Syntax

```
►►─ TRIM ( ─┬──────────────────────────────────────┬─ value-expression-2 ── ) ─►◄
            └─┬────────────┬─ value-expression-1 FROM ┘
              ├─ LEADING ──┤
              ├─ TRAILING ─┤
              └─ BOTH ─────┘
```

TRIM removes leading or trailing (or both) pad characters to be removed from a CHARACTER or VARCHAR value-expression.

The optional value expression defines the pad character to be removed. It must specify a one-character value. In the absence of a trim specifier, BOTH is assumed. In the absence of an explicit pad character, BLANK is assumed.

Parameters

leading

Indicates the orientation of the TRIM function.

trailing

Indicates the orientation of the TRIM function.

both

Indicates the orientation of the TRIM function.

TRUNCATE-function

Syntax

```
►►─ TRUNCATE ( value-expression1, value-expression2 ) ─────────►◄
```

Parameters

value-expression1

Specifies a numeric value-expression. See Expansion of Value-expression.

value-expression2

Specifies a numeric value-expression. See Expansion of Value-expression.

TRUNCATE returns value-expression1 truncated to value-expression2 places to the right of the decimal point if value-expression2 is positive or 0. If value-expression2 is negative, value-expression1 is truncated to the absolute value of value-expression2 places to the left of the decimal point. If the absolute value of value-expression2 is not smaller than the number of digits to the left of the decimal point, the result is 0.

value-expression1 must be of any numeric data type.

value-expression2 must be of any numeric data type but will be internally converted to INTEGER.

The result of the function has the same data type and attributes as value-expression1.

If any of the value-expressions are null, the result is the null value. If a data error occurs, an exception is raised.

Example

The following statement returns 627.46380   627.46300   627.46000 627.40000 627.00000   620.00000   600.00000   0.00000 0.00000:

```
SELECT  TRUNCATE(627.46381, 4) ,
              TRUNCATE(627.46381, 3) ,
              TRUNCATE(627.46381, 2) ,
              TRUNCATE(627.46381, 1) ,
              TRUNCATE(627.46381, 0) ,
              TRUNCATE(627.46381,-1) ,
              TRUNCATE(627.46381,-2) ,
              TRUNCATE(627.46381,-3) ,
              TRUNCATE(627.46381,-4)
FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

UCASE or UPPER-function

Syntax

```
►►─┬─ UCASE ──────┬─ ( value-expression ) ───►◄
   └─ UPPER ──────┘
```

UCASE (or UPPER) operates on CHARACTER or VARCHAR value-expressions. The result is a string of equal length where all lower case characters have been folded into upper case.

USER-function

Syntax

```
►►─ USER () ──────────►◄
```

USER is equivalent to the special-register USER. See Expansion of Special-register for more information.

Example

The following statement returns ABCDE01, user executing the SELECT statement:

```
SELECT USER()
   FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

VALUE or COALESCE-function

Syntax

```
                       ┌────────── , ──────────┐
►►┬ VALUE ────┬ ( ─▼─ value-expression ──┴─ ) ────────►◄
  └ COALESCE ─┘
```

The VALUE scalar function is used to substitute a value for the null value.

The data types of the **value-expressions** must be compatible. Character strings are not converted to date/time values. Therefore, if any **value-expression** is a date, each **value-expression** must be a date, if any **value-expression** is a time, each **value-expression** must be a time, if any **value-expression** is a timestamp, each **value-expression** must be a timestamp, and if any **value-expression** is a character string, each **value-expression** must be a character string.

The **value-expressions** are evaluated in the order they are specified, and the result of the function is equal to the first **value-expression** that is not null. The result can be null only if all **value-expressions** are null.

The result is defined as "equal to" a **value-expression** because that **value-expression** is converted or extended, if necessary, to conform to the data type of the function. The data type of the result is derived from the data types of the specified **value-expressions** as follows:

Strings: If any **value-expression** is a varying length string, the result is a varying length string whose maximum length is equal to the longest string that can result from the application of the function.

If all **value-expressions** are fixed length strings, the result is a fixed length string whose length is equal to the longest string that can result from the application of the function.

Date/time values: If the **value-expressions** are dates, the result is a date. If the **value-expressions** are times, the result is a time. If the **value-expressions** are timestamps, the result is a timestamp.

Numbers: If the **value-expressions** are numbers, the result is the numeric data type that would occur if all **value-expressions** were part of a single arithmetic expression. If that data type is decimal or numeric, it has precision of *p* and scale of *s* so *s* is the largest result scale of any **value-expression**, and *p* is *s* + *n*, where *n* is the largest integral part of any **value-expression**. Conversion errors are possible if *s* + *n* is greater than 31.

VARGRAPHIC-function

Syntax

```
►►─ VARGRAPHIC ( value-expression ) ──────────►◄
```

The VARGRAPHIC function is supported only in active DBCS environments.

The VARGRAPHIC function is used to obtain a graphic string representation of a character string. **Value-expression** must be a binary or character string. If it is binary, the value is treated as graphic, and no data conversion takes place.

If the **value-expression** must be a character string, the characters are converted to their DBCS equivalent. If the string contains shift-in and shift-out characters, they must be properly paired under the rules for mixed data.

The result of the function is a varying length graphic string. If the **value-expression** can be null, the result can be null; if the **value-expression** is null, the result is the null value.

If **value-expression** is character, it is interpreted as a mixed data string. The result includes all DBCS characters of the **value-expression** and the DBCS equivalent of all single byte characters of the **value-expression**. The first character of the result is the first logical character of the **value-expression**, the second character of the result is the second logical character of the **value-expression**, and so forth. The result does not include shift-in and shift-out characters.

The length of the result depends on the number of logical characters in the **value-expression**. If the length or maximum length of the **value-expression** is *n* bytes, the maximum length of the result is *n* (DBCS characters).

WEEK-function

Syntax

```
►►─ WEEK ( value-expression ) ──────────►◄
```

WEEK returns the week of the year for the specified **value-expression**. The function uses the ISO definition: a week starts with Monday and comprises 7 days. Week 1 is the first week of the year that contains a Thursday (or the first week that contains January 4).

value-expression must be a DATE or TIMESTAMP data type or must be a CHARACTER or VARCHAR data type and represent a valid string representation of a date or timestamp.

The result is an INTEGER data type and is in the range of 1 to 53.

The result is null if value-expression is null.

Example

The following statement returns 52 1:

```
SELECT WEEK ('2000-01-01'), WEEK('2000-01-03')
        FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM'
```

XMLPOINTER-function

Returns a BINARY(4) value that is a pointer to a LOB (Large Object) that holds the serialized value of **XML-value-expression**.

The XMLPOINTER function is used in programs that need to process serialized XML values. The structure of the LOB is a variable-length storage object. It starts with a signed integer of 32 bit and contains the LOB data length (max 2 GB), followed by the LOB data.

Syntax

```
►►─ XMLPOINTER ── (── XML-value-expression ──) ──────────────►◄
```

Notes:

- If **XML-value-expression** is NULL or empty, XMLPOINTER returns a NULL value.
- The storage object of the LOB is allocated from a CA IDMS CV storage pool or from the batch address space for local mode programs. The storage object is only addressable in client programs that run in the same CA IDMS CV as the database server or in batch local mode programs.
- The program invoking the XMLPOINTER function must free the storage of the LOB when it is no longer needed. If no free storage is done, the storage associated with the LOB is freed at task termination.
- Client programs that cannot access the LOB returned by XMLPOINTER can use XMLSERIALIZE (returns a maximum of 30,000 characters) or the table procedure SYSCA.XMLSLICE to process XML values.
- XMLPOINTER is not part of the SQL standard. It is a CA IDMS extension to facilitate access to XML LOBs.

Example

The following statement returns pointers to XML LOB objects:

```
SELECT XMLPOINTER(XMLFOREST(NAME as "Name"
                          , SCHEMA as "Schema")
                 ) AS "PointerToLob"
 FROM  SYSTEM.TABLE
```

where schema = 'DEMOPROJ'

The result is similar to the following:

```
*+
*+ PointerToLob
*+ ------------
*+ 20003008
*+ 20003088
```

XMLSERIALIZE-function

Returns a value of character string or binary string. Serialization is an operation on an XML value that transforms the XML value in a continuous character string representation. Serialization is the inverse operation of parsing.

Syntax

```
►►─ XMLSERIALIZE ── ( ──┬─ CONTENT ─┬──────────────────────────►
                        └─ DOCUMENT ┘

 ►─── XML-value-expression ── AS string-data-type ── ) ───────►◄
```

Parameters

string-data-type

Must be one of the character data types of data type: CHAR(n), CHARACTER(n), VARCHAR(n), CHAR VARYING(n).

Note: The DOCUMENT option is not functional in this feature. Therefore, CONTENT should always be specified.

Example

Use of XMLSERIALIZE to serialize an XML value as a character string of 50 characters.

```
 SELECT NAME
      , XMLSERIALIZE(CONTENT
                    XMLELEMENT(NAME "Schema"
                             , XMLATTRIBUTES (NAME AS "Name"
                                            , CUSER AS "User"))
                    AS CHAR(50)) AS "Serialized XML"
  FROM SYSTEM.SCHEMA WHERE NAME IN ('SYSTEM', 'SYSDICT') ;

NAME        Serialized XML
----        --------------
SYSTEM      <Schema Name="SYSTEM" User="ABCDE01"</Schema>
SYSDICT     <Schema Name="SYSDICT" User="VWXYZ01"</Schema>
```

YEAR-function

Syntax

```
►►─ YEAR ( value-expression ) ─────────►◄
```

YEAR obtains the year part of the value in **value-expression**.

value-expression must be a date, timestamp, or date duration.

The result of the YEAR function is an integer, as shown in the following table.

Value-expression	Result
TIMESTAMP value	1 to 9999 (the year part of the timestamp)
DATE value	1 to 9999 (the year part of the date)
Date duration	The year part of the value (an integer in the range -9999 to 9999 with the same sign as **value-expression** if the result is not 0)

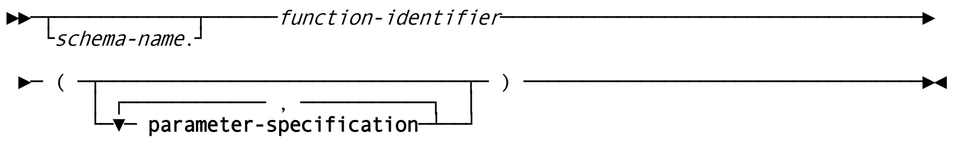
Expansion of User-defined-function

This section describes how user-defined functions are invoked, including the purpose, syntax, parameters, usage considerations, and examples.

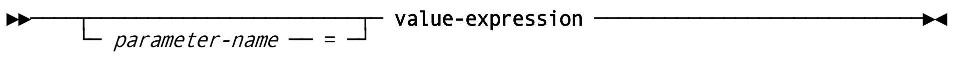
A user-defined function is invoked through a qualified or unqualified function identifier together with an optional set of parameter values and returns a single value. To invoke a user-defined function, you must either own or hold the SELECT privilege on the named function.

Syntax

Expansion of user-defined-function



Expansion of parameter-specification



Parameters

schema-name

Specifies the schema with which the function identified by function-identifier is associated.

Note: For more information about using a schema name to qualify a function, see Identifying Entities in Schemas. (see page 42)

function-identifier

Identifies a function defined in the dictionary.

parameter-specification

Specifies a value to be assigned to a parameter of a function. Both the positional (with NO parameter-name) and the non-positional (with parameter-name) forms of parameter specification can be used in a single function invocation. If a non-positional parameter specification is used, all remaining parameter specifications in the parameter list MUST be non-positional. Positional parameter specifications are assumed to correspond to the declared parameters of a function in the sequence of their declaration.

parameter-name

Specifies the name of a parameter associated with the function.

value-expression

Specifies a value-expression. See Expansion of Value-expression.

Usage

Passing and Returning Values to a Function: During SQL function processing, CA IDMS issues a call to the corresponding SQL-invoked routine with the values supplied in the function invocation. Before returning control, the SQL-invoked routine must set a value for the implicitly defined output parameter USER_FUNC; this then becomes the function return value.

Usage Restriction: You cannot reference a user-defined function within the search condition of a table's check constraint.

Examples

The invocation of the function UDF_FUNBOUS, defined in the schema FIN, causes the external program FUNBONUS to be called by CA IDMS with two parameters. The first parameter contains the value for EMP_ID, the second is the implicitly defined parameter USER_FUNC, which needs to be given a value by FUNBONUS before returning control to CA IDMS.

```
SELECT EMP_ID, FUN.UDF_FUNBONUS(EMP_ID) FROM DEMOEMPL.EMPLOYEE;
```

More Information

- For more information about assignment of values to function parameters, see Defining and Using Functions.
- For more information about using a schema name to qualify a function, see Identifying Entities in Schemas.

More information:

Defining and Using Functions (see page 639)
Identifying Entities in Schemas (see page 42)

Expansion of XML-value-function

The expanded parameters of **XML-value-function** represent the invocation of an **XML-value-function**.

Syntax

Expansion of XML-value-function

```
►──────┬── XMLAGG-function ──────┬──────────────────────────►◄
       ├── XMLCOMMENT-function ──┤
       ├── XMLCONCAT-function ───┤
       ├── XMLELEMENT-function ──┤
       ├── XMLFOREST-function ───┤
       ├── XMLPARSE-function ────┤
       ├── XMLPI-function ───────┤
       └── XMLROOT-function ─────┘
```

Parameters

Specifies the **XML-value-function** to be invoked. For detailed descriptions of the XML value functions, see XML Value Functions.

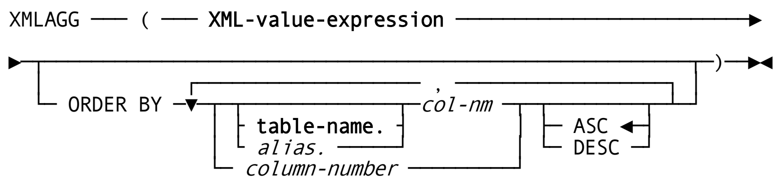
XML Value Functions

This section describes the XML value functions including their purpose, syntax, parameters, and examples.

XMLAGG-function

Returns an XML value that is computed from a collection of rows. The result is the XML concatenation of a list of XML elements, aggregated in the statement containing the XMLAGG-function.

Syntax



Parameters

ORDER BY

Before the aggregation takes place, the XML elements, specified by **XML-value-expression**, are sorted in ascending or descending order by the values in the specified columns. XML elements are ordered first by the first column specified, then by the second column specified within the ordering established by the first column, then by the third column specified, and so on.

col-nm

Specifies the name of column.

table-name.

Specifies the table, view, procedure, or table procedure that includes the named column. For expanded **table-name** syntax, see Expansion of Table-name.

alias

Specifies the *alias* associated with the table, view, procedure, or table procedure that includes the named column. The *alias* must be defined in the FROM parameter of the subquery, query specification, or SELECT statement that includes the XMLAGG function.

column-number

Specifies a column number. You can specify from 1 through 254 columns. Multiple columns must be separated by commas.

Examples

Example 1

Use of the XMLAGG function to display all employees belonging to each department.

```
SELECT XMLSERIALIZE(CONTENT
                       XMLELEMENT(NAME "dept",
                                  XMLATTRIBUTES(e.DEPT_ID AS "id"),
                                  XMLAGG(XMLELEMENT(NAME "lname",
                                                    e.EMP_LNAME)))
                       AS VARCHAR(256)) AS "EMP_NAME_COL"
     FROM DEMOEMPL.EMPLOYEE e GROUP BY DEPT_ID ;
```

The result is similar to the following. Note that the content of the EMP_NAME_COL column has been formatted for convenience.

```
EMP_NAME_COL
------------
<dept id="1100">
  <lname>Fordman</lname>
  <lname>Halloran</lname>
  <lname>Hamel</lname>
</dept>
<dept id="1110">
  <lname>Widman</lname>
  <lname>Alexander</lname>
</dept>
<dept id="1120">
  <lname>Umidy</lname>
  <lname>White</lname>
  <lname>Johnson</lname>
</dept>
```

Example 2

Use of the XMLAGG function to display all employees belonging to each department. For each employee, the positions and jobs are included. This example shows that the use of the XMLAGG function together with the ability to specify subqueries as arguments for the SQL/XML functions allows creating very complex XML structures.

```
select xmlpointer (
 xmlelement
 ( Name "Employees"
 , xmlagg
   ( xmlelement
     ( NAME "Department"
     , xmlattributes(DEPT_ID as "DeptId")
     ,  xmlelement
        ( NAME "EmployeesInDepartment"
        , select xmlagg
          ( xmlelement
            ( name "Employee"
            , xmlattributes(EMP_ID as "EmpId")
            , EMP_FNAME
            , EMP_LNAME
            , xmlelement
              ( name "Address"
              , XMLFOREST
                ( e.STREET     as  "Street"
                , e.CITY       as  "City"
                , e.STATE      as  "State"
                )
              )
            , xmlelement
              ( name "Positions"
              , select xmlagg
                ( xmlelement
                  ( name "Position"
                  , xmlattributes
                    ( p.JOB_ID      as "JobId" )
                  , JOB_TITLE
                  , SALARY_AMOUNT
                  , BONUS_PERCENT
                  )
                )
                 from DEMOEMPL.POSITION p, DEMOEMPL.JOB j
                where p.EMP_ID = e.EMP_ID
                  and p.JOB_ID = j.JOB_ID
              )
            )
          )
           from DEMOEMPL.EMPLOYEE e
          where d.DEPT_ID = e.DEPT_ID
        )
     )
   )
 )
)from DEMOEMPL.DEPARTMENT d
```

The result is similar to the following. It has been formatted and displayed with an "XML-enabled" Web browser that allows collapsing and expanding XML elements in an XML tree.

```
- <Employees>
+ <Department DeptId=">1120">
- <Department DeptId="5000">
- <EmployeesInDepartment>
- <Employee EmpId="3449">
  Cynthia Taylor
- <Address>
  <Street>201 Washington St</Street>
  <City>Concord</City>
  <State>MA</State>
  </Address>
- <Positions>
  <Position JobId="4023">Accountant 74776.0</Position>
  </Positions>
  </Employee>
+ <Employee EmpId="5103">
&invellip.
  </EmployeesInDepartment>
  </Department>
+ <Department DeptId="4500">
  </Employees>
```

Example 3

Use of the XMLAGG function and subqueries to display part of an SQL catalog as an XML document.

```
select xmlpointer (
 xmlelement
 ( Name "Catalog"
 , xmlagg
   ( xmlelement
     ( Name "Schema"
     , xmlattributes
       ( s.NAME as "Name"
       , s.TYPE as "Type"
       )
     , 'Referencing SQL Schema:'
     , s.REFDSQLSCHEMA
     , 'Referencing Non SQL Schema:'
     , s.NTWKSCHEMA
     , select
         xmlagg
         ( xmlelement
           ( Name "TablesInSchema"
           , xmlattributes
             ( t.NAME    as "Name"
             , t.TYPE    as "Type"
             , t.LENGTH  as "Length"
             )
           , SEGMENT
           , '.'
           , 'AREA'
           , xmlelement
             ( Name "TableStats"
             , xmlattributes
               ( t.NUMCOLS        as "NumCols"
               , t.NUMINDEXES     as "NumIndexes"
               , t.NUMREFERENCING as "NumReferencing"
               , t.NUMROWS        as "NumRows"
               , t.NUMPAGES       as "NumPages"
               , t.NUMSYNTAX      as "NumSyntax"
               , t.ESTROWS        as "EstRows"
               )
             )
           , select
               xmlagg
               ( xmlelement
                 ( Name "ColumnsInTable"
                 , xmlattributes
                   ( c.NAME   as "Name"
                   , c.NUMBER as "Nr"
                   )
                 , TYPE
                 , xmlelement
                   ( Name "DataTypeDetails"
                   , xmlattributes
                     ( c.TYPECODE  as "Code"
                     , c.PRECISION as "Precision"
                     , c.SCALE     as "Scale"
                     )
                   )
                 , xmlelement
                   ( Name "OtherDetails"
                   , xmlattributes
                     ( c.NULLS     as "Null"
                     , c.DEFAULT   as "Default"
                     , c.VOFFSET   as "VOffset"
                     , c.VLENGTH   as "VLength"
                     , c.NOFFSET   as "NOffset"
                     , c.NLENGTH   as "NLength"
                     , c.NUMVALUES as "NumValues"
                     )
                   )
                 )
               )
               from SYSTEM.COLUMN c
              where c.TABLE  = t.NAME
                and c.SCHEMA = t.SCHEMA
           )
         )
         from SYSTEM.TABLE t
        where t.SCHEMA = s.NAME
          and TYPE = 'T'
     )
   )
 )
)from SYSTEM.SCHEMA s
```

The result is similar to the following. It has been formatted and displayed with an "XML-enabled" Web browser that allows collapsing and expanding XML elements in an XML tree.

```
- <Catalog>
  <Schema Name="EMPSCHM" Type="N">
   Referencing SQL Schema: Referencing Non SQL Schema:EMPSCHM</Schema>
- <Schema Name="DEMOEMPL" Type="R">
   Referencing SQL Schema:Referencing Non SQL Schema:
+ <TablesInSchema Name="DEPARTMENT" Type="T" Length="68">
+ <TablesInSchema Name="DIVISION" Type="T" Length="56">
+ <TablesInSchema Name="EMPL_MANAGER_INFO" Type="T" Length="56">
+ <TablesInSchema Name="EMPLOYEE" Type="T" Length="204">
   SQLDEMO .AREA
  <TableStats NumCols="15" NumIndexes="4" NumReferencing="2" NumRows="55"
   NumPages="40" NumSyntax="1" EstRows="0" />
- <ColumnsInTable Name="DEPT_ID" Nr="5">
   UNSIGNED NUMERIC
  <DataTypeDetails Code="128" Precision="4" Scale="0" />
  <OtherDetails Null="N" Default="N" VOffset="49" VLength="4" NOffset="0"
   NLength="0" NumValues="14" />
  </ColumnsInTable>
- <ColumnsInTable Name="EMP_FNAME" Nr="3">
   CHARACTER
  <DataTypeDetails Code="1" Precision="0" Scale="0" />
  <OtherDetails Null="N" Default="N" VOffset="9" VLength="20" NOffset="0"
   NLength="0" NumValues="0" />
  </ColumnsInTable>

- <ColumnsInTable Name="EMP_ID" Nr="1">
   UNSIGNED NUMERIC
  <DataTypeDetails Code="128" Precision="4" Scale="0" />
  <OtherDetails Null="N" Default="N" VOffset="0" VLength="4" NOffset="0"
   NLength="0" NumValues="0" />
  </ColumnsInTable>
        &invellip.
  </TablesInSchema>
        &invellip.
+ <TablesInSchema Name="INSURANCE_PLAN" Type="T" Length="168">
+ <TablesInSchema Name="JOB" Type="T" Length="188">
+ <TablesInSchema Name="POSITION" Type="T" Length="64">
   </Schema>
        &invellip.
   </Catalog>
```

XMLCOMMENT-function

Returns an XML value that is an XML comment, generated from *string-value-expression*. The XML value consists of an XML root information item with one child, an XML comment information item whose [content] property is *string-value-expression*.

Syntax

```
XMLCOMMENT ─── ( ── string-value-expression ── ) ────────────►◄
```

Parameters

string-value-expression

Specifies a character string **value-expression**, that is a **value-expression** that returns a value of type character.

If *string-value-expression* is NULL, XMLCOMMENT returns a NULL value. *string-value-expression* cannot contain a hyphen (--) sequence of characters and cannot end with a hyphen (-) character.

Example

The following statement returns a single XML comment:

```
SELECT XMLSERIALIZE(CONTENT XMLCOMMENT('My personal opinion')
                    AS CHAR(80)) as "Comment Only"
 FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

The result is similar to the following:

```
Comment Only
------------
<!--My personal opinion-->
```

XMLCONCAT-function

Returns an XML value that is the concatenation of all the **XML-value-expressions**. If all the **XML-value-expressions** are NULL or empty, a NULL value is returned.

Syntax

```
XMLCONCAT ── ( XML-value-expression ───────────────────────────►

                ┌────────────────────────────────┐
►───────────────▼─,── XML-value-expression ──────┴── ) ─────────────►◄
```

Example

Use of the XMLCONCAT function to concatenate two XML elements defined using the XMLELEMENT function.

```
SELECT e.EMP_ID,
       XMLSERIALIZE(CONTENT
                    XMLCONCAT(XMLELEMENT(NAME "fname",
                                         e.EMP_FNAME),
                              XMLELEMENT(NAME "lname",
                                         e.EMP_LNAME))
                    AS VARCHAR(64)) AS "EMP_NAME_COL"
  FROM DEMOEMPL.EMPLOYEE e WHERE EMP_ID < 1500 ;
```

The result is similar to the following:

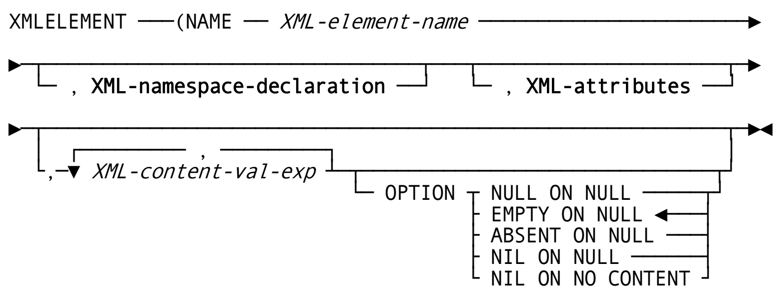
```
EMP_ID  EMP_NAME_COL
------  ------------
  1003  <fname>James</fname><lname>Baldwin</lname>
  1034  <fname>James</fname><lname>Gallway</lname>
  1234  <fname>Thomas</fname><lname>Mills</lname>
```

XMLELEMENT-function

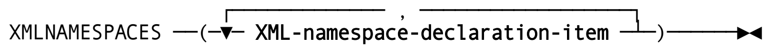
Returns an XML value that is a single XML element information item as a child of its XML root information. Provided are an XML element name, an optional list of XML namespace declarations, an optional list of attributes, and an optional list of values as the content of the new element.

The XMLATTRIBUTES pseudo function can be used to specify XML attributes in an XML element. The XMLNAMESPACES pseudo function can be used to declare XML namespace in an XML element.

Syntax



Expansion of XML-namespace-declaration



Expansion of XML-namespace-declaration-item

```
►─┬ XML-namespace-URI-char-lit ─ AS ─ XML-namespace-prefix-id ┬►◄
  ├── DEFAULT ── XML-namespace-URI-char-lit ──────────────────┤
  └── NO DEFAULT ─────────────────────────────────────────────┘
```

Expansion of XML-attributes

```
                   ┌───────────────────── , ───────────────────┐
XMLATTRIBUTES ─(─▼─ XML-att-val-exp ─┬──────────────────────┬─┴─)─►◄
                                     └ AS ─ XML-att-name ───┘
```

Parameters

XML-element-name

Specifies an identifier that is used as an XML element name. This name must be an XML QName. If the name is qualified, the namespace prefix must be declared within the scope. The maximum length of the identifier is 128 characters.

XML-content-val-exp

Specifies a **value-expression** or an **XML-value-expression** that after mapping according to Mapping SQL Data Type Values to XML Schema Data Type Values, is used as the content of the generated XML element.

XML-namespace-URI-char-lit

Specifies a character string literal of an XML namespace through a URI. For example, http://www.w3.org/2001/XMLSchema. This character string literal can be empty when used with the DEFAULT option only.

XML-namespace-prefix-id

Specifies an identifier that is used as a namespace prefix that is bound to the XML namespace given by *XML-namespace-URI-char-lit*. The maximum length of the identifier is 128 characters.

This identifier must be an XML NCName. It cannot be equal to "xml" or "xmlns", and it cannot start with the characters "xml" (in any combination). Be sure that no duplicate namespace prefixes are declared in the same XMLNAMESPACES function call.

XML-att-name

Specifies an identifier that is used as the XML attribute name. The maximum length of the identifier is 128 characters. The attribute name must be an XML QName. It cannot be equal to "xmlns" or start with "xmlns:". Be sure that no duplicate attribute names are declared in the same XMLATTRIBUTES function call.

XML-att-val-exp

Specifies a *value-expression* that is used as the value of the XML attribute. The *value-expression* can be of any type except GRAPHIC or VARGRAPHIC. The length of the value is limited to 512 characters.

If *XML-att-name* is not specified, the attribute name is derived from the *XML-att-val-exp* value. The *XML-att-val-exp* value must be a valid SQL column name, optionally qualified with **table-name** or *alias*. The fully escaped mapping is applied on the SQL column name to create the attribute name.

OPTION

Specifies the processing of null values for *XML-content-val-exp* as follows:

ABSENT ON NULL

The returned value is never null, but element is completely absent when all *XML-content-val-exp* are NULL.

EMPTY ON NULL

The returned value is never null. Element has no content for each NULL value of *XML-content-val-exp* that is NULL. This is the default.

NIL ON NO CONTENT

The returned value is not null. When the [children] property of the element does not contain at least one XML element information item or at least one XML character information item, the element is:

```
<XML-element-name xsi:nil="true"/>
```

NIL ON NULL

The returned value is not null, but when all *XML-content-val-exp* are NULL, element is

```
<XML-element-name xsi:nil="true"/>
```

with implicit xmlns:xsi=http://www.w3.org/2001/XMLSchema-instance.

NULL ON NULL

The returned value is NULL when all *XML-content-val-exp* are NULL.

Notes:

- XMLATTRIBUTES look like any other SQL/XML function, but it is not an SQL function. It is a function-like construct that can only be used in an XMLELEMENT invocation.
- An *XML-namespace-declaration* can have only one *XML-namespace-declaration-item* containing the literal DEFAULT or NO DEFAULT.
- *XML-element-name* is an identifier in the SQL language. Some valid XML names, that is, all XML QNames with a non-null prefix, require this identifier to be delimited by double quotes.

Examples

Example 1

The following SELECT statement produces a row for each employee with one column representing an 'emp' XML element containing the employee's last name. The data type of the result column is VARCHAR(64).

```
SELECT XMLSERIALIZE(CONTENT
                    XMLELEMENT(NAME "emp", EMP_LNAME)
                    AS VARCHAR(64)) AS "EMP_NAME_COL"
  FROM DEMOEMPL.EMPLOYEE ;
```

The result is similar to the following:

```
EMP_NAME_COL
------------
<emp>Baldwin</emp>
<emp>Gallway</emp>
<emp>Mills</emp>
```

Example 2

Same as Example 1, but this example includes a first column containing the employee ID, which uses the "e" alias for the table name and a WHERE clause on the SELECT statement.

```
SELECT e.EMP_ID,
       XMLSERIALIZE(CONTENT
                    XMLELEMENT(NAME "emp", e.EMP_LNAME)
                    AS VARCHAR(64)) AS "EMP_NAME_COL"
  FROM DEMOEMPL.EMPLOYEE e WHERE EMP_ID < 1500 ;
```

The result is similar to the following:

```
EMP_ID  EMP_NAME_COL
------  ------------
  1003  <emp>Baldwin</emp>
  1034  <emp>Gallway</emp>
  1234  <emp>Mills</emp>
```

Example 3

Same as Example 2, but this example also includes the employee ID as an attribute within the <emp> tag.

```
SELECT e.EMP_ID,
       XMLSERIALIZE(CONTENT
                    XMLELEMENT(NAME "emp",
                               XMLATTRIBUTES(e.EMP_ID AS "id"),
                               e.EMP_LNAME)
                    AS VARCHAR(64)) AS "EMP_NAME_COL"
  FROM DEMOEMPL.EMPLOYEE e WHERE EMP_ID < 1500 ;
```

The result is similar to the following:

```
EMP_ID  EMP_NAME_COL
------  ------------
  1003  <emp id="1003">Baldwin</emp>
  1034  <emp id="1034">Gallway</emp>
  1234  <emp id="1234">Mills</emp>
```

Example 4

Same as Example 3, but this example includes a second attribute within the <emp> tag with the employee's first name.

```
SELECT e.EMP_ID,
    XMLSERIALIZE(CONTENT
                 XMLELEMENT(NAME "emp",
                            XMLATTRIBUTES(e.EMP_ID    AS "id",
                                        e.EMP_FNAME AS "fname"),
                            e.EMP_LNAME)
                 AS VARCHAR(64)) AS "EMP_NAME_COL"
  FROM DEMOEMPL.EMPLOYEE e WHERE EMP_ID < 1500 ;
```

The result is similar to the following. Note that the content of the EMP_NAME_COL column has been formatted for convenience.

```
EMP_ID  EMP_NAME_COL
------  ------------
  1003  <emp id="1003" fname="James">Baldwin</emp>
  1034  <emp id="1034" fname="James">Gallway</emp>
  1234  <emp id="1234" fname="Thomas">Mills</emp>
```

Example 5

Same as Example 4, but this example removes the attributes and uses the employee's first name and last name as sub-elements of <emp>.

```
SELECT e.EMP_ID,
       XMLSERIALIZE(CONTENT
                    XMLELEMENT(NAME "emp",
                         XMLELEMENT(NAME "fname", e.EMP_FNAME),
                         XMLELEMENT(NAME "lname", e.EMP_LNAME))
                    AS VARCHAR(64)) AS "EMP_NAME_COL"
  FROM DEMOEMPL.EMPLOYEE e WHERE EMP_ID < 1500 ;
```

The result is similar to the following. Note that the content of the EMP_NAME_COL column has been formatted for convenience.

```
EMP_ID  EMP_NAME_COL
------  ------------
  1003  <emp>
          <fname>James</fname>
          <lname>Baldwin</lname>
        </emp>
  1034  <emp>
          <fname>James</fname>
          <lname>Gallway</lname>
        </emp>
  1234  <emp>
          <fname>Thomas</fname>
          <lname>Mills</lname>
        </emp>
```

Example 6

Same as Example 5, but this example concatenates the employee's first name and last name into one sub-element of <emp>.

```
SELECT e.EMP_ID,
       XMLSERIALIZE(CONTENT
         XMLELEMENT(NAME "emp",
                    XMLELEMENT(NAME "name",
                               e.EMP_FNAME ||' '|| e.EMP_LNAME))
          AS VARCHAR(64)) AS "EMP_NAME_COL"
       FROM DEMOEMPL.EMPLOYEE e WHERE EMP_ID < 1500 ;
```

The result is similar to the following. Note that the content of the EMP_NAME_COL column has been formatted for convenience.

```
EMP_ID  EMP_NAME_COL
------  ------------
  1003  <emp>
          <name>James Baldwin</name>
        </emp>
  1034  <emp>
          <name>James Gallway</name>
        </emp>
  1234  <emp>
          <name>Thomas Mills</name>
        </emp>
```

Example 7

Same as Example 6, but this example uses XMLNAMESPACES.

```
SELECT e.EMP_ID,
       XMLSERIALIZE(CONTENT
         XMLELEMENT(NAME "emp",
              XMLNAMESPACES(
                         DEFAULT 'http://ca.com/hr/globalxml',
                         'http://ca.com/hr/frenchxml' AS "fr" ),
                    XMLELEMENT(NAME "fr:nom",
                               e.EMP_FNAME ||' '|| e.EMP_LNAME))
          AS VARCHAR(64)) AS "EMP_NAME_COL"
       FROM DEMOEMPL.EMPLOYEE e WHERE EMP_ID < 1500 ;
```

The result is similar to the following. Note that the content of the EMP_NAME_COL column has been formatted for convenience.

```
EMP_ID  EMP_NAME_COL
------  ------------
1003    <emp xmlns="http://ca.com/hr/globalxml"
             xmlns:fr="http://ca.com/hr/frenchxml">
          <fr:nom>James Baldwin</fr:nom>
        </emp>
1034    <emp xmlns="http://ca.com/hr/globalxml"
             xmlns:fr="http://ca.com/hr/frenchxml">
          <fr:nom>James Gallway</fr:nom>
        </emp>
1234    <emp xmlns="http://ca.com/hr/globalxml"
             xmlns:fr="http://ca.com/hr/frenchxml">
          <fr:nom>Thomas Mills</fr:nom>
        </emp>
```

Example 8

This example illustrates the use of a **subquery** as an argument of XMLELEMENT.

```
SELECT
  XMLSERIALIZE
  ( CONTENT
    XMLELEMENT
    ( NAME "Employee"
    ,XMLATTRIBUTES(e.EMP_ID as "Id")
    , e.EMP_FNAME
    , e.EMP_LNAME
    , SELECT
        XMLELEMENT
        ( NAME "Manager"
        , XMLATTRIBUTES(m.EMP_ID as "MgrId")
        , m.EMP_FNAME || m.EMP_LNAME
        )
       FROM DEMOEMPL.employee m
      WHERE e.MANAGER_ID = m.EMP_ID
  ) AS VARCHAR(120)) AS "EmployeeManager"
FROM DEMOEMPL.EMPLOYEE e
```

The result is similar to the following:

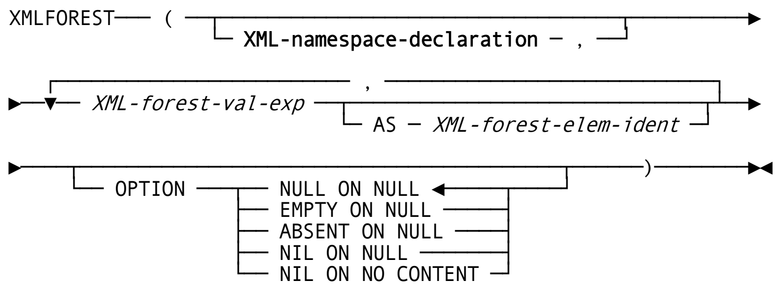
```
EmployeeManager
---------------
<Employee Id="5008">Timothy Fordman
   <Manager MgrId="2246">Marylou Hamel</Manager></Employee>
<Employee Id="4703">Martin Halloran
   <Manager MgrId="2246">Marylou Hamel</Manager></Employee>
```

XMLFOREST-function

Returns an XML value that is a list of XML element information items as the children of its XML root information. An XML element is produced from each *XML-forest-val-exp*, using the column name or, if provided, the *XML-forest-elem-ident* as the XML element name and the *XML-forest-val-exp* as the element content. The value of *XML-forest-val-exp* can be any value that has a mapping to an XML value.

The XMLNAMESPACES pseudo function can be used to declare XML namespace in an XML element.

Syntax



Note: For more information about the expansion of **XML-namespace-declaration**, see XMLELEMENT-function.

Parameters

XML-forest-elem-ident

Specifies an identifier that is used as an XML element name. The identifier must be an XML QName. If a namespace prefix is used, it must have been declared in the scope of the element. The maximum length of the identifier is 128 characters.

XML-forest-val-exp

Specifies a *value-expression* that is used as the element content of an XML element. If *XML-forest-elem-ident* is not specified, the forest element name is derived from the *XML-forest-val-exp* value. The *XML-forest-val-exp* value must be a valid SQL column name, optionally qualified with **table-name** or *alias*. The fully escaped mapping is applied on the SQL column name to create the forest element name.

OPTION

Specifies the processing of null values for *XML-forest-val-exp* as follows:

ABSENT ON NULL

The returned value is never null, but element is completely absent from the list when *XML-forest-val-exp* is NULL.

EMPTY ON NULL

The returned value is never null. Element has no content for each NULL value of *XML-forest-val-exp*.

NIL ON NO CONTENT

The returned value is not null. When the [children] property of element does not contain at least one XML element information item or at least one XML character information item, the element is:

`<XML-forest-element-name xsi:nil="true"/>.`

NIL ON NULL

The returned value is not null, but when an *XML-forest-val-exp* is NULL, element becomes

`<XML-forest-element-name xsi:nil="true"/>`

with implicit xmlns:xsi=http://www.w3.org/2001/XMLSchema-instance.

NULL ON NULL

The returned value is NULL when all *XML-forest-val-exp* are NULL. This is the default.

Note: *XML-element-name* is an identifier in the SQL language. Some valid XML names, that is, all XML QNames with non-null namespace prefix, requires this identifier to be delimited by double quotes.

Example

Similar to Example 5 of the XMLELEMENT function, but the use of two XMLELEMENT invocations to declare two sub-elements of <emp> is replaced by a single XMLFOREST invocation.

```
SELECT e.EMP_ID,
       XMLSERIALIZE(CONTENT
                    XMLELEMENT(NAME "emp",
                              XMLFOREST(e.EMP_FNAME AS "fname",
                                        e.EMP_LNAME AS "lname"))
                    AS VARCHAR(64)) AS "EMP_NAME_COL"
  FROM DEMOEMPL.EMPLOYEE e WHERE EMP_ID < 1500 ;
```

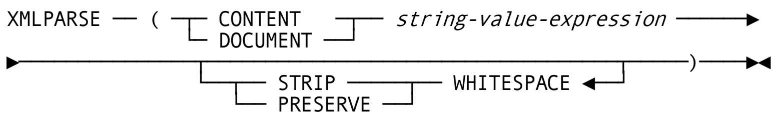
The result is similar to the following. Note that the content of the EMP_NAME_COL column has been formatted for convenience.

```
EMP_ID  EMP_NAME_COL
------  ------------
  1003  <emp>
          <fname>James</fname>
          <lname>Baldwin</lname>
        </emp>
  1034  <emp>
          <fname>James</fname>
          <lname>Gallway</lname>
        </emp>
  1234  <emp>
          <fname>Thomas</fname>
          <lname>Mills</lname>
        </emp>
```

XMLPARSE-function

Returns an XML value as the result of performing a non-validating parse of a character string. Parsing is the inverse operation of serializing.

Syntax



Parameters

string-value-expression

Specifies a character string **value-expression**, that is a **value-expression** that returns a value of type character. If *string-value-expression* is NULL, XMLPARSE returns a NULL value.

Note: The DOCUMENT and STRIP WHITESPACEoptions are not functional in this feature. Therefore, CONTENT and PRESERVE WHITESPACE should always be specified.

Example

The following statement causes an SQL statement exception because the XML is not completely serialized. The serialization is truncated after 20 characters.

```
SELECT
  XMLPARSE
  ( CONTENT
    XMLSERIALIZE
    ( CONTENT
      XMLELEMENT
      ( NAME "EMP", EMP_LNAME
      ) AS CHAR(20)
    )
  )
 FROM DEMOEMPL.EMPLOYEE ;

*+ Status = -4       SQLSTATE = 38000        Messages follow:
*+ DB001075 C-4M321: Procedure IDMSQFUX exception 38000 XMLPARSE: Premature end
*+ of data in tag EMP line 1
```

XMLPI-function

Returns an XML value that is an XML processing instruction (PI). The XML value consists of:

- An XML root information item with one child
- An XML processing information item whose [target] property is the partially escaped mapping of *identifier* to an XML Name, and whose [content] property is *string-value-expression*, trimmed of leading blanks.

Syntax

```
XMLPI ── ( NAME ── identifier ─┬─────────────────────────────┬─ ) ─►◄
                               └─ , string-value-expression ─┘
```

Parameters

Identifier

Specifies the target in the processing instruction. It must be a valid NCName. The maximum length of the *identifier* is 128 characters.

string-value-expression

Specifies a character string **value-expression**, that is a **value-expression** that returns a value of type character. It can be NULL or empty, but if present, it cannot contain the "?>" sequence.

A processing instruction takes the following syntactical form in XML 1.0:

```
<?target data?>
```

Processing instructions instruct applications to perform some type of extra processing on a given document.

An example of a processing instruction, which is supported by most Web browsers is:

```
<?xml-stylesheet href="mystyle.xsl" type="text/xsl"?>
```

When the browser loads an XML document and recognizes the processing instruction, it performs a transformation using the specified XSLT file and displays the result of the transformation instead of the raw XML file. This processing instruction has been accepted as a W3C recommendation. For more information, see http://www.w3.org/TR/xml-stylesheet.

Another example of a processing instruction accepted as a W3C recommendation is the use of the XML declaration:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
```

The pseudo-attribute *version* currently must have value "1.0". The pseudo-attribute *standalone* specifies whether any markup declarations are defined in separate documents. Finally, the pseudo-attribute *encoding* specifies the encoding of the XML document. XML parsers are required to support at least encoding UTF-8 and UTF-16.

Example

The following statement returns only a single processing instruction:

```
SELECT XMLSERIALIZE(CONTENT XMLPI (NAME "xml" ,
     '   version="1.0" encoding="UTF-8" standalone="yes"')
                   AS CHAR(80)) as "PI Instruction"
 FROM SYSTEM.SCHEMA WHERE NAME = 'SYSTEM';
```

The result is similar to the following:

```
PI Instruction
--------------
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
```

XMLROOT-function

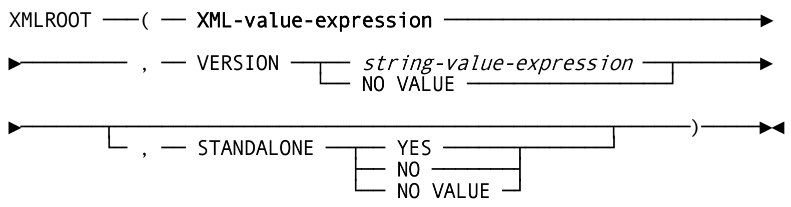
Returns an XML value by modifying the properties of the XML root information item of another XML value.

All XML documents must have at least one well-formed root element. The root element, often called the document tag, must follow the prolog (XML declaration plus DTD) and must be a non-empty tag that encompasses the entire document.

Notes:

- The Encoding property cannot be specified in the XMLROOT function. However, the XMLROOT function sets the value of the property by using the value from the XML ENCODING parameter in the SQL SET SESSION statement, unless the given XML value already has a non-null value for its Encoding property.
- If the input **XML-value-expression** is NULL or empty, XMLROOT returns a NULL value.

Syntax



Parameters

string-value-expression

Specifies a character string **value-expression**, that is a **value-expression** that returns a value of type character.

Example

Use of the XMLROOT function to generate the XML declaration in an XML document.

```
set session XML ENCODING UTF8;

select
  XMLSERIALIZE(CONTENT
    XMLROOT(
      XMLELEMENT(NAME "Employee",
        XMLATTRIBUTES(EMP_ID AS "Id",
                      DEPT_ID AS "DeptId",
                      MANAGER_ID AS "MgrId"),
        TRIM(EMP_FNAME)||' '||trim(EMP_LNAME),
        ' from ', CITY),
      VERSION '1.0', STANDALONE YES)
                         AS VARCHAR(256)) AS "EmployeeData"
  from DEMOEMPL.EMPLOYEE  where EMP_ID = 1003;
```

The result is similar to the following. Note that the content of the EmployeeData column has been formatted for convenience:

```
*+ EmployeeData
*+ ------------
*+ <?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<Employee Id="1003" DeptId="6200">James Baldwin from Boston </Employee>
```

Chapter 6: Predicates and Search Condition

This section contains the following topics:

Overview

This chapter presents expanded syntax for each predicate that can be used in a search condition. It concludes with expanded syntax for **search-condition**.

What is a Predicate?

A predicate is an operand of a search condition. It expresses or implies a comparison operation.

What is a Search Condition?

A search condition is a Boolean expression that yields a truth value. The operands of a search condition are predicates, and the operators are the logical operators AND, OR, and NOT.

A search condition establishes a criterion for selecting rows from a table.

More information:

ALTER TABLE (see page 290)
CREATE TABLE (see page 378)
Expansion of Search-condition (see page 223)

Expansion of Between-predicate

The between-predicate tests whether a value is within a range of values.

Usage

Comparable Data Types

The data types of the values specified in a between-predicate must be comparable.

Note: For information about comparing values of different data types, see Comparison, Assignment, Arithmetic, and Concatenation Operations. (see page 66)

Truth Value of a BETWEEN Predicate without NOT

The result of a BETWEEN predicate that does *not* include NOT is:

- True when value being tested is greater than or equal to the starting value of the test range and less than or equal to the ending value of the test range
- False when the value being tested is less than the starting value of the test range or greater than the ending value of the test range
- Unknown when one or more of the values specified in the predicate are null

Truth Value of a BETWEEN predicate with NOT

The result of a BETWEEN predicate that includes NOT is:

- True when value being tested is less than the starting value of the test range or greater than the ending value of the test range
- False when the value being tested is greater than or equal to the starting value of the test range and less than or equal to the ending value of the test range
- Unknown when one or more of the values specified in the predicate are null

Rounded Values

The BETWEEN predicate is useful for testing values derived from value expressions that may have been affected by rounding.

Example

As the Search Condition in a CHECK Parameter

The following CREATE TABLE statement defines the EXPERTISE table with four columns. The CHECK parameter defines a restriction on the data that can be stored in the SKILL_LEVEL column.

```
create table expertise
   (emp_id      integer       not null,
   skill_id     integer       not null,
   skill_level  character(2),
   exp_date     date,
   check (skill_level between '01' and '04');
```

More Information

- For more information about search conditions, see Expansion of Search-condition.
- For more information about the CHECK parameter, see CREATE TABLE.
- For more information about the ADD CHECK parameter, see ALTER TABLE.

Expansion of Comparison-predicate

The comparison-predicate tests whether a value is less than, equal to, or greater than another value.

Syntax

Expansion of comparison-predicate

```
►►── value-expression   comparison-operator ─┬─ value-expression ─┬──────────►◄
                                             └─ ( subquery ) ─────┘
```

Parameters

value-expression

Specifies a value to be used in the comparison. For expanded **value-expression** syntax, see Expansion of Value-expression.

comparison-operator

Specifies the comparison operator to be used in the test. Valid values for *comparison-operator* are:

Comparison operator	Meaning
=	Equal to
¬= <>	Not equal to
<	Less than
¬<	Not less than
<=	Less than or equal to
>	Greater than
¬>	Not greater than
>=	Greater than or equal to

(subquery)

Specifies a subquery that returns no more than one row and whose result table consists of a single column.

Note: For more information about expanded **subquery** syntax, see Expansion of Subquery. (see page 239)

Usage

Comparable Data Types

The data types of the values being compared must be comparable.

Note: For information about comparing values of different data types, see Comparison, Assignment, Arithmetic, and Concatenation Operations. (see page 66)

Truth Value of a Comparison Predicate

The result of a comparison predicate is:

- True when the first value relates to the second value in the way specified by the comparison operator
- False when the first value does not relate to the second value in the way specified by the comparison operator
- Unknown when one or both of the values being compared are null or when the result of the subquery is an empty set

Example

As the Search Condition in a WHERE Parameter

The following DELETE statement deletes rows in the EXPERTISE table for employees who were terminated before January 1, 2006. The search condition in the WHERE parameter of the subquery consists of a single comparison predicate.

```
delete from expertise
   where emp_id in
      (select emp_id
         from employee
         where termination_date <'2006-01-01');
```

Expansion of Exists-predicate

The exists-predicate tests for the existence of data meeting criteria specified in a subquery.

Syntax

Expansion of exists-predicate

```
►►── EXISTS ( subquery ) ──────────────────────────────────────────►◄
```

Parameters

(subquery)

Specifies a subquery that returns a set of zero or more rows. For expanded **subquery** syntax, see Expansion of Subquery.

Usage

Truth Value of an EXISTS Predicate

The result of an EXISTS predicate is:

- True when the result of the subquery is a set containing one or more rows
- False when the result of the subquery is an empty set

Example

With the Unary Operator NOT in a WHERE Parameter

The following SELECT statement identifies employees for whom no expertise information has been stored in the database.

```
select e1.emp_id
   from employee e1
   where not exists
      (select * from expertise e2
      where e1.emp_id = e2.emp_id);
```

Note: For more information about search conditions, see Expansion of Search-condition.

More information:

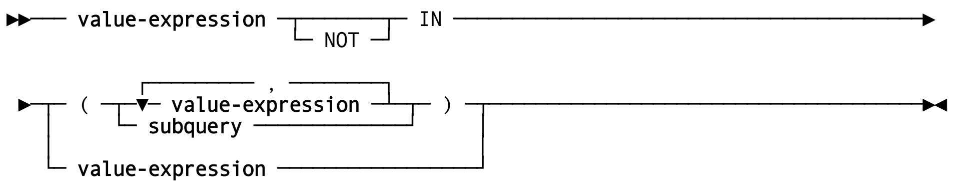
Expansion of Search-condition (see page 223)

Expansion of In-predicate

The in-predicate tests whether a value occurs in a specified set of values.

Syntax

Expansion of in-predicate



Parameters

value-expression

Specifies the value to be compared to the set of values identified by the IN parameter. For expanded **value-expression** syntax, see Expansion of Value-expression.

NOT

Reverses the test. NOT directs CA IDMS to test whether a value is not in the specified set of values.

IN

Identifies the set of values to which the value being tested is compared.

value-expression

Specifies a value that is a member of the set of test values.

Value-expression may be enclosed in parentheses. Multiple occurrences of **value-expression** must be separated by commas and enclosed in parentheses.

subquery

Specifies a subquery that returns zero or more rows and whose result table consists of a single column. The column values are members of the set of test values. For expanded **subquery** syntax, see Expansion of Subquery.

Usage

Equivalence

Value-expression IN **value-expression** is equivalent to a comparison predicate in the form **value-expression** = **value-expression**.

Value-expression IN (**subquery**) is equivalent to a quantified predicate in the form **value-expression** = ANY (**subquery**).

Comparable Data Types

The data types of the values in an IN predicate must be comparable.

Note: For more information about comparing values of different data types, see Comparison, Assignment, Arithmetic, and Concatenation Operations. (see page 66)

Truth Value of an IN Predicate without NOT

The result of an IN predicate that does *not* include NOT is:

- True when the value being tested is equal to at least one of the values in the test set
- False when the value being tested is not equal to any of the values in the test set or when the result of the subquery is an empty set
- Unknown when the value being tested is null or when values in the test set are a combination of null value and values not equal to the value being tested

This table presents examples of results of IN predicates without NOT:

Predicate	**Result**
'A' IN ('A','B')	True
'A' IN ('B')	False
'A' IN (*null-value*)	Unknown
'A' IN ('A',*null-value*)	True
'A' IN ('B',*null-value*)	Unknown

Truth Value of an IN Predicate with NOT

The result of an IN predicate that includes NOT is:

- True when the value being tested is not equal to any of the values in the test set or when the result of the subquery is an empty set
- False when the value being tested is equal to at least one of the values in the test set
- Unknown when the value being tested is null or values in the test set are a combination of null value and values not equal to the value being tested

This table presents examples of results of IN predicates with NOT:

Predicate	Result
'A' NOT IN ('A','B')	False
'A' NOT IN ('B')	True
'A' NOT IN (*null-value*)	Unknown
'A' NOT IN ('A',*null-value*)	False
'A' NOT IN ('B',*null-value*)	Unknown

Example

As the Search Condition in a WHERE Parameter

The following SELECT statement identifies employees who live in one of four specified cities:

```
select emp_fname, emp_lname, dept_id
   from employee
   where emp_city in ('Newton','Wellesley','Natick','Wayland');
```

Expansion of Like-predicate

The like-predicate tests whether a character value matches the pattern of another character value.

Syntax

Expansion of like-predicate

```
►►─── value-expression ─────────────────────────────────────────────────────►

►─┬─────────┬─ LIKE ─┬─ 'pattern' ────────────────────────────────┬─────────►
  └─ NOT ───┘        ├─ G 'graphics pattern' ────────────────────┤
                     ├─ host-variable ────────────────────────────┤
                     ├─ special-register ─────────────────────────┤
                     ├─ dynamic-parameter-marker ─────────────────┤
                     ├─ routine-parameter ────────────────────────┤
                     └─ local-variable ───────────────────────────┘

►─┬──────────────────────────────────────────────┬──────────────────────────►◄
  └─ ESCAPE ──┬─ 'escape-character' ─────────────┤
              ├─ host-variable ──────────────────┤
              ├─ dynamic-parameter-marker ───────┤
              ├─ routine-parameter ──────────────┤
              └─ local-variable ─────────────────┘
```

Parameters

value-expression

Specifies a value to be tested against a pattern or other value.

Value-expression must have a data type of CHARACTER, VARCHAR, BINARY, GRAPHIC, or VARGRAPHIC.

NOT

Reverses the test. NOT directs CA IDMS to test whether a specified value does not match the specified pattern.

LIKE

Identifies the pattern to which the value being tested is compared.

'*pattern*'

Specifies a character string literal to be used as the test pattern.

A test pattern can include wildcard characters:

Character	Meaning
_ (underscore)	Represents any single character
% (percent sign)	Represents any string of zero or more characters

Wildcard characters can be used in any combination and any number of times in a test pattern.

G'*graphics-pattern*'

Specifies a double-byte character literal to be used as a test pattern.

Wildcard characters can be used as described for *pattern* except that the wildcard characters are the double-byte equivalents of the characters shown in the table above, and they are used to represent double-byte characters.

host-variable

Identifies a host variable that contains the character value to be used as the test pattern. The host variable must have been declared in an SQL declaration section and must be an elementary item instead of a group field.

special-register

Identifies a special register that contains the value to which the value being tested is compared.

CURRENT TIMEZONE may not be specified for **special-register**. For expanded **special-register** syntax, see Expansion of Special-register.

dynamic-parameter-marker

Indicates that a dynamic parameter is used to contain the character value for the test pattern.

host-variable

Identifies a local variable that contains the character value to be used as the test pattern. The local variable must have been declared in an SQL declaration statement.

routine-parameter

Identifies a routine parameter that contains the character value to be used as the test pattern. The routine parameter must have been defined in the parameter-definition of the SQL routine.

local-variable

Specifies a local variable to be used in the value-expression.

ESCAPE

The ESCAPE option allows the designation of an escape character for the pattern. The option must specify a one byte character value. If it appears in the pattern string, the escape character must be immediately followed by either a wildcard character or by another instance of the escape character. When this happens, the leading escape character is dropped from the match and the following character (wildcard or escape) is treated at face value instead of as a special character. For example, LIKE 'A_%' matches all values beginning with A, while LIKE 'AZ_%' ESCAPE 'Z' matches all values beginning with A_.

Important! Escape characters are not supported in installations with active DBCS support.

'*escape character*'

Specifies the character to be used as the escape character. *Escape-character* must be a one-byte character value.

host-variable

Specifies the character to be used as the escape character. *Escape-character* must be a one-byte character field.

dynamic-parameter-marker

Specifies that the one-byte escape character is supplied through a dynamic parameter.

routine-parameter

Specifies the character to be used as the escape character. *Escape-character* must be a one-byte character field.

local-variable

Specifies the character to be used as the escape character. *Escape-character* must be a one-byte character field.

Usage

Truth Value of a LIKE Predicate without NOT

The result of a LIKE predicate that does *not* include NOT is:

- True when the value being tested matches the test pattern
- False when the value being tested does not match the test pattern
- Unknown when either the value being tested or the test pattern is null

Truth Value of a LIKE Predicate with NOT

The result of a LIKE predicate that includes NOT is:

- True when the value being tested does not match the test pattern
- False when the value being tested matches the test pattern
- Unknown when either the value being tested or the test pattern is null

Equivalence

If '*pattern*' contains no wildcard character, the LIKE predicate is the equivalent of a comparison predicate using an equal sign, with the restriction that the lengths of the two values being compared must be identical. This restriction distinguishes a test for a match from a test for equality.

Evaluation of Trailing Blanks

If **value-expression** containing a character string with trailing blanks is compared to the same character string without trailing blanks in a LIKE predicate, the result is false. For example, 'ABC ' is not like 'ABC'. Similarly, 'ABC' is not like 'ABC '.

Graphics and Character Values

If **value-expression** is a character value, then the search pattern must also be a character value. If **value-expression** is a graphics value, then the search pattern must also be a graphics value.

Using Host Variables and Dynamic Parameters As Test Patterns

The value of the test pattern can be supplied through a host variable or a dynamic parameter. The value of the variable or parameter can include wildcard characters as described above. For example, assume you code the following:

```
02  PATTERN   PIC X(10).
 ....
MOVE '%ABC%' TO PATTERN.
 ....
SELECT .... WHERE .... LIKE :PATTERN;
```

The pattern being used is '%ABC%   ', which means 0 to n of anything followed by ABC, followed by 0 to n of anything, followed by 5 spaces. This doesn't yield the same result as:

```
SELECT .... WHERE .... LIKE '%ABC%';
```

which means 0 to n of anything, followed by ABC, followed by 0 to n of anything.

Examples

Using the Underscore in a Pattern

The following SELECT statement identifies the consultants working on projects with four-character identifiers where the middle two characters are 2 and 0:

```
select con_id, con_lname
   from consultant
   where proj_id like '_20_';
```

Using the Percent Sign in a Pattern

The following SELECT statement identifies all employees whose last names begin with A or B:

```
select emp_fname, emp_lname, dept_id
   from employee
   where emp_lname like 'A%'
      or emp_lname like 'B%';
```

More Information

- For more information about character string literals, see Literals.
- For more information about host variables, see Host Variables.
- For more information about declaring local variables, see Local Variables.
- For more information about declaring routine-parameters, see Routine Parameters.

More information:

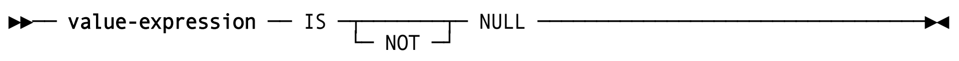
Local Variables (see page 81)
Host Variables (see page 77)
Literals (see page 75)
Routine Parameters (see page 84)

Expansion of Null-predicate

The null-predicate tests whether a value in a column is null.

Syntax

Expansion of null-predicate



Parameters

value-expression

Specifies the value to be tested.

IS NULL

Directs CA IDMS to test for the presence of a null value.

NOT

Reverses the test. NOT directs CA IDMS to test for the presence of a non-null value.

Usage

Truth Value of a NULL Predicate without NOT

The result of a NULL predicate that does *not* include NOT is:

- True when the value being tested is null
- False when the value being tested is not null

Truth Value of a NULL Predicate with NOT

The result of a NULL predicate that includes NOT is:

- True when the value being tested is not null
- False when the value being tested is null

Example

As the Search Condition in a WHERE Parameter

The following SELECT statement identifies employees for whom no telephone number has been stored in the database:

```
select emp_id
   from employee
   where phone is null;
```

Note: For more information about search conditions, see Expansion of Search-condition. (see page 223)

Expansion of Quantified-predicate

The quantified-predicate tests the comparison of a value to either some or all the values in a specified set.

Syntax

Expansion of quantified-predicate

```
►►── value-expression ─────────────────────────────────────────────►

►── comparison-operator ─┬─ ALL ──────┬─ ( subquery ) ─────────────►◄
                         └─┬─ SOME ─┬─┘
                           └─ ANY ──┘
```

Parameters

value-expression

Specifies a value to be compared to the set of values. For expanded **value-expression** syntax, see Expansion of Value-expression.

comparison-operator

Specifies the comparison operator to be used in the test. Valid values for *comparison-operator* are:

Comparison operator	Meaning
=	Equal to
¬= <>	Not equal to
<	Less than
¬<	Not less than
<=	Less than or equal to
>	Greater than
¬>	Not greater than
>=	Greater than or equal to

ALL

Directs CA IDMS to test whether the specified value relates to all the values in the test set in the way specified by the comparison operator.

SOME/ANY

Directs CA IDMS to test whether the specified value relates to at least one value in the test set in the way specified by the comparison operator.

SOME and ANY are synonyms.

(subquery)

Specifies a subquery that returns zero or more rows and whose result table consists of a single column. For expanded **subquery** syntax, see Expansion of Subquery.

Usage

Comparable Data Types

The data types of the values being compared must be comparable.

Note: For more information about comparing values of different data types, see Comparison, Assignment, Arithmetic, and Concatenation Operations.

Truth Table for a Quantified Predicate with ALL

The result of a quantified predicate that includes ALL is:

- True when the value being tested relates to every value in the test set in the way specified by the comparison operator or when the result of the subquery is an empty set
- False when the value being tested does not relate to at least one value in the test set in the way specified by the comparison operator
- Unknown when the value being tested is null or when at least one value in the test set is null and the value being tested relates to all other values in the test set in the way specified by the comparison operator

Truth Table for a Quantified Predicate with SOME or ANY

The result of a quantified predicate that includes SOME or ANY is:

- True when the value being tested relates to at least one value in the test set in the way specified by the comparison operator
- False when the value being tested does not relate to any value in the test set in the way specified by the comparison operator or when the result of the subquery is an empty set
- Unknown when the value being tested is null or when at least one value in the test set is null and the value being tested does not relate to any value in the test set in the way specified by the comparison operator

Examples

Using ALL

The following SELECT statement identifies the employees whose percent of salary increase at their 1999 review was greater than their percent of salary increase in any other year:

```
select emp_id
   from benefits b1
   where fiscal_year = '99'
      and review_percent > all
         (select review_percent
            from benefits b2
            where b1.emp_id = b2.emp_id
               and fiscal_year <> '99');
```

Using ANY

The following SELECT statement identifies employees who earned more in commission in the 1999 fiscal year than they did in salary in at least one fiscal year:

```
select s.emp_id
   from sales s, position p1
   where s.emp_id = p1.emp_id
      and s.fiscal_year = '99'
      and comm_percent * sales_to_date > any
         (select salary_amount
            from position p2
            where s.emp_id = p2.emp_id);
```

Expansion of Search-condition

The search-condition represents a truth value in an SQL statement.

Syntax

Expansion of search-condition

```
►►─┬───────┬─┬─ between-predicate ────┬──────────────────────────────────────►
   └─ NOT ─┘ ├─ comparison-predicate ─┤
             ├─ exists-predicate ─────┤
             ├─ in-predicate ─────────┤
             ├─ like-predicate ───────┤
             ├─ null-predicate ───────┤
             ├─ quantified-predicate ─┤
             └─ ( search-condition ) ─┘

 ►─┬──────────────────────────────────────────────────────────┬───────────►◄
   │ ┌────────────────────────────────────────────────────┐   │
   └─▼─┬─ AND ─┬──┬───────┬─┬─ between-predicate ────┬────┴───┘
       └─ OR ──┘  └─ NOT ─┘ ├─ comparison-predicate ─┤
                            ├─ exists-predicate ─────┤
                            ├─ in-predicate ─────────┤
                            ├─ like-predicate ───────┤
                            ├─ null-predicate ───────┤
                            ├─ quantified-predicate ─┤
                            └─ ( search-condition ) ─┘
```

Parameters

NOT

Reverses the truth value, if known, of the operand that follows; that is:

- A true value becomes false
- A false value becomes true
- An unknown value remains unknown

between-predicate

Represents the truth value resulting from the evaluation of a BETWEEN predicate. For expanded **between-predicate** syntax, see Expansion of Between-predicate.

comparison-predicate

Represents the truth value resulting from the evaluation of a comparison predicate. For expanded **comparison-predicate** syntax, see Expansion of Comparison-predicate.

exists-predicate

Represents the truth value resulting from the evaluation of an EXISTS predicate. For expanded **exists-predicate** syntax, see Expansion of Exists-predicate.

in-predicate

Represents the truth value resulting from the evaluation of an IN predicate. For expanded **in-predicate** syntax, see Expansion of In-predicate.

like-predicate

Represents the truth value resulting from the evaluation of a LIKE predicate. For expanded **like-predicate** syntax, see Expansion of Like-predicate.

null-predicate

Represents the truth value resulting from the evaluation of a NULL predicate. For expanded **null-predicate** syntax, see Expansion of Null-predicate.

quantified-predicate

Represents the truth value resulting from the evaluation of a quantified predicate. For expanded **quantified-predicate** syntax, see Expansion of Quantified-predicate.

(search-condition)

Specifies another search condition to be used as a single operand in the search condition. To be manipulated as a single operand, the search condition must be enclosed in parentheses.

AND

Specifies that both the operand preceding the operator and the operand following the operator must be true for the search condition to be true.

OR

Specifies that either the operand preceding the operator, the operand following the operator, or both operands must be true for the search condition to be true.

Usage

A search condition in an SQL statement specifies criteria used to restrict the data processed by the statement:

- In a WHERE parameter, the search condition restricts the rows processed by the statement.

  The WHERE parameter occurs in **query-specification** and in the DELETE, SELECT, and UPDATE statements.

- In a HAVING parameter, the search condition restricts the table groupings processed by the statement.

  The HAVING parameter occurs in **query-specification** and the SELECT statement.

- In a CHECK or ADD CHECK parameter, the search condition restricts the data that can be stored in a table. A search condition in a CHECK or ADD CHECK parameter is also called a check constraint.

  The CHECK parameter occurs in the CREATE TABLE statement. The ADD CHECK parameter occurs in the ALTER TABLE statement.

Restrictions on search-condition in a CHECK or ADD CHECK Parameter

In the CHECK parameter of the CREATE TABLE statement or the ADD CHECK parameter of the ALTER TABLE statement:

- The search condition cannot include any host variables, routine parameters, local variables, user-defined-functions, aggregate functions, EXISTS predicates, quantified predicates, subqueries, or dynamic parameter markers.
- Column references in the search condition must identify columns in the table being created or altered.

Truth Values

The result of a search condition is one of three possible truth values: true, false, or unknown. The unknown value occurs only when the search condition includes one or more null values.

CA IDMS obtains the result by evaluating the search condition for a particular row in a table or a particular table grouping. Processing occurs according to the results, as described in the following table:

If the result is:	CA IDMS:
True	Continues processing the statement for the row or group
False	CA IDMS does not process the statement for the row or group
Unknown	■ Does not process the row when the search condition occurs in the WHERE or HAVING parameters of a SELECT, UPDATE, or DELETE statement, or query specification ■ Processes the row when the search condition occurs in a CHECK clause that is tested during an INSERT or UPDATE operation

Truth Table for AND

The result of the AND operation for each possible combination of operands is given by the following truth table:

AND	**True**	**False**	**Unknown**
True	True	False	Unknown
False	False	False	False

AND	True	False	Unknown
Unknown	Unknown	False	Unknown

Truth Table for OR

The result of the OR operation for each possible combination of operands is given by the following truth table:

OR	True	False	Unknown
True	True	True	True
False	True	False	Unknown
Unknown	True	Unknown	Unknown

Order of Evaluation

After evaluating the individual operands, CA IDMS performs the operations in a search condition in the following order:

1. The unary operation NOT from left to right
2. AND from left to right
3. OR from left to right

You can use parentheses to override the default order of evaluation. Operations in parentheses are performed first.

For example, assuming the value in :SALARY is 35,000, the result of the following search condition is true:

```
:salary > 20000 or :salary = 0 and :salary < 30,000
```

When the OR operation is enclosed in parentheses, the result of the expression is false:

```
(:salary > 20000 or :salary = 0) and :salary < 30,000
```

Examples

A Single Operand

The following ALTER TABLE statement directs CA IDMS to store only values less than or equal to 10 in the BONUS_PERCENT column of the POSITION table. The search condition in the ADD CHECK parameter consists of a single operand (a comparison predicate).

```
alter table position
   add check (bonus_percent <= 10);
```

Two Operands with OR

The following SELECT statement returns the number of employees in each department that has either five or more employees or no employees:

```
select dept_id, count(emp_id)
   from employee
   group by dept_id
   having count(emp_id) >= 5
      or count(emp_id) = 0;
```

Multiple Operands

The following SELECT statement identifies the project leaders of projects that were scheduled to have started by now but have not and that have no assigned employees. The search condition in the first WHERE parameter includes three operands. The first is a comparison predicate, the second is a NULL predicate, and the third is an EXISTS predicate with the unary operator NOT.

```
select proj_leader_id
   from project p
   where est_start_date < current date
      and act_start_date is null
      and not exists
         (select emp_id
            from employee e
            where e.proj_id = p.proj_id);
```

More Information

- For more information about the WHERE parameter, see:
  - Expansion of Subquery
  - Expansion of Query-specification
  - DELETE, SELECT, UPDATE
- For more information about the HAVING parameter, see:
  - Expansion of Subquery
  - Expansion of Query-specification
  - SELECT or UPDATE
- For more information about the CHECK parameter, see CREATE TABLE.
- For more information about the ADD CHECK parameter, see ALTER TABLE.

Chapter 7: Query Specifications, Subqueries, Query Expressions, and Cursor Specifications

This section contains the following topics:

Query Specifications

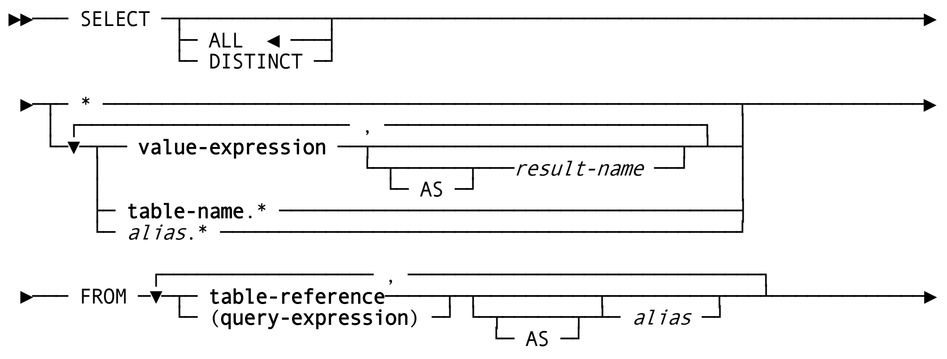
A query specification is the form of the SELECT statement used to represent a table of values in an SQL statement. The values represented by a query specification are derived from the tables, views, procedures and table procedures named in the FROM parameter of the query specification.

Expansion of Query-specification

The expansion of query-specification represents a table to be used in the evaluation of an SQL statement.

Syntax

Expansion of query-specification



```
►─┬─────────────────────────────────────────────────────────────────────────►
  └─ WHERE ─┬─ search-condition ──────────┬─┘
            └─ extended-search-condition ─┘

►─┬─────────────────────────────────────────────────────────────────────────►
  └─ PRESERVE ─┬─ table-name ─┬─┘
               └─ alias ──────┘

►─┬─────────────────────────────────────────────────────────────────────────►
  │             ┌────────────── , ──────────────┐
  └─ GROUP BY ─▼┬┬─────────────────┬ column-name ┴┬┘
                │├─ table-name. ─┤               │
                │└─ alias. ──────┘               │
                └─ rowid-pseudo-column ──────────┘

►─┬─────────────────────────────────────────────────────────────────────────►
  └─ HAVING search-condition ─┘

►─┬────────────────────────────────────────────────────────────────────────►◄
  └─ OPTIMIZE FOR literal ROWS ─┘
```

Parameters

ALL

Directs CA IDMS to return all the rows, including duplicates, in the requested result table. ALL is the default when you specify neither ALL nor DISTINCT.

DISTINCT

Directs CA IDMS to eliminate duplicate rows from the result table of the query specification.

*****

Specifies that the result table is to include all columns in the tables, views, procedures and table procedures named in the FROM parameter of the query specification. The columns in the tables, views, procedures and table procedures are concatenated in the order in which the tables and views are specified in the FROM parameter.

value-expression

Identifies the values to be included in a result column. Typically, **value-expression** includes a column reference.

Each column reference in **value-expression** must identify a column in a table named in the FROM parameter of the query specification.

The number of columns in a result table is the same as the number of value expressions in the query specification defining the result table. For expanded **value-expression** syntax, see Expansion of Value-expression.

AS *result-name*

Specifies a name for the result column identified by **value-expression**. *Result-name* must be a 1- through 32-character name that follows the conventions for SQL identifiers.

table-name.*

Specifies that the result table is to include all columns in the table identified by **table-name**.

Table-name must match an occurrence of **table-name** in the FROM parameter.

alias*.

Specifies that the result table is to include all columns in the table identified by *alias*.

Alias must match an occurrence of *alias* in the FROM parameter.

FROM table-reference

Identifies one or more tables, views, procedures or table procedures from which the result table is to be derived. For expanded **table-reference** syntax, see Expansion of Table-reference.

(query-expression)

Represents a table to be used in the evaluation of an SQL statement.

AS *alias*

Defines a new name to be used to identify the table, view, procedure or table procedure within the query specification. *Alias* must be a 1- through 18-character name that follows the conventions for SQL identifiers.

WHERE

Introduces criteria that a row must meet to be included in the result table.

search-condition

Specifies the set of values against which a row is tested:

- When the value of **search-condition** is true, the row is included in the result table
- When the value of **search-condition** is false or unknown, the row is not included in the result table

For expanded **search-condition** syntax, see Expansion of Search-condition.

extended-search-condition

Specifies a search condition that includes a set specification. For expanded **extended-search-condition** syntax, see Expansion of Extended-search Condition.

PRESERVE

Requests an outer join on the specified table, view, or table procedure. The PRESERVE parameter is a CA IDMS extension of the SQL standard.

To specify a more powerful outer join that is compatible with the SQL standard, use the **joined-table** construct as **table-reference**.

table-name

Specifies by name the table, view, procedure or table procedure to be preserved in an outer join. For expanded **table-name** syntax, see Expansion of Table-name.

alias

Specifies the table, view, procedure or table procedure to be preserved in an outer join by the alias defined for the table, view, procedure or table procedure in the FROM parameter of the query specification.

GROUP BY *column-name*

Groups the rows in the table defined by the FROM and WHERE parameters by the values in the specified columns. Rows with the same value in each grouping column are grouped together.

Column-name must identify a column in a table, view, procedure or table procedure named in the FROM parameter of the query specification. Multiple column names must be separated by commas.

table-name

Specifies the table, view, procedure or table procedure includes the named column. For expanded **table-name** syntax, see Expansion of Table-name.

alias

Specifies the alias associated with the table, view, procedure or table procedure that includes the named column. *Alias* must be defined in the FROM parameter of the query specification.

rowid-pseudo-column

Specifies a pseudo-column ROWID to be used as a grouping column. See Expansion of rowid-pseudo-column for more information.

HAVING search-condition

Specifies criteria a group must meet to be included in the result table:

- When the value of **search-condition** is true, the group is included in the result table
- When the value of **search-condition** is false or unknown, the group is not included in the result table

For expanded **search-condition** syntax, see Expansion of Search-condition.

OPTIMIZE FOR literal ROWS

Specifies the expected number of output rows from this query-specification. It is used by the optimizer to generate the best possible access strategy for satisfying query-expression. The string **literal** is an integer constant. The OPTIMIZE FOR parameter is a CA IDMS extension of the SQL standard.

Usage

Outer Join Using PRESERVE

Within **query-specification**, PRESERVE can be used to request an outer join on one of the tables, views, procedures or table procedures named in the FROM parameter. If PRESERVE is specified, the result table includes rows of the preserved table for which no matching row exists in the other tables used in the join operation.

If no matching row exists, the corresponding columns in the result table are set to null. Predicates in the WHERE clause other than those used to perform the outer join are evaluated *before* determining whether a matching row exists.

The following statement returns the names of all active employees. The name of the employee's spouse is also returned if found. The logic of the statement is that the result table includes the name of each active employee, and whether the employee has a spouse:

```
select e.first_name, e.last_name,
       s.first_name, s.last_name
  from employee e, relation s
  where e.empid=s.empid
    and e.status='A'         -- active employee
    and s.relationship='S'   -- employee's spouse
  preserve e ;
```

Note: Outer join and many other join types can be specified to be compatible with the SQL standard using the **joined-table** construct in **table-reference**. See Expansion of Table-reference, for more information.

PRESERVE and Column Order

When using PRESERVE and specifying "*" as the result column list, the order of the columns in the result table depend on which table is being preserved. The columns of the preserved table are always first.

Value Expressions without Column References

If the value expression that identifies a result column does not include any column references, the result column contains the same value in each row. This value is derived directly from the value expression without reference to the table defined by the FROM parameter of the query specification.

Uniqueness of Table References

Each alias and each table reference without an associated alias must be unique within the FROM parameter of a query specification.

Column References in the WHERE Parameter

Each column reference directly included in the search condition in the WHERE parameter of a query specification must unambiguously identify a column in a table, view, procedure or table procedure specified in the FROM parameter of the query specification, or must be an outer reference.

Note: For information about outer references, see Subqueries.

GROUP BY Parameter Requirements

When a query specification includes the GROUP BY parameter, each column reference in the value expressions that identify the result columns must either identify a column specified in the GROUP BY parameter or occur only in the argument of an aggregate function. If the result columns are identified by an asterisk (*), the GROUP BY parameter must include all the columns in the tables, views, and table procedures specified in the FROM parameter.

Query Specifications without the GROUP BY Parameter

If a query specification does not include the GROUP BY parameter and any column reference in a value expression that identifies a result column is included in the argument of an aggregate function:

- All column references in all the value expressions must be in aggregate functions
- The entire table defined by the FROM and WHERE parameters is treated as a single group

Column References in the HAVING Parameter

Each column reference included in the search condition in the HAVING parameter of a query specification must either identify a column specified in the GROUP BY parameter of the query specification, occur in the argument of an aggregate function, or be an outer reference.

When to Use OPTIMIZE FOR Literal ROWS

Under some circumstances, the SQL optimizer may choose a less than optimal access strategy to satisfy a query expression. This typically happens with host program embedded SQL statements which contain WHERE clauses with host variable references, rather than explicit constants. For example, a BETWEEN clause involving host variables may induce the optimizer to assume many rows will be retrieved, causing it to choose an area sweep to satisfy the request. Without knowing the underlying values of the host variables, the optimizer cannot know if the BETWEEN will always qualify a small number of rows, thus possibly making an index retrieval much more efficient. The OPTIMIZE FOR literal ROWS clause is used to override the number of expected rows deduced by the optimizer. This allows it to generate better access strategies.

Examples

In a CREATE VIEW Statement

The following CREATE VIEW statement defines a view derived from three tables:

```
create view former_employee
   as select e.emp_id, emp_fname, emp_lname,
         job_title, start_date, finish_date
      from employee e, job j, position p
      where e.emp_id = j.emp_id
         and e.emp_id = p.emp_id
         and finish_date is not null;
```

In an INSERT Statement

The following INSERT statement inserts rows into the TEMP_EMP_SKILL table.

```
insert into temp_emp_skill
   select emp.emp_id, dept_id, skill_name, skill_level
      from employee emp, expertise exp, skill s
      where emp.emp_id = exp.emp_id
         and exp.skill_id = s.skill_id;
```

Subqueries

A subquery is a query specification used in predicates or in the SET clause of the UPDATE statement or in **XML-value-expression**. Each subquery in a predicate represents a set of zero or more values to be used in the test specified by the predicate. A subquery used in the SET clause of the UPDATE statement or in **XML-value-expression** represents either the NULL value or a single value. The values represented by a subquery are derived from the query specification of the subquery.

Subqueries are always enclosed in parentheses, except when used as **XML-value-expression**

Nesting Subqueries

You can nest subqueries in an SQL statement. For example, a subquery in the WHERE parameter of a SELECT statement can include another subquery in its own WHERE or HAVING parameter:

```
select ... where ... (select ... where ... (select ...) );
                                           └─────┬────┘
                                              Subquery 2
                     └────────────────┬───────────────┘
                                  Subquery 1
└──────────────────────────────┬──────────────────────────┘
                     SELECT statement
```

Outer References

An outer reference is a reference to a column named in an outer subquery, an outer query specification, or the SELECT statement where the subquery occurs.

For example, with reference to the illustration above:

- If Subquery 2 contains a reference to a column named in Subquery 1, it is an outer reference
- If Subquery 2 contains a reference to a column named in the SELECT statement, it is an outer reference
- If Subquery 1 contains a reference to a column named in the SELECT statement, it is an outer reference

Correlated Subqueries

A correlated subquery is a subquery that contains an outer reference.

CA IDMS must evaluate a correlated subquery once for each value in the outer-reference column. The result of the evaluation differs depending on the value in the outer-reference column.

In contrast, CA IDMS must evaluate a subquery that does *not* include any outer references only once.

For an example of a correlated subquery, see A Correlated Subquery in a Comparison Predicate.

Expansion of Subquery

The expansion of subquery specifies a set of values to be used in the evaluation of a predicate or the SET clause of an UPDATE statement.

Syntax

Expansion of subquery

```
►►─── query-specification ──────────────────────────────────────────►◄
```

Parameters

query-specification

Specifies the query specification that comprises the subquery. For expanded **query-specification** syntax, see Expansion of Query-specification.

Usage

Restriction on DISTINCT

You can specify DISTINCT only once in a subquery (not counting occurrences in nested subqueries). For example, if the value expression that identifies the result column includes an aggregate function with the keyword DISTINCT, you cannot specify DISTINCT either before the value expression or with any other aggregate function.

Column References in the WHERE parameter

Each column that the query specification of a subquery references must identify a column of a table, view, procedure or table procedure named in the FROM clause of the query specification or be an outer reference.

Examples

A Subquery Without Correlation in an IN Predicate

The following SELECT statement returns the name and department identifier of each employee who has more than 80 hours of outstanding vacation time. The set of values returned by the subquery consists of the identifiers of all employees with more than 80 hours of outstanding vacation time.

```
select emp_fname, emp_lname, dept_id
   from employee
   where emp_id in
      (select emp_id
         from benefits
         group by emp_id
         having sum(vac_accrued) - sum(vac_taken) > 80);
```

A Correlated Subquery in a Comparison Predicate

The following SELECT statement identifies employees who earn more than their managers. The subquery is evaluated once for each value in the EMP_ID column of the EMPLOYEE table named in the outer SELECT statement.

```
select e1.emp_id
   from employee e1, position p1
   where e1.emp_id = p1.emp_id
      and p1.salary_amount >
         (select p2.salary_amount
            from employee e2, position p2
            where e1.manager_id = e2.emp_id
               and e2.emp_id = p2.emp_id);
```

More Information

- For more information about aggregate functions in subqueries, see Aggregate-function.
- For more information about subqueries in comparison predicates, see Expansion of Comparison-predicate.

Query Expressions

A query expression is an expression used to represent a table of values in an SQL statement. The operands in a query expression are tables represented by query specifications. A query expression can include one or more query specifications. Each query specification is linked to the next by the UNION operator. The data lengths of the unioned columns must be identical.

Result of a Query Expression

The table resulting from the evaluation of a query expression is derived from the concatenation of the rows in the tables defined by the operands.

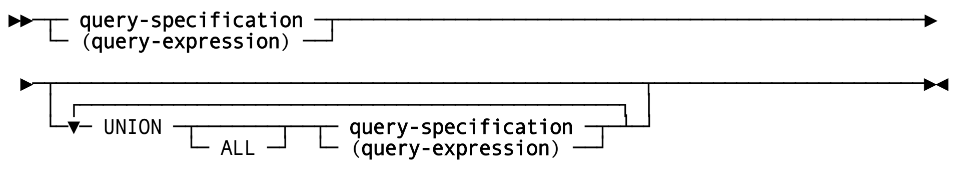
Note: For more information about other types of expressions, see Values and Value Expressions.

Expansion of Query-expression

The expanded parameters of query-expression represent a table to be used in the evaluation of an SQL statement.

Syntax

Expansion of query-expression



Parameters

query-specification

Represents a table resulting from the evaluation of a query specification. For expanded **query-specification** syntax, see Expansion of Query-specification.

(query-expression)

Specifies another query expression to be used as a single operand in the query expression.

UNION all

Specifies that:

- The result table is to include the rows from the table represented by the operand preceding the UNION operator and the rows from the table represented by the operand following the UNION operator
- Duplicate rows are eliminated from the table resulting from the UNION operation, unless the ALL keyword is present.

The data types and lengths of unioned columns must be compatible. Detailed information is presented under "Usage".

ALL

Specifies that all rows from the UNION operation are retained; duplicates are not discarded.

Usage

Result Data Type

This matrix shows the data type that results when a UNION operation is performed on columns of compatible data types.

	I2	I4	I8	R4	R8	PD	ZD	UP	UZ	CH	VC	BI	DT	GR	VG	TI	DI
I2	I2	I4	I8	R4	R8	PD	ZD	PD	ZD	-	-	-	-	-	-	TI	DI
I4	I4	I4	I8	R4	R8	PD	ZD	PD	ZD	-	-	-	-	-	-	TI	DI
I8	I8	I8	I8	R4	R8	PD	ZD	PD	ZD	-	-	-	-	-	-	TI	DI
R4	R4	R4	R4	R4	R8	R4	R4	R4	R4	-	-	-	-	-	-	TI	DI
R8	R8	R8	R8	R8	R8	R8	R8	R8	R8	-	-	-	-	-	-	TI	DI
PD	PD	PD	PD	R4	R8	PD	PD	PD	PD	-	-	-	-	-	-	TI	DI
ZD	ZD	ZD	ZD	R4	R8	PD	ZD	PD	ZD	-	-	-	-	-	-	TI	DI
UP	PD	PD	PD	R4	R8	PD	ZD	UP	UZ	-	-	-	-	-	-	TI	DI
UZ	ZD	ZD	ZD	R4	R8	PD	ZD	UP	UZ	-	-	-	-	-	-	TI	DI
CH	-	-	-	-	-	-	-	-	-	CH	VC	CH	-	GR	VG	-	-
VC	-	-	-	-	-	-	-	-	-	VC	VC	VC	-	VG	VG	-	-
BI	-	-	-	-	-	-	-	-	-	CH	VC	BI	-	GR	VG	-	-
DT	-	-	-	-	-	-	-	-	-	-	-	-	DT	-	-	-	-
GR	-	-	-	-	-	-	-	-	-	CH	VC	BI	-	GR	VG	-	-
VG	-	-	-	-	-	-	-	-	-	VC	VC	BI	-	VG	VG	-	-
TI	TI	TI	TI	TI	TI	TI	TI	TI	TI	-	-	-	-	-	-	TI	-
DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	-	-	-	-	-	-	-	DI

Key:

I2–Small integer	BI–Binary
I4–Integer	DT–Date/time
I8–Long integer	UP–Unsigned decimal
R4–Real	UZ–Unsigned numeric
R8–Double precision	GR–Graphic
PD–Decimal	VG–Vargraphic
ZD–Numeric	TI–Time interval
CH–Character	DI–Date interval
VC–Varchar	-–Incompatible types

Nullable Columns

If both columns in a UNION operation are not nullable, the result is not nullable; otherwise the result is nullable.

Result Precision

The result precision of decimal, numeric, char, varchar, graphic, vargraphic, and binary is always large enough to hold the larger of the source columns in a UNION operation.

Restrictions on Multiple Query Specifications

If a query expression includes more than one query specification:

- Result tables returned by the query specifications must all have the same number of columns
- Columns in any given position in the result tables returned by the query specifications must be compatible for assignment

Updateable Query Expressions

A query expression is updateable under the following conditions:

- The expression consists of a single query specification (that is, the query expression does not include the UNION operator)
- The FROM parameter in the query specification specifies only one table, view, procedure or table procedure
- If a view is named in the FROM parameter, it is updateable
- The query specification does not contain DISTINCT, PRESERVE, GROUP BY, or HAVING parameters, nor is an aggregate function used in the specification of a result column

Note: For more information about usage considerations for query expressions, see "Usage" under Expansion of Query-specification

Example

In a DECLARE CURSOR Statement

The following DECLARE CURSOR statement creates a cursor for the table resulting from the UNION of two query specifications. The four result columns identified by the second query specification have the same data types, lengths, and null specifications as the four result columns identified by the first query specification.

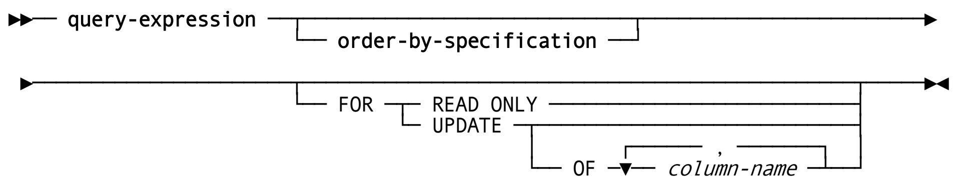
```
declare all_curr_emp cursor
   for select emp_id, emp_fname, emp_lname, dept_id
      from employee
      where status <> 'T'
      union select con_id, con_fname, con_lname, dept_id
         from consultant
         where proj_id is not null
   order by 4, 1, 2, 3;
```

Expansion of Cursor-specification

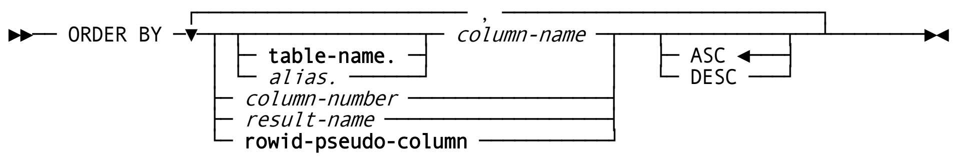
The expanded parameters of cursor-specification represent the body of a cursor definition.

Syntax

Expansion of cursor-specification



Expansion of order-by-specification



Parameters

Expansion of cursor-specification

query-expression

Represents a table resulting from the evaluation of a query-expression. For expanded syntax, see Expansion of Query-expression.

order-by-specification

Specifies a sort order for the rows in the result table defined by **query-expression**. Expanded syntax for **order-by-specification** is shown above, immediately following the **cursor-specification** syntax.

FOR READ ONLY

Specifies the cursor associated with this *cursor-expression* is used for retrieval operations only. If specified, it prohibits the execution of both positioned UPDATEs and DELETEs that reference the cursor.

FOR UPDATE

Specifies that the cursor is used for positioned UPDATE operations.

OF *column-name*

Identifies a column that may be updated through positioned UPDATE statements. If no columns are specified, then all columns in the table may be updated.

Expansion of order-by-specification

ORDER BY

Sorts the rows in the result table defined by **query-expression** in ascending or descending order by the values in the specified columns. Rows are ordered first by the first column specified, then by the second column specified with the ordering established by the first column, then by the third column specified, and so on.

column-name

Specifies a sort column by name. *Column-name* must identify a column in the result table of the query expression.

table-name

Specifies the table, view, procedure or table procedure that includes the named column. For Expansion of Table-name expanded **table-name** syntax, see Identifying Entities in Schemas (see page 42).

alias

Specifies the alias associated with the table, view, procedure or table procedure that includes the named column. *Alias* must be defined in the FROM parameter of the query specification that makes up the query expression.

column-number

Specifies a sort column by the position of the column in the result table. The first result column is in position 1.

Column-number must be an integer in the range 1 through the number of columns in the result table.

result-name

Specifies the sort column by the result name specified in the AS parameter of the query expression.

rowid-pseudo-column

Specifies the sort column as a ROWID pseudo-column. For expanded syntax, see Expansion of rowid-pseudo-column.

ASC

Indicates that the values in the specified column are to be sorted in ascending order. ASC is the default.

DESC

Indicates that the values in the specified column are to be sorted in descending order.

Usage

Updateable cursors

A cursor defined by a cursor specification is updateable if the cursor specification:

- Contains an updateable query-expression
- Does not contain an ORDER BY clause
- Does not contain a FOR READ ONLY clause

Updateable cursors may be referenced in positioned DELETE statements.

To reference a cursor in a positioned UPDATE statement, it must be updateable and the FOR UPDATE clause must be specified within the cursor specification.

Note: To ensure optimal performance when processing a cursor that is referenced in a positioned UPDATE statement, you should explicitly identify the columns to be updated rather than specifying FOR UPDATE without naming the columns.

Example

Defining a Cursor for retrieval-only

The following DECLARE CURSOR statement defines a static cursor by including a **cursor-specification** directly. In this case, the cursor being defined can only be used to retrieve rows from the database. By coding the FOR READ ONLY option, you ensure that neither positioned UPDATEs nor DELETEs are allowed against the cursor:

```
EXEC SQL
  DECLARE EMP_CURSOR CURSOR FOR
    SELECT EMP_ID, DEPT_ID, EMP_LNAME
       FROM EMPLOYEE
       FOR READ ONLY
END-EXEC
```

Defining a Dynamic Cursor for UPDATE Operations

The following set of code defines a dynamic cursor to be used to update the DEPT_ID column of the EMPLOYEE table. The **cursor-specification** containing the FOR UPDATE clause is first prepared and then an ALLOCATE CURSOR statement is used to create the cursor:

```
MOVE 'SELECT *
       FROM EMPLOYEE FOR UPDATE OF DEPT_ID'
  TO ST-TEXT.

EXEC SQL
  PREPARE 'EMP-STATEMENT' FROM :ST-TEXT
END-EXEC

EXEC SQL
  ALLOCATE 'EMP-CURSOR' CURSOR FOR 'EMP-STATEMENT'
END-EXEC
```

Chapter 8: Statements

This section contains the following topics:

Statement Categories

CA IDMS SQL statements fall into the following categories:

Category	Description
Access module management	Control the creation and characteristics of access modules
Authorization	Control access to and ownership of database entities
Control	Define the flow of control in an SQL routine and assign values from expressions to routine parameters or local variables
Data description	Control the creation and characteristics of logical database entities

Category	Description
Data manipulation	Retrieve and update data in the database
Diagnostics & Statistics	Diagnose the execution of SQL statements and return statistical information of the current transaction.
Dynamic compilation	Control the run-time compilation and execution of SQL statements
Precompiler directives	Instruct the precompiler to include specified data structures and to generate specified error-processing code
Session management	Establish and control the characteristics of SQL sessions
Transaction management	Establish and control the characteristics of CA IDMS database transactions

Access Module Management Statements

Statement	Purpose
ALTER ACCESS MODULE	Modifies an access module in the dictionary
CREATE ACCESS MODULE	Creates an access module from one or more SQL statement modules (RCMs)
DROP ACCESS MODULE	Deletes an access module and its definition from the dictionary
EXPLAIN	Describes the strategy used to access data for a DELETE, INSERT, SELECT, or UPDATE statement

Authorization Statements

Statement	Purpose
GRANT definition privileges	Gives one or more users the privilege of performing selected actions on a specified schema, access module, table, or view
GRANT execution privilege	Gives one or more users the privilege of executing a specified access module
GRANT all privileges	Gives one or more users all definition and access privileges on a specified table or view

Statement	Purpose
GRANT table access privileges	Gives one or more users the privilege of performing selected actions on a specified table or view
REVOKE definition privileges	Removes from one or more users the privilege of performing selected actions on a specified schema, access module, table, or view
REVOKE execution privilege	Removes from one or more users the privilege of executing a specified access module
REVOKE all privileges	Removes from one or more users all definition and access privileges on a specified table or view
REVOKE table access privileges	Removes from one or more users the privilege of performing selected actions on a specified table or view
TRANSFER OWNERSHIP	Passes ownership of a schema from one user or group of users to another

Control Statements

The CA IDMS SQL Control statements allow you to define the flow of control in an SQL routine and assign values to routine parameters or local variables. These statements are used primarily by the following:

- Developers of SQL routines
- Programmers developing SQL application programs
- Users of interactive SQL tools

Note: For more information about the individual Control statements, see Control Statements.

Data Description Statements

Statement	Purpose
ALTER CATALOG	Supports the correct sorting of additional national characters for specific languages (used by the alternate character set feature)
ALTER FUNCTION	Modifies the definition of a function in the dictionary

Statement	Purpose
ALTER INDEX	Enables the maximum number of entries to be changed without affecting the existing index structure
ALTER PROCEDURE	Modifies the definition of a procedure in the dictionary
ALTER TABLE PROCEDURE	Modifies the definition of a table procedure in the dictionary
ALTER SCHEMA	Modifies the definition of a schema in the dictionary
ALTER TABLE	Modifies the definition of a base table in the dictionary
CREATE CALC	Defines a CALC key on a base table
CREATE CONSTRAINT	Defines a constraint in the dictionary
CREATE FUNCTION	Defines a function in the dictionary
CREATE INDEX	Defines an index on a base table
CREATE PROCEDURE	Defines a procedure in the dictionary
CREATE SCHEMA	Defines a schema in the dictionary
CREATE TABLE	Defines a table in the dictionary
CREATE TABLE PROCEDURE	Defines a table procedure in the dictionary
CREATE TEMPORARY TABLE	Defines a temporary table
CREATE VIEW	Defines a view in the dictionary
DROP CONSTRAINT	Deletes the definition of a constraint from the dictionary
DROP CALC	Deletes the definition of a CALC key from the dictionary
DROP FUNCTION	Deletes the definition of a function from the dictionary
DROP INDEX	Deletes the definition of an index from the dictionary
DROP PROCEDURE	Deletes the definition of a procedure in the dictionary
DROP SCHEMA	Deletes the definition of a schema from the dictionary
DROP TABLE	Deletes the definition of a base table from the dictionary

Statement	Purpose
DROP TABLE PROCEDURE	Deletes the definition of a table procedure in the dictionary
DROP VIEW	Deletes the definition of a view from the dictionary

Data Manipulation Statements

Statement	Purpose
CLOSE*	Places a specified cursor in the closed state
DECLARE CURSOR*	Defines a cursor for a specified result table
DECLARE EXTERNAL CURSOR*	Identifies an externally defined global cursor to be used by the application program
DELETE	Deletes one or more rows from a table
FETCH*	Retrieves values from the result table associated with a cursor
INSERT	Adds one or more new rows to a table
OPEN*	Places a specified cursor in the open state
SELECT	Retrieves values from one or more tables and views
UPDATE	Modifies the values in one or more rows of a table

**Programmatic only*

Diagnostics and Statistics Statements

The SQL Diagnostic statements category is used for diagnosing the execution of SQL statements and for returning statistical information for the current transaction.

Note: These statements can be used as embedded SQL, including embedding in an SQL-invoked routine. The GET STATISTICS statement can also be used in the SQL command facility and the CA IDMS Visual DBA command console.

Statement	Purpose
GET DIAGNOSTICS*	Diagnoses the execution of the last executed SQL statement.

Statement	Purpose
GET STATISTICS	Returns statistical information for the current transaction.

**Programmatic only*

Dynamic Compilation Statements

Statement	Purpose
ALLOCATE CURSOR*	Defines a cursor for a dynamically-prepared statement
DEALLOCATE PREPARE*	Destroys a dynamically-compiled statement and all other dynamically-compiled statements that directly or indirectly reference it.
DESCRIBE*	Directs CA IDMS to return information about a dynamically-compiled SQL statement in an SQL descriptor area
EXECUTE*	Executes a dynamically-compiled SQL statement
EXECUTE IMMEDIATE*	Dynamically compiles and executes an SQL statement
PREPARE*	Dynamically compiles an SQL statement for later execution in the application program

**Programmatic only*

Precompiler-directive Statements

Statement	Purpose
BEGIN DECLARE SECTION*	Notifies the precompiler that a host variable definition is beginning.
END DECLARE SECTION*	Notifies the precompiler that a host variable definition has ended.
INCLUDE*	Directs the precompiler to create host variable definitions for a specified structure or table in the application program

Statement	Purpose
WHENEVER*	Specifies an action to be taken when the execution of an SQL statement results in a nonzero SQLCODE value

**Programmatic only*

Session Management Statements

Statement	Purpose
CONNECT	Establishes a connection to a CA IDMS dictionary and begins an SQL session
RELEASE	Releases a connection to a CA IDMS dictionary and ends the SQL session
RESUME SESSION	Resumes a suspended SQL session
SET SESSION	Establishes SQL session characteristics
SUSPEND SESSION	Suspends an SQL session and any transaction currently active within the session

Transaction Management Statements

Statement	Purpose
COMMIT	Makes permanent the changes to the database made during the current transaction and optionally ends the transaction
ROLLBACK	Cancels changes made to the database during the current transaction and ends the transaction
SET ACCESS MODULE*	Identifies the access module to be used by a transaction
SET TRANSACTION	Overrides access module defaults for conditions under which a transaction executes

**Programmatic only*

ALLOCATE CURSOR

The ALLOCATE CURSOR statement defines a cursor for a dynamically-prepared statement or for a result set returned from a previously invoked procedure.

Syntax

```
►►── ALLOCATE extended-cursor-name ──────────────────────────────────────►

 ►┬─ CURSOR ───────────────┬── FOR extended-statement-name ──────┬──────►◄
  │              ├ WITH RETURN ──┤                                │
  │              └ WITHOUT RETURN ◄┘                              │
  └┬──────────┬─ FOR PROCEDURE SPECIFIC PROCEDURE spec-routine-designator ─┘
   └─ CURSOR ─┘
```

Parameters

extended-cursor-name

Identifies the name of the cursor being defined. The name must conform to the rules for an identifier and must be unique within the specified scope.

extended-statement-name

Identifies the name of the statement for which the cursor is being defined. A statement with this name and scope must have been prepared within the same SQL transaction as that in which the ALLOCATE CURSOR statement is being executed.

WITH RETURN

Defines the cursor as a returnable cursor. If a returnable cursor is allocated in an SQL-invoked procedure and is in the open state when the procedure terminates, a result set is returned to the caller.

WITHOUT RETURN

Specifies that the cursor is not a returnable cursor. This is the default.

FOR PROCEDURE SPECIFIC PROCEDURE

Specifies that the cursor is to be allocated for a result set returned by the invocation of the identified procedure. This type of cursor is called a received cursor.

spec-routine-designator

Identifies the SQL-invoked procedure.

Parameters for Expansion of spec-routine-designator

schema-name

Specifies the schema with which the procedure identified by *procedure-identifier* is associated.

procedure-identifier

Identifies a procedure defined in the dictionary.

host-variable

Identifies a host variable containing the name of the previously invoked procedure.

routine-parameter

Identifies a routine parameter containing the name of the previously invoked procedure.

local-variable

Identifies a local variable containing the name of the previously invoked procedure.

SCHEMA

Qualifies the procedure name with the name of the schema with which it is associated. This option is an extension to the SQL standard.

schema-name

Specifies the schema with which the procedure is associated.

host-variable

Identifies a host variable containing the name of the schema with which the previously invoked procedure is associated.

routine-parameter

Identifies a routine parameter containing the name of the schema with which the previously invoked procedure is associated.

local-variable

Identifies a local variable containing the name of the schema with which the previously invoked procedure is associated.

Note: For more information about using a schema name to qualify a procedure, see Identifying Entities in Schemas.

Usage

Updateable Cursors

The PREPAREd statement referenced in the ALLOCATE CURSOR statement must be a **cursor-specification**. The cursor created as a result of the ALLOCATE CURSOR statement, is updateable, if the **cursor-specification** is updateable.

Allocating a Received Cursor for a Result Set

If the ALLOCATE statement is used for a result set, then the procedure identified by **spec-routine-designator** must have been previously invoked by an SQL CALL or SELECT statement in the same transaction as that in which the ALLOCATE CURSOR statement is executed.

The result sets that the SQL-invoked procedure returns, form a list ordered in the sequence in which the cursors were opened by the procedure. When a received cursor is allocated, the following actions are taken:

- The new cursor is associated with the first result set in the list of returned result sets.
- The result set is removed from the list.
- The cursor is placed in the open state.
- The cursor is positioned at the same point at which the corresponding returnable cursor was left by the procedure.

If an SQL-invoked procedure has started multiple sessions, the sequence of returned result sets is by session, in the order in which the sessions were connected. Within each session, the result sets are sequenced by the order in which their cursors were opened.

A received cursor cannot be used to return a result set nor can it be referenced in a positioned update or delete statement.

Note: For more information about updateable cursors, see DESCRIBE.

Examples

Creating a Local Cursor

The following ALLOCATE CURSOR statement creates a local cursor called C1 and associates it with the local statement whose name is passed in :sname:

```
EXEC SQL
  ALLOCATE 'C1' CURSOR FOR :SNAME
END-EXEC
```

Creating a Global Cursor

The following ALLOCATE CURSOR statement creates a global cursor whose name is passed in :CNAME and associates it with the global statement whose name is passed in :SNAME:

```
EXEC SQL
  ALLOCATE GLOBAL :CNAME CURSOR FOR :SNAME
END-EXEC
```

Sharing a Statement Definition

The following two ALLOCATE CURSOR statements create two cursors, one of which is local and one of which is global. They are both associated with the same local statement:

```
EXEC SQL
  ALLOCATE 'C1' CURSOR FOR 'S1'
END-EXEC
EXEC SQL
  ALLOCATE GLOBAL CURSOR 'G1' FOR 'S1'
END-EXEC
```

Allocating a Received Cursor for a Result Set

```
exec sql
      call GET_EMPLOYEE_INFO(1003)
end-exec
exec sql
      allocate 'RECEIVED_CURSOR_GET_EMPG' for procedure specific
      procedure GET_EMPLOYEE_INFO
end-exec
```

ALTER ACCESS MODULE

The ALTER ACCESS MODULE access module management statement modifies an access module in the dictionary. It is a CA IDMS extension of the SQL standard.

Authorization

To issue an ALTER ACCESS MODULE statement, you must hold the ALTER privilege on or own the access module named in the statement.

In addition to enforcing this authorization requirement, CA IDMS validates the access module owner's authority to execute each DML statement if the dictionary to which the SQL session is connected is controlled by CA IDMS internal security.

If the access module owner does not hold the authority to execute a DML statement in the access module, when the access module is altered, a warning is issued. If the owner still lacks a necessary authority when the access module is executed, an error is returned.

Syntax

```
►►─── ALTER ACCESS MODULE ─┬───────────────┬─ access-module-name ──────►
                           └─ schema-name. ┘

►─┬────────────────────────────────┬─────────────────────────────────────►
  └─ VERSION am-version-number ────┘

►─┬──────────────────────────────────┬───────────────────────────────────►
  │           ┌──────── , ─────────┐ │
  └─ ADD ─▼─ rcm-specification ─┴─┘

►─┬───────────────────────────┬──────────────────────────────────────────►
  │          ┌───── , ─────┐ │
  └─ DROP ─▼─ rcm-name ─┴──┘

►─┬──────────────────────────────────────────────────────────────────────┬─►
  │              ┌──────────── , ──────────┐                            │
  └─ REPLACE ─┬─▼─ rcm-specification ─┴────────────────────────┤
              ├─ CHANGED ────────────────────────────────────────────────┤
              └─ ALL ─┬──────────────────────────────────────────────────┤
                      │        ┌──────────────── , ──────────────┐       │
                      └─ MAP ─▼─┬─ schema-name-1 ─┬─ TO - schema-name-2 ─┴──┘
                                └─ NULL ──────────┘

►─┬──────────────────────────────┬───────────────────────────────────────►
  └─ AUTO RECREATE ─┬─ ON ───────┤
                    └─ OFF ──────┘

►─┬─────────────────────────────────────┬────────────────────────────────►
  └─ VALIDATE ─┬─ BY STATEMENT ─────────┤
               ├─ BY MODULE ────────────┤
               └─ ALL ──────────────────┘

►─┬───────────────┬──────────────────────────────────────────────────────►
  ├─ READ ONLY ───┤
  └─ READ WRITE ──┘

►─┬──────────────────────────────────────────────────┬───────────────────►
  └─ DEFAULT ISOLATION ─┬─ CURSOR STABILITY ─────────┤
                        └─ TRANSIENT READ ───────────┘

►─┬────────────────────────────────────────────────────────────────────┬──►◄
  │           ┌──────────────────────── , ──────────────────────┐      │
  └─ READY ─┬─▼─ segment-name.area-name ready-options ─┴──────┤
            └─ ALL ready-options ──────────────────────────────────────┘
```

Expansion of rcm-specification

```
►►─┬────────────────────┬─ rcm-name ─┬──────────────────────────────┬─►◄
   └─ dictionary-name. ─┘            └─ VERSION rcm-version-number ─┘
```

Expansion of ready-options

```
►►─┬──────────────────────────┬──────────────────────────────────────────►
   ├─ SHARED RETRIEVAL ───────┤
   ├─ SHARED UPDATE ──────────┤
   ├─ PROTECTED RETRIEVAL ────┤
   ├─ PROTECTED UPDATE ───────┤
   └─ EXCLUSIVE ──────────────┘

►─┬────────────────┬─────────────────────────────────────────────────────►◄
  ├─ INCREMENTAL ──┤
  └─ PRECLAIM ─────┘
```

Parameters

access-module-name

Specifies the name of the access module being modified. *Access-module-name* must identify an access module defined and stored in the dictionary.

schema-name

Specifies the schema associated with the access module. *Schema-name* must identify the schema associated with the version of the access module being modified.

If you do not specify *schema-name*, the value used by CA IDMS is the current schema for your SQL session.

am-version-number

Specifies the version of the access module to be modified.

If you do not specify *am-version-number*, the version number is set to that found as a result of loading the access module from the dictionary. This depends on the test version number and the loadlist in effect for your user session.

ADD rcm-specification

Specifies one or more RCMs to be added to the access module.

Expanded syntax for **rcm-specification** appears at the end of the statement syntax. Descriptions for these parameters are located at the end of this section.

DROP *rcm-name*

Specifies one or more RCMs to be deleted from the access module.

REPLACE rcm-specification

Directs CA IDMS to replace one or more RCMs in the access module with the most recent copies from the dictionary.

Expanded syntax for **rcm-specification** appears at the end of the statement syntax. Descriptions for these parameters are located at the end of this section.

CHANGED

Directs CA IDMS to replace all RCMs whose definition timestamp in the access module does not match the definition timestamp in the RCM load module.

ALL

Directs CA IDMS to recompile all RCMs in the access module.

MAP

Specifies one or more mappings for schema names that qualify table and view identifiers in data manipulation statements. MAP can be specified only with REPLACE ALL.

If you specify MAP, you must supply all schema mappings because existing rules are deleted from the access module.

If you do not specify MAP, schema-name mappings in the existing access module remain in effect.

schema-name-1

Directs CA IDMS to replace occurrences of the specified schema name with the schema name specified in the TO parameter.

NULL

Directs CA IDMS to use the schema name specified in the TO parameter as the qualifier for unqualified table and view identifiers.

TO *schema-name-2*

Directs CA IDMS to use the specified schema name as the replacement for *schema-name-1* or as the qualifier for unqualified table and view identifiers.

AUTO RECREATE

Specifies whether CA IDMS is to re-create the access module after detecting any of the following at runtime:

- An attempt to execute an uncompiled statement
- A change to the definition of a table referenced in the access module
- The execution of a program that has been recompiled since its RCM was included in the access module

CA IDMS identifies the above conditions by comparing definition timestamps in the access module to corresponding timestamps in the database and the host program.

If AUTO RECREATE is not specified, the existing AUTO RECREATE specification for the access module remains in effect.

Note: For more information about the ON and OFF options of AUTO RECREATE, see CREATE ACCESS MODULE.

VALIDATE

Indicates when CA IDMS is to check the definition timestamps of tables in the access module to ensure that the definition has not changed since the access module was created or last altered.

If VALIDATE is not specified, the existing VALIDATE specification for the access module remains in effect.

Note: For more information about the BY STATEMENT, BY MODULE, and ALL options of VALIDATE, see CREATE ACCESS MODULE.

READ ONLY

Specifies transactions started by the access module that do not execute a SET TRANSACTION statement specifying READ WRITE can retrieve data but cannot update the database.

READ WRITE

Specifies transactions started by the access module that do not execute a SET TRANSACTION statement specifying READ ONLY can retrieve data and update the database.

Note: For more information about the READ ONLY and READ WRITE transaction states, see CREATE ACCESS MODULE.

DEFAULT ISOLATION

Specifies the isolation level of transactions started by the access module that do not execute a SET TRANSACTION statement specifying an isolation level.

At runtime, the isolation level of a transaction determines the length of time retrieval locks are held for the purpose of insulating the transaction from the effects of other concurrent transactions. (Update locks are always held until a transaction is committed or rolled back.)

Note: For more information about the CURSOR STABILITY, and TRANSIENT READ DEFAULT ISOLATION options, see CREATE ACCESS MODULE.

READY

Specifies a ready mode for one or more areas accessed through the access module, and specifies when the ready occurs.

The ready mode associated with an area determines:

- Under the central version, the ready mode in which transactions access the area. (The ready mode determines the types of area and row locks CA IDMS places for a transaction.)
- In local mode, the type of physical lock CA IDMS places on the area.

If READY is not specified, the default ready options for areas used by the access module are:

- The existing specifications for areas included in the existing access module
- SHARED UPDATE and INCREMENTAL for areas added as a result of new or replaced RCMs

Parameters for Expansion of rcm-specification

dictionary-name

Identifies the dictionary in which the named RCM is located.

If you do not specify *dictionary-name*, it is set to the name of the dictionary to which your SQL session is connected.

rcm-name

Identifies the RCM.

Rcm-name must identify an RCM stored in the dictionary and must be unique within the list of RCM names.

rcm-version-number

Identifies the version of the RCM.

If you do not specify *rcm-version-number*:

1. CA IDMS looks for an RCM with a version number that matches *am-version-number*
2. If no such RCM is found, CA IDMS looks for version 1
3. If CA IDMS does not find a match, it issues a warning

Parameters for Expansion of ready-options

Note: For more information about **ready-options**, see CREATE ACCESS MODULE.

Usage

Defaulting the Access Module Version Number

If the version of an access module is not specified, it defaults to the version located as a result of a load operation. This is the same version that would be loaded as a result of executing a program associated with the access module.

For example, assume you have set a test version of 10 and you are using the default loadlist that CA IDMS supplied. CA IDMS loads version 10 of the access module if it exists; otherwise, it loads version 1.

Replacing All or Changed RCMs

When replacing all RCMs in an access module or replacing all RCMs which have been changed since being included in the access module, CA IDMS locates the replacement RCM using the same rules as when the RCM was added to (or explicitly replaced in) the access module. Specifically:

- The dictionary name is the name of the dictionary from which the RCM was previously loaded
- The version is that specified when the RCM was included in the access module, or, if not specified, CA IDMS first looks for an RCM whose version is the same as that of the access module being altered (and if that version is not found, then version 1 of the RCM).

Dropping RCMs

When dropping RCMs from an access module, the newly generated access module has a less than optimal structure unless the ALTER statement contains the REPLACE ALL clause. All RCMs need processing to determine the minimum set of control blocks in the access module.

Avoiding Deadlocks

If you use the access module of an ALTER ACCESS MODULE statement in other SQL statements in the same session, the ALTER should immediately be followed implicitly or explicitly by a COMMIT. This allows the new copy of the access module to load. Without the COMMIT, a deadlock may occur, even if the two SQL statements refer to different access modules.

Transaction State and Isolation Level

If you specify neither transaction state nor DEFAULT ISOLATION on an ALTER ACCESS MODULE statement, the existing values remain in effect. If either is specified, it also establishes a value for the other, as follows:

- If READ WRITE or READ ONLY are specified, CURSOR STABILITY is assumed
- If TRANSIENT READ is specified, READ ONLY is assumed
- If CURSOR STABILITY is specified, READ WRITE is assumed

Examples

Replacing Changed RCMs

The following ALTER ACCESS MODULE statement replaces any changed RCMs in access module EMPAM001 with the most recent copies from the dictionary:

```
alter access module hrprod.empam001
   replace changed;
```

Adding New RCMs

The following ALTER ACCESS MODULE statement adds two new RCMs to the SALES001 access module. The statement also changes the lock options for two areas.

```
alter access module prod.sales001
   add sales.bdgt_001,
   add sales.comm_003
   ready
      salesseg.sales_area shared update incremental
      demoseg.emp_area shared retrieval preclaim;
```

More Information

- For more information about access modules, see CREATE ACCESS MODULE and DROP ACCESS MODULE (see page 418) or see the *CA IDMS Database Administration Guide*.
- For more information about schema-name mappings, see Identifying Entities in Schemas.
- For more information about isolation levels, see CREATE ACCESS MODULE.
- For more information about ready modes, see the *CA IDMS Database Administration Guide*.

ALTER CATALOG

The ALTER CATALOG statement establishes the character set for character columns of the tables defined within the current dictionary. The character set is used to correctly sort additional national characters for the named language. It is also a CA IDMS extension of the SQL standard.

Authorization

To issue an ALTER CATALOG statement, you must have DBADMIN authority, and ALTER authority for the SYSTEM schema.

Note: This statement must be executed immediately following the execution of the TABLEDDL file that records the definition of the catalog tables themselves. The statement must precede the definition of any user SQL tables in that catalog.

Syntax

```
►►── ALTER CATALOG DEFAULT CHARACTER SET alternate-character-set-name ──────►◄
```

Parameters

alternate-character-set-name

Identifies the character set whose collating scheme is to be used for the CHAR and VARCHAR columns defined in the catalog. Currently-supported values for *alternate-character-set-name* are DENMARK, FINLAND, NORWAY, and SWEDEN.

Usage

The ALTER CATALOG DEFAULT CHARACTER SET statement changes the collating sequence for all CHAR and VARCHAR columns defined in user tables in the dictionary, including non-SQL defined tables. It does not affect columns in the SYSTEM tables.

Swedish and Finnish

The additional national characters, the uppercase forms of which are represented by the symbols **$, #,** and **&theta.**, sort at the end of the standard alphabet. The accented **E** and **U** sort the same as their unaccented equivalents, and are returned to application programs as their unaccented equivalents.

Norwegian and Danish

The additional national characters, the uppercase form of which is represented by the symbols **#, &theta.**, and **$**, sort at the end of the standard alphabet. The accented **U** sort in the same sequence as its unaccented equivalent and are returned to application programs as an unaccented U.

Example

The following statement causes the data values of all CHAR and VARCHAR columns to collate according to the conventions of the Finnish alphabet.

```
alter catalog default character set FINLAND
```

ALTER CONSTRAINT

The ALTER CONSTRAINT statement changes the characteristics of an existing referential constraint. This statement is a CA IDMS extension to the SQL standard.

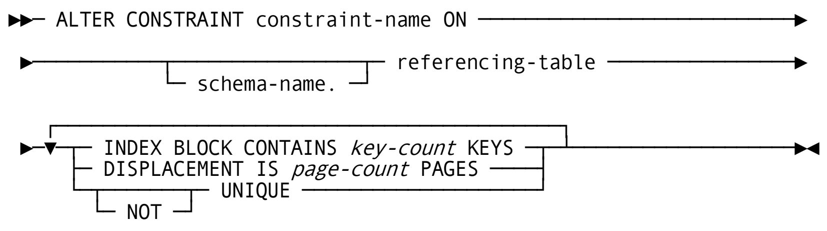
Authorization

To issue an ALTER CONSTRAINT statement, you must:

- Either hold the ALTER privilege on or own the referencing table in the constraint being altered
- Hold the REFERENCES privilege on the referenced table in the constraint being altered

Note: To issue an ALTER CONSTRAINT statement you must own or hold the ALTER privilege on the table on which the constraint is defined.

Syntax: ALTER CONSTRAINT


ALTER CONSTRAINT constraint-name ON
schema-name.
referencing-table
INDEX BLOCK CONTAINS *key-count* KEYS
DISPLACEMENT IS *page-count* PAGES
UNIQUE
NOT

ALTER CONSTRAINT Parameters

This section describes the ALTER CONSTRAINT parameters:

constraint-name

Identifies the referential constraint to be changed. Constraint-name must be the name of a constraint on the table identified in the ON clause.

referencing-table

Specifies the name of the referencing table in the constraint to be changed.

schema-name

Identifies the schema associated with the referencing table.

Default: The default varies depending on where the statement is encountered.

If you do not specify schema-name, it defaults to:

- The current schema associated with your SQL session when the statement is entered through the Command Facility or executed dynamically.
- The schema associated with the access module used at runtime when the statement is embedded in an application program.

***key-count* KEYs**

Establishes a new value for the maximum number of entries in each internal index record (SR8 system record).

Limits: Key-count must be an unsigned integer in the range 3 through 8180.

***page-count* PAGES**

Specifies how far away from the referenced row the bottom-level index records are stored.

If the value of page-count is zero (0), the bottom-level internal index records are not displaced from the referenced row.

Limits: Page-count must be an unsigned integer in the range 0 through 32,767.

UNIQUE

Specifies that the sort-key value in any given row of the referencing table must be different from the sort-key value in all other rows that have the same non-null referencing key value.

NOT UNIQUE

Removes the restriction that all values of the sort-key with the same non-null foreign key value must be unique.

Example: Alter the DEPT_EMPL Constraint

In this example, the physical characteristics of the DEPT_EMPL constraint are changed. Each internal index record will have a maximum of 10 keys and the bottom level index records will be displaced 50 pages from the associated referenced row:

```
alter constraint dept_empl on emp.empl
      displacement is 50 pages
      index block contains 10 keys;
```

ALTER FUNCTION

The ALTER FUNCTION data description statement modifies the definition of a function in the dictionary.

Using the ALTER FUNCTION statement, you can:

- Revise the estimated row and I/O counts
- Change the external name of the function
- Change the size and characteristics of the work areas passed to the function
- Change the execution mode of the function
- Change the protocol
- Change the language of the function
- Change the timestamp
- Change the default database
- Change the transaction sharing mode

The ability to change attributes other than language and external name is a CA IDMS extension of the SQL standard.

Authorization

To issue an ALTER FUNCTION statement, you must either own or hold the ALTER privilege on the function named in the statement.

Syntax

```
►►─ ALTER FUNCTION ─┬────────────────┬─ function-identifier ───────────────►
                    └─ schema-name. ─┘

►─┬─ EXTERNAL NAME external-routine name ─────────────────────┬────────────►◄
  ├─ ESTIMATED ROWS row-count ────────────────────────────────┤
  ├─ ESTIMATED IOS io-count ──────────────────────────────────┤
  ├─ LOCAL WORK AREA local-stge-size ─────────────────────────┤
  ├─ GLOBAL WORK AREA global-stge-size ─┬────────────────────┬┤
  │                                     └─ KEY ┬─ key-ID ─┬──┘│
  │                                            └─ NULL . ─┘   │
  ├─ USER MODE ───────────────────────────────────────────────┤
  ├─ SYSTEM MODE ─────────────────────────────────────────────┤
  ├─ PROTOCOL ─────────────────────────┬─ IDMS ─┬─────────────┤
  │                                    └─ ADS ──┘             │
  ├─ language-clause ─────────────────────────────────────────┤
  ├─ TIMESTAMP timestamp-value ───────────────────────────────┤
  ├─ DEFAULT DATABASE ─────────────────┬─ NULL ────┬──────────┤
  │                                    └─ CURRENT ─┘          │
  └─ TRANSACTION SHARING ──────────────┬─ ON ──────┬──────────┘
                                       ├─ OFF ─────┤
                                       └─ DEFAULT ─┘
```

Expansion of language-clause

```
►►── LANGUAGE ───────────────────┬─ ADS ───────┬─────────────────────►◄
                                 ├─ ASSEMBLER ─┤
                                 ├─ COBOL ─────┤
                                 ├─ PLI ───────┤
                                 └─ SQL ───────┘
```

Parameters

function-identifier

Specifies the name of the function being modified. *Function-identifier* must identify a function defined in the dictionary.

schema-name

Identifies the schema associated with the named function.

If you do not specify a *schema-name*, the default value is:

- The current schema associated with your SQL session, if the statement is entered through the Command Facility or executed dynamically.
- The SQL schema associated with the access module used at runtime, if the statement is embedded in an application program.

external-routine-name

Specifies the one- to eight-character name of the program which CA IDMS calls to process function invocations.

row-count

Specifies an integer value, in the range of 0 through 2,147,483,647, which represents the average number of rows that the CA IDMS optimizer uses for cost calculation of the function invocation.

io-count

Specifies an integer value, in the range of 0 through 2,147,483,647, which represents the average number of disk accesses that the function generates for a given set of input parameters.

local-stge-size

Specifies an integer, in the range of 0 through 32767, which represents the size, in bytes, of a local storage area that CA IDMS allocates at runtime and passes to the function on each invocation.

CA IDMS allocates a local storage area on the first call to a function.

global-stge-size

Specifies an integer, in the range of 0 through 32767, which represents the size, in bytes, of a global storage area that CA IDMS allocates at runtime and passes to the function on each invocation.

CA IDMS allocates a global storage area once within a transaction and retains it until the transaction terminates.

key-id

Specifies the one- to four-character identifier for the global storage area. CA IDMS passes the same piece of global storage within a transaction to all routines that have the same global storage key.

If you do not specify a storage key, its value remains unchanged. To remove a storage key, specify NULL as the key.

USER MODE

Specifies that the function should execute as a user-mode application program within CA IDMS. Do not specify user mode for functions specified with protocol ADS, such as is the case with functions written as CA ADS mapless dialogs or written in SQL.

SYSTEM MODE

Specifies that the procedure should execute as a system-mode application program. To execute as a system mode application, the program must be fully reentrant and written in either:

- ADS as a mapless dialog
- SQL
- Assembler using DC calling conventions
- COBOL or PL/I and compiled with an LE-compliant compiler

PROTOCOL

Specifies the environment.

IDMS

Use IDMS for SQL-invoked functions that are written in COBOL, PL/I, or Assembler.

ADS

Use ADS for SQL-invoked functions that are written in SQL or CA ADS. The name of the dialog that will be loaded and run when the SQL function is invoked is given by the *external-routine-name* in the EXTERNAL NAME clause. Setting the protocol to ADS, requires the function to have its mode set to system.

language-clause

Specifies the programming language of the function.

timestamp-value

Specifies the value of the synchronization stamp to be assigned to the function. *Timestamp-value* must be a valid external representation of a timestamp.

DEFAULT DATABASE

Specifies whether a default database should be established for database sessions started by the function.

NULL

Specifies that no default database should be established.

CURRENT

Specifies that the database to which the SQL session is connected should become the default for any database session started by the function.

TRANSACTION SHARING

Specifies whether to enable transaction sharing for database sessions started by the function. If transaction sharing is enabled for a function's database session, it will share the current SQL session's transaction.

ON

Specifies to enable transaction sharing.

OFF

Specifies to disable transaction sharing.

DEFAULT

Specifies to retain the transaction sharing setting that is in effect when the function is invoked.

Parameters for Expansion of language-clause

ADS

Specifies that the SQL routine is written in the CA ADS language.

ASSEMBLER

Specifies that the SQL routine is written in the assembler language.

COBOL

Specifies that the SQL routine is written in the COBOL language.

PLI

Specifies that the SQL routine is written in the PL/I language.

SQL

Specifies that the SQL routine is written in the SQL language.

Note: The ability to specify ADS or ASSEMBLER as a language is a CA IDMS extension.

Usage

Changing the language of a function

A function with language SQL cannot be changed to any other language and a function whose language is not SQL cannot be changed to language SQL.

Specifying a Synchronization Stamp

When defining or altering a function, you can specify a value for its synchronization stamp. You should use care when doing so because the purpose of the stamp is to enable the detection of discrepancies between an entity and its definition. If explicitly specified, you must set the synchronization stamp to a new value following a change so that the change is detectable by the runtime system.

If not specified, the synchronization stamp is automatically set to the current date and time.

Note: For more information about creating a function, see CREATE FUNCTION.

Example

The following example shows the use of ALTER FUNCTION to change the external name of a function.

```
alter function fin.udf_funbonus external name funbon09;
```

ALTER INDEX

The ALTER INDEX statement alters the characteristics of an existing index. It is also a CA IDMS extension of the SQL standard. You can change the structure and location of an index through the modification of the following attributes:

- Key count
- Displacement
- Uniqueness
- Area association

Authorization

To issue an ALTER INDEX statement, you must have the ALTER privilege on or own the table on which the index is defined.

Syntax

```
►►─ ALTER INDEX index-name ON ─┬───────────────┬─ table-identifier ──►
                               └─ schema-name. ┘

 ┌────────────────────────────────────────────────┐
►─▼─┬─ INDEX BLOCK CONTAINS key-count KEYS ─┬─┘────────────────────────────►◄
    ├─ DISPLACEMENT IS page-count PAGES ────┤
    ├─┬───────┬─ UNIQUE ─────────────────────┤
    │ └─ NOT ─┘                              │
    └─ IN segment-name.area-name ───────────┘
```

Parameters

This section describes the parameters for the ALTER INDEX statement:

page-count **PAGES**

Specifies how far away from the index owner the bottom-level index records are stored.

If the value of page-count is zero (0), the bottom-level internal index records are not displaced from the index owner.

Limit: An unsigned integer from 0–32,767.

UNIQUE

Specifies that the index-key value in any given row of the table on which the index is defined must be different from the index-key value in all other rows of the table. The table cannot contain any duplicate index-key values.

If you specify UNIQUE and the table contains duplicate index-key values, the alter statement will fail.

NOT UNIQUE

Removes the restriction that all values of the index-key within the table must be unique.

When the UNIQUE restriction is used to ensure uniqueness of a referenced key in some constraint, you cannot remove it from an index unless another index or CALC key can be used in its place.

IN

Requests a change in the location of the named index.

area-name

Identifies a new area with which the index is to be associated. Area-name must identify an area defined in the dictionary.

segment-name

Identifies the segment associated with the area.

Usage

System tables

You cannot alter an index defined on a table in the SYSTEM schema.

Changing the Number of Entries in an SR8

It is sometimes desirable to change the number of entries in an SR8 system record after an index has been loaded. The ALTER INDEX statement enables the maximum number of entries to be changed without affecting the existing index structure.

Note: For more information about index structure and design considerations, see the *CA IDMS Database Administration Guide*.

Example

In this example, the EMP_LNAME index is moved from its current location to the DEMO.EMPAREA area. Each internal index record will have a maximum of 30 keys and the bottom-level index records will be displaced 40 pages from the top of the index.

```
alter index emp_lname (last_name) on emp.benefits
      displacement is 40 pages
           index block contains 30 keys
      in area demo.emparea;
```

ALTER PROCEDURE

The ALTER PROCEDURE data description statement modifies the definition of a procedure in the dictionary. Using the ALTER PROCEDURE statement, you can:

- Add a new parameter to a procedure
- Revise the estimated row and I/O counts
- Change the external name of the procedure
- Change the size and characteristics of the work areas passed to the procedure
- Change the execution mode of the procedure
- Change the language of the procedure
- Update the timestamp
- Change the default database option
- Change the transaction sharing option
- Change the protocol
- Change the maximum number of dynamic result sets

The ability to change attributes other than language, external name, and the maximum number of dynamic result sets is a CA IDMS extension of the SQL standard.

Authorization

To issue an ALTER PROCEDURE statement, you must either own or hold the ALTER privilege on the procedure named in the statement.

Syntax

```
►►── ALTER PROCEDURE ─┬──────────────────┬─ procedure-identifier ─────►
                      └─ schema-name. ───┘

 ►─┬─ ADD parameter-definition ──────────────────────────────────┬────►◄
   │                                                              │
   │        ┌────────── , ──────────┐                             │
   ├─ ADD ( ─▼─ parameter-definition ─┴─ ) ──────────────────────┤
   ├─ EXTERNAL NAME external-routine-name ───────────────────────┤
   ├─ ESTIMATED ROWS row-count ──────────────────────────────────┤
   ├─ ESTIMATED IOS io-count ────────────────────────────────────┤
   ├─ LOCAL WORK AREA local-stge-size ───────────────────────────┤
   ├─ GLOBAL WORK AREA global-stge-size ─┬────────────────────┬──┤
   │                                     └─ KEY ─┬─ key-ID ─┬─┘  │
   │                                             └─ NULL ───┘    │
   ├─ USER MODE ─────────────────────────────────────────────────┤
   ├─ SYSTEM MODE ───────────────────────────────────────────────┤
   ├─ PROTOCOL ─────────────────────────┬─ IDMS ─┬───────────────┤
   │                                    └─ ADS ──┘               │
   ├─ language-clause ───────────────────────────────────────────┤
   ├─ TIMESTAMP timestamp-value ─────────────────────────────────┤
   ├─ DEFAULT DATABASE ─────────────────┬─ NULL ────┬────────────┤
   │                                    └─ CURRENT ─┘            │
   ├─ TRANSACTION SHARING ──────────────┬─ ON ──────┬────────────┤
   │                                    ├─ OFF ─────┤            │
   │                                    └─ DEFAULT ─┘            │
   └─ DYNAMIC RESULT SETS maximum-dynamic-result-sets ───────────┘
```

Expansion of parameter-definition

```
►►── parameter-name ── data-type ─┬──────────────┬──────────────────────►◄
                                  └ WITH DEFAULT ┘
```

Expansion of language-clause

```
►►── LANGUAGE ─────────────────────┬─ ADS ──────────┬──────────────────────►◄
                                   ├─ ASSEMBLER ────┤
                                   ├─ COBOL ────────┤
                                   ├─ PLI ──────────┤
                                   └─ SQL ──────────┘
```

Parameters

procedure-identifier

Specifies the name of the procedure being modified. *Procedure-identifier* must identify a procedure defined in the dictionary.

schema-name

Identifies the schema associated with the named procedure. If you do not specify a *schema-name* it defaults to:

- The current schema associated with your SQL session, if you enter the statement through the Command Facility or execute it dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

parameter-definition

Defines one or more new parameters to be associated with the procedure. New parameters are added, in the order specified, after the last existing parameter.

For a description of parameter-definition, see CREATE PROCEDURE. Descriptions for the expansion parameters are located at the end of this section.

external-routine-name

Specifies the one- to eight-character name of the program which CA IDMS calls to process references to the procedure.

row-count

Specifies an integer value, in the range of 0 through 2,147,483,647, which represents the average number of rows that the procedure returns for a given set of input parameters.

io-count

Specifies an integer value, in the range of 0 through 2,147,483,647, which represents the average number of disk accesses that the procedure generates for a given set of input parameters.

local-stge-size

Specifies an integer, in the range of 0 through 32767, which represents the size, in bytes, of a local storage area that CA IDMS allocates at runtime and passes to the procedure on each invocation.

global-stge-size

Specifies an integer, in the range of 0 through 32767, which represents the size, in bytes, of a global storage area that CA IDMS allocates at runtime and passes to the procedure on each invocation.

CA IDMS allocates a global storage area once within a transaction and retains it until the transaction terminates.

key-id

Specifies the one- to four-character identifier for the global storage area. CA IDMS passes the same piece of global storage within a transaction to all routines that have the same global storage key.

If you do not specify a storage key, its value remains unchanged. To remove a storage key, specify NULL as the key.

USER MODE

Specifies that the procedure should execute as a user-mode application program within CA IDMS. Do not specify user mode for procedures specified with protocol ADS, such as is the case with procedures written as CA ADS mapless dialogs or written in SQL.

SYSTEM MODE

Specifies that the procedure should execute as a system mode application program. To execute as a system mode application, the program must be fully reentrant and be written in either:

- ADS as a mapless dialog
- SQL
- Assembler using DC calling conventions
- COBOL or PL/I and compiled with an LE-compliant compiler

PROTOCOL

Specifies the environment.

IDMS

Use IDMS for SQL-invoked functions that are written in COBOL, PL/I, or Assembler.

ADS

Use ADS for SQL-invoked functions that are written in SQL or CA ADS. The name of the dialog that will be loaded and run when the SQL function is invoked is given by the *external-routine-name* in the EXTERNAL NAME clause. Setting the protocol to ADS, requires the function to have its mode set to system.

language-clause

Specifies the programming language of the procedure.

timestamp-value

Specifies the value of the synchronization stamp to be assigned to the procedure. *Timestamp-value* must be a valid external representation of a timestamp.

DEFAULT DATABASE

Specifies whether a default database should be established for database sessions started by the procedure.

NULL

Specifies that no default database should be established.

CURRENT

Specifies that the database to which the SQL session is connected should become the default for any database session started by the procedure.

TRANSACTION SHARING

Specifies whether transaction sharing should be enabled for database sessions started by the procedure. If transaction sharing is enabled for a procedure's database session, it will share the current SQL session's transaction.

ON

Specifies that transaction sharing should be enabled.

OFF

Specifies that transaction sharing should be disabled.

DEFAULT

Specifies that the transaction sharing setting that is in effect when the procedure is invoked should be retained.

DYNAMIC RESULT SETS

Defines the maximum number of result sets that a procedure invocation can return to its caller. A result set is a sequence of rows specified by a *cursor-specification*, created by the opening of a cursor and ranged over that cursor.

maximum-dynamic-result-sets

Defines an integer in the range 0-32767 specifying the maximum number of result sets a procedure can return.

Parameters for Expansion of parameter-definition

parameter-name

Specifies a 1- to 32-character name of a parameter to be passed to the table procedure. *Parameter-name* must:

- Be unique within the table procedure that you are defining
- Follow the conventions for SQL identifiers

All parameters are implicitly nullable. Input parameters can be assigned NULL as a parameter value and output parameters can return NULL.

data-type

Defines the data type for the named parameter. For expanded **data-type** syntax, see Expansion of Data-type.

WITH DEFAULT

Directs CA IDMS to pass a default value for the named parameter if no value for the parameter is specified.

The default value for a parameter is based on its data type:

Column data type	Default value
CHARACTER	Blanks
VARCHAR	A character string literal with a length of zero (that is, '')
GRAPHIC	Double-byte blanks
VARGRAPHIC	A double-byte character string literal with a length of zero
DATE	The value in the CURRENT DATE special register
TIME	The value in the CURRENT TIME special register
TIMESTAMP	The value in the CURRENT TIMESTAMP special register
All numeric data types	0 (zero)

Parameters for Expansion of language-clause

ADS

Specifies that the SQL routine is written in the CA ADS language.

ASSEMBLER

Specifies that the SQL routine is written in the assembler language.

COBOL

Specifies that the SQL routine is written in the COBOL language.

PLI

Specifies that the SQL routine is written in the PL/I language.

SQL

Specifies that the SQL routine is written in the SQL language.

Note: The ability to specify ADS or ASSEMBLER as a language is a CA IDMS extension.

Usage

Changing the language of a procedure

A procedure with language SQL cannot be changed to any other language, and a procedure whose language is not SQL cannot be changed to language SQL.

Specifying a Synchronization Stamp

When defining or altering a procedure, you can specify a value for its synchronization stamp. You should use care when doing so because the purpose of the stamp is to enable the detection of discrepancies between an entity and its definition. If explicitly specified, you must set the synchronization stamp to a new value following a change so that the change is detectable by the runtime system.

If not specified, the synchronization stamp is automatically set to the current date and time.

Note: For more information about creating a procedure, see CREATE PROCEDURE.

Examples

Adding Parameters to a Procedure

The following ALTER PROCEDURE statement adds two new parameters to the EMP.GET_BONUS procedure:

```
alter procedure emp.get_bonus
  add (start_month  char (2),
       start_year   char (2));
```

ALTER SCHEMA

The ALTER SCHEMA data description statement that modifies the definition of a schema in the dictionary. It is also a CA IDMS extension of the SQL standard.

Authorization

To issue an ALTER SCHEMA statement, you must hold the ALTER privilege on the schema named in the statement.

If you specify FOR NONSQL SCHEMA, you must have the USE privilege on the non-SQL schema.

If you specify DBNAME, you must have USE privilege on the database; if you do not specify DBNAME or specify a value of NULL, you must have DBADMIN privilege on DBNAME SYSTEM.

Syntax

```
►►─── ALTER SCHEMA schema-name ──────────────────────────────────────────────►

 ►─┬──────────────────────────────────────────────────────┬──────────────────►◄
   ├─ DEFAULT AREA ─┬─ segment-name.area-name ─┬──────────┤
   │                └─ NULL ───────────────────┘          │
   ├─ DBNAME ─┬─ database-name ─┬─────────────────────────┤
   │          └─ NULL ──────────┘                         │
   ├─ FOR NONSQL SCHEMA nonsql-schema-specification ──────┤
   └─ FOR SQL SCHEMA sql-schema-specification ────────────┘
```

Expansion of nonsql-schema-specification (ALTER SCHEMA)

```
►►─┬──────────────────────┬─ nonsql-schema-name ─┬────────────────────────────┬─►
   └─ dictionary-name. ───┘                      └─ VERSION version-number ───┘

 ►─┬────────────────────────────────┬────────────────────────────────────────►◄
   └─ DBNAME ─┬─ database-name ─┬───┘
              └─ NULL ──────────┘
```

Expansion of sql-schema-specification (ALTER SCHEMA)

```
►►──────────────────────────── sql-schema-name ──────────────────────────────►

 ►─┬────────────────────────────────┬────────────────────────────────────────►◄
   └─ DBNAME ─── database-name ─────┘
```

Parameters

schema-name

Specifies the name of the schema being modified. *Schema-name* must identify a schema defined in the dictionary.

DEFAULT AREA

Modifies the default area specification for the named schema. This parameter is valid only for a schema that is not associated with a non-SQL-defined schema.

The named area is used by default for storing rows of tables *subsequently* defined in the named schema. It replaces any previous default area specification for the schema.

segment-name.area-name

Identifies the segment and area.

You do not need to define the named segment or area in the dictionary before issuing the ALTER SCHEMA statement.

NULL

Removes any previous default area specification for the named schema.

If the default area specification is removed, all subsequent CREATE TABLE statements that qualify the table name with the name of the schema being altered must include the IN parameter.

DBNAME

If the schema has been associated with a non-SQL-defined schema, you can add or change the specification of the database using this parameter.

Descriptions of the *database-name* and NULL parameters are presented under **nonsql-schema-specification**.

nonsql-schema-specification

Identifies the non-SQL-defined schema to associate with the SQL schema.

Expanded syntax for **nonsql-schema-specification** appears immediately following the statement syntax. Descriptions for these parameters are located at the end of this section.

sql-schema-specification

Identifies an existing SQL-defined schema to which the new SQL schema refers. Expanded syntax for *sql-schema-specification* appears immediately following the statement syntax.

Parameters for Expansion of nonsql-schema-specification

***dictionary-name*.**

Names the dictionary that contains the non-SQL-defined schema.

If you do not specify *dictionary-name*, it is set to the dictionary to which your SQL session is connected.

nonsql-schema-name

Identifies the non-SQL-defined schema.

VERSION *version-number*

Identifies the version number of the non-SQL-defined schema. If VERSION *version-number* is not specified, *version-number* defaults to 1.

DBNAME

Specifies the database that the non-SQL-defined schema describes or removes a database specification.

For considerations about whether to specify a database when you create a schema for a non-SQL-defined schema, see the "Usage" section of CREATE SCHEMA.

database-name

Identifies one of the following:

- The segment containing the areas described by the non-SQL-defined schema.
- A database name that includes segments containing the areas described by the non-SQL-defined schema.

  At runtime CA IDMS accesses the segments associated with the database name that contain areas with the same name as the areas in the non-SQL-defined schema.

NULL

Initializes the database name for the non-SQL-defined schema to blanks.

If no *database-name* is specified in the schema definition, at runtime the database name to which the SQL session is connected must include segments containing the areas described by the non-SQL-defined schema.

Parameters for Expansion of sql-schema-specification

sql-schema-name

Names the referenced SQL-defined-schema. this named schema must not itself reference another schema.

DBNAME *database-name*

Identifies the database containing the data described by the referenced SQL-defined schema. Database-name must be a database name that is defined in the database name table or a segment name defined in the DMCL.

Usage

System-owned Schema

You cannot modify the definition of the schema named SYSTEM.

Changing non-SQL-defined Schema Information

If you change the name or version number of the non-SQL defined schema associated with an SQL-defined schema or if you change the database name associated with the schema, you must recompile all affected access modules and drop and recreate all affected views.

To determine which access modules are affected, use the DISPLAY ALL ACCESS MODULE statement with the TABLE selection criteria.

To recompile an affected access module, use the ALTER ACCESS MODULE statement with the REPLACE ALL option.

Views must be dropped and recreated if the structure of one or more referenced records in the new non-SQL-defined schema is different than the structure at the time the view was created. Views are also invalid if a referenced record has been deleted from the non-SQL schema. To determine which views are affected, use the DISPLAY ALL VIEW statement with the REFERENCEd selection criteria. Before dropping the view, display its syntax by using the DISPLAY or PUNCH VIEW statement.

Restricted Changes

You cannot alter the type of a schema:

- You cannot change a non-referencing schema to a referencing schema or a referencing schema to a non-referencing schema.
- You cannot change the type of schema being referenced from SQL to non-SQL or from non-SQL to SQL.

Changing Referenced SQL Schema Information

If you change the name of the SQL schema that is referenced, you must drop and recreate all views that reference tables in the referencing schema, for example, the schema being altered. To determine which views are affected, use the DISPLAY ALL VIEW statement with the REFERENCED selection criteria. Before dropping the view, display its syntax by using the DISPLAY or PUNCH VIEW statement.

Example

Removing the Default Area Specification

The following ALTER SCHEMA statement removes the default area specification from the SALES schema:

```
alter schema sales
   default area null;
```

More Information

- For more information about defining schemas, see CREATE SCHEMA and DROP SCHEMA.
- For more information about non-SQL schemas, see Accessing Non-SQL-Defined Databases.
- For more information about displaying access modules and views, see DISPLAY/PUNCH ACCESS MODULE and DISPLAY/PUNCH VIEW.

ALTER TABLE

The ALTER TABLE data description statement modifies the definition of a base table in the dictionary.

Using ALTER TABLE, you can perform the following tasks:

- Add one or more columns to a table
- Alter a column’s data type or null attribute
- Drop or change a column’s default clause
- Rename a column
- Drop a column
- Specify additional restrictions on the data that can be stored in a table
- Remove all restrictions on the data that can be stored in a table
- Add or delete the default index associated with a table
- Revise the estimated row count for a table
- Update the table's timestamp

The ability to revise the estimated row count and to update the table's timestamp is a CA IDMS extension of the SQL standard.

Authorization

To issue an ALTER TABLE statement, you must hold the ALTER privilege on or own the table named in the statement.

Syntax

```
►►─ ALTER TABLE ─┬─────────────────┬─ table-identifier ──────────────►
                 └─ schema-name ─.─┘

 ►──────┬─ ADD CHECK ( search-condition ) ───────────────────────┬──────►◄
        ├─ DROP CHECK ───────────────────────────────────────────┤
        ├─ ADD DEFAULT INDEX ────────────────────────────────────┤
        ├─ DROP DEFAULT INDEX ───────────────────────────────────┤
        ├─ ADD ──┬──────────┬─ column-definition ────────────────┤
        │        └─ COLUMN ─┘                                    │
        │                        ┌────────── , ─────────┐        │
        ├─ ADD ──┬──────────┬─ (─▼─ column-definition ──┴─)──────┤
        │        └─ COLUMN ─┘                                    │
        ├─ ALTER ─┬──────────┬─ column-alteration ───────────────┤
        │         └─ COLUMN ─┘                                   │
        ├─ DROP ──┬──────────┬─ column-name ─┬───────────┬───────┤
        │         └─ COLUMN ─┘               └─ CASCADE ─┘       │
        ├─ RENAME ─┬──────────┬─ column-name TO new-column-name ─┤
        │          └─ COLUMN ─┘                                  │
        ├─ ESTIMATED ROWS estimated-row-count ───────────────────┤
        └─ TIMESTAMP timestamp-value ────────────────────────────┘
```

Expansion of column-definition

```
►►──────column-name data-type ─┬────────────┬─┬────────────────┬──►◄
                               └─ NOT NULL ─┘ └─ WITH DEFAULT ─┘
```

Expansion of column-alteration

```
►►──────column-name ───┬─ SET ─┬─ DATA TYPE ─ data-type ─┬───┬────►◄
                       │       ├┬─ ALLOW ─┬─ NULL ───────┤   │
                       │       │└─ NOT ───┘              │   │
                       │       └─ WITH DEFAULT ──────────┘   │
                       └─ DROP DEFAULT ──────────────────────┘
```

Parameters

table-identifier

Specifies the name of the table being modified. *Table-identifier* must identify a base table defined in the dictionary.

schema-name

Identifies the schema associated with the named table.

If not specified, *schema-name* defaults to:

- The current schema associated with your SQL session, if the statement is entered through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

column-definition

Defines one or more new columns to be included in the table. New columns are added after the last existing column.

Expanded syntax for **column-definition** is shown immediately following the ALTER TABLE syntax. Descriptions of **column-definition** parameters follow description of ALTER TABLE parameters.

ADD CHECK (search-condition)

Specifies additional restrictions on the data that can be stored in the table.

If the table definition already includes data restrictions in a search condition, CA IDMS appends the search condition specified in the ADD CHECK parameter to the existing search condition with the binary operator AND. CA IDMS stores a new row in the table only if the value of the entire expression formed by the concatenation of the search conditions is true.

Restrictions on the use of *search-condition* with ADD CHECK are discussed under "Usage" following these parameter descriptions. For expanded **search-condition** syntax, see Expansion of Search-condition.

DROP CHECK

Removes any existing restrictions on the data that can be stored in the table.

ADD DEFAULT INDEX

Creates a default index for the named table.

Note: The table must not have a default index already ssociated with it.

DROP DEFAULT INDEX

Deletes the default index associated with the table.

column-alteration

Specifies the changes to be made to the attributes of a column.

Note: The expanded syntax for column-alteration is shown after the ALTER TABLE syntax. Descriptions of column-alteration parameters follow the description of ALTER TABLE parameters.

DROP COLUMN *column-name*

Identifies the column to be removed from the table. Column-name must be the name of a column in the table.

Note: You cannot drop columns that are part of a CALC key of a populated table or that are named in a check constraint.

CASCADE

Drops the following entities:

- The CALC key if it includes the column.
- All referential constraints in which the named column is a referenced or a foreign key column.
- All linked constraints in which the named column is a sort column.
- All indexes in which the named column is an indexed column.
- All views in which the column is named.

Note: If CASCADE is not specified, the column must not participate in a referential constraint or index, or be named in a view.

RENAME COLUMN *column-name*

Identifies the column name to be changed. Column-name must be the name of a column in the table.

Note: You cannot rename a column if the column is named in a check constraint or in a view.

TO *new-column-name*

Specifies the new name for the identified column.

Limit: 1–32 characters that follows the SQL identifier standard.

Note: The new column name must be distinct from the name of any existing column in the table.

ESTIMATED ROWS *estimated-row-count*

Indicates the number of rows expected to be stored for the table. *Estimated-row-count* must be an integer that does not exceed 16,777,214. The specified value replaces any previous estimated row count for the table.

TIMESTAMP *timestamp-value*

Specifies the value of the synchronization stamp to be assigned to the table. *Timestamp-value* must be a valid external representation of a timestamp.

Parameters for Expansion of column-definition

column-name

Specifies the name of a column to be included in the table being created. *Column-name* must be a one- through 32-character name that follows the conventions for SQL identifiers.

Column-name must be unique within the table being defined.

data-type

Defines the data type for the named column. For expanded **data-type** syntax, see Expansion of Data-type.

NOT NULL

Indicates that the column cannot contain null values.

If NOT NULL is specified *without* WITH DEFAULT, the table being altered must be empty.

If NOT NULL is not specified, the column is defined to allow null values.

WITH DEFAULT

Directs CA IDMS to establish a default value for the column being added.

The default value is based on the data type of the column:

Column data type	Default value
CHARACTER	Blanks
VARCHAR	A character string literal with a length of zero (that is, '')
GRAPHIC	Double-byte blanks
VARGRAPHIC	A double-byte character string literal with a length of zero
DATE	'0001-01-01' for existing rows The value in the CURRENT DATE special register for newly inserted rows
TIME	'00.00.00' for existing rows The value in the CURRENT TIME special register for newly inserted rows
TIMESTAMP	'0001-01-01-00.00.00.000000' for existing rows The value in the CURRENT TIMESTAMP special register for newly inserted rows
All numeric data types	0 (zero)

If you do not specify WITH DEFAULT, then:

- If you specify NOT NULL, the table must be empty
- If you do *not* specify NOT NULL, the default value for the column is NULL

Parameters for Expansion of column-alteration

column-name

Identifies the column whose attributes are to be changed. Column-name must be the name of a column in the table.

data-type

Defines the new data type for the named column. The specified data type must be compatible for assignment with the column’s existing data type. For expanded data-type syntax, see Expansion of Data-type.

You cannot change the data type of a column that is part of a CALC key of a populated table or that is a referenced or foreign key column in a constraint.

ALLOW NULL

Indicates that the column can contain null values. You cannot change the null attribute of a column that is part of a CALC key of a populated table or a referenced key.

NOT NULL

Indicates that the column cannot contain null values. You cannot change the null attribute of a column that is part of a CALC key of a populated table or a referenced key.

WITH DEFAULT

Sets the column’s value to a default if no value for the column is specified when a row is inserted.

DROP DEFAULT

Does not set the column’s value to a default when a row is inserted.

Usage

Tables in System Schemas

You cannot modify the definition of a table in the SYSTEM schema.

Maximum Row Length

When adding a column to a table, you must ensure that the total number of bytes required for all columns in the table does not exceed the maximum allowed.

Note: For more information about maximum row length, see CREATE TABLE.

Restrictions on search-condition

In the ADD CHECK parameter of an ALTER TABLE statement:

- **Search-condition** cannot include any host variables, local variables, routine parameters, aggregate or user-defined functions, EXISTS predicates, quantified predicates, or subqueries
- Each column reference in **search condition** must identify a column in the table being modified

Modifying Tables that Contain Data

If the table specified in an ALTER TABLE statement contains one or more rows of data (that is, the table is not empty), and the ALTER TABLE statement specifies:

- ADD **column-definition**, you must supply a default value in the DEFAULT parameter of the column definition if you specify NOT NULL
- ADD CHECK, the value of the search condition specified in the ADD CHECK parameter must be true for each existing row in the table

Add a Default to a Column

Allowing a column to have a default value affects only the table's definition; existing table rows are not affected.

Remove a Column's Default

If the table is populated and the column does not allow null values, every existing row must contain a value in the changed column. To ensure this, each row is accessed and updated if it does not contain a value for the column.

Rename a Column

A column that is named in a check constraint or a view cannot be renamed.

The definition of all referential constraints, sort keys, CALC keys and indexes in which the column participates are updated to show the new column name.

Drop a Column

Every row in the table is updated to remove the column value.

If a column is named in a check constraint or is part of the CALC key of a populated table, you cannot drop the column.

If you do not specify CASCADE, the column must not be one of the following types of columns:

- A column in a CALC key
- A referenced or foreign key column in a referential constraint
- An indexed column
- A sort column of a linked constraint
- Named in a view

If you specify CASCADE, how the column is used determines what other items are dropped:

- Dropping a CALC key column also drops the CALC key
- Dropping a referenced or foreign key column in a referential constraint also drops the constraint
- Dropping an indexed column also drops the index
- Dropping a sort column of a linked constraint also drops the constraint
- Dropping a column named in a view also drops the view

Change a Column’s Null Attribute

The following situations apply when you change a column's null attribute:

- When the column is part of a CALC key of a populated table, or is a referenced column in a constraint, the ALTER statement fails.
- When you change a null attribute, every row in the table is updated to add or remove the null attribute byte for that column.
- When the changed column is a sort column, every index and linked indexed constraint is automatically rebuilt.
- When disallowing nulls and the value of the column is null for a row in the table, the ALTER statement fails.

Change a Column’s Data Type

The following situations apply when you change a column's data type:

- When the column is part of a CALC key of a populated table, or is a referenced column in a constraint, the ALTER statement fails.
- When changing a column’s data type, the new data type you enter must be compatible for assignment with the original data type.
- Every row in the table is restructured to convert the column value to the new type. This might involve increasing or decreasing the length of the row.
- The ALTER statement will fail if a loss of data (such as truncation of a non-blank character or numeric overflow) would occur as part of the conversion.
- When you change data type, every index and linked indexed constraint in which the column is a sort column is rebuilt.

Examining Check Constraints on a Table

You can examine the current check constraint on a table by using the DISPLAY TABLE statement.

Examining existing check constraints is useful if you are planning to change a constraint by dropping it and adding the changed constraint.

Adding Columns with Multiple ALTER TABLE Statements

When columns are added with the ALTER TABLE statement, the first column in the column definition list is aligned on a full word boundary in the physical data structure that represents table rows. Since each individual ALTER TABLE statement will cause alignment, columns added in separated ALTERs versus one ALTER can result in different row lengths and column offsets within the physical row data structure.

Specifying a Synchronization Stamp

When defining or altering a table, you can specify a value for its synchronization stamp. You should use care when doing so because the purpose of the stamp is to enable the detection of discrepancies between an entity and its definition. If explicitly specified, you must set the synchronization stamp to a new value following a change so that the change is detectable by the runtime system.

If not specified, the synchronization stamp is automatically set to the current date and time.

Examples

Adding a Column to a Table

The following ALTER TABLE statement adds a new column, STATUS, to the CONSULTANT table. The value of STATUS in all existing rows is blank because the statement specifies WITH DEFAULT.

```
alter table consultant
   add status character(1) not null with default;
```

Further Restricting Data in a Table

The following ALTER TABLE statement defines an additional restriction on the data that can be stored in the CONSULTANT table. CA IDMS adds the constraint only if each existing row of the CONSULTANT table already has 'A' or 'I' in the STATUS column.

```
alter table consultant
   add check (status in ('A', 'I');
```

Change a column's data type:

```
alter table demo.empl
      alter column city
      set data type varchar(20);
```

Drop a column using the CASCADE option:

```
alter table demo.empl
      drop column status cascade;
```

Rename a column:

```
alter table demo.empl
      rename column proj_id to project_id;
```

Adding a default index:

```
alter table emp.dept
      add default index;
```

More Information

- For more information about defining tables, see CREATE TABLE and DROP TABLE.
- For more information about implementing indexes, see the *CA IDMS Database Design Guide*.
- For more information about displaying a table, see DISPLAY/PUNCH TABLE.

ALTER TABLE PROCEDURE

The ALTER TABLE PROCEDURE data description statement modifies the definition of a table procedure in the dictionary. It is also a CA IDMS extension of the SQL standard. Using the ALTER TABLE PROCEDURE statement, you can:

- Add a new parameter to a table procedure
- Revise the estimated row and I/O counts
- Change the external name of the procedure
- Change the size and characteristics of the work areas passed to the procedure
- Change the execution mode of the procedure
- Update the table procedure's synchronization timestamp
- Change the table procedure's default database option
- Change the table procedure's transaction sharing option

Authorization

To issue an ALTER TABLE PROCEDURE statement, you must own or hold the ALTER privilege on the table procedure named in the statement.

Syntax

```
►►── ALTER TABLE PROCEDURE ─┬──────────────┬─ table-procedure-identifier ─►
                            └ schema-name. ┘

►─┬─ ADD parameter-definition ──────────────────────────┬──────────────►◄
  │                   ┌───── , ─────┐                   │
  ├─ ADD ( ─▼─ parameter-definition ─┴─ ) ───────────────┤
  ├─ EXTERNAL NAME external-routine-name ────────────────┤
  ├─ESTIMATED ROWS row-count ────────────────────────────┤
  ├─ESTIMATED IOS io-count ──────────────────────────────┤
  ├─LOCAL WORK AREA local-stge-size ─────────────────────┤
  ├─GLOBAL WORK AREA global-stge-size ─┬───────────────────┬┤
  │                                    └ KEY ┬ key-ID ┬┘ │
  │                                          └ NULL . ┘  │
  ├─USER MODE ───────────────────────────────────────────┤
  ├─SYSTEM MODE ─────────────────────────────────────────┤
  ├─TIMESTAMP timestamp-value ───────────────────────────┤
  ├─DEFAULT DATABASE ──────────┬─ NULL ────┬─────────────┤
  │                            └─ CURRENT ─┘             │
  └─TRANSACTION SHARING ───────┬─ ON ──────┬─────────────┘
                               ├─ OFF ─────┤
                               └─ DEFAULT ─┘
```

Expansion of parameter-definition

```
►►── parameter-name ── data-type ─┬──────────────┬──────────────────►◄
                                  └─ WITH DEFAULT ┘
```

Parameters

table-procedure-identifier

Specifies the name of the table procedure being modified. *Table-procedure-identifier* must identify a table procedure defined in the dictionary.

schema-name

Identifies the schema associated with the named table procedure. If you do not specify a *schema-name*, it defaults to:

- The current schema associated with your SQL session, if the statement is entered through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

parameter-definition

Defines one or more new parameters to be associated with the table procedure. New parameters are added, in the order specified, after the last existing parameter.

For a description of **parameter-definition**, see CREATE TABLE PROCEDURE.

external-routine-name

Specifies the one- to eight-character name of the program which CA IDMS calls to process references to the table procedure.

row-count

Specifies an integer value, in the range of 0 through 2,147,483,647, which represents the average number of rows that the table procedure returns for a given set of input parameters.

io-count

Specifies an integer value, in the range of 0 through 2,147,483,647, which represents the average number of disk accesses that the table procedure generates for a given set of input parameters.

local-stge-size

Specifies an integer, in the range of 0 through 32767, which represents the size, in bytes, of a local storage area that CA IDMS allocates at runtime and passes to the table procedure on each invocation.

CA IDMS allocates a local storage area on the first call to a table procedure for each SQL statement within a transaction or for a set of SQL statements related through reference to the same cursor. OPEN, CLOSE, FETCH, POSITIONED UPDATE and POSITIONED DELETE statements are related through a cursor. CA IDMS passes the same local storage area to the table procedure for all calls for one statement or related statements. CA IDMS releases the local work area when the SQL statement has completed execution or at the time the cursor is closed.

global-stge-size

Specifies an integer, in the range of 0 through 32767, which represents the size, in bytes, of a global storage area that CA IDMS allocates at runtime and passes to the table procedure on each invocation.

CA IDMS allocates a global storage area once within a transaction and retains it until the transaction terminates.

key-id

Specifies the one- to four-character identifier for the global storage area. CA IDMS passes the same piece of global storage within a transaction to all routines that have the same global storage key.

If you do not specify a storage key, its value remains unchanged. To remove a storage key, specify **NULL** as the key.

USER MODE

Specifies the table procedure should execute as a user-mode application program within CA IDMS.

SYSTEM MODE

Specifies the table procedure should execute as a system-mode application program. To execute as a system mode application, the program must be fully reentrant and be written in either:

- Assembler using DC calling conventions
- COBOL or PL/I and compiled with an LE-compliant compiler

timestamp-value

Specifies the value of the synchronization stamp to be assigned to the table procedure. *Timestamp-value* must be a valid external representation of a timestamp.

DEFAULT DATABASE

Specifies whether a default database should be established for database sessions started by the table procedure.

NULL

Specifies that no default database should be established.

CURRENT

Specifies that the database to which the SQL session is connected should become the default for any database session started by the table procedure.

TRANSACTION SHARING

Specifies whether transaction sharing should be enabled for database sessions started by the table procedure. If transaction sharing is enabled for a table procedure's database session, it will share the current SQL session's transaction.

ON

Specifies that transaction sharing should be enabled.

OFF

Specifies that transaction sharing should be disabled.

DEFAULT

Specifies that the transaction sharing setting that is in effect when the procedure is invoked should be retained.

Parameters for Expansion of parameter-definition

parameter-name

Specifies a 1- to 32-character name of a parameter to be passed to the table procedure. *Parameter-name* must:

- Be unique within the table procedure that you are defining
- Follow the conventions for SQL identifiers

All parameters are implicitly nullable. Input parameters can be assigned NULL as a parameter value and output parameters can return NULL.

data-type

Defines the data type for the named parameter. For expanded **data-type** syntax, see Expansion of Data-type.

WITH DEFAULT

Directs CA IDMS to pass a default value for the named parameter if no value for the parameter is specified.

The default value for a parameter is based on its data type:

Column data type	Default value
CHARACTER	Blanks
VARCHAR	A character string literal with a length of zero (that is, '')
GRAPHIC	Double-byte blanks
VARGRAPHIC	A double-byte character string literal with a length of zero
DATE	The value in the CURRENT DATE special register
TIME	The value in the CURRENT TIME special register
TIMESTAMP	The value in the CURRENT TIMESTAMP special register
All numeric data types	0 (zero)

Usage

Specifying a Synchronization Stamp

When defining or altering a table procedure, you can specify a value for its synchronization stamp. You should use care when doing so because the purpose of the stamp is to enable the detection of discrepancies between an entity and its definition. If explicitly specified, you must set the synchronization stamp to a new value following a change so that the change is detectable by the runtime system.

If not specified, the synchronization stamp is automatically set to the current date and time.

Examples

Adding Parameters to a Table Procedure

The following ALTER TABLE PROCEDURE statement adds two new parameters to the EMP.ORG table procedure:

```
alter table procedure emp.org
  add (job_level    decimal(1),
       job_title    char(20));
```

BEGIN DECLARE SECTION

The BEGIN DECLARE SECTION statement notifies the precompiler that an SQL declare section follows. You can use this statement only in SQL that is embedded in a program.

Authorization

None required.

Syntax

```
►►── BEGIN DECLARE SECTION ─────────────────────────────────────────────────►◄
```

Parameter

BEGIN DECLARE SECTION.

Notifies the precompiler that an SQL declare section follows. An SQL declare section contains the definition of one or more host variables.

Usage

Declaring Host Variables

You can:

- Place an SQL declare section in an application program wherever host language rules allow variable declarations
- Define any number of host variable declarations in an SQL declare section
- Include any number of SQL declare sections in a single application program

Example

Beginning and Ending an SQL Declaration Section

In this COBOL example, BEGIN DECLARE SECTION begins an SQL declare section and END DECLARE SECTION ends it. The SQL declare section contains the definition of five host variables.

```
WORKING-STORAGE SECTION.
 .
 .
 .
 EXEC SQL BEGIN DECLARE SECTION END-EXEC
   01  HV-EMP-ID           PIC S9(8)     USAGE COMP.
   01  HV-EMP-LNAME        PIC X(20).
   01  HV-SALARY-AMOUNT    PIC S9(6)V(2) USAGE COMP-3.
   01  HV-PROMO-DATE       PIC X(10).
   01  HV-PROMO-DATE-I     PIC S9(4)     USAGE COMP.
 EXEC SQL END DECLARE SECTION END-EXEC
```

More Information

- For more information about ending an SQL declare section, see END DECLARE SECTION.
- For more information about declaring host variables, see Host Variables or the *CA IDMS SQL Programming Guide*.

CALL

The CALL data manipulation statement executes a procedure or a table procedure. The values of output parameters return in the form of 0 to 1 result row for the call of a procedure and 0 to multiple rows for the call of a table procedure. When the CALL statement is:

- Submitted through the command facility, the values of all parameters are contained in the result rows and displayed in tabular form.
- Embedded in an application program, at most a single row can return and the values in the result row are stored in host variables.
- Dynamically prepared, the result rows must return through a cursor just as if the prepared statement were a SELECT statement.

Authorization

To issue a CALL statement, you must either own or have the SELECT privilege on the procedure or table procedure explicitly named in the statement.

Syntax

```
►►── CALL ──┬─ procedure-reference ───────┬──────────────────────────────►◄
            └─ table-procedure-reference ─┘
```

Parameters

procedure-reference

Identifies the procedure that is invoked, the input values that pass to the procedure and optionally the host.variables for passing and returning values of input/output parameters.

table-procedure-reference

Identifies the table procedure that is invoked, the input values that pass to the table procedure and optionally the host.variables for passing and returning values of input/output parameters.

Usage

Embedding a CALL statement

When embedding a CALL statement in an application program, output values return only for those parameters that you specify as host-variables, local variables, or routine parameters.

```
call myproc (5, :wk-out)
```

If the procedure or table procedure updates the value of the first parameter and the application program needs to see that value, then you must specify both parameters as host-variables. You should set the first host-variable to 5 before executing the CALL statement:

```
move 5 to wk-val
call myproc (:wk-val, :wk-out)
```

Initializing parameters

It is important to initialize all host-variables, local variables, and routine parameters that you reference in a CALL statement prior to its execution. Since all such parameters are treated as input values, failure to initialize such host-variables, local variables, or routine parameters results in a data exception if its value does not conform to its data type. If there is no value to pass, you should declare the host-variable with a null indicator with a value set to -1 and set the local variables and routine parameters to null.

Dynamically executing a CALL statement

When describing the output from a dynamically prepared CALL statement, the SQLD field of the SQLDA contains a count of the number of parameters for the procedure or table procedure. The first SQLD entries within the SQLDA contain a description of those parameters.

You must return the output parameter values of a dynamically prepared CALL statement using a cursor. In other words, you must treat a dynamically prepared CALL statement as a dynamically prepared SELECT statement.

Result Sets from SQL-invoked Procedures

An SQL-invoked procedure can return results to the caller by assigning values to one or more parameters of the procedure. Using Dynamic Result Sets, an SQL-invoked procedure can return result sets in the form of rows of result tables.

To exploit result sets returned by an SQL-invoked procedure, an application must consist of at least an SQL-invoked procedure and a caller of that procedure. The caller can be an SQL client program or another SQL-invoked routine. The SQL-invoked procedure that returns the result sets can be an external procedure (COBOL, PL/I, Assembler or CA ADS) or an internal SQL procedure written in SQL.

For an SQL-invoked procedure to return result sets to its caller, it must be defined with a positive integer value for the new *Dynamic Result Sets* attribute.

A cursor declared or dynamically allocated in the SQL-invoked procedure becomes a potential returned result set if its definition contains *With Return* as the value for the new returnability attribute. Such a cursor is called a **returnable cursor**. It becomes a returned result set if it is in the open state when the SQL-invoked procedure terminates.

An SQL-invoked procedure can return multiple result sets up to the number specified by the Dynamic Result Sets attribute of the procedure. The list of returned result sets are sequenced in the order of the open of the cursors. If the procedure starts multiple sessions, then returned result sets are grouped by session and the sessions are sequenced in the order of the connects. After a procedure CALL, the new SQLCA field SQLCNRRS contains the number of result sets returned by the procedure.

The caller of an SQL-invoked procedure accesses returned result sets by allocating a dynamic cursor and associating it with the procedure through an ALLOCATE CURSOR FOR PROCEDURE statement. Such a cursor is called a **received cursor**.

A successful ALLOCATE CURSOR FOR PROCEDURE statement associates the received cursor with the first result set from the sequence of returned result sets and places the cursor in the open state. The cursor position is the same as it was when the SQL-invoked procedure terminated and the associated returned result set is removed from the list of returned result sets.

The caller of the procedure can access the next in the sequence of returned result sets by either allocating another cursor for the procedure or by closing the previously allocated received cursor. If the close is successful and the list of remaining returned result sets is not empty, the received cursor is automatically placed in the open state and associated with the result set that is now first in the list. The newly associated result set is also removed from the list. This process can be repeated until the list of returned result sets is empty.

A new invocation of the SQL-invoked procedure automatically destroys all the returned result sets from the previous invocation.

The received cursors, allocated by the caller and associated with returned result sets, are necessarily dynamic. Unless the program knows the returned columns and their data type, a DESCRIBE CURSOR statement is needed to retrieve the description of the returned result set in an SQL descriptor area (SQLDA).

Only the immediate caller of an SQL-invoked procedure can process returned result sets. There is no mechanism for the caller to return returned result sets to its caller.

Calling an SQL Procedure

An SQL procedure is an SQL-invoked procedure with language SQL. Any transaction started by this procedure is shared with the transaction of the caller. After returning from an SQL procedure, any session opened by the procedure is automatically released except for sessions that have result sets. Such sessions are released when their last result set has been processed and the associated received cursor has been closed.

Note: When calling an SQL procedure or table procedure, if error message DB001078 with condition 38999 is returned, it might indicate that a record associated with the dialog was too large to fit into the buffer. If this occurs, see messages DC171027 and DC466014 in the IDMS log for more information on the dialog and process causing this problem and how to resolve it.

Calling an SQL-invoked Procedure Returning Result Sets

After a CALL of an SQL-invoked procedure that has been defined with a positive value for the Dynamic Result Sets attribute the number of actual returned results sets is available in the field SQLCNRRS of the SQLCA. The number of returned result sets can also be determined by issuing a GET DIAGNOSTICS statement to retrieve the IDMS_RETURNED_RESULT_SETS information item.

The successful execution of a CALL statement may result in one of two warning conditions:

0100C SQL invoked procedure returned result sets

Indicates that the number of result sets returned by the procedure is less than or equal to the value of the procedure's DYNAMIC RESULT SETS attribute.

0100E Attempt to return too many result sets

Indicates that the procedure attempted to return more result sets than permitted by its DYNAMIC RESULT SETS attribute. The actual number of result sets is reduced to the value of the DYNAMIC RESULT SETS attribute.

A call of a procedure destroys any result sets left over from a previous invocation of the same procedure.

Example

The following example illustrates the basic coding techniques to use dynamic result sets in an application. The SQL procedure, SQLROUT.PROCESSRESULTSET, calls the SQL procedure SQLROUT.CREATERESULTSET and dynamically processes the returned results sets. Included in the example are the definition of a table SQLROUT.RSTAB, the load of this table, the definitions of the SQL procedures SQLROUT.CREATERESULTSET and SQLROUT.PROCESSRESULTSET, and finally the CALL of SQLROUT.PROCESSRESULTSET.

```
create table SQLROUT.RSTAB
  ( ID            integer,
    MES              character(10)
  ) in PROJSEG.PROJAREA ++
insert into SQLROUT.RSTAB values (1, 'txt1')++
insert into SQLROUT.RSTAB values (2, 'txt2')++
insert into SQLROUT.RSTAB values (3, 'txt3')++
insert into SQLROUT.RSTAB values (4, 'txt4')++
insert into SQLROUT.RSTAB values (5, 'txt5')++
insert into SQLROUT.RSTAB values (6, 'txt6')++
commit++

create procedure SQLROUT.CREATERESULTSET
    (TITLE             char(10)  with default,
     P_ID              integer   with default,
     RESULT            char(30)  with default
  )
  external name CRRESSET language SQL
  dynamic result sets 4
begin not atomic
 declare DYNST         char(100);
 declare L_ID          integer default 2;
 declare TEST_CUR2 cursor with return for
  select ID, MES from SQLROUT.RSTAB
  where ID >= P_ID;
 declare TEST_CUR4 cursor with return for
 select ID, MES from SQLROUT.RSTAB
 where ID < P_ID;
set DYNST = 'SELECT ID, MES FROM SQLROUT.RSTAB '
     || 'WHERE ID < CAST(? AS INTEGER)';
 prepare 'DYNSTMT1' FROM DYNST;
 allocate 'TEST_CUR1' cursor with return for 'DYNSTMT1';
 prepare 'DYNSTMT3' FROM DYNST;
 allocate 'TEST_CUR3' cursor with return for 'DYNSTMT3';
 open TEST_CUR4;
 open 'TEST_CUR3' using L_ID;
 set L_ID = L_ID + 1;
 open 'TEST_CUR1' using L_ID;
 open TEST_CUR2;
set RESULT = '4 RESULT SET RETURNED';
end
++
commit++

create procedure SQLROUT.PROCESSRESULTSET
    ( TITLE       character(10) with default,
      P_ID        integer with default,
      CNT_RESULT_SETS      integer,
      RESULT      varchar(1024) with default,
      ERROR1      varchar(72) with default
     )
      external name PRRESSET  language SQL
begin not atomic
 declare L_MES         char(20);
 declare L_ID        integer;
 declare BINBUF        binary(200);
 declare CNT           integer;
 declare L_CNT_RESULT_SETS integer default 0;
 declare continue handler for SQLWARNING
  set RESULT = RESULT|| SQLSTATE|| ' ';
 declare exit handler for SQLEXCEPTION
  begin
   declare C_FUN  CHAR(64);
   declare L_MES varchar(256);
   declare M_TEXT CHAR(256);
     get diagnostics C_FUN = COMMAND_FUNCTION;
   get diagnostics CONDITION 1 M_TEXT = MESSAGE_TEXT;
   set ERROR1 = TRIM(CHAR(CNT))|| ' ROWS FETCHED; '||
          TRIM(C_FUN)|| ' '|| TRIM(M_TEXT);
   get DIAGNOSTICS CONDITION 2 M_TEXT = MESSAGE_TEXT;
   set ERROR1 = ERROR1|| TRIM(M_TEXT);
  end;
 set RESULT = 'ROWS FETCHED: ';
 call SQLROUT.CREATERESULTSET(TITLE,P_ID, L_MES);
 get diagnostics CNT_RESULT_SETS = IDMS_RETURNED_RESULT_SETS;
 allocate 'CUR2' for procedure
   specific procedure SQLROUT.CREATERESULTSET;

 while (L_CNT_RESULT_SETS < CNT_RESULT_SETS)
  do
   set CNT = 0;
   describe cursor 'CUR2' structure using SQL descriptor SQLDA;

   fetch 'CUR2' into L_ID, L_MES;
   while (SQLSTATE = '00000')
    do
     set RESULT = RESULT|| '<'|| trim(L_MES)|| '>';
     set CNT = CNT + 1;
     fetch 'CUR2' into L_ID, L_MES;
    end while;
   close 'CUR2';
   set L_CNT_RESULT_SETS = L_CNT_RESULT_SETS + 1;
   set RESULT = RESULT|| '# '|| trim(char(CNT))|| '//';
  end while;
end
++
commit++
call SQLROUT.PROCESSRESULTSET('T4',4)++

*+  TITLE              P_ID  CNT_RESULT_SETS
*+  -----              ----  ---------------
*+  T4                    4                4
*+
*+  RESULT
*+  ------
*+  ROWS FETCHED: 0100C <txt1><txt2><txt3>0100D # 3//<txt1>0100D
*+                 # 1//<txt1><txt2>0100D # 2//<txt4><txt5><txt6># 3//
*+  ERROR1
*+  ------
set options command delimiter default++
```

More Information

- For more information about defining procedures, see CREATE PROCEDURE and Defining and Using Procedures.
- For more information about defining table procedures, see CREATE TABLE PROCEDURE and Defining and Using Table Procedures.
- For more information about writing procedures, see Writing an External Procedure in COBOL, PL/I or Assembler.
- For more information about writing table procedures, see Writing a Table Procedure.
- For more information about calling an SQL-invoked procedure returning result sets, see ALLOCATE CURSOR.
- For more information about GET DIAGNOSTICS, see GET DIAGNOSTICS.
- For more information about ALLOCATE CURSOR, see ALLOCATE CURSOR.
- For more information about DESCRIBE CURSOR, see DESCRIBE CURSOR.

CLOSE

The CLOSE statement places a specified cursor in the closed state or disassociates a received cursor from the current returned result set and associates it with the next result set returned by the procedure. Use this statement only in SQL that is embedded in a program.

Authorization

None required.

Syntax

```
►►── CLOSE cursor-name ───────────────────────────────────────────────►◄
```

Parameter

cursor-name

Specifies the cursor to be closed. **Cursor-name** must identify a cursor previously defined by a DECLARE CURSOR statement within the application program or by an ALLOCATE CURSOR statement executed within the same SQL transaction.

Usage

Automatic Closing of Cursors

The COMMIT statement without the CONTINUE clause and the ROLLBACK statement automatically close all open cursors used by the application program.

Closing Declared Global Cursors

Cursors declared with the GLOBAL option may be closed only within the same application program in which the global cursor declaration was made. This restriction does not apply to global cursors defined using an ALLOCATE CURSOR statement.

Closing a Received Cursor

A received cursor is a dynamically allocated cursor used to process one or more result sets returned by an SQL-invoked procedure. Returned result sets are maintained in an ordered list. An ALLOCATE CURSOR statement associates the cursor with the first result set in the list and removes it from the list.

If the list of returned result sets is not empty when a received cursor is closed, the CLOSE statement causes the following actions to be taken:

- Disassociates the cursor from its current result set
- Associates the cursor with the first result set in the list of returned result sets
- Removes the result set from the list
- Positions the cursor at the same point at which the corresponding returnable cursor was left by the procedure
- Returns a warning "Additional result sets returned" (SQLSTATE "0100D)

Closing the cursor associated with the last result set of a session started by the called procedure, releases that session.

Examples

Closing a Cursor

The following CLOSE statement places the cursor named ALL_EMP_CURSOR in the closed state:

```
EXEC SQL
   CLOSE ALL_EMP_CURSOR
END-EXEC
```

Closing a Global Dynamic Cursor

The following statement closes the global cursor whose name is passed in :CNAME:

```
EXEC SQL
  CLOSE GLOBAL :CNAME
END-EXEC
```

More Information

- For more information about defining and manipulating cursors, see DECLARE CURSOR, FETCH, and OPEN.
- For more information about using cursors in an application program, see the *CA IDMS SQL Programming Guide*.
- For more information about closing a received cursor, see ALLOCATE CURSOR.

COMMIT

The COMMIT transaction management statement requests that changes to the database made by the SQL session be made permanent. Optionally, the SQL session continues or terminates.

Authorization

None required.

Syntax

```
►►─── COMMIT work ─┬────────────┬──────────────────────────────────────►◄
                   ├─ CONTINUE ─┤
                   └─ RELEASE ──┘
```

Parameters

CONTINUE

Directs CA IDMS to maintain the state of the SQL session after committing changes to the database. This has the effect of maintaining the position of open cursors, retaining temporary tables and associating a new transaction with the session after terminating the current one.

If you do not specify CONTINUE, CA IDMS terminates the current transaction and does not start a new one. It also closes all open cursors and drops all temporary tables. The CONTINUE parameter is a CA IDMS extension of the SQL standard.

RELEASE

Directs CA IDMS to end the current SQL session as well as the current transaction after committing the changes to the database. The RELEASE parameter is a CA IDMS extension of the SQL standard.

Usage

Effect of a COMMIT on the SQL Session's Transaction

If the SQL session's database transaction is not shared, a COMMIT statement has the following impact on its transaction:

- Commits all changes made by the SQL session
- Releases all exclusive locks
- Terminates the transaction
- Associates a new transaction with the SQL session if CONTINUE is specified

Effect of a COMMIT on an SQL Session

A COMMIT statement without the CONTINUE option has the following impact on the SQL session:

- Releases all locks used to protect cursor currencies
- Closes all open cursors
- Drops all temporary tables
- Deletes all dynamically compiled statements
- Replaces the access module in the dictionary if the module was recreated during transaction execution
- Terminates the SQL session if CA IDMS connected it automatically or if RELEASE is specified

If CONTINUE is specified, the COMMIT statement impacts the SQL session's transaction but has no impact on the session itself. Its state remains as it was before the COMMIT statement was issued.

Effect of Transaction Sharing

A COMMIT statement requests that changes made by an SQL session be committed. However, if more than one database session is sharing the session's transaction, those changes might not be committed immediately. All sharing sessions that have had activity since the last commit, rollback or session start must signal their willingness to commit by issuing a COMMIT statement before changes are actually made permanent. The last one to do so causes the transaction to be committed.

A teleprocessing commit statement such as a COMMIT TASK can be used to cause the immediate committing of a shared transaction, since it impacts all of the associated sessions. A COMMIT issued by an encompassing session automatically commits all of its subordinate sessions.

Example

Committing Changes to the Database

The following COMMIT statement commits changes made during the current transaction to the database, but does not end the transaction:

```
EXEC SQL
   COMMIT CONTINUE
END-EXEC
```

More Information

- For more information about ending a transaction without committing changes to the database, see ROLLBACK.
- For more information about ending an SQL session, see RELEASE.
- For more information about managing transactions, see the *CA IDMS SQL Programming Guide*.
- For more information about establishing an SQL session, see CONNECT.

CONNECT

The CONNECT session management statement begins an SQL session by connecting to a CA IDMS dictionary. The dictionary you specify must contain the definitions of the database to be accessed during the session.

Authorization

To issue a CONNECT statement:

- In central version, you must have the authority to sign on to the DC/UCF system with which the dictionary is associated.
- In local mode, no privileges are required.

Syntax

```
►►─── CONNECT TO ─┬─ dictionary-name ─────────────┬──────────────────────────────►◄
                  ├─ :dictionary-variable-name ───┤
                  └─ dictionary-sqlvariable-name ─┘
```

Parameters

dictionary-name

Specifies the name of the dictionary to which the session is connected.

:*dictionary-variable-name*

Identifies a host variable containing the name of the dictionary to which the session is connected. *Dictionary-variable-name* must be a host variable previously declared in the application program.

dictionary-sqlvariable-name

Identifies a routine parameter or local variable containing the name of the dictionary to which the session will be connected. *Dictionary-sqlvariable-name* must be previously declared in the SQL routine.

You can specify :*dictionary-variable-name* or *dictionary-sqlvariable-name* only when you embed the CONNECT statement in an application program or SQL routine.

Usage

Ending an SQL Session

If you use the CONNECT statement to begin an SQL session, you must end the session with one of the following statements:

- RELEASE
- COMMIT RELEASE
- ROLLBACK RELEASE

Automatic Connection

The CONNECT statement is not required to establish a connection. CA IDMS automatically attempts to establish a connection upon executing the first SQL statement. When establishing an automatic connection, CA IDMS establishes a connection to a default dictionary.

Specifying a Dictionary Name

The name specified on a CONNECT statement should be associated with a DDLDML area, a DDLCAT area; or a DDLDML and a DDLCAT area. The name can represent:

- A DBNAME that contains the appropriate segments
- An individual segment

If you specify a DBNAME, it can include segments in addition to those for the dictionary itself.

Examples

Specifying the Dictionary Name

The following CONNECT statement establishes a connection to the dictionary named EMPDICT.

```
connect to empdict;
```

Using a Host Variable

The following CONNECT statement establishes a connection to the dictionary name contained in the host variable :DICT-NAME:

```
EXEC SQL
   CONNECT TO :DICT-NAME
END-EXEC
```

More Information

- For more information about releasing a connection and ending an SQL session, see RELEASE.
- For more information about user profiles, see the *CA IDMS Security Administration Guide*.
- For more information about system profiles and DCUF SET DICTNAME, see the *CA IDMS System Tasks and Operator Commands Guide*.
- For more information about host variables, see Host Variables.
- For more information about managing SQL sessions, see the *CA IDMS SQL Programming Guide*.
- For more information about how the default dictionary is determined, see the *CA IDMS SQL Programming Guide*.
- For more information about the components of a dictionary, see the *CA IDMS Database Administration Guide*.

CREATE ACCESS MODULE

The CREATE ACCESS MODULE statement creates an access module from one or more RCMs. CA IDMS stores the access module definition and the access module itself in the dictionary. It is also a CA IDMS extension of the SQL standard.

Authorization

To issue a CREATE ACCESS MODULE statement, you must own the schema with which the access module is being associated or hold the CREATE privilege on the named access module.

In addition to enforcing this authorization requirement, CA IDMS also validates the access module owner's authority to execute every DML statement in the RCMs included in the access module if the dictionary to which the SQL session is connected is controlled by CA IDMS internal security.

If the access module owner does not hold the authority to execute a DML statement in the access module, when the access module is created, a warning is issued. If the owner still lacks a necessary authority when the access module is executed, an error is returned.

Syntax

```
►►─── CREATE ACCESS MODULE ─┬───────────────┬─ access-module-name ──────────►
                            └ schema-name. ─┘

 ►─┬────────────────────────────┬──────────────────────────────────────────►
   └─ VERSION am-version-number ─┘

 ►── FROM ─▼┬──────────────────┬ rcm-name ┬──────────────────────────────┬┬─►
           │└ dictionary-name. ┘          └ VERSION rcm-version-number ─┘│
           └───────────────────────────── , ─────────────────────────────┘

 ►─┬──────────────────────────────────────────────────────┬────────────────►
   └─ MAP ─▼┬─ schema-name-1 ─┬─ TO ── schema-name-2 ─┬───┘
           │└─ NULL ──────────┘                      │
           └──────────────────── , ──────────────────┘

 ►─┬─────────────────────────────┬─────────────────────────────────────────►
   └─ AUTO RECREATE ─┬─ ON ◄──┬──┘
                     └─ OFF ──┘

 ►─┬──────────────────────────────────┬────────────────────────────────────►
   └─ VALIDATE ─┬─ BY STATEMENT ─┬────┘
                ├─ BY MODULE ────┤
                └─ ALL ──────────┘

 ►─┬───────────────┬───────────────────────────────────────────────────────►
   ├─ READ ONLY ───┤
   └─ READ WRITE ◄─┘

 ►─┬──────────────────────────────────────────────────┬────────────────────►
   └─ DEFAULT ISOLATION ─┬─ CURSOR STABILITY ─┬───────┘
                         └─ TRANSIENT READ ───┘

 ►─┬──────────────────────────────────────────────────────────┬───────────►◄
   └─ READY ─┬▼─ segment-name.area-name ready-options ─┬┬─────┘
             │└──────────────────── , ─────────────────┘│
             └─ ALL ready-options ──────────────────────┘
```

Expansion of ready-options

```
►►─┬─────────────────────────┬────────────────────────────────────────────►
   ├─ SHARED RETRIEVAL ──────┤
   ├─ SHARED UPDATE ─────────┤
   ├─ PROTECTED RETRIEVAL ───┤
   ├─ PROTECTED UPDATE ──────┤
   └─ EXCLUSIVE ─────────────┘

 ►─┬─────────────────┬────────────────────────────────────────────────────►◄
   ├─ INCREMENTAL ───┤
   └─ PRECLAIM ──────┘
```

Parameters

access-module-name

Specifies the name of the access module being created. *Access-module-name* must be a one- through eight-character name that follows the conventions for SQL identifiers.

The combination of *access-module-name* and *am-version-number* must be unique within the dictionary. Multiple access modules with the same *access-module-name* can be associated with a given schema provided they have different version numbers.

schema-name

Specifies the schema to be associated with the access module. *Schema-name* must identify a schema defined in the dictionary.

The owner of the schema with which the access module is associated implicitly becomes owner of the access module.

If you do not specify *schema-name*, CA IDMS uses the current schema in effect for your SQL session.

am-version-number

Specifies the version number of the access module to be created.

If the specified version of the access module already exists, an error is returned.

If you do not specify VERSION, *am-version-number* is set to 1.

FROM *rcm-name*

Specifies one or more RCMs from which CA IDMS is to create the access module. *Rcm-name* must identify an RCM stored in the dictionary and must be unique within the list of RCM names.

dictionary-name

Identifies the dictionary in which the named RCM resides.

If you do not specify *dictionary-name*, it is set to the name of the dictionary to which the SQL session is connected.

rcm-version-number

Specifies the version of the RCM to be included in the access module.

If you do not specify *rcm-version-number*:

1. CA IDMS looks for an RCM with a version number that matches *am-version-number*
2. If no such RCM is found, CA IDMS looks for version 1
3. If CA IDMS does not find a match, it issues a warning

MAP

Specifies one or more mappings for schema names that qualify table and view identifiers in data manipulation statements.

If you do not specify MAP, table and view identifiers are not replaced. If a table or view has no qualifier, CA IDMS uses the schema name of the access module as the qualifier.

schema-name-1

Directs CA IDMS to replace occurrences of the specified schema name with the schema name specified in the TO parameter.

NULL

Directs CA IDMS to use the schema name specified in the TO parameter as the qualifier for unqualified table and view identifiers.

TO *schema-name-2*

Directs CA IDMS to use the specified schema name as the replacement for *schema-name-1* or as the qualifier for unqualified table and view identifiers.

AUTO RECREATE

Specifies whether CA IDMS is to re-create the access module after detecting any of the following:

- An attempt to execute an uncompiled statement
- A change to the definition of a table referenced in the access module
- The execution of a program that has been recompiled since its RCM was included in the access module

CA IDMS identifies the above conditions by comparing definition timestamps in the access module to corresponding timestamps in the database and the host program.

If you do not specify AUTO RECREATE, the default is ON.

ON

Directs CA IDMS to re-create the access module at runtime when timestamps do not match. CA IDMS continues the current transaction with the re-created access module but does not replace the access module in the dictionary until the transaction terminates with a COMMIT statement.

OFF

Directs CA IDMS not to re-create the access module at runtime. If CA IDMS detects a mismatch in timestamps, it returns an error and terminates the current transaction.

VALIDATE

Indicates when CA IDMS is to check the definition timestamps of tables in the access module to ensure that the definition has not changed since the access module was created or last altered.

If you do not specify VALIDATE, the default is VALIDATE ALL.

BY STATEMENT

Directs CA IDMS to check the definition timestamp for a table immediately before executing the first statement in the access module that references the table.

BY MODULE

Directs CA IDMS to check the definition timestamp for each table referenced by a statement in an RCM immediately before executing the first statement in the RCM.

ALL

Directs CA IDMS to check the definition timestamp for each table in the access module immediately before executing the first statement in the access module.

READ ONLY

Specifies transactions started by the access module that do not execute a SET TRANSACTION statement can retrieve data but cannot update the database.

READ WRITE

Specifies transactions started by the access module that do not execute a SET TRANSACTION statement can retrieve data and update the database.

DEFAULT ISOLATION

Specifies the isolation level of transactions started by the access module that do not execute a SET TRANSACTION statement.

At runtime, the isolation level of a transaction determines the length of time retrieval locks are held for the purpose of insulating the transaction from the effects of other concurrent transactions. (Update locks are always held until the transaction is committed or rolled back.)

If you do not specify DEFAULT ISOLATION, the default is CURSOR STABILITY.

CURSOR STABILITY

Specifies the default isolation level for a transaction is cursor stability.

An isolation level of cursor stability guarantees **read integrity**. Read integrity ensures that:

- All data read by the transaction is in a committed state
- The current row of an updateable cursor is protected from update by other transactions while it remains current

TRANSIENT READ

Specifies the default isolation level for a transaction is transient read.

An isolation level of transient read provides no guarantees of read integrity. A transaction executing under transient read cannot perform updates to the database. CA IDMS does not maintain any locks for a transaction with an isolation level of transient read.

The combination of TRANSIENT READ and a transaction state of READ WRITE is invalid. Thus, if you specify TRANSIENT READ, CA IDMS assumes a transaction state of READ ONLY.

READY

Specifies a ready mode for one or more areas accessed through the access module, and specifies when the ready occurs.

The ready mode associated with an area determines:

- Under the central version, the ready mode in which transactions access the area. The ready mode determines the types of area and row locks CA IDMS places for a transaction.
- In local mode, the type of physical lock CA IDMS places on the area.

If you do not specify READY, the ready options for all areas used by the access module are determined at runtime by:

- The transaction state (READ WRITE or READ ONLY)
- The isolation level
- The availability of the area under the central version

Note: For more information, see "Usage," following these parameter descriptions.

segment-name

Identifies the segment associated with the area to which the following ready options apply.

If the access module is used to access a non-SQL-defined database, *segment-name* is optional. In this case, if you do not specify *segment-name*, CA IDMS accesses the first segment for which it finds a match on *area-name*.

area-name

Specifies the name of the area to which the following ready options apply. *Area-name* must identify an area used by the access module.

ALL

Specifies the following ready options apply to all areas in the access module.

Parameters for Expansion of ready-options

The ready-options are used for a specified area or for all areas in the access module. Expanded syntax for **ready-options** is shown immediately following the CREATE ACCESS MODULE syntax.

SHARED RETRIEVAL

Specifies a transaction can retrieve, but not update, data in the area. Other concurrent transactions can retrieve and update data in the area.

SHARED UPDATE

Specifies that:

- Under the central version, transactions access the indicated areas in shared update mode.

  With access to an area in shared update mode, a transaction can retrieve and update data in the area. Other concurrent central version transactions can also both retrieve and update data in the area.

- In local mode, CA IDMS first places a physical lock on the indicated areas.

  With a physical lock on an area, a local mode transaction can retrieve and update data in the area. Concurrent transactions executing in other address spaces can retrieve but not update data in the area.

PROTECTED RETRIEVAL

Specifies that:

- Under the central version, transactions access the indicated areas in protected retrieval mode.

  With access to an area in protected retrieval mode, a transaction can retrieve, but not update, data in the area. Other concurrent central version transactions can also retrieve, but not update, data in the area.

- In local mode, a ready mode of PROTECTED RETRIEVAL is equivalent to a ready mode of SHARED RETRIEVAL.

PROTECTED UPDATE

Specifies that:

- Under the central version, transactions access the indicated areas in protected update mode.

  With access to an area in protected update mode, a transaction can retrieve and update data in the area. Other concurrent central version transactions can retrieve, but not update, data in the area.

- In local mode, a ready mode of PROTECTED UPDATE is equivalent to a ready mode of SHARED UPDATE.

EXCLUSIVE

Specifies that:

- Under the central version, transactions access the indicated areas in exclusive mode.

  With access to an area in exclusive mode, a transaction can retrieve and update data in the area. All other concurrent central version transactions can neither retrieve nor update data in the area except transactions with an isolation level of transient read, which can retrieve data in the area.

- In local mode, a ready mode of EXCLUSIVE is equivalent to a ready mode of SHARED UPDATE.

INCREMENTAL

Directs CA IDMS to defer the ready of each indicated area until execution of the first statement in the access module that requires access to the area.

PRECLAIM

Directs CA IDMS to ready each indicated area when executing the first statement in the access module that requires database or dictionary access.

Usage

Automatic Access Module Recreation

An automatic recreation of the access module occurs when CA IDMS detects a change in the definition of a table referenced in the access module.

The scope of what is recreated is limited by how you specify the VALIDATE option, as described in the following table:

If validation is by	CA IDMS recompiles
STATEMENT	Only the statement just checked; other statements which reference the same table or another table with a changed definition are recompiled as they are encountered
MODULE	All statements in the current RCM that reference tables with changed definitions when the first such statement is encountered
ALL	All statements in the access module that reference tables with changed definitions when the first such statement is encountered

Repeatability of Retrieval Operations

An isolation level of cursor stability assures that data currently being accessed by a transaction is protected from update by other transactions. Cursor stability does not protect data that was accessed previously by the transaction.

Therefore, a cursor might return six rows the first time it is opened and five rows the second time, even though both operations are performed within the same transaction and that transaction has not made intervening updates. The discrepancy would be caused by updates by other transactions executing concurrently.

To completely isolate a transaction from the effects of other transactions, specify a protected ready mode for the areas that the transaction accesses. A ready mode of protected retrieval for retrieval applications and protected update for update applications ensures the repeatability of retrieval operations.

Runtime Ready Modes

The ready mode in which an area is accessed at runtime depends on the requested ready mode, the transaction state, the isolation level, and the area's availability:

- If the transaction state and isolation level are READ ONLY and TRANSIENT READ, all areas are accessed using transient retrieval mode, in which no row locks are placed.
- If the transaction state and isolation level are READ ONLY and CURSOR STABILITY, all areas are accessed using retrieval modes only.

  If update modes were specified on the CREATE or ALTER ACCESS MODULE statement, they are changed to shared retrieval, and if no ready option was specified, the default is shared retrieval.
- If the transaction state and isolation level are READ WRITE and CURSOR STABILITY, all areas are accessed using the mode specified on the CREATE ACCESS MODULE.

  If no mode was specified, the default is:
  - Shared update under the central version if the area status is update
  - Shared update in local and no other copy of IDMS has update control of the area
  - Shared retrieval under the central version if the area status is retrieval
  - Shared update in local if another copy of IDMS has update control of the area

Under central version, if an area is being readied in a retrieval mode and the status of the area is transient retrieval, the ready mode is changed to transient retrieval.

Ready Modes and Area Status Under the Central Version

The ready mode in which a central version transaction obtains access to an area must be compatible with the status of the area within the DC/UCF system. If the area's status is:

- Update, transactions executing under the system can obtain access to the area in any ready mode
- Retrieval or transient retrieval, transactions executing under the system can obtain access to the area in a retrieval ready mode only
- Offline to the system, transactions executing under the system cannot obtain access to the area

Shared, Protected, and Exclusive Ready Modes

In the shared ready modes (shared retrieval and shared update), CA IDMS provides protection from the effects of other transactions at the row level. In the protected ready modes (protected retrieval and protected update), CA IDMS provides protection at the area level. The shared ready modes, therefore, allow for greater transaction concurrency than the protected ready modes. The protected ready modes, on the other hand, create less overhead than the shared ready modes and reduce the chances for deadlocking.

In exclusive ready mode, as in the protected ready modes, CA IDMS provides protection at the area level. However, exclusive ready mode prohibits other transactions from retrieving data from the area.

Ready Modes and Later Modifications

The ready clause only affects areas accessed by statements compiled at the time the CREATE ACCESS MODULE statement is issued. If new areas are added at a later time because the access module is altered or because dynamic SQL accesses additional areas at runtime, those areas are accessed using a ready mode determined by the above rules as if no READY option had been specified (unless the READY option is repeated on the ALTER ACCESS MODULE statement).

Example

Creating an Access Module

The following CREATE ACCESS MODULE statement creates an access module from seven RCMs. The schema name EMP_TEST is replaced with EMP_PROD when it qualifies a table or view name, and unqualified tables and views are assumed to be in the EMP_PROD schema.

By default, CA IDMS performs the following tasks:

- Checks the definition timestamps for all tables in the access module before executing the first statement and automatically re-creates the access module if any timestamps do not match
- Places a shared update lock on each area in the access module at the time of the first request for data in the area

The following example shows creating an access module.

```
create access module hrprod.empam001
   from emp_dict.empdsp01,
      emp_dict.empdsp02,
      emp_dict.empdsp03,
      emp_dict.empadd01,
      emp_dict.empupd01,
      emp_dict.empupd02,
      emp_dict.empdel01
   map emp_test to emp_prod,
      null to emp_prod;
```

More Information

- For more information about ACCESS modules, see ALTER ACCESS MODULE and DROP ACCESS MODULE (see page 418) or see the *CA IDMS Database Administration Guide*.
- For more information about schema-name mappings, see Identifying Entities in Schemas.
- For more information about specifying isolation level, see SET TRANSACTION or see the *CA IDMS SQL Programming Guide*.
- For more information about ready modes, see the *CA IDMS Database Administration Guide*.

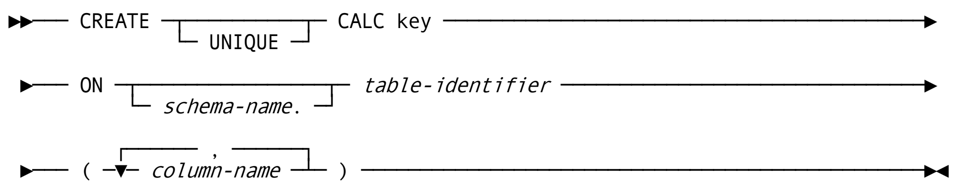
CREATE CALC

The CREATE CALC data description statement defines a CALC key on a base table. The CALC key definition is stored in the dictionary. It is also a CA IDMS extension of the SQL standard. You can define only one CALC key on any given table.

Authorization

To issue a CREATE CALC statement, you must own or have the ALTER privilege on the table on which the CALC key is being defined.

Syntax



Parameters

UNIQUE

Specifies the CALC key value in any given row of the table on which the CALC key is being defined must be different from the CALC key value in any other row of the table. A table with a unique CALC key cannot contain duplicate CALC key values.

table-identifier

Specifies the table on which the CALC key is being defined. *Table-identifier* must identify a base table defined in the dictionary. The named table cannot:

- Contain any data
- Have a clustered index defined on it
- Be the referencing table in a clustered referential constraint

schema-name

Identifies the schema associated with the named table.

If you do not specify *schema-name*, it defaults to:

- The current schema associated with your SQL session, if the statement is entered through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

(*column-name*)

Specifies one or more columns that make up the CALC key. *Column-name* must identify a column in the table on which the CALC key is being created and must be unique within the list of column names.

You can include from 1 through 32 columns in a CALC key.

Usage

SYSTEM tables

You cannot define a CALC key on a table in the SYSTEM schema.

Example

Defining a Unique CALC Key

The following CREATE CALC statement defines a unique CALC key on the COVERAGE table. The CALC key consists of two columns: PLAN_CODE and EMP_ID.

```
create unique calc key
   on coverage
      (plan_code, emp_id);
```

Note: For more information about dropping CALC key definitions, see DROP CALC.

CREATE CONSTRAINT

The CREATE CONSTRAINT data description statement defines a referential constraint in the dictionary. A referential constraint establishes a relationship between two tables.

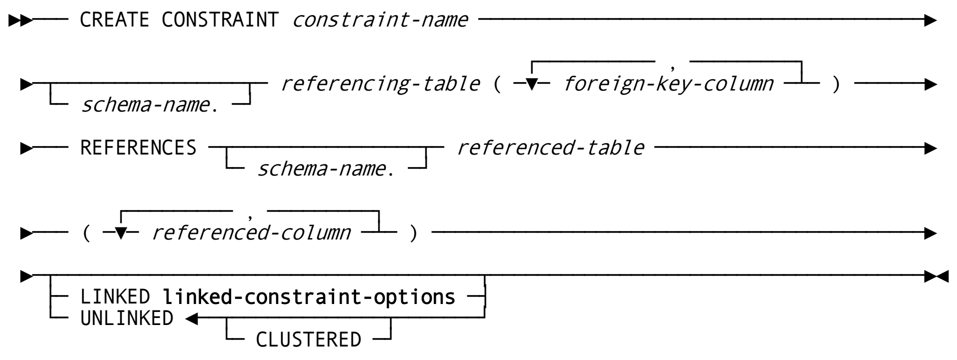
Using the CREATE CONSTRAINT statement, you can also specify how the constraint is implemented physically. It is also a CA IDMS extension of the SQL Standard.

Authorization

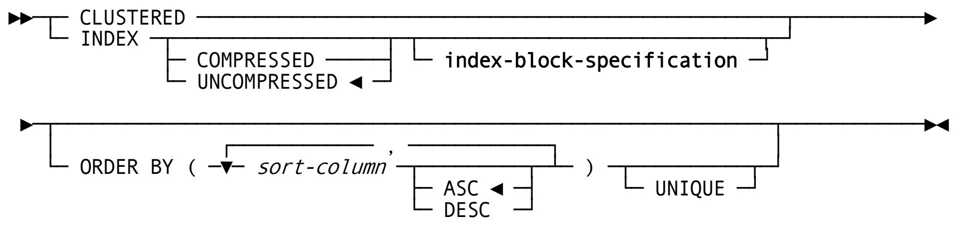
To issue a CREATE CONSTRAINT statement, you must:

- Either hold the ALTER privilege on or own the referencing table in the constraint being defined
- Hold the REFERENCES privilege on the referenced table in the constraint being defined

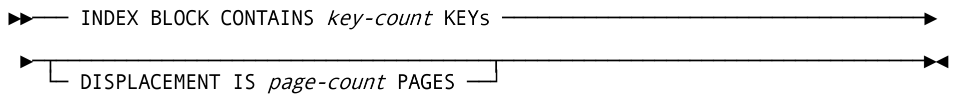
Syntax



Expansion of linked-constraint-options



Expansion of index-block-specification


INDEX BLOCK CONTAINS key-count KEYs
DISPLACEMENT IS page-count PAGES

Parameters

constraint-name

Specifies the name of the referential constraint being created. *Constraint-name* must be a 1- through 18-character name that follows the conventions for SQL identifiers.

Constraint-name must be unique for the schema of the referencing table.

referencing-table

Specifies the referencing table in the constraint. *Referencing-table* must identify a base table defined in the dictionary.

If you specify CLUSTERED in the CREATE CONSTRAINT statement, *referencing-table*:

- Cannot have a CALC key or clustered index defined on it
- Cannot be the referencing table in another clustered constraint

If you specify LINKED in the CREATE CONSTRAINT statement, *referencing-table*:

- Must be empty
- Must not be the same table as *referenced-table*

schema-name

Identifies the schema associated with the referencing table.

If you do not specify *schema-name*, it defaults to:

- The current schema associated with your SQL session, if the statement is entered through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

(*foreign-key-column*)

Specifies one or more columns that make up the foreign key in the referencing table. *Foreign-key-column* must identify a column in the referencing table and must be unique within the list of column names.

If you specify UNLINKED in a CREATE CONSTRAINT statement (or accept UNLINKED as the default), the foreign key must be a CALC key or an index key, as defined by a CREATE CALC or CREATE INDEX statement.

You can include from 1 through 32 columns in a foreign key.

REFERENCES *referenced-table*

Specifies the referenced table in the constraint. *Referenced-table* must identify a base table defined in the dictionary.

If you specify LINKED in a CREATE CONSTRAINT statement, *referenced-table*:

- Must be empty
- Must not be the same table as *referencing-table*

schema-name

Identifies the schema associated with the referenced table.

If you do not specify *schema-name*, it defaults to:

- The current schema associated with your SQL session, if the statement is entered through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

(*referenced-column*)

Specifies one or more non-null columns that make up a unique key in the referenced table, as defined by a CREATE CALC or CREATE INDEX statement.

Referenced-column must identify a column in the referenced table and must be unique within the list of column names. The columns must be named in the CREATE CONSTRAINT statement in the same order in which they are named in the CREATE CALC or CREATE INDEX statement that defines the unique key.

You must specify the same number of referenced columns as the number of columns included in the foreign key of the referencing table. The corresponding referenced and foreign-key columns must have the same data type, length, precision, and scale.

LINKED

Directs CA IDMS to maintain a physical linkage between the rows in the referenced and referencing tables.

linked-constraint-options

Specifies additional characteristics of a linked constraint. Expanded syntax for **linked-constraint-options** is shown immediately following the CREATE CONSTRAINT syntax.

UNLINKED

Directs CA IDMS not to physically link the referenced and referencing tables.

If you specify UNLINKED, the referencing table must have a CALC key or index defined on the foreign key and the order of columns of the CALC or index key must match the order of columns of the foreign key. The index or CALC key on the foreign key does not have to be unique.

A constraint in which a single table is the referencing table and the referenced table must be unlinked.

UNLINKED is the default when you specify neither LINKED nor UNLINKED.

Note: If you are using an index, it can contain additional columns that are not part of the foreign key. The foreign key columns must precede any additional columns in the index key.

CLUSTERED

Specifies each row of the referencing table is to be stored close to other rows of the referencing table that have the same non-null foreign-key value.

Parameters for Expansion of linked-constraint-options

INDEX

Directs CA IDMS to create an index between the referenced and referencing tables.

COMPRESSED

Directs CA IDMS to maintain index entries in a compressed form in the database.

UNCOMPRESSED

Directs CA IDMS to maintain index entries in an uncompressed form in the database.

UNCOMPRESSED is the default when you specify neither COMPRESSED nor UNCOMPRESSED.

index-block-specification

Establishes characteristics of the index created between the referenced and referencing tables.

Syntax for **index-block-specification** follows the syntax for **linked-constraint-options**.

ORDER BY (*sort-column*)

Specifies one or more columns that make up a sort key for a linked constraint. CA IDMS uses the sort key to determine the order in which the rows of the referencing table are to be linked within the referential constraint. Rows are linked in ascending or descending order, first by the first column specified, then by the second column specified within the ordering established by the first column, then by the third column specified, and so on.

Sort-column must identify a column in the referencing table and must be unique within the list of column names.

If you specify the UNIQUE option of the ORDER BY parameter, each column included in the sort key must be defined as NOT NULL.

You can specify a maximum of 32 sort columns.

ASC

Indicates that values in the named column are to be ordered in ascending sequence. ASC is the default when you specify neither ASC nor DESC.

DESC

Indicates that values in the named column are to be ordered in descending sequence.

UNIQUE

Specifies the sort-key value in any given row of the referencing table must be different from the sort-key value in any other row of the table that has the same non-null foreign-key value. A table with a unique sort key cannot contain duplicate rows.

Parameters for Expansion of index-block-specification

***key-count* KEYs**

Establishes the maximum number of entries in each internal index record (SR8 system record).

Key-count must be an unsigned integer in the range 3 through 8130.

If you do not specify KEYS, *key-count* defaults to 10.

***page-count* PAGES**

Indicates how far away from the referenced row the bottom-level index records are to be stored.

Page-count must be an unsigned integer in the range 0 through 32767.

If **index-block-specification** is omitted, the value of *page-count* is 0.

If the value of *page-count* is 0, the bottom-level internal index records cannot be displaced from the referenced row with which they are associated.

Usage

System-owned Tables

You cannot define a referential constraint where the referencing table or the referenced table is in the SYSTEM schema.

Specifying a Linked Constraint

A linked constraint (as opposed to an unlinked constraint) is used by the optimizer in determining the most efficient access for an SQL DML statement. It does not affect either the syntax or the semantics of the statement.

Dropping Tables

When you define a referential constraint, you restrict the conditions under which tables can be dropped.

Mixed Page Group

A constraint defined as linked clustered can not span page groups. The referencing and referenced tables of a constraint defined as linked clustered must be in the same page group.

Examples

Defining a self-referencing Constraint

The following CREATE CONSTRAINT statement defines a referential constraint in which the EMPLOYEE table is the referencing and the referenced table. This constraint directs CA IDMS to ensure that the value in the MANAGER_ID column in each row of the EMPLOYEE table matches the value in the EMP_ID column in another row of the table. By default, the constraint is unlinked. (Self-referencing constraints must be unlinked.)

```
create constraint manager_emp
   employee
      (manager_id)
   references employee
      (emp_id);
```

Defining a Linked Constraint

The following CREATE CONSTRAINT statement defines a referential constraint between the BENEFITS table and the EMPLOYEE table. This constraint directs CA IDMS to ensure that the value in the EMP_ID column in each row of the BENEFITS table matches the value in the EMP_ID column in a row of the EMPLOYEE table. The referential constraint is implemented with a linked index, with the index entries sorted in descending order by the value in the FISCAL_YEAR column.

```
create constraint emp_benefits
   benefits
      (emp_id)
   references employee
      (emp_id)
   linked index
      order by (fiscal_year desc);
```

More Information

- For more information about dropping referential constraints, see DROP CONSTRAINT.
- For more information about defining CALC keys, see CREATE CALC.
- For more information about defining indexes, see CREATE INDEX.
- For more information about implementing referential constraints, see the *CA IDMS Database Design Guide*.
- For more information about dropping tables, see DROP TABLE.

CREATE FUNCTION

The CREATE FUNCTION data description statement stores the definition of a function in the SQL catalog. You can then invoke the function in any value-expression of an SQL statement except in the search condition of a table's check constraint. The function invocation results in CA IDMS calling the corresponding routine. Such routines can perform any action and return a single scalar value. You use the formal parameters of a function definition to specify the data type and format of the data to be passed to the function. Similarly, the data type of the return value is specified in the function definition.

Functions can be defined with a language of SQL, in which case, the routine actions written as SQL statements are specified and stored together with the function definition in the SQL catalog.

Authorization

To issue a CREATE FUNCTION statement, you must own the schema in which the function is being defined or hold the CREATE privilege on the named function.

Syntax

```
►►─ CREATE FUNCTION ──┬─────────────────────────────┬─ function-identifier ──►
                      └─────── schema-name. ────────┘

         ┌──────────── , ────────────┐
►─ (─▼─ parameter-definition ─┴─) ─ RETURNS ─ data-type ─────────────────────►

►─ EXTERNAL NAME external-routine-name ──────────────────────────────────────►

►─┬───────────────────┬─┬────────────────────────────┬──────────────────────►
  └─ language-clause ─┘ └─ PROTOCOL ──┬─ IDMS ─┬─────┘
                                      └─ ADS ──┘

►─┬──────────────────────────┬─┬─────────────────────────┬──────────────────►
  └─ ESTIMATED ROWS row-count ─┘ └─ ESTIMATED IOS io-count ─┘

►─┬──────────────────┬──────────────────────────────────────────────────────►
  ├─ USER MODE ◄─────┤
  └─ SYSTEM MODE ────┘

►─┬───────────────────────────────────────┬──────────────────────────────────►
  └── LOCAL WORK AREA  local-stge-size ───┘

►─┬────────────────────────────────────────────────────────────┬────────────►
  └─ GLOBAL WORK AREA ─ global-stge-size ─┬──────────────────┬──┘
                                          └─ KEY key-id ─────┘
```

```
►─┬──────────────────────────────────────────────────────┬───────────►
  └─ TRANSACTION SHARING ──────────────┬─ ON ──────┬─────┘
                                       ├─ OFF ─────┤
                                       └─ DEFAULT ◄┘

►─┬──────────────────────────────────────────────────────────┬────────►
  └─ DEFAULT DATABASE  ──────────────┬─ NULL ◄───┬───────────┘
                                     └─ CURRENT ─┘

►─┬──────────────────────────────────────────┬────────────────────────►
  └── TIMESTAMP  timestamp-value ────────────┘

►─┬─────────────────────────────────────────────┬─ procedure-statement ─┬─►◄
  └─ ADS COMPILE OPTION ─▼─ compile-option ─┴─ ; ─┘
```

Expansion of parameter-definition

```
►►── parameter-name ── data-type ─┬──────────────────┬──────────────►◄
                                  └─ WITH DEFAULT ───┘
```

Expansion of language-clause

```
►►── LANGUAGE ─────────────────────┬─ ADS ────────┬──────────────────►◄
                                   ├─ ASSEMBLER ──┤
                                   ├─ COBOL ──────┤
                                   ├─ PLI ────────┤
                                   └─ SQL ────────┘
```

Expansion of procedure-statement

```
►──────┬── SQL-AM-mgmt-stmt ────────────┬─────────────────────────►◄
       ├── SQL-authorization-stmt ──────┤
       ├── SQL-Control-stmt ────────────┤
       ├── SQL-Diagnostics-stmt ────────┤
       ├── SQL-DDL-stmt ────────────────┤
       ├── SQL-DML-stmt ────────────────┤
       ├── SQL-session-mgmt-stmt ───────┤
       └── SQL-transaction-mgmt-stmt ───┘
```

Parameters

function-identifier

Specifies the 1- to 18-character name of the function you are creating. *Function-identifier* must:

- Be unique among the function, table, table procedure, procedure and view identifiers within the schema associated with the function
- Follow conventions for SQL identifiers

schema-name

Specifies the schema name qualifier to be associated with the function. *Schema-name* must identify a schema defined in the dictionary. If you do not specify a *schema-name*, it defaults to:

- The current schema associated with your SQL session, if the statement is specified through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

parameter-definition

Defines a parameter to be associated with the function. Parameters pass to the function in the order you specify them. You must enclose the list of parameters in parentheses. You must separate multiple parameter definitions by commas.

Expanded syntax for **parameter-definition** is shown above immediately following the CREATE FUNCTION syntax. Descriptions for these parameters are located at the end of this section.

RETURNS data-type

Specifies the data type of the returned value. The returned value is implicitly nullable and can be set to NULL in the external routine. The returned value is accessible to the external routine as an extra parameter with the implicit name USER_FUNC, which comes immediately after the function parameters.

external-routine-name

Specifies the one- to eight-character name of the program or mapless dialog that CA IDMS calls to process function invocation.

For functions written in SQL, the external-routine-name should specify a name that is unique within the dictionary that holds the function definition. In other words, the name should be different from any other external name of any SQL-invoked routine and from any CA ADS dialog, RCM, or AM name.

row-count

Specifies an integer value, in the range 0 through 2,147,483,647, representing the average number of rows the CA IDMS optimizer uses for cost calculation of the function invocation.

io-count

Specifies an integer value, in the range 0 through 2,147,483,647, representing the average number of disk accesses generated by the function for a given set of input parameters.

language-clause

Specifies the programming language of the function. This clause is required for functions written in SQL. For others, it is documentational only. if the language is not specified, it is treated as null. Expanded syntax for **language-clause** is shown above immediately following the CREATE FUNCTION syntax. Descriptions for these parameters are located at the end of this section.

PROTOCOL

Specifies the protocol with which the function is invoked. This specification is required except with language SQL. If LANGUAGE SQL is specified, PROTOCOL must be ADS or the clause must not be specified.

IDMS

Use IDMS for functions that are written in COBOL, PL/I, or Assembler.

ADS

Use ADS for functions that are written in CA ADS. The name of the dialog that is loaded and executed when the function is invoked is specified by the external-routine-name in the EXTERNAL NAME clause. ADS is the default if LANGUAGE SQL is specified.

USER MODE

Specifies that the function should execute as a user-mode application program within CA IDMS. This cannot be specified with language SQL or protocol ADS. For other languages and protocols, it is the default.

SYSTEM MODE

Specifies that the function should execute as a system-mode application program. SYSTEM MODE is the default if language is SQL.

To execute as a system mode application, the program must be fully reentrant and be written in either:

- ADS as a mapless dialog
- Assembler using DC calling conventions
- COBOL or PL/I and compiled with an LE-compliant compiler.

Note: If protocol is set to ADS, you must specify MODE SYSTEM.

local-stge-size

Specifies an integer value, in the range 0 through 32767, representing the size, in bytes, of a local storage area that CA IDMS allocates at runtime and passes to the function on each invocation.

global-stge-size

Specifies an integer value, in the range 0 through 32767, representing the size, in bytes, of the global storage area that CA IDMS allocates at runtime and passes to the function on each invocation.

CA IDMS allocates a global storage area once within a transaction and retains it until the transaction terminates.

key-id

Specifies the one- to four-character identifier for the global storage area. CA IDMS passes the same piece of global storage within a transaction to all routines that have the same global storage key.

If you do not specify a storage key, CA IDMS allocates each function its own global storage area, which will not be used for any other routine within the transaction.

TRANSACTION SHARING

Specifies whether transaction sharing should be enabled for database sessions started by the function. If transaction sharing is enabled for a function's database session, it shares the current transaction of the SQL session. If language SQL is specified, TRANSACTION SHARING must be ON or the clause must not be specified.

ON

Specifies that transaction sharing should be enabled. ON is the default if language is SQL.

OFF

Specifies that transaction sharing should be disabled.

DEFAULT

Specifies that the transaction sharing setting in effect when the function is invoked should be retained. DEFAULT is the default for languages other than SQL.

compile-option

Specifies a CA ADS option to be used when compiling the dialog associated with an SQL function. The options that can be specified and the syntax to use are given in the *CA ADS Reference Guide*, Appendix D.2.6 Dialog-expression. *Compile-option* can be specified only if language is SQL.

Note: The ability to specify the ADS COMPILE OPTION clause is a CA IDMS extension.

procedure-statement

Specifies the actions taken in the function. **Procedure-statement** is required if language is SQL. It cannot be specified otherwise. Expanded syntax for **procedure-statement** is shown above immediately following the CREATE FUNCTION syntax. Descriptions for these parameters are located at the end of this section.

DEFAULT DATABASE

Specifies whether a default database should be established for database sessions started by the function.

NULL

Specifies that no default database should be established.

CURRENT

Specifies that the database to which the SQL session is connected should become the default for any database session started by the function.

timestamp-value

Specifies the value of the synchronization stamp to be assigned to the function. *Timestamp-value* must be a valid external representation of a timestamp.

Parameters for Expansion of parameter-definition

parameter-name

Specifies a 1- to 32-character name of a parameter that passes to the function. *Parameter-name* must:

- Be unique within the function that you are defining
- Follow the conventions for SQL identifiers

All parameters are implicitly nullable and thus can be assigned NULL as a parameter value.

data-type

Defines the data type for the named parameter. For expanded **data-type** syntax, see Expansion of Data-type.

WITH DEFAULT

Directs CA IDMS to pass a default value for the named parameter if you do not specify a value for the function invocation.

The default value for a parameter is based on its data type:

Column data type	**Default value**
CHARACTER	Blanks
VARCHAR	A character string literal with a length of zero (that is, '')
GRAPHIC	Double-byte blanks
VARGRAPHIC	A double-byte character string literal with a length of zero
DATE	The value in the CURRENT DATE special register
TIME	The value in the CURRENT TIME special register
TIMESTAMP	The value in the CURRENT TIMESTAMP special register
All numeric data types	0 (zero)

Parameters for Expansion of language-clause

ADS

Specifies that the SQL routine is written in the CA ADS language.

ASSEMBLER

Specifies that the SQL routine is written in the assembler language.

COBOL

Specifies that the SQL routine is written in the COBOL language.

PLI

Specifies that the SQL routine is written in the PL/I language.

SQL

Specifies that the SQL routine is written in the SQL language.

Note: The ability to specify ADS or ASSEMBLER as a language is a CA IDMS extension.

Parameters for Expansion of procedure-statement

SQL-AM-mgmt-stmt

Specifies a statement from the Access Module Management Statements category.

SQL-authorization-stmt

Specifies a statement from the Authorization Statements category.

SQL-Control-stmt

Specifies a statement from the Control Statements category.

SQL-Diagnostics-stmt

Specifies a statement from the Diagnostics Statements category.

SQL-DDL-stmt

Specifies a statement from the Data Description Statements category.

SQL-DML-stmt

Specifies a statement from the Data Manipulation Statements category.

SQL-session-mgmt-stmt

Specifies a statement from the Session Management Statements category.

Note: The ability to include a RELEASE, SUSPEND, or RESUME statement in an SQL routine is a CA IDMS extension.

SQL-transaction-mgmt-stmt

Specifies a statement from the Transaction Management Statements category.

Note: The ability to include a COMMIT or ROLLBACK statement in an SQL routine is a CA IDMS extension.

Usage

Coding functions with language SQL

The rules for coding the procedure body of an SQL function are given by **procedure-statement**. A procedure body typically contains multiple SQL statements and according to the SQL grammar, SQL statements are terminated by the semi-colon. However, to define SQL routines, the Command Facility (OCF, IDMSBCF, or Visual DBA OCF console) needs to be used. It also has the semi-colon as the default command terminator. Before a new command can be specified, the CREATE FUNCTION needs to be terminated by a semi-colon. Clearly, the semi-colon cannot concurrently be used as a terminator by both the SQL procedure language and the Command Facility. Therefore, when **procedure-statement** contains multiple SQL statements or when the ADS COMPILE OPTION is specified, the Command Facility needs to use a terminator different from the semi-colon. To accomplish this, a SET OPTIONS COMMAND DELIMITER 'delimiter-string' must be executed. Changing the terminator of the Command Facility remains in effect until the end of the session or until a new SET OPTIONS COMMAND DELIMITER is encountered. For more information about SET OPTIONS, see the Command Facility chapter in the *CA IDMS Common Facilities Guide*.

Language SQL

If LANGUAGE SQL is specified, the following attribute settings are established by default and must not be overridden to a different value:

- Protocol is ADS
- Mode is SYSTEM
- Transaction sharing is ON

Functions whose language is SQL are implemented through an automatically generated CA ADS dialog whose name is *external-routine-name*.

An error while parsing **procedure-statement** or an error while compiling the associated CA ADS dialog causes termination of the CREATE FUNCTION statement with a warning instead of a statement error. This allows the erroneous **procedure-statement** syntax to be saved in the catalog for later correction using the DISPLAY FUNCTION command. The CA ADS dialog and associated access module are not created.

Specifying CA ADS Compile Options

If LANGUAGE SQL is specified, you can specify one or more compile options to be used when the associated dialog is compiled. Specifying compile options can be useful for debugging purposes to enable tracing and the use of online debugging facilities. Compile options can also be used to include additional work records and SQL tables which can be referenced in native CA ADS code included in the routine body.

Some useful compile options include:

- SYMBOL TABLE IS YES - to allow the use of symbols by the TRACE command and the online debug facilities
- ADD RECORD record-name - to enable manipulation of elements from the specified record
- ADD SQL TABLE table-name - to enable manipulation of columns or parameters of the specified SQL table-like object.

Specifying a Synchronization Stamp

When defining or altering a function, you can specify a value for its synchronization stamp. You should use care when doing so because the purpose of the stamp is to enable the detection of discrepancies between an entity and its definition. If explicitly specified, you must set the synchronization stamp to a new value following a change so that the change is detectable by the runtime system.

If not specified, the synchronization stamp is automatically set to the current date and time.

Grouping Procedure Statements into a Single Statement

Multiple procedure statements can be grouped together as a compound statement. A compound statement is a control statement and therefore it is also a procedure statement.

Examples

Example for CREATE FUNCTION

```
CREATE FUNCTION FIN.UDF_FUNBONUS
       ( F_EMP_ID        DECIMAL(4)     )
         RETURNS DECIMAL(10)
         EXTERNAL NAME FUNBONUS PROTOCOL IDMS
         DEFAULT DATABASE CURRENT
         USER MODE
         LOCAL WORK AREA 0
         ;
```

Example for Language SQL

```
set options command delimiter '++';
drop function USER01.TCNTEQNAME++
commit++
create function USER01.TCNTEQNAME
  ( TITLE     varchar(40) with default
  , P_FNAME   char(20)
  , P_COUNT     integer
  , RESULT    varchar(10)
  ) RETURNS   varchar(20)
    EXTERNAL NAME TCNTEQN LANGUAGE SQL


Label_700:
begin not atomic
 /*
 ** Count number of employees with equal Firstname
 */
  declare FNAME       char(20);
  declare LNAME       varchar(20);
  declare P_COUNT_SAV integer default 0;

  declare EMP1 CURSOR FOR
        Select EMP_FNAME, EMP_LNAME
          From DEMOEMPL.EMPLOYEE
         where EMP_FNAME = P_FNAME;
   open EMP1;
  fetch EMP1 into FNAME, LNAME;
  fetching_loop:
  loop
      if (SQLSTATE < > '00000')
        then leave fetching_loop;
      end if;
      set P_COUNT = P_COUNT + 1;
      fetch EMP1 into FNAME, LNAME;
  end loop fetching_loop;
  set RESULT = SQLSTATE;

  close EMP1;
  if (P_COUNT < = P_COUNT_SAV)
    then return null;
    else return 'Res: ' || cast(P_COUNT as char(5));
  end if;
end
++
```

More Information

- For more information about coding the external routine, see Defining and Using Procedures.
- For more information about Control Statements, see Control Statements.
- For more information about Diagnostics Statements see GET DIAGNOSTICS.
- For more information about the other categories see Statement Categories.
- For more information about the SET OPTIONS COMMAND DELIMITER, see the "Using SET OPTIONS to Select Options" topic in the *CA IDMS Common Facilities Guide*.

CREATE INDEX

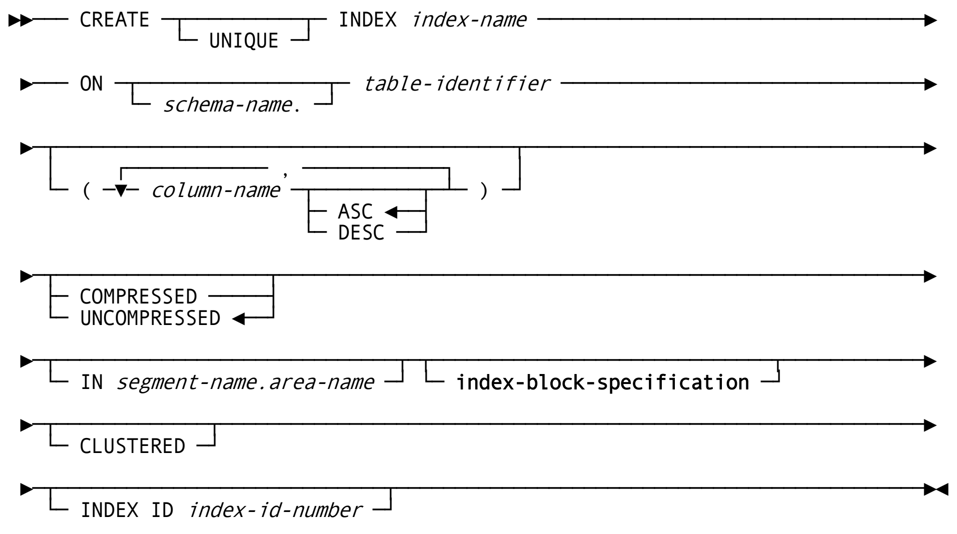
The CREATE INDEX data description statement defines an index on a base table. The index definition is stored in the dictionary. It is also a CA IDMS extension of the SQL standard.

Authorization

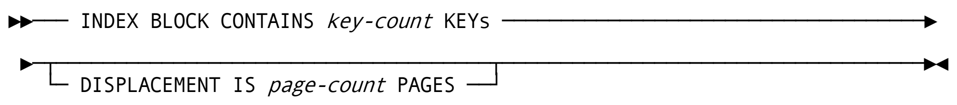
To issue a CREATE INDEX statement, you must:

- Hold the ALTER privilege on or own the table on which the index is being defined
- Hold the USE privilege on the area where the named index is stored

Syntax



Expansion of index-block-specification


INDEX BLOCK CONTAINS key-count KEYs
DISPLACEMENT IS page-count PAGES

Parameters

UNIQUE

Specifies that the index-key value in any given row of the table on which the index is being defined must be different from the index-key value in any other row of the table. A table with a unique index cannot contain duplicate index key values.

If you specify UNIQUE, and the table on which the index is being defined contains duplicate rows, CA IDMS returns an error.

index-name

Specifies the name of the index being created. *Index-name* must be a 1- through 18-character name that follows the conventions for SQL identifiers.

Index-name must be unique for the table on which the index is defined.

ON *table-identifier*

Specifies the table on which the index is being defined. *Table-identifier* must identify a base table defined in the dictionary.

If you specify CLUSTERED in a CREATE INDEX statement, the named table:

- Cannot have a CALC key defined on it
- Cannot have another clustered index defined on it
- Cannot be the referencing table in a clustered referential constraint

schema-name

Identifies the schema associated with the named table.

If you do not specify *schema-name*, it defaults to:

- The current schema associated with your SQL session, if the statement is entered through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

(*column-name*)

Specifies one or more columns that make up the index key. CA IDMS maintains index entries in ascending or descending order according to the values in the specified columns. Entries are ordered first by the first column specified, then by the second column specified within the ordering established by the first column, then by the third column specified, and so on.

Column-name must identify a column in the table on which the index is being created and must be unique within the list of column names.

You can include from 1 through 32 columns in an index key.

If no column name is specified, CA IDMS creates an index on the db-key sorted in ascending order.

ASC

Indicates that values in the named column are to be sorted in ascending order. ASC is the default when you specify neither ASC nor DESC.

DESC

Indicates that values in the named column are to be sorted in descending order.

COMPRESSED

Directs CA IDMS to maintain index entries in a compressed form in the database.

UNCOMPRESSED

Directs CA IDMS to maintain index entries in an uncompressed form in the database.

UNCOMPRESSED is the default when you specify neither COMPRESSED nor UNCOMPRESSED.

IN

Specifies the area to be used to store entries in the index.

If you do not associate an area with an index, CA IDMS uses the area associated with the table on which the index is being defined.

segment-name

Identifies the segment associated with the area.

area-name

Identifies the area to be associated with the index. *Area-name* must identify an area defined in the dictionary.

index-block-specification

Establishes characteristics of the index.

Syntax for **index-block-specification** immediately follows the syntax for CREATE INDEX.

If **index-block-specification** is omitted, values for *key-count* and *page-count* are calculated by CA IDMS using available information about actual or estimated row count for the table on which the index is being defined.

CLUSTERED

Specifies that each row of the table on which the index is being defined is to be stored as close as possible to the table row with the immediately preceding index-key value.

INDEX ID *index-id-number*

Assigns an index ID value for the index being created. The index-id-number must be in the range of 1 through 32767.

Parameters for Expansion of index-block-specification

***key-count* KEYs**

Establishes the maximum number of entries in each internal index record (SR8 system record).

Key-count must be an unsigned integer in the range 3 through 8180.

***page-count* PAGES**

Indicates how far away from the top of the index (the SR7 system record) the bottom-level index records are to be stored.

Page-count must be an unsigned integer in the range 0 through 32767.

If the value of *key-count* is 0, the bottom-level internal index records are not displaced from the SR7 record.

Usage

Specifying an Index ID

When defining an index you can specify a value for its numeric index identifier. If explicitly specified, it must be unique across all other indexes residing in the same database area. If not specified, the index's numeric identifier is automatically set to the next available number in the range 1 through 32,767.

SYSTEM Tables

You cannot define an index on a table in the SYSTEM schema.

SYSTEM Areas

You cannot associate an index with a system area supplied with CA IDMS.

Order of Null Values

If the value of an index key column is null, it is treated as higher than all non-null values.

Null Values in Unique Indexes

Nullable columns are allowed to be used in a UNIQUE index. Null values are treated like any other value when the uniqueness of an index is evaluated. For example, a single column index can only contain one null value.

Mixed Page Group

An index must reside in the same page group as the table on which the index is created.

Example

Defining a Unique Index

The following CREATE INDEX statement defines a unique index on the JOB table. The index key consists of two columns: JOB_ID and JOB_TITLE. The index entries are stored in compressed form in the same area as the JOB table.

```
create unique index job_title_index
   on job
      (job_id, job_title)
   compressed;
```

Defining a Clustered Index

The following CREATE INDEX statement defines an index on the MONTHLY_BUDGET table. The index key consists of two columns: FISCAL_YEAR and MONTH. The index entries are stored in compressed form in the SALESSEG.SALES_X_AREA area. Rows of the MONTHLY_BUDGET table that have consecutive index-key values are stored close to each other.

```
create index budget_date_index
   on sales_sch.monthly_budget
      (fiscal_year desc, month)
   compressed
   in salesseg.sales_x_area
   clustered;
```

More Information

- For more information about dropping indexes, see DROP INDEX.
- For more information about implementing indexes, see the *CA IDMS Database Design Guide*.
- For more information about calculations, see Error! Reference source not found..

More information:

DROP INDEX (see page 424)

CREATE KEY

The CREATE KEY statement defines a key on a procedure or table procedure. The key definition is stored in the dictionary. It is also a CA IDMS extension of the SQL standard.

Authorization

To issue a CREATE KEY statement, you must own or hold the ALTER privilege on the procedure or table procedure on which the key is being defined.

Syntax

```
►►── CREATE ─┬────────────┬─ KEY key-name ──────────────────────────────►
             ├─ UNIQUE ──┤
             └─ PRIMARY ─┘

►── ON ─┬─────────────────┬─┬─ procedure-identifier ───────┬─────────────►
        └─ schema-name. ──┘ └─ table-procedure-identifier ─┘

►─ ( ─▼─ parameter-name. ─┴─ ) ─┬─────────────────────────────┬──────────►
      └─────── , ───────┘       └─ ESTIMATED ROWS row-count ──┘

►─┬────────────────────────────┬─────────────────────────────────────────►◄
  └─ ESTIMATED IOS io-count ───┘
```

Parameters

UNIQUE

Specifies the key value is unique to a row that the procedure or table procedure returns. CA IDMS does not enforce this restriction. The procedure or table procedure itself must enforce uniqueness.

PRIMARY

Specifies the key is unique and that it is the most commonly-used key for identifying specific rows returned by the procedure. While you can define several unique keys for a procedure or table procedure, you can specify only one primary key.

key-name

Specifies the name of the key. The *key-name* must be:

- A 1- to 18-character name that follows the conventions for SQL identifiers
- Unique for the procedure or table procedure on which the key is defined

ON *table-procedure-identifier*

Specifies the table procedure for which you are defining the key. The *table-procedure-identifier* must identify a table procedure defined in the dictionary.

procedure-identifier

Specifies the procedure for which you define the key. The procedure-identifier must identify a procedure defined in the dictionary.

schema-name

Identifies the schema associated with the procedure or table procedure.

If you do not specify a *schema-name* it defaults to:

- The current schema associated with your SQL session, if the statement is entered through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

(*parameter-name*)

Specifies one or more procedure or table procedure parameters that form the key. The *parameter-name* must:

- Identify a parameter of the procedure or table procedure on which the key is defined
- Be unique within the list of parameter names

You can include as many as 32 parameters in a key.

row-count

Specifies an integer value, in the range of 0 through 2,147,483,647, which represents the number of rows that the procedure or table procedure returns when input values are provided for all the parameters in the key.

io-count

Specifies an integer value, in the range of 0 through 2,147,483,647, which represents the number of disk accesses that the procedure or table procedure generates while returning *row-count* rows when input values are provided for all the parameters in the key.

Usage

Enforcing Uniqueness

It is the responsibility of the procedure or table procedure to enforce the uniqueness of the procedure or table procedure keys; for example, on an INSERT into a table procedure, CA IDMS makes no attempt to determine whether a duplicate row, with respect to a unique table procedure key, exists. The table procedure, in conjunction with database services it invokes, is responsible for ensuring uniqueness.

Influencing Join Strategies

CA IDMS uses procedure or table procedure key information when determining the best approach to satisfy queries that join procedure or table procedures with other tables, views, procedures or table procedures. Specifically, if the set of column values provided on a particular call to the table procedure matches the columns defined in the table procedure's KEY, the ESTIMATED ROWS and ESTIMATED I/Os for that KEY are used during optimization. If these statistics are provided, and data is passed to the table procedure's key by the WHERE clause during execution, the optimizer uses the statistical information when the table procedure is joined with other tables or views. Providing estimated-row and I/O counts, for the procedure or table procedure and for each access key that the procedure uses, allows CA IDMS to select the optimal access strategy.

Unique Keys for CA IDMS Server

If you define procedure or table procedure keys, CA IDMS Server reports this information when processing an ODBC request to return key information for a procedure. The ability to return key information is particularly important for certain ODBC-based products which require a unique key to update and delete data.

Example

The following CREATE KEY statements define three keys on the EMP.ORG table procedure. The first two keys are simple access keys; the third defines a primary key for CA IDMS Server to use.

```
(1)       CREATE KEY ORG1 ON EMP.ORG (EMP_ID)
             ESTIMATED ROWS 3
             ESTIMATED IOS  3;
(2)       CREATE KEY ORG2 ON EMP.ORG (MGR_ID)
             ESTIMATED ROWS 5
             ESTIMATED IOS  5;
(3)       CREATE PRIMARY KEY ORG3 ON EMP.ORG
             (MGR_ID, EMP_ID, START_DATE)
             ESTIMATED ROWS 1
             ESTIMATED IOS  3;
```

More Information

- For more information about influencing join strategies, see Defining and Using Table Procedures.
- For more information about defining table procedures, see CREATE TABLE PROCEDURE.
- For more information about dropping keys, see DROP KEY.
- For more information about defining procedures, see CREATE PROCEDURE.
- For more information about the WHERE clause, see WHERE Clause References.

CREATE PROCEDURE

The CREATE PROCEDURE data description statement stores the definition of a procedure in the SQL catalog. You can refer to the procedure in an SQL CALL statement or in an SQL SELECT statement just as you would a table procedure. These references result in CA IDMS calls to the corresponding routine. Such routines can perform any action, such as manipulating data stored in some other organization (for example, in a non SQL-defined database or in a set of VSAM files). You can also use them to implement business logic.

Procedures can be defined with a language of SQL. The routine actions, written as SQL statements, are specified and stored together with the procedure definition in the SQL catalog.

The formal parameters of a procedure definition can be used like columns of a table during a procedure invocation to pass values to and from the procedure.

Authorization

To issue a CREATE PROCEDURE statement, you must own the schema in which the procedure is being defined or hold the CREATE privilege on the named procedure.

Syntax

```
►►─ CREATE PROCEDURE ─┬───────────────────────────┬─ procedure-identifier ─►
                      └──── schema-name. ─────────┘

    ┌────────── , ──────────┐
 ►─(▼parameter-definition ─┴) EXTERNAL NAME external-routine-name ──────────►

 ►──┬────────────────────┬──┬──────────────────────────────┬─────────────────►
    └─ language-clause ─┘  └── PROTOCOL ──┬─ IDMS ──┬───┘
                                          └─ ADS ───┘

 ►──┬──────────────────────────────────┬─┬──────────────────────────┬───────►
    └──────── ESTIMATED ROWS row-count ─┘ └─ ESTIMATED IOS io-count ─┘
```

```
►──┬──────────────────┬─────────────────────────────────────────────────────►
   ├─ USER MODE ◄─────┤
   └─ SYSTEM MODE ────┘

►──┬───────────────────────────────────────────┬────────────────────────────►
   └─ LOCAL WORK AREA  local-stge-size ────────┘

►──┬────────────────────────────────────────────────────────────┬───────────►
   └─ GLOBAL WORK AREA ── global-stge-size ──┬──────────────┬───┘
                                              └─ KEY key-id ─┘

►──┬──────────────────────────────────────────────────────────────────┬─────►
   └─ TRANSACTION SHARING ──────────────────┬─ ON ────────────────────┘
                                             ├─ OFF ───────┤
                                             └─ DEFAULT ◄──┘

►──┬──────────────────────────────────────────────────────────────────┬─────►
   └─ DEFAULT DATABASE  ─────────────────┬─ NULL ◄─────────────────────┘
                                          └─CURRENT──┘

►──┬──────────────────────────────────────────────┬─────────────────────────►
   └─ TIMESTAMP  timestamp-value ─────────────────┘

►──┬────────────────────────────────────────────────────────────┬───────────►
   └─ DYNAMIC RESULT SETS maximum-dynamic-result-sets ──────────┘

►──┬───────────────────────────────────────────────────────────────────┬────►◄
   └┬──────────────────────────────────────────────────┬─ procedure-statement ─┘
    └─ ADS COMPILE OPTION ─▼─ compile-option ─┴─  ; ───┘
```

Expansion of parameter-definition

```
►►── parameter-name ── data-type ─┬───────────────────┬──────────────────────►◄
                                  └─ WITH DEFAULT ────┘
```

Expansion of language-clause

```
►►── LANGUAGE ─────────────────────┬─ ADS ─────────────┬────────────────────►◄
                                   ├─ ASSEMBLER ───────┤
                                   ├─ COBOL ───────────┤
                                   ├─ PLI ─────────────┤
                                   └─ SQL ─────────────┘
```

Expansion of procedure-statement

```
►────────┬── SQL-AM-mgmt-stmt ─────────────┬────────────────────────────────►◄
         ├── SQL-authorization-stmt ───────┤
         ├── SQL-Control-stmt ─────────────┤
         ├── SQL-Diagnostics-stmt ─────────┤
         ├── SQL-DDL-stmt ─────────────────┤
         ├── SQL-DML-stmt ─────────────────┤
         ├── SQL-session-mgmt-stmt ────────┤
         └── SQL-transaction-mgmt-stmt ────┘
```

Parameters

procedure-identifier

Specifies the 1- to 18-character name of the procedure you are creating. *Procedure-identifier* must:

- Be unique among the function, procedure, table, table procedure and view identifiers within the schema associated with the procedure
- Follow conventions for SQL identifiers

schema-name

Specifies the schema name qualifier to be associated with the procedure. *Schema-name* must identify a schema defined in the dictionary. If you do not specify a *schema-name*, it defaults to:

- The current schema associated with your SQL session, if the statement is specified through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

parameter-definition

Defines a parameter to be associated with the procedure. Parameters pass to the procedure in the order you specify them. You must enclose the list of parameters in parentheses. You must separate multiple parameter definitions by commas.

Expanded syntax for **parameter-definition** is shown above immediately following the CREATE PROCEDURE syntax. Descriptions for these parameters are located at the end of this section.

external-routine-name

Specifies the one- to eight-character name of the program which is called to process references to the procedure.

For procedures written in SQL, the external-routine-name should specify a name that is unique within the dictionary that holds the procedure definition. In other words, the name should be different from any other external name of any SQL-invoked routine and from any &U$IDCADS. dialog, RCM, or AM name.

language-clause

Specifies the programming language of the procedure. This clause is required for procedures written in SQL. For others, it is documentational only. If the language is not specified, it is treated as null.

PROTOCOL

Specifies the PROTOCOL with which the procedure is invoked. This specification is required except with language SQL. If LANGUAGE SQL is specified, PROTOCOL must be ADS or the clause must not be specified.

IDMS

Use IDMS for procedures that are written in COBOL, PL/I, or Assembler.

ADS

Use ADS for procedures that are written in CA ADS. The name of the dialog that is loaded and executed when the procedure is invoked is specified by the *external-routine-name* in the EXTERNAL NAME clause. ADS is the default if LANGUAGE SQL is specified.

row-count

Specifies an integer value, in the range 0 through 2,147,483,647, representing the average number of rows returned by the procedure for a given set of input parameters.

io-count

Specifies an integer value, in the range 0 through 2,147,483,647, representing the average number of disk accesses generated by the procedure for a given set of input parameters.

USER MODE

Specifies that the procedure should execute as a user-mode application program within CA IDMS. This can not be specified with language SQL or protocol ADS. For other languages and protocols, it is the default.

SYSTEM MODE

Specifies that the procedure should execute as a system mode application program. SYSTEM MODE is the default if language is SQL.

To execute as a system mode application, the program must be fully reentrant and be written in either:

- ADS as a mapless dialog
- Assembler using DC calling conventions
- COBOL or PL/I and compiled with an LE-compliant compiler

local-stge-size

Specifies an integer, in the range 0 through 32767, which represents the size, in bytes, of a local storage area which CA IDMS allocates at runtime and passes to the procedure on each invocation.

Note: If you do not code a LOCAL WORK AREA clause, the default local storage size is 1024 bytes.

global-stge-size

Specifies an integer, in the range 0 through 32767, representing the size, in bytes, of the global storage area that CA IDMS allocates at runtime and passes to the procedure on each invocation.

CA IDMS allocates a global storage area once within a transaction and retains it until the transaction terminates.

key-id

Specifies the one- to four-character identifier for the global storage area. CA IDMS passes the same piece of global storage within a transaction to all SQL routines that have the same global storage key.

If you do not specify the storage key, CA IDMS allocates each procedure its own global storage area, which is not used for any other routine within the transaction.

TRANSACTION SHARING

Specifies whether transaction sharing should be enabled for database sessions started by the procedure. If transaction sharing is enabled for a procedure's database session, it shares the current transaction of the SQL session. If language SQL is specified, TRANSACTION SHARING must be ON or the clause must not be specified.

ON

Specifies that transaction sharing should be enabled. ON is the default if language is SQL.

OFF

Specifies that transaction sharing should be disabled.

DEFAULT

Specifies that the transaction sharing setting in effect when the procedure is invoked should be retained. Default is the default for languages other than SQL.

compile-option

Specifies a CA ADS option to be used when compiling the dialog associated with an SQL procedure. The options that can be specified and the syntax to use are given in the *CA ADS Reference Guide*, Appendix D.2.6 Dialog-expression. *Compile-option* can be specified only if language is SQL.

Note: The ability to specify the ADS COMPILE OPTION clause is a CA IDMS extension.

procedure-statement

Specifies the actions taken in the procedure. **Procedure-statement** is required if language is SQL. It cannot be specified otherwise.

Expanded syntax for **procedure-statement** is shown above immediately following the CREATE PROCEDURE syntax. Descriptions for these parameters are located at the end of this section.

DEFAULT DATABASE

Specifies whether a default database should be established for database sessions started by the procedure.

NULL

Specifies that no default database should be established.

CURRENT

Specifies that the database to which the SQL session is connected should become the default for any database session started by the procedure.

timestamp-value

Specifies the value of the synchronization stamp to be assigned to the procedure. *Timestamp-value* must be a valid external representation of a timestamp.

DYNAMIC RESULT SETS

Defines the maximum number of result sets that a procedure invocation can return to its caller. A result set is a sequence of rows specified by a *cursor-specification*, created by the opening of a cursor and ranged over that cursor.

maximum-dynamic-result-sets

Defines an integer in the range 0-32767 specifying the maximum number of result sets a procedure can return. The default is 0.

Parameters for Expansion of parameter-definition

parameter-name

Specifies a 1- to 32-character name of a parameter to be passed to the table procedure. *Parameter-name* must:

- Be unique within the table procedure that you are defining
- Follow the conventions for SQL identifiers

All parameters are implicitly nullable. Input parameters can be assigned NULL as a parameter value and output parameters can return NULL.

data-type

Defines the data type for the named parameter. For expanded **data-type** syntax, see Expansion of Data-type.

WITH DEFAULT

Directs CA IDMS to pass a default value for the named parameter if no value for the parameter is specified.

The default value for a parameter is based on its data type:

Column data type	**Default value**
CHARACTER	Blanks
VARCHAR	A character string literal with a length of zero (that is, '')
GRAPHIC	Double-byte blanks
VARGRAPHIC	A double-byte character string literal with a length of zero
DATE	The value in the CURRENT DATE special register
TIME	The value in the CURRENT TIME special register
TIMESTAMP	The value in the CURRENT TIMESTAMP special register
All numeric data types	0 (zero)

Parameters for Expansion of language-clause

ADS

Specifies that the SQL routine is written in the CA ADS language.

ASSEMBLER

Specifies that the SQL routine is written in the assembler language.

COBOL

Specifies that the SQL routine is written in the COBOL language.

PLI

Specifies that the SQL routine is written in the PL/I language.

SQL

Specifies that the SQL routine is written in the SQL language.

Note: The ability to specify ADS or ASSEMBLER as a language is a CA IDMS extension.

Parameters for Expansion of procedure-statement

SQL-AM-mgmt-stmt

Specifies a statement from the Access Module Management Statements category.

SQL-authorization-stmt

Specifies a statement from the Authorization Statements category.

SQL-Control-stmt

Specifies a statement from the Control Statements category.

SQL-Diagnostics-stmt

Specifies a statement from the Diagnostics Statements category.

SQL-DDL-stmt

Specifies a statement from the Data Description Statements category.

SQL-DML-stmt

Specifies a statement from the Data Manipulation Statements category.

SQL-session-mgmt-stmt

Specifies a statement from the Session Management Statements category.

Note: The ability to include a RELEASE, SUSPEND, or RESUME statement in an SQL routine is a CA IDMS extension.

SQL-transaction-mgmt-stmt

Specifies a statement from the Transaction Management Statements category.

Note: The ability to include a COMMIT or ROLLBACK statement in an SQL routine is a CA IDMS extension.

Usage

Influencing Join Strategies

CA IDMS uses estimated row and I/O counts in determining the cost of joining a procedure with other tables, views, procedures or table procedure. To determine the optimal access strategy, CA IDMS examines different sequences for retrieving information. By providing the estimated row and I/O counts for both the procedure and for each access key used by the procedure, CA IDMS can select the optimal access strategy.

In determining the cost of a specific access strategy, CA IDMS uses estimates provided in CREATE PROCEDURE unless input values are available for each of the parameters included in a key. If values are available for each of these parameters, CA IDMS uses the estimates specified in the CREATE KEY statement instead of those specified in CREATE PROCEDURE.

Specifying a Synchronization Stamp

When defining or altering a procedure, you can specify a value for its synchronization stamp. You should use care when doing so because the purpose of the stamp is to enable the detection of discrepancies between an entity and its definition. If explicitly specified, you must set the synchronization stamp to a new value following a change so that the change is detectable by the runtime system.

If not specified, the synchronization stamp is automatically set to the current date and time.

Coding procedures with language SQL

The rules for coding the procedure body of an SQL procedure are given by **procedure-statement**. A procedure body typically contains multiple SQL statements and according to the SQL grammar, SQL statements are terminated by the semi-colon. However, to define SQL routines, the Command Facility (OCF, IDMSBCF, or Visual DBA OCF console) needs to be used. It also has the semi-colon as the default command terminator. Before a new command can be specified, the CREATE PROCEDURE needs to be terminated by a semi-colon. Clearly, the semi-colon cannot concurrently be used as a terminator by both the SQL procedure language and the Command Facility. Therefore, when **procedure-statement** contains multiple SQL statements or when the ADS COMPILE OPTION is specified, the Command Facility needs to use a terminator different from the semi-colon. To accomplish this, a SET OPTIONS COMMAND DELIMITER 'delimiter-string' must be executed. Changing the terminator of the Command Facility remains in effect until the end of the session or until a new SET OPTIONS COMMAND DELIMITER is encountered. For more information about SET OPTIONS, see the Command Facility chapter in the *CA IDMS Common Facilities Guide*.

Language SQL

If LANGUAGE SQL is specified, the following attribute settings are established by default and must not be overridden to a different value:

- Protocol is ADS
- Mode is SYSTEM
- Transaction sharing is ON

Procedures whose language is SQL are implemented through an automatically generated CA ADS dialog whose name is *external-routine-name*.

An error while parsing **procedure-statement** or an error while compiling the associated CA ADS dialog causes the CREATE PROCEDURE statement to terminate with a warning instead of a statement error. This allows the erroneous **procedure-statement** syntax to be saved in the catalog for later correction using the DISPLAY PROCEDURE command. The CA ADS dialog and associated access module are not created.

Specifying CA ADS Compile Options

If LANGUAGE SQL is specified, you can specify one or more compile options to be used when the associated dialog is compiled. Specifying compile options can be useful for debugging purposes to enable tracing and the use of online debugging facilities. Compile options can also be used to include additional work records and SQL tables which can be referenced in native CA ADS code included in the routine body.

Some useful compile options include:

- SYMBOL TABLE IS YES - to allow the use of symbols by the TRACE command and the online debug facilities
- ADD RECORD record-name - to enable manipulation of elements from the specified record
- ADD SQL TABLE table-name - to enable manipulation of columns or parameters of the specified SQL table-like object

Grouping procedure statements into a single statement

Multiple procedure statements can be grouped together as a compound statement. A compound statement is a control statement and therefore is also a procedure statement.

Dynamic Result Sets

An SQL invoked procedure can return one or more result sets to its caller, up to the maximum number specified by its dynamic result sets attribute. A result set is returned for each returnable cursor that is still open when the procedure returns control to its caller.

Example

The following CREATE PROCEDURE statement defines a procedure.

```
create procedure emp.get_bonus
   (emp_id              unsigned numeric(4)    with default,
    bonus               unsigned numeric(10)   with default,
    currency_bonus char(3)                     with default)
   external name getbonus
   protocol idms;
```

The procedure USER01.TSELECT1 uses the given employee ID to retrieve the first and last name. It returns the edited name in the RESULT parameter.

```
create procedure USER01.TSELECT1
  ( TITLE        varchar(10) with default
  , P_EMP_ID     numeric(4)
  , RESULT       varchar(20)
  )
    EXTERNAL NAME TSELECT1 LANGUAGE SQL
 select trim(EMP_FNAME) || ' ' || trim(EMP_LNAME)
   into RESULT
   from DEMOEMPL.EMPLOYEE
  where EMP_ID = P_EMP_ID
;

call user01.tselect1('TSIGNAL3', 1003);
*+
*+ TITLE        P_EMP_ID  RESULT
*+ -----        --------  ------
*+ TSIGNAL3         1003  Jim Baldwin
```

The GET_EMPLOYEE_INFO procedure uses the given employee ID, to construct two result set cursors:

- A static declared cursor RET_COVERAGE returns a cursor with the data from the COVERAGE table.
- The allocated dynamic cursor RET_BENEFITS to return the data from the BENEFITS data.

```
set options command delimiter '++';
create procedure SQLROUTE.GET_EMPLOYEE_INFO
  ( TITLE       varchar(10) with default
  , P_EMP_ID    numeric(4)
  , RESULT      varchar(20)
  )
    EXTERNAL NAME GETEMPIN LANGUAGE SQL
    DYNAMIC RESULT SETS 2
begin not atomic
  declare STMNT_NAME    char(10) default 'DYN_STMNT1';
  declare STMNT_BUF     char(80) default ' ';
  declare RET_COVERAGE cursor with return for
    select * from DEMOEMPL.COVERAGE
     where EMP_ID = P_EMP_ID;
  open RET_COVERAGE;
  set STMNT_BUF = 'select * from DEMOEMPL.BENEFITS'
                || 'where EMP_ID = ' || P_EMP_ID;
  prepare STMT_NAME from STMT_BUF;
  allocate 'RET_BENEFITS' cursor with return for STMT_NAME;
  open 'RET_BENEFITS';
  set RESULT = '2 returned result sets';
end
set options command delimiter default ++
```

More Information

- For more information about expanded procedure references, see Expansion of Procedure-reference.
- For more information about coding external routines, see Defining and Using Procedures.
- For more information about Control Statements, see Control Statements.
- For more information about Diagnostics Statements, see GET DIAGNOSTICS.
- For more information about the other categories, see Statement Categories.
- For more information about defining a returnable cursor, see ALLOCATE CURSOR or DECLARE CURSOR.
- For more information about how the caller processes the returned result sets, see ALLOCATE CURSOR.
- For more information about CALL, see CALL.
- For more information about DESCRIBE CURSOR, see DESCRIBE CURSOR.
- For more information about CREATE KEY, see CREATE KEY.
- For more information about the SET OPTIONS COMMAND DELIMITER, see the "Using SET OPTIONS to Select Options" topic in the *CA IDMS Common Facilities Guide*.

CREATE SCHEMA

The CREATE SCHEMA data description statement defines a schema in the dictionary.

Authorization

To issue a CREATE SCHEMA statement, you must have the CREATE privilege on the schema named in the statement.

If you specify FOR NONSQL SCHEMA, you must have the USE privilege on the non-SQL schema.

If you specify DBNAME, you must have USE privilege on the database; if you do not specify DBNAME or specify a value of NULL, you must have DBADMIN privilege on DBNAME SYSTEM.

Syntax

```
►►─── CREATE SCHEMA schema-name ─────────────────────────────────────►

►─┬────────────────────────────────────────────────────────┬──────────►◄
  ├─ DEFAULT AREA segment-name.area-name ──────────────────┤
  ├─ FOR NONSQL SCHEMA nonsql-schema-specification ────────┤
  └─ FOR SQL SCHEMA sql-schema-specification ──────────────┘
```

Expansion of nonsql-schema-specification

```
►►─┬────────────────────┬─ nonsql-schema-name ─┬───────────────────────────┬─►
   └─ dictionary-name. ─┘                      └─ VERSION version-number ─┘

►─┬─────────────────────────────────┬──────────────────────────────────►◄
  └─ DBNAME nonsql-database-name ───┘
```

Expansion of sql-schema-specification

```
►►─────────────────────── sql-schema-name ───────────────────────────►

►─┬──────────────────────────────┬─────────────────────────────────────►◄
  └─ DBNAME sql-database-name ───┘
```

Parameters

schema-name

Specifies the name of the schema being created. *Schema-name* must be a 1- through 18-character name that follows the conventions for SQL identifiers. *Schema-name* must be unique within the dictionary.

DEFAULT AREA

Specifies the default area for storing rows of tables associated with the named schema. This area is used for any such table that is not explicitly assigned an area in the CREATE TABLE statement.

segment-name.area-name

Identifies the segment and area.

You do not need to define the named segment or area in the dictionary before issuing the CREATE SCHEMA statement.

nonsql-schema specification

Identifies the nonSQL-defined schema to associate with the SQL schema.

Expanded syntax for **nonsql-schema-specification** appears immediately following the statement syntax. Descriptions for these parameters are located at the end of this section.

sql-schema-specification

Identifies an existing SQL-defined schema to which the new SQL schema refers. Expanded syntax for sql-schema-specification appears immediately following the statement syntax.

Parameters for Expansion of nonsql-schema-specification

nonsql-schema-name

Names the nonSQL-defined schema.

dictionary-name

Names the dictionary that contains the nonSQL-defined schema.

If you do not specify *dictionary-name*, it defaults to the dictionary to which the SQL session is connected.

VERSION *version-number*

Identifies the version number of the nonSQL-defined schema. If VERSION *version-number* is not specified, *version-number* defaults to 1.

DBNAME *nonsql-database-name*

Identifies the database containing the data described by the nonSQL-defined schema. *nonsql-database-name* must be a segment name or a database name that is defined in the database name table.

If you do not specify DBNAME, no database name is included in the definition of *schema-name*. At runtime the database to which the SQL session is connected must include segments containing the areas described by the non-SQL-defined schema.

For considerations about whether to specify the database when you create a schema for a non-SQL-defined schema, see "Usage," later in this section.

Parameters for Expansion of sql-schema-specification

sql-schema-name

Names the referenced SQL-defined-schema. This named schema must not itself reference another schema.

DBNAME *sql-database-name*

Identifies the database containing the data described by the referenced SQL-defined schema. *SQL-database-name* must be a database name that is defined in the database name table or a segment name defined in the DMCL.

If you do not specify DBNAME, no database name is included in the definition of schema-name. At runtime, the database to which the SQL session is connected must include segments containing the areas described by the referenced SQL-defined schema.

Usage

If You Omit DEFAULT AREA

If you do not associate a default area with the schema, you must assign an area to each table that you associate with the schema in a CREATE TABLE statement. You use the IN parameter of CREATE TABLE to assign an area to a table.

Creating a Referencing Schema

If either a FOR NONSQL SCHEMA or a FOR SQL SCHEMA clause is specified, then the new SQL-defined schema that is being created is said to reference the specified schema and itself becomes a referencing schema. If a non-SQL-defined schema is specified, then creation of a referencing schema enables SQL access to a non-SQL-defined database described by the referenced schema. Similarly, if the referenced schema is SQL-defined, then the creation of a referencing schema enables SQL access to an SQL-defined database described by the referenced schema.

In either case, if a DBNAME is specified, the referencing schema provides access to the database instance identified by database-name. If no DBNAME is specified, the referencing schema is unbound and the instance of the database to be accessed is determined at runtime. Access modules that reference tables through an unbound referencing schema can therefore be used to access more than one instance of a database.

You cannot define either a table or a view in a referencing schema. However, you can define a view in another schema that references a table through a referencing schema.

Specifying non-SQL-DBNAME

When you create a schema for a non-SQL-defined schema, you use the DBNAME parameter to specify the name of the database containing the data. The name specified can be the name of a segment or a database name defined in the database name table.

If you do not specify a database name, the database to which your SQL session is connected when accessing the non-SQL-defined tables must include the segments containing the data.

Note: For more information about defining a schema for a non-SQL-defined schema, see SQL Schema Considerations.

Specifying SQL DBNAME

When you create a referencing schema, you use the DBNAME parameter to specify the name of the database containing the data. The name specified can be either the name of a database name defined in the database name table or the name of a segment included in the DMCL.

If you do not specify a database name, the database to which your SQL session is connected when accessing the data through the referencing schema must include the segments containing the data.

Examples

Defining a Schema with a Default Area

The following CREATE SCHEMA statement defines the schema SALES. The default area for the schema is SALES_SEG.SALES_AREA.

```
create schema sales
   default area sales_seg.sales_area;
```

Defining a Schema for a Non-SQL-defined Schema

In this example, the statement creates schema SALES for a non-SQL schema:

```
create schema sales
   for nonsql schema corpdict.sales version 100;
```

Defining a Schema for an SQL-defined Schema

The following CREATE SCHEMA statement defines a schema for an SQL-defined schema:

```
create schema any_sales for sql schema sales;
```

More Information

- For more information about defining schemas, see ALTER SCHEMA and DROP SCHEMA (see page 428).
- For more information about non-SQL-defined schemas, see the *CA IDMS Database Administration Guide*.

CREATE TABLE

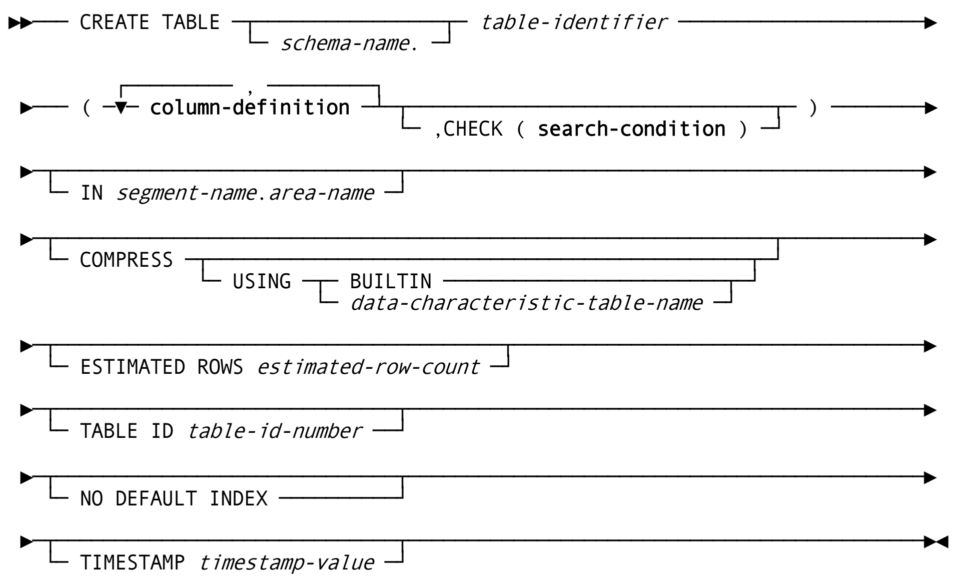
The CREATE TABLE data description statement defines a table in the dictionary. Tables defined with the CREATE TABLE statement are called base tables.

Authorization

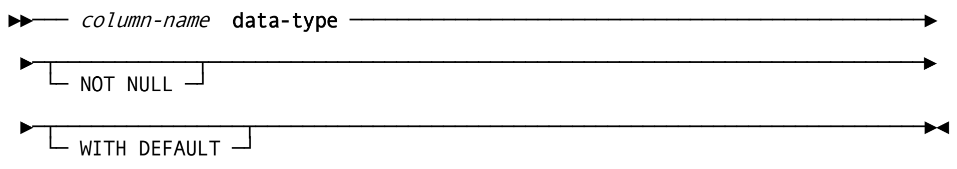
To issue a CREATE TABLE statement, you must:

- Own the schema where the table is being defined or hold the CREATE privilege on the named table
- Hold the USE privilege on the area where rows of the named table are stored

Syntax


CREATE TABLE
schema-name.
table-identifier
(
,
column-definition
,CHECK (search-condition)
)
IN segment-name.area-name
COMPRESS
USING
BUILTIN
data-characteristic-table-name
ESTIMATED ROWS estimated-row-count
TABLE ID table-id-number
NO DEFAULT INDEX
TIMESTAMP timestamp-value

Expansion of column-definition



Parameters

table-identifier

Specifies the name of the table being treated. *Table-identifier* must be a 1- through 18-character name that follows the conventions for SQL identifiers.

Table-identifier must be unique among the table, view, function, procedure and table procedure identifiers within the schema associated with the table.

schema-name

Specifies the schema to be associated with the table. *Schema-name* must identify a schema defined in the dictionary.

If you do not specify *schema-name*, it defaults to:

- The current schema associated with your SQL session, if the statement is entered through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

column-definition

Defines a column to be included in the table.

Columns are included in the table in the order they are specified.

The list of column definitions together with the CHECK parameter (if specified) must be enclosed in parentheses. Multiple column definitions must be separated by commas.

Expanded syntax for **column-definition** is shown immediately following the CREATE TABLE syntax. Descriptions for these parameters are located at the end of this section.

CHECK (search-condition)

Specifies criteria to be used to restrict the data that can be stored in the table. CA IDMS stores a new row in the table only if the value of **search-condition** is true for the row.

For expanded **search-condition** syntax, see Expansion of Search-condition. Restrictions on the use of **search-condition** in the CHECK parameter are discussed in "Usage" later in this section.

IN

Specifies the area to be used for storing rows of the table.

If you do not associate an area with a table, CA IDMS:

- Uses the default area, if any, for the schema associated with the table
- Returns an error if the schema does not have a default area

The IN parameter is a CA IDMS extension of the SQL standard.

segment-name

Identifies the segment associated with the named area.

area-name

Identifies the area to be associated with the table. *Area-name* must identify an area defined in the dictionary.

COMPRESS

Specifies that data in the table is to be compressed before being stored in the database.

The COMPRESS parameter is valid only if CA IDMS Presspack is installed at your site.

The COMPRESS parameter is a CA IDMS extension of the SQL standard.

USING *data-characteristic-table-name*

Specifies the data characteristic table CA IDMS Presspack is to use to compress data in the table.

Data-characteristic-table must identify a data characteristic table created by CA IDMS Presspack. If *data-characteristic-table* is not specified, the default, BUILTIN, directs CA IDMS Presspack to use the data characteristic table supplied with the product.

ESTIMATED ROWS *estimated-row-count*

Indicates the number of rows expected to be stored for the table. *Estimated-row-count* must be an integer that does not exceed 16,777,214.

CA IDMS uses the estimated row count when determining default index characteristics and estimating statistics.

The ESTIMATED ROWS parameter is a CA IDMS extension of the SQL standard.

TABLE ID *table-id-number*

Assigns a table ID value for the table being created. The table-id number must be in the range of 1024 through 4095.

NO DEFAULT INDEX

Indicates that the TABLE will have no initially assigned default index. The default index is an index sorted by DBKEY in ascending order in such a way that all TABLE rows can be accessed with the minimum number of I/Os.

Note: For more information about retaining or dropping the default index, see the Usage topic later in this section or the *CA IDMS Database Design Guide*.

TIMESTAMP *timestamp-value*

Specifies the value of the synchronization stamp to be assigned to the table. *Timestamp-value* must be a valid external representation of a timestamp.

Parameters for Expansion of column-definition

column-name

Specifies the name of a column to be included in the table being created. *Column-name* must be a 1- through 32-character name that follows the conventions for SQL identifiers.

Column-name must be unique within the table being defined.

data-type

Defines the data type for the named column. For expanded **data-type** syntax, see Expansion of Data-type.

NOT NULL

Indicates the column cannot contain null values.

If you do not specify NOT NULL, the column is defined to allow null values.

If you specify NOT NULL *without* WITH DEFAULT, an INSERT statement must specify a value for the column.

WITH DEFAULT

Directs CA IDMS to store the default value in the named column if no value for the column is specified when a row is inserted.

The default value for a column is based on its data type:

Column data type	Default value
CHARACTER	Blanks
VARCHAR	A character string literal with a length of zero (that is, '')
GRAPHIC	Double-byte blanks
VARGRAPHIC	A double-byte character string literal with a length of zero
DATE	The value in the CURRENT DATE special register
TIME	The value in the CURRENT TIME special register
TIMESTAMP	The value in the CURRENT TIMESTAMP special register
All numeric data types	0 (zero)

Usage

Tables in the SYSTEM Schema

You cannot define a table in the SYSTEM schema.

Tables in System Areas

You cannot associate a table with a system area supplied with CA IDMS.

Maximum Row Length

When defining the columns in a table, you must ensure that the total number of bytes required for all columns in the table does not exceed the maximum allowed.

The total number of bytes allowed for all columns included in a table defined with the COMPRESS option is 32,760. If the table is defined without the COMPRESS option, the total number of bytes allowed for all columns is limited by the database page size and the size of the page reserve. The length of all columns must be less than or equal to (*page-size* - *page-reserve* - 40).

The number of bytes used for each column is determined by the column data type. Columns that allow null values take one additional byte each.

Each linked clustered referential constraint where the table is the referencing table reduces the total number of bytes allowed for columns by 12. Each linked clustered referential constraint in which the table is the referenced table or linked indexed referential constraint where the table is the referencing or the referenced table reduces the total by 8 bytes.

A CALC key defined on a table also reduces the total number of bytes allowed for columns by 8.

Recommended Row Length

The absolute maximum row length for an uncompressed table is (*page-size* - *page-reserve* - 40). The recommended maximum row length is 30% of the absolute maximum.

Restrictions on search-condition

In the CHECK parameter of a CREATE TABLE statement:

- **Search-condition** cannot include any host variables, routine parameters, local variables, aggregate or user-defined functions, EXISTS predicates, quantified predicates, or subqueries
- Each column reference in **search condition** must identify a column in the table being defined

Default Indexes

The default index for a table is stored in the same area as the table. CA IDMS uses the default index to cluster rows of the table when no other clustered index, CALC key, or clustered referential constraint is defined for the table.

For such a table, the default index improves processing efficiency. CA IDMS uses the default index instead of an area sweep to locate rows of the table for retrieval.

The ESTIMATED ROWS Parameter with Large Tables

To enable CA IDMS to choose optimal attributes for indexes on a large table, you should supply an estimated number of rows in the table definition or specify index block characteristics yourself.

If you do not specify ESTIMATED ROWS and if you do not update statistics *after* the table has been loaded, CA IDMS calculates index characteristics using an estimated row count of 1000.

Omitting NOT NULL and WITH DEFAULT

If you omit *both* NOT NULL nor WITH DEFAULT, the column is assigned a null value if no value is specified for the column on an INSERT statement.

Specifying a Synchronization Stamp

When defining or altering a table, you can specify a value for its synchronization stamp. You should use care when doing so because the purpose of the stamp is to enable the detection of discrepancies between an entity and its definition. If explicitly specified, you must set the synchronization stamp to a new value following a change so that the change is detectable by the runtime system.

If not specified, the synchronization stamp is automatically set to the current date and time.

Example

Defining a Base Table

The following CREATE TABLE statement defines the EMPLOYEE table in the DEMO_LIB schema. The table includes 16 columns. The CHECK parameter in the table definition restricts the values that can be stored in the STATUS column. Data in the table is stored in a compressed form in the EMP_SPACE area. The expected number of rows for the table is 350.

```
create table demo_lib.employee
   (emp_id            integer        not null,
   manager_id         integer,
   emp_fname          varchar(20)    not null,
   emp_lname          varchar(20)    not null,
   dept_id            integer        not null,
   proj_id            varchar(10),
   street             varchar(40)    not null,
   city               character(20)  not null,
   state              character(2)   not null,
   zip_code           character(9)   not null,
   phone              character(10),
   status             character(1),
   ss_number          integer        not null,
   start_date         date           not null,
   termination_date   date,
   birth_date         date,
   check (status in ('A', 'S', 'L', 'T')))
   in demoseg.emp_space
   compress
   estimated rows 350;
```

More Information

- For more information about defining tables, see ALTER TABLE and DROP TABLE.
- For more information about implementing indexes, see the *CA IDMS Database Design Guide*.
- For more information about compressing data, see the *CA IDMS Presspack User Guide*.
- For more information about differences between the CREATE TABLE statement in CA IDMS and the SQL standard CREATE TABLE statement.

CREATE TABLE PROCEDURE

The CREATE TABLE PROCEDURE data description statement stores the definition of a table procedure in the SQL catalog. You can refer to the table procedure in SQL SELECT, INSERT, UPDATE and DELETE statements just as you would a table. These references result in CA IDMS calls to the corresponding external routine. Although such routines can perform any action, you use them typically to manipulate data stored in some other organization (for example, in a non-SQL-defined database or in a set of VSAM files).

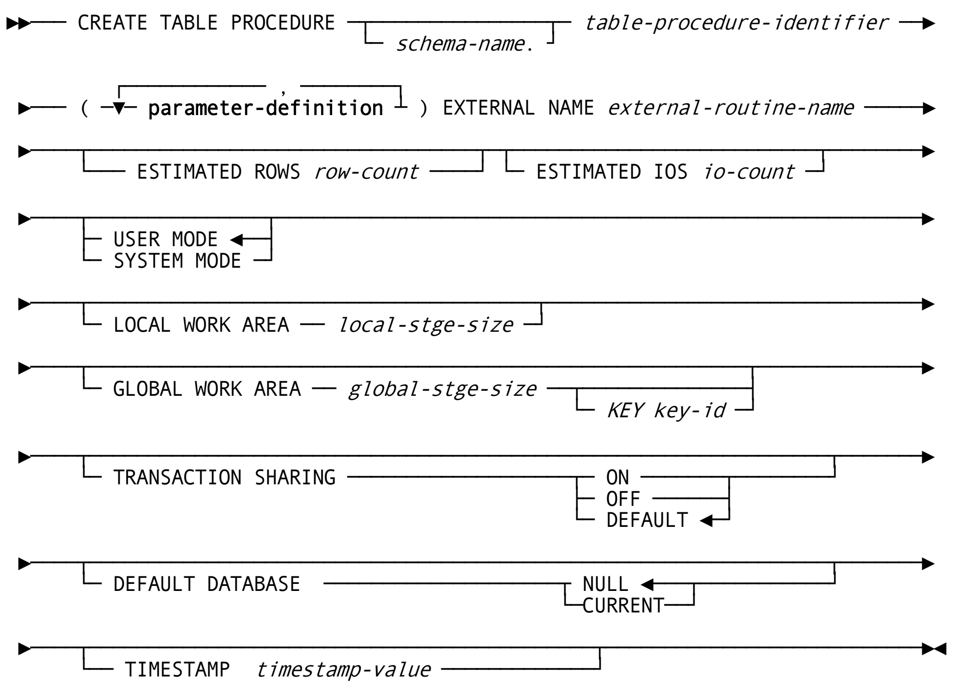
You use the formal parameters of a table procedure definition like the columns of a table during a procedure invocation. You can input values in and return them from the table procedure using column-like syntax.

The CREATE TABLE PROCEDURE statement is a CA IDMS extension of the SQL standard.

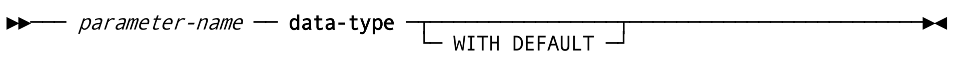
Authorization

To issue a CREATE TABLE PROCEDURE statement, you must own the schema in which the table procedure is being defined or hold the CREATE privilege on the named table procedure.

Syntax



Expansion of parameter-definition



Parameters

table-procedure-identifier

Specifies the 1- to 18-character name of the table procedure you are creating. *table-procedure-identifier* must:

- Be unique among the table, view, function, procedure and table procedure identifiers within the schema associated with the table procedure
- Follow conventions for SQL identifiers

schema-name

Specifies the schema name qualifier to be associated with the table procedure. *Schema-name* must identify a schema defined in the dictionary. If you do not specify a *schema-name*, it defaults to:

- The current schema associated with your SQL session, if the statement is specified through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

parameter-definition

Defines a parameter to be associated with the table procedure. Parameters are passed to the table procedure in the order they are specified. The list of parameters must be enclosed in parentheses. Multiple parameter definitions must be separated by commas.

Expanded syntax for **parameter-definition** is shown immediately following the CREATE TABLE PROCEDURE syntax. Descriptions for these parameters are located at the end of this section.

external-routine-name

Specifies the one- to eight-character name of the program which is called to process references to the table procedure.

row-count

Specifies an integer value, in the range 0 through 2,147,483,647, representing the average number of rows returned by the table procedure for a given set of input parameters.

io-count

Specifies an integer value, in the range 0 through 2,147,483,647, representing the average number of disk accesses generated by the table procedure for a given set of input parameters.

USER MODE

Specifies the table procedure should execute as a user-mode application program within CA IDMS. This is the default value unless SYSTEM MODE is specified.

SYSTEM MODE

Specifies the table procedure should execute as a system mode application program. To execute in system mode, the program must be fully reentrant and be written in either:

- Assembler using DC calling conventions
- COBOL or PL/I and compiled with an LE-compliant compiler

local-stge-size

Specifies an integer, in the range 0 through 32767, which represents the size, in bytes, of a local storage area which is allocated by CA IDMS at runtime and passed to the table procedure on each invocation.

CA IDMS allocates a local storage area on the first call to a table procedure for each SQL statement within a transaction or for a set of SQL statements which are related through reference to the same cursor (OPEN, FETCH, CLOSE, positioned UPDATE, and DELETE statements are related through a cursor). The same local storage area is passed to the table procedure for all calls for one statement or related statements. When the SQL statement has completed execution or when the cursor is closed, the local work area is released.

Note: If you do not code a LOCAL WORK AREA clause, the default local storage size is 1024 bytes.

global-stge-size

Specifies an integer, in the range 0 through 32767, representing the size, in bytes, of the global storage area that CA IDMS allocates at runtime and passes to the table procedure on each invocation.

CA IDMS allocates a global storage area once within a transaction and retains it until the transaction terminates.

key-id

Specifies the one- to four-character identifier for the global storage area. CA IDMS passes the same piece of global storage within a transaction to all SQL routines that have the same global storage key.

If you do not specify a storage key, CA IDMS allocates each table procedure its own global storage area, which is not used for any other routine within the transaction.

TRANSACTION SHARING

Specifies whether transaction sharing should be enabled for database sessions started by the table procedure. If transaction sharing is enabled for a procedure's database session, it will share the current SQL session's transaction.

ON

Specifies that transaction sharing should be enabled

OFF

Specifies that transaction sharing should be disabled.

DEFAULT

Specifies that the transaction sharing setting that is in effect when the table procedure is invoked should be retained.

DEFAULT DATABASE

Specifies whether a default database should be established for database sessions started by the table procedure.

NULL

Specifies that no default database should be established.

CURRENT

Specifies that the database to which the SQL session is connected should become the default for any database session started by the table procedure.

timestamp-value

Specifies the value of the synchronization stamp to be assigned to the table procedure. *Timestamp-value* must be a valid external representation of a timestamp.

Parameters for Expansion of parameter-definition

parameter-name

Specifies a 1- to 32-character name of a parameter to be passed to the table procedure. *Parameter-name* must:

- Be unique within the table procedure that you are defining
- Follow the conventions for SQL identifiers

All parameters are implicitly nullable. Input parameters can be assigned NULL as a parameter value and output parameters can return NULL.

data-type

Defines the data type for the named parameter. For expanded **data-type** syntax, see Expansion of Data-type.

WITH DEFAULT

Directs CA IDMS to pass a default value for the named parameter if no value for the parameter is specified.

The default value for a parameter is based on its data type:

Column data type	Default value
CHARACTER	Blanks
VARCHAR	A character string literal with a length of zero (that is, '')
GRAPHIC	Double-byte blanks
VARGRAPHIC	A double-byte character string literal with a length of zero
DATE	The value in the CURRENT DATE special register
TIME	The value in the CURRENT TIME special register
TIMESTAMP	The value in the CURRENT TIMESTAMP special register
All numeric data types	0 (zero)

Usage

Influencing Join Strategies

CA IDMS uses estimated row and I/O counts in determining the cost of joining a table procedure with other tables, views, or table procedures. To determine the optimal access strategy, CA IDMS examines different sequences for retrieving information. By providing the estimated row and I/O counts for the table procedure and for each access key used by the table procedure, CA IDMS can select the optimal access strategy.

In determining the cost of a specific access strategy, CA IDMS uses estimates provided in CREATE TABLE PROCEDURE unless input values are available for each of the parameters included in a key. If values are available for each of these parameters, CA IDMS uses the estimates specified in the CREATE KEY statement instead of those specified in CREATE TABLE PROCEDURE.

Specifying a Synchronization Stamp

When defining or altering a table procedure, you can specify a value for its synchronization stamp. You should use care when doing so because the purpose of the stamp is to enable the detection of discrepancies between an entity and its definition. If explicitly specified, you must set the synchronization stamp to a new value following a change so that the change is detectable by the runtime system.

If not specified, the synchronization stamp is automatically set to the current date and time.

Example

The following CREATE TABLE PROCEDURE statement defines a table procedure.

```
create table procedure emp.org
   (top_key          unsigned numeric(4),
   level             smallint,
   mgr_id            unsigned numeric(4),
   mgr_lname         char(25)
   emp_id            unsigned numeric (4),
   emp_lname         char(25)
   start_date        DATE,
   structure_code    char(2))
   external name procorgu
   local work area 800
   global work area 600 KEY EMP
   estimated rows 100
   estimated ios 50;
```

More Information

- For more information about expanded table procedure references, see Expansion of Table-procedure-reference.
- For more information about coding the external routine, see Defining and Using Table Procedures.
- For more information about CREATE KEY, see CREATE KEY.

CREATE TEMPORARY TABLE

The CREATE TEMPORARY TABLE data description statement defines a temporary table. A temporary table exists for the duration of the transaction in which the table is created. When the transaction ends, CA IDMS deletes the definition of and the data associated with the temporary table.

The CREATE TEMPORARY TABLE statement is a CA IDMS extension of the SQL standard.

Authorization

None required.

Syntax

```
►►── CREATE TEMPORARY TABLE table-identifier ─────────────────────────────►

         ┌───────── , ─────────┐
 ►── ( ─▼─ column-definition ─┴─ ) ─────────────────────────────────────►◄
```

Expansion of column-definition

```
►►── column-name  data-type ─────────────────────────────────────────►

►─┬────────────┬─────────────────────────────────────────────────────►
  └─ NOT NULL ─┘

►─┬────────────────┬─────────────────────────────────────────────────►◄
  └─ WITH DEFAULT ─┘
```

Parameters

table-identifier

Specifies the name of the temporary table being created. *Table-identifier* must be a 1- through 18-character name that follows the conventions for SQL identifiers.

Table-identifier must be unique within the transaction in which the temporary table is defined. To prevent possible ambiguity, temporary table identifiers should differ from the identifiers of any base tables and views defined in the dictionary.

column-definition

Defines a column to be included in the temporary table.

Columns are included in the table in the order they are specified.

The list of column definitions must be enclosed in parentheses. Multiple column definitions must be separated by commas.

Expanded syntax for **column-definition** is shown immediately following the CREATE TEMPORARY TABLE syntax. Descriptions for these parameters are located at the end of this section.

Parameters for Expansion of column-definition

column-name

Specifies the name of a column to be included in the temporary table. *Column-name* must be a 1- through 32-character name that follows the conventions for SQL identifiers.

Column-name must be unique within the temporary table being defined.

data-type

Defines the data type for the named column. For expanded **data-type** syntax, see Expansion of Data-type.

NOT NULL

Indicates that the column cannot contain null values.

If you specify NOT NULL *without* WITH DEFAULT, an INSERT statement must specify a value for the column.

If you do not specify NOT NULL, the column is defined to allow null values.

WITH DEFAULT

Directs CA IDMS to store the default value for the named data type in the named column if no value for the column is specified when a new row is stored.

The default value for a column is based on its data type:

Column data type	Default value
CHARACTER	Blanks
VARCHAR	A character string literal with a length of zero (that is, '')
GRAPHIC	Double-byte blanks
VARGRAPHIC	A double-byte character string literal with a length of zero
DATE	The value in the CURRENT DATE special register
TIME	The value in the CURRENT TIME special register
TIMESTAMP	The value in the CURRENT TIMESTAMP special register
All numeric data types	0 (zero)

Usage

Maximum Row Length

The total number of bytes allowed for all columns included in a temporary table is 32,767. The number of bytes used for each column is determined by the column data type. Columns that allow null values take one additional byte each.

Example

Defining a Temporary Table

The following CREATE TEMPORARY TABLE statement defines the temporary table TEMP_BUDGET with two columns:

```
create temporary table temp_budget
   (dept_id      integer  not null,
   all_expenses  decimal(9,2));
```

CREATE VIEW

The CREATE VIEW data description statement defines a view in the dictionary.

Authorization

To issue a CREATE VIEW statement, you must own the schema where the view is being defined or hold the CREATE privilege on the named view.

Syntax

```
►►── CREATE VIEW ─┬────────────────┬─ view-identifier ─────────────────────►
                  └─ schema-name. ─┘

 ►─┬─────────────────────────────────────┬─────────────────────────────────►
   │         ┌──────── , ────────┐       │
   └─ ( ─▼─ view-column-name ─┴─ ) ─┘

 ►── AS query-expression ──────────────────────────────────────────────────►

 ►─┬────────────────────────────┬───────────────────────────────────────────►
   └─ order-by-specification ─┘

 ►─┬──────────────────────┬─────────────────────────────────────────────────►
   └─ WITH CHECK OPTION ─┘

 ►─┬──────────────────────────────────────────┬────────────────────────────►◄
     └── TIMESTAMP  timestamp-value ──────────┘
```

Expansion of order-by-specification

```
►►── ORDER BY ─▼┬─┬─────────────────┬─ column-name ─┬─┬──────────┬─┴──────►◄
              │ ├─ table-name. ─┤               │ ├─ ASC ◄─┤
              │ └─ alias. ──────┘               │ └─ DESC ─┘
              ├─ column-number ─────────────────┤
              ├─ result-name ───────────────────┤
              └─ rowid-pseudo-column ───────────┘
                 └──────────────── , ────────────────────────────┘
```

Parameters

view-identifier

Specifies the name of the view being created. *View-identifier* must be a 1- through 18-character name that follows the conventions for SQL identifiers.

View-identifier must be unique among the table, view, procedure and table procedure identifiers within the schema associated with the view.

schema-name

Specifies the schema to be associated with the view. *Schema-name* must identify a schema defined in the dictionary.

If you do not specify *schema-name*, it defaults to:

- The current schema associated with your SQL session, if the statement is entered through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

(***view-column-name*** **)**

Assigns names to the columns to be included in the view. The number of column names must be the same as the number of columns in the result table represented by **query-expression**. The first column name is assigned to the first column in the result table, the second column name to the second result column, and so on.

Column-name must be a 1- through 32-character name that follows the conventions for SQL identifiers and must be unique within the view being defined.

The list of column names must be enclosed in parentheses. Multiple column names must be separated by commas.

If you do not specify any column names, CA IDMS assigns to the columns in the view the same names as those of the result table of **query-expression**.

AS query-expression

Defines the columns to be included in the view. The first column in the result table is the first column in the view, the second result column is the second column in the view, and so on.

Note: For more information about expanded **query-expression** syntax, see Expansion of Query-expression.

order-by-specification

Specifies a sort order for the rows in the result table defined by **query-expression**. Expanded syntax for **order-by-specification** is shown immediately following the CREATE VIEW syntax.

The use of the ORDER BY parameter in a CREATE VIEW statement is a CA IDMS extension of the SQL standard.

WITH CHECK OPTION

Specifies that any row inserted or updated through the view must satisfy the search condition of the WHERE clause in the query specification. This means you cannot add data through a view that the view would prevent you from retrieving.

TIMESTAMP *timestamp-value*

specifies the value of the synchronization stamp to be assigned to the view. *Timestamp-value* must be a valid external representation of a timestamp.

Parameters for Expansion of order-by-specification

ORDER BY

Sorts the rows in the result table defined by **query-expression** in ascending or descending order by the values in the specified columns. Rows are ordered first by the first column specified, then by the second column specified within the ordering established by the first column, then by the third column specified, and so on.

You can specify from 1 through 254 columns in the ORDER BY parameter. Multiple columns must be separated by commas.

column-name

Specifies a sort column by name. *Column-name* must identify a column in the result table of the query expression.

table-name

Specifies the table, view, procedure or table procedure that includes the named column. For expanded **table-name** syntax, see Identifying Entities in Schemas.

alias

Specifies the alias associated with the table, view, procedure or table procedure that includes the named column. *Alias* must be defined in the FROM parameter of the query specification that makes up the query expression.

column-number

Specifies a sort column by the position of the column in the result table defined by **query-expression**. The first result column is in position 1.

Column-number must be an integer in the range 1 through the number of columns in the result table.

result-name

Specifies the sort column by the result name specified in the AS parameter of **query-expression**.

rowid-pseudo-column

Specifies a sort column as a ROWID pseudo-column. See Expansion of rowid-pseudo-column.

ASC

Indicates that the values in the specified column are to be sorted in ascending order. ASC is the default when you specify neither ASC nor DESC.

DESC

Indicates that the values in the specified column are to be sorted in descending order.

Usage

Views on SYSTEM Tables

You can define a view on a table in the SYSTEM schema, but you cannot associate the view with the SYSTEM schema.

Required Column Names

You must include column names in a CREATE VIEW statement when any one of the following is true:

- Two or more of the result columns specified in the query-expression have the same name
- One or more of the value expressions representing the columns in the result table include a literal, an arithmetic operation (unary or binary), or an aggregate function
- A column in the result table has been assigned an alias through the AS parameter of the query specification

Restriction on query-expression

In a CREATE VIEW statement, **query-expression** cannot include:

- Host variables, local variables, or routine parameters
- References to temporary tables

Grouped Views

If the query-expression in a CREATE VIEW statement includes a GROUP BY or HAVING parameter that is not contained in a subquery, the view defined by the statement is a grouped view.

Updateable Views

For a view to be updateable:

- The query-expression must be updateable
- The view definition must not contain an ORDER BY clause

Result columns derived from a value expression other than a simple column reference cannot be updated or inserted through a view.

Using WITH CHECK OPTION

WITH CHECK OPTION has meaning only if the view is updateable and cannot be specified if the WHERE clause of the query expression contains a subquery.

When a view defined *with* WITH CHECK OPTION is referenced in the FROM clause of a second view definition, the check criterion of the original view is applied to data inserted or updated through the second view. If the second view is part of a third view definition, the check criterion of the original view is applied to data inserted or updated through the third view, and so on.

If a view defined *without* WITH CHECK OPTION is referenced in the FROM clause of a second view that has a WITH CHECK OPTION, the search conditions in the WHERE clause of both view definitions must be satisfied by an UPDATE or INSERT statement that references the second view. This principle holds true regardless of the number of levels of view references involved.

Once WITH CHECK OPTION is encountered in a view definition, all subordinate views referenced by that view are treated as if their definitions also contain WITH CHECK OPTION.

Use of * in a View Definition

Avoid the use of ***** in the query expression to denote all columns of a table named in the FROM parameter. If * is used and new columns are added to the table, the view becomes invalid; it must be dropped and recreated.

Altering the definition of an underlying table does not impact the view if you explicitly identify columns in the view definition.

Specifying a Synchronization Stamp

When defining a view, you can specify a value for its synchronization stamp. You should use care when doing so because the purpose of the stamp is to enable the detection of discrepancies between an entity and its definition. If explicitly specified, you must set the synchronization stamp to a new value following a change so that the change is detectable by the runtime system.

If not specified, the synchronization stamp is automatically set to the current date and time.

Note: For more information about dropping view definitions, see DROP VIEW.

Examples

Specifying Column Names in a View Definition

The following CREATE VIEW statement defines a view with three columns derived from two tables. The definition of the third column includes aggregate functions and a binary arithmetic operation. Therefore, the CREATE VIEW statement must specify names for all the columns in the view.

```
create view emp_vacation
   (emp_id, dept_id, vac_time)
   as select e.emp_id, dept_id, sum(vac_accrued) - sum(vac_taken)
      from employee e, benefits b
      where e.emp_id = b.emp_id
      group by dept_id, e.emp_id;
```

Defining an Updateable View

The following CREATE VIEW statement defines an updateable view:

```
create view emp_home_info
   as select emp_id, emp_lname, emp_fname, street, city, state,
         zip_code, phone
      from employee;
```

DEALLOCATE PREPARE

The DEALLOCATE PREPARE statement destroys a dynamically-compiled statement and all other dynamically-compiled statements that directly or indirectly reference it. You can use this statement only in SQL embedded in an application program.

Authorization

None required.

Syntax

```
►►── DEALLOCATE PREPARE statement-name ─────────────────────────────────►◄
```

Parameters

statement-name

Identifies the statement to be destroyed. It must identify a statement previously created using a PREPARE statement.

Usage

Effect on Dependent Statements

Upon successful execution of a DEALLOCATE PREPARE statement, the following actions have taken place:

- The target statement is destroyed.
- If the target statement was a **cursor-specification**, all cursors that reference the target statement are destroyed. If the cursors were open at the time the DEALLOCATE PREPARE statement was executed, they are first closed.
- If any dynamically compiled positioned UPDATE or DELETE statements reference a cursor being destroyed, they too are destroyed.

Examples

Destroying a Prepared Statement

The following statement destroys the local statement named S1 and any cursors that reference the statement. It also destroys any statements that reference the cursors.

```
EXEC SQL
  DEALLOCATE PREPARE S1
END-EXEC
```

DECLARE CURSOR

The DECLARE CURSOR data manipulation statement defines a cursor for a specified result table. Use this statement only in SQL that is embedded in a program.

Authorization

To issue a DECLARE CURSOR statement that includes a cursor specification, you must own or have the SELECT privilege on each table, view, table procedure, and function explicitly named in the cursor specification. Authorization checking for cursors that reference a statement is done during execution of the corresponding PREPARE statement.

Additional authorization requirements apply to each view explicitly named in the cursor specification, to each view explicitly named in the definition of such a view, to each view explicitly named in the definition of those views, and so forth.

For any such view, the owner of the view must own or have the grantable SELECT privilege on each table, view, table procedure, and function explicitly named in the view definition.

Syntax

```
►►── cursor-declaration ──────────────────────────────────────────────────►◄
```

Expansion of cursor-declaration

```
►►── DECLARE static-cursor-name ─┬──────────┬─ CURSOR ──────────────────────►
                                 └─ GLOBAL ─┘

 ►─┬────────────────────┬─ FOR ─┬─ cursor-specification ──┬───────────────►◄
   ├─ WITH RETURN ──────┤       └─ static-statement-name ─┘
   └─ WITHOUT RETURN ◄──┘
```

Parameters

Parameters for Expansion of cursor-declaration

static-cursor-name

Assigns a name to the cursor. *Cursor-name* must be a 1- through 18-character name that follows the conventions for SQL identifiers.

GLOBAL

Specifies the cursor can be used by other application programs sharing the access module that contains the cursor definition.

The GLOBAL parameter is not valid for cursors associated with result tables defined by dynamically compiled SELECT statements.

The GLOBAL parameter is a CA IDMS extension of the SQL standard.

WITH RETURN

Defines the cursor as a returnable cursor. If a returnable cursor is declared in an SQL-invoked procedure and is in the open state when the procedure returns to its caller, a result set is returned to the caller.

WITHOUT RETURN

Specifies that the cursor is not a returnable cursor. This is the default.

FOR

Defines the result table associated with the cursor.

cursor-specification

Specifies the result table in the form of a cursor definition. For expanded **cursor-specification** syntax, see Expansion of Cursor-specification.

static-statement-name

Specifies the result table in the form of a dynamically compiled SELECT statement. *Statement-name* must identify a statement named in a PREPARE statement.

You cannot use a dynamically-compiled SELECT statement to define the result table associated with a global cursor using the DECLARE CURSOR statement. This can be achieved using an ALLOCATE CURSOR statement.

Usage

Uniqueness of Cursor Names

Each cursor name must be unique within an application program. Global cursor names must be unique within an access module.

Updateable Cursors

The cursor defined by a DECLARE CURSOR statement is updateable if the cursor specification, contained in the DECLARE CURSOR statement or represented by the *static-statement-name* is updateable.

Defining Returnable Cursors

While any cursor can be defined as a returnable cursor using WITH RETURN, it only makes sense to do so in programs that are invoked as SQL-invoked procedures and that are defined with a non-zero dynamic result set attribute.

The invoker must use the ALLOCATE CURSOR statement to associate returned result sets with received cursors for further processing.

Note: For more information about how the caller processes returned result sets, see ALLOCATE CURSOR (see page 258) and CALL (see page 306).

Examples

Declaring a Global Cursor with a Specified Row Order

The following DECLARE CURSOR statement defines a global cursor for a result table containing information about all current employees and consultants. The rows in the table are ordered first by last name, then by department, and then by employee identifier.

```
EXEC SQL
   DECLARE ALL_EMP_CURSOR GLOBAL CURSOR
      FOR SELECT DEPT_ID, EMP_ID, 'EMPLOYEE', EMP_LNAME,
            EMP_FNAME, STREET, CITY, STATE, ZIP_CODE
         FROM EMPLOYEE
         WHERE STATUS IN ('A', 'L', 'S')
         UNION SELECT DEPT_ID, CON_ID, 'CONSULTANT', CON_LNAME,
               CON_FNAME, STREET, CITY, STATE, ZIP_CODE
            FROM CONSULTANT
      ORDER BY 4, 5, 1, 2
END-EXEC
```

Naming an Updateable Column

The following DECLARE CURSOR statement defines a cursor for a result table containing fiscal year 1999 bonus information for each employee. The statement specifies that the BONUS_AMOUNT column of the BENEFITS table can be updated through the cursor.

```
EXEC SQL
   DECLARE BONUS_CURSOR CURSOR
      FOR SELECT EMP_ID, BONUS_AMOUNT
         FROM BENEFITS
         WHERE FISCAL_YEAR = '99'
      FOR UPDATE OF BONUS_AMOUNT
END-EXEC
```

Associating a Cursor with a Dynamically Compiled SELECT Statement

The DECLARE CURSOR statement shown next, defines a cursor for the result table derived from a dynamically compiled SELECT statement named DYN_PROJ_SELECT. The application program must include a PREPARE statement for DYN_PROJ_SELECT.

```
EXEC SQL
DECLARE PROJECT_CURSOR CURSOR
   FOR DYN_PROJ_SELECT
END-EXEC
```

Defining Returnable Cursors

The following DECLARE CURSOR statement is specified in an SQL-invoked procedure written in SQL. The cursor RET_COVERAGE returns a result set consisting of the rows of the table DEMOEMPL.COVERAGE for which the column EMP_ID equals the value of the parameter P_EMP_ID. To effectively return the result set, the cursor must be left open on the return from the procedure.

```
declare RET_COVERAGE cursor with return for
    select * from DEMOEMPL.COVERAGE
     where EMP_ID = P_EMP_ID;
```

More Information

- For more information about manipulating cursors, see CLOSE, FETCH, and OPEN (see page 494).
- For more information about sharing cursors within an access module, see DECLARE EXTERNAL CURSOR.
- For more information about the dynamic compilation of SQL statements, see PREPARE or the *CA IDMS SQL Programming Guide*.
- For more information about using cursors in an application program, see the *CA IDMS SQL Programming Guide*.

DECLARE EXTERNAL CURSOR

The DECLARE EXTERNAL CURSOR data manipulation statement identifies an externally-defined global cursor to be used by the application program. You can use this statement only in SQL that is embedded in a program. The DECLARE EXTERNAL CURSOR statement is a CA IDMS extension of the SQL standard.

Authorization

None required.

Syntax

```
►►── DECLARE static-cursor-name EXTERNAL CURSOR ──────────────────────────►◄
```

Parameter

static-cursor-name

Specifies the name of a global cursor to be used by the application program. *Static-cursor-name* must identify a cursor defined by a DECLARE CURSOR statement with the GLOBAL option in another application program that shares an access module with the program containing the DECLARE EXTERNAL CURSOR statement.

Usage

Sharing Cursors

For one program (program B) to use a cursor defined in another program (program A):

- Program A must:
  - Include a DECLARE CURSOR statement that defines the cursor as a global cursor
  - Include an OPEN statement that opens the cursor
  - Open the cursor before program B attempts to use the cursor
- Program B must include a DECLARE EXTERNAL CURSOR statement that names the cursor
- The two programs must:
  - Use the same access module
  - Execute within the same transaction

Example

Identifying an Externally Defined Global Cursor

The following DECLARE EXTERNAL CURSOR statement identifies ALL_EMP_CURSOR as an externally defined global cursor that is used in the application program:

```
EXEC SQL
   DECLARE ALL_EMP_CURSOR EXTERNAL CURSOR
END-EXEC
```

More Information

- For more information about defining global cursors, see DECLARE CURSOR
- For more information about using cursors in an application program, see the *CA IDMS SQL Programming Guide*.

DELETE

The DELETE data manipulation statement deletes one or more rows from a table.

Authorization

To issue a DELETE statement, you must:

- Hold the DELETE privilege on or own the table, view, or table procedure named in the FROM parameter
- Hold the SELECT privilege on or own each table, view, and table procedure explicitly named in a subquery in the search condition in the WHERE parameter

Additional authorization requirements apply to:

- A view named in the FROM parameter, each view named in the FROM parameter of such a view, each view named in the FROM parameters of those views, and so forth.

  For any such view, the owner of the view must hold the grantable DELETE privilege on or own the table, view, or table procedure named in the FROM parameter of the view definition.

- Each view named in the FROM parameter of a subquery in the search condition, each view named in the FROM parameter of such a view, each view named in the FROM parameters of those views, and so forth.

  For any such view, the owner of the view must hold the grantable SELECT privilege on or own each table, view, and table procedure named in the FROM parameter of the view definition.

Syntax

```
►►── DELETE FROM table-reference ─┬─────────┬──────────────────────────────►
                                  └─ alias ─┘

►─┬──────────────────────────────────────────────────────────┬─────────────►◄
  └─ WHERE ─┬─ search-condition ───────────────────────────┬─┘
            └─ CURRENT OF ─┬─ cursor-name ────────────┬──┘
                           └─ dynamic-name-clause ─┘
```

Expansion of dynamic-name-clause

```
►►─┬─────────────┬─ cursor-name ──────────────────────────────────────────►◄
   ├─ LOCAL ◄ ─┤
   └─ GLOBAL ──┘
```

Parameters

FROM table-reference

Specifies the table, view, or table procedure from which rows are to be deleted. Table-reference must not specify a procedure or a joined table. If table-reference identifies a view:

- The view must be updateable
- The applicable rows are deleted from the table from which the view is derived

For expanded **table-reference** syntax, see Expansion of Table-reference.

alias

Defines a new name to be used to identify the table, view, or table procedure within the DELETE statement. *Alias* must be a 1- through 18-character name that follows the conventions for SQL identifiers.

WHERE

Restricts the rows to be deleted. If the DELETE statement does not include the WHERE parameter, CA IDMS deletes *all* rows from the specified table, view, or table procedure.

search-condition

Specifies criteria a row must meet to be deleted:

- When the value of **search-condition** is true, the row is deleted
- When the value of **search-condition** is false or unknown, the row is not deleted

For expanded **search-condition** syntax, see Expansion of Search-condition.

CURRENT OF

Specifies only the row that corresponds to the current row of the named cursor is to be deleted.

cursor-name

Identifies the cursor whose current row will be deleted. **Cursor-name** must identify an open cursor previously defined by a DECLARE CURSOR statement within the application program or by an ALLOCATE CURSOR statement executed within the same SQL transaction.

Note: This option may only be used in a DELETE statement embedded in an application program.

dynamic-name-clause

Identifies the cursor whose current row will be deleted.

Note: This option may only be used in a DELETE statement dynamically compiled using a PREPARE or EXECUTE IMMEDIATE statement.

Parameters for Expansion of dynamic-name-clause

LOCAL

Indicates the named cursor has a local scope and was defined using a DECLARE CURSOR statement or an ALLOCATE CURSOR statement. The default is LOCAL.

GLOBAL

Indicates the named cursor was created by an ALLOCATE CURSOR statement and is global in scope.

cursor-name

Specifies the name of the cursor as an identifier. *Cursor-name* must identify an open cursor previously defined by a DECLARE CURSOR statement within the application program or by an ALLOCATE CURSOR statement executed within the same SQL transaction.

Usage

Searched Deletes

A DELETE statement that include the WHERE **search-condition** parameter or does not include the WHERE parameter at all is called a **searched delete**. Searched deletes may be entered through the Command Facility, executed dynamically, or embedded within application programs.

Positioned Deletes

A DELETE statement that includes the WHERE CURRENT OF CURSOR parameter is called a **positioned delete**. The cursor identified in the positioned delete statement must be updateable. Positioned deletes are valid only from within an application program.

Dynamic Positioned Deletes

A dynamic positioned DELETE statement is one that references a dynamic cursor. Such a DELETE statement may be embedded within an application program or created dynamically using a PREPARE or EXECUTE IMMEDIATE statement.

A positioned DELETE statement embedded in an application program may reference a static cursor or a dynamic cursor. A positioned DELETE statement created dynamically using a PREPARE or EXECUTE IMMEDIATE statement can only reference a dynamic cursor.

Ambiguous Cursor References

When a dynamic positioned DELETE statement is being created by a PREPARE or EXECUTE IMMEDIATE statement, it is possible that CA IDMS may not be able to determine which cursor is being referenced. This occurs if the application program contains a DECLARE CURSOR statement that defines a cursor having the referenced name and the program has also executed an ALLOCATE cursor statement that creates a cursor with the same name and a local scope. Under these conditions, CA IDMS cannot determine which of the two cursors is being referenced. To avoid such problems, it is advisable to use different names for cursors that are declared from those that are allocated with a local scope.

Restrictions on table-reference

In a searched delete, the table, view, or table procedure named in the FROM parameter of the DELETE statement cannot also be named in the FROM parameter of any subquery included in the specified search condition or, in the case of a view, in any search condition used in the view definition. This means that you cannot delete data from a table from which you select in a subquery.

In a positioned delete, the table, view, or table procedure named in the FROM parameter of the DELETE statement must also be named in the FROM parameter of the query specification used in the definition of the named cursor.

Restriction for Tables in Referential Constraints

If the table referenced in a DELETE statement is the referenced table in a referential constraint, and the referencing table in the referential constraint includes one or more rows whose key-column values match those of a row to be deleted, CA IDMS returns an error and does not delete the row.

Cursor Position After a Positioned Delete

After a positioned delete, the position of the cursor named in the DELETE statement is before the row that immediately followed the deleted row. If the deleted row was the last row in the result table associated with the cursor, the position of the cursor is after the last row.

Transaction State for the DELETE Statement

CA IDMS processes a DELETE statement only when the transaction state is read write.

Deleting Through a View

If you specify a view in the FROM clause of a DELETE statement, the view must be updateable, and only rows that can be retrieved through the view can be deleted through the view.

Examples

Requesting a Searched Delete

The following DELETE statement deletes rows from the BENEFITS table for employees that have been terminated (status T):

```
delete from benefits
   where emp_id in
      (select emp_id
         from employee
         where status = 'T');
```

Requesting a Positioned Delete

The following DELETE statement deletes the row of the EST_COST table that corresponds to the current row of the EST_COST_CURSOR cursor:

```
EXEC SQL
   DELETE FROM EST_COST
      WHERE CURRENT OF EST_COST_CURSOR
END-EXEC
```

Deleting All Rows

The following DELETE statement deletes all rows from the PROPOSED_BUDGET table:

```
delete from proposed_budget;
```

A Positioned DELETE Referencing a DECLAREd Cursor

The following statement deletes the current row of the cursor C1. C1 may be a dynamic or static cursor, and it must have been defined using a DECLARE CURSOR statement:

```
EXEC SQL
  DELETE FROM EMPLOYEE WHERE CURRENT OF C1
END-EXEC
```

A Positioned DELETE Referencing an ALLOCATEd Cursor

The following statement deletes the current row of a cursor whose name is specified in the variable CNAME. The referenced cursor must have been defined using an ALLOCATE CURSOR statement:

```
EXEC SQL
  DELETE FROM EMPLOYEE WHERE CURRENT OF :CNAME
END-EXEC
```

A Dynamically-compiled Positioned DELETE Statement

The following statement deletes the current row of local cursor C1. C1 may have been defined using a DECLARE CURSOR statement or an ALLOCATE CURSOR statement. In either case, the cursor name in the DELETE statement is specified as an identifier rather than as a literal or host variable:

```
EXEC SQL
  EXECUTE IMMEDIATE
  'DELETE FROM EMPLOYEE WHERE CURRENT OF LOCAL C1'
END-EXEC
```

Note: The keyword LOCAL is unnecessary since it is the default. Regardless of whether it is specified, if two local cursors named C1 have been defined, one using a DECLARE CURSOR statement and one using an ALLOCATE CURSOR statement, the EXECUTE IMMEDIATE statement fails on an ambiguous cursor error.

More Information

- For more information about updateable views, see CREATE VIEW.
- For more information about defining and manipulating cursors, see CLOSE, DECLARE CURSOR, FETCH, and OPEN (see page 494).
- For more information about updateable result tables, see DECLARE CURSOR

DESCRIBE

The DESCRIBE data compilation statement directs CA IDMS to return information about a dynamically-compiled SQL statement into an SQL descriptor area.

You can use this statement only in SQL that is embedded in a program.

Authorization

None required.

Syntax

```
►►─ DESCRIBE ─┬─ OUTPUT ◄─┬─ statement-name ──────────────────────────────►
              └─ INPUT ───┘

 ►─ USING sql DESCRIPTOR descriptor-area-name1 ──────────────────────────►

 ►─┬───────────────────────────────────────────────────────────────┬────►◄
   ├─ INPUT ──┬─ USING sql DESCRIPTOR descriptor-area-name2 ─┘
   └─ OUTPUT ─┘
```

Note: If DESCRIBE OUTPUT is specified or implied, you may only specify the INPUT USING parameter; similarly, if DESCRIBE INPUT is specified, you may only specify the OUTPUT USING parameter.

```
Note: For compatibility with earlier releases, you can specify "INTO sql descriptor"
in place of "USING sql DESCRIPTOR"; however, this is an extension to the SQL standard.
```

Parameters

INPUT/OUTPUT

Specifies the type of information to be returned in the associated descriptor area. INPUT means that information about dynamic parameters is to be returned in the SQL descriptor area. OUTPUT means that information about output values is to be returned.

statement-name

Specifies the name of the statement being described.

Note: For more information about the expansion of **statement-name**, see Expansion of Statement-name.

USING SQL DESCRIPTOR

Specifies the SQL descriptor area where CA IDMS is to return information about the named statement.

descriptor-area-name1

Directs CA IDMS to use the named area as the descriptor area. *Descriptor-area-name1* must identify an SQL descriptor area.

INPUT/OUTPUT USING SQL DESCRIPTOR *descriptor-area-name2*

Specifies the type of information to be returned in the associated descriptor area. INPUT means that information about dynamic parameters is to be returned in the SQL descriptor area. OUTPUT means that information about output values is to be returned.

Descriptor-area-name2 is the name of the SQL descriptor area.

Note: If DESCRIBE OUTPUT is specified or implied, you may only specify the INPUT USING parameter; similarly, if DESCRIBE INPUT is specified, you may only specify the OUTPUT USING parameter.

The ability to specify INPUT/OUTPUT USING SQL DESCRIPTOR *descriptor-area-name2* is a CA IDMS extension to the SQL standard.

Usage

Describing Dynamic Parameters

The INPUT option is used to return information about dynamic parameters that may be embedded in the SQL statement being described. The SQLD field of the descriptor area indicates the number of dynamic parameters that appear in the statement. If no dynamic parameters are used, this field is zero (0).

If dynamic parameters do appear in the statement, CA IDMS returns descriptions of the parameters in the descriptor area. The data type information is derived from the context in which the dynamic parameter appears.

Describing Output Values

The OUTPUT option is used to return information about values output from CA IDMS:

- For a SELECT statement, CA IDMS returns a description of the result table defined by the statement. The SQLD field of the descriptor area indicates the number of columns in the result table.
- For a statement other than SELECT, CA IDMS returns the value zero (0) in the SQLD field of the descriptor area.

Specifying the Maximum Number of Column Entries

The application program must specify the maximum number of entries it can accept by setting the value of the SQLN field of the descriptor area before issuing the DESCRIBE statement. If the number of entries is insufficient to hold all the requested information, CA IDMS returns the number of entries needed into the SQLD field but does not return any descriptions.

Example

Describing a Dynamically Compiled Statement

The following DESCRIBE statement returns information about the result table of the dynamically compiled statement named DYN_TEMP_SEL_1 in the descriptor area named SQLDA:

```
EXEC SQL
   DESCRIBE DYN_TEMP_SEL_1
      USING DESCRIPTOR SQLDA
END-EXEC
```

More Information

- For more information about the SQL descriptor area, see SQL Descriptor Area.
- For more information about the dynamic compilation of SQL statements, see the *CA IDMS SQL Programming Guide*.

DESCRIBE CURSOR

The DESCRIBE CURSOR data manipulation statement directs CA IDMS to return information about the result set associated with a received cursor into an SQL descriptor area.

Use this statement only in SQL that is embedded in a program.

Syntax

Parameters

extended-cursor-name

Specifies the name of the cursor whose result set is to be described. The cursor must have been previously associated with a returned result set using the ALLOCATE CURSOR statement.

USING sql DESCRIPTOR

Specifies the SQL descriptor area where CA IDMS is to return information about the result set with which the cursor is associated.

descriptor-area-name

Directs CA IDMS to use the named area as the descriptor area. *descriptor-area-name* must identify an SQL descriptor area.

Example

The GET_EMPLOYEE_INFO procedure returns two result sets for a given EMP_ID:

- One for COVERAGE info
- One for BENEFITS info

Note: For more information about how to define this procedure, see the examples in CREATE PROCEDURE.

* Invocation of the procedure GET_EMPLOYEE_INFO.

```
exec sql
      call GET_EMPLOYEE_INFO(1003)
end-exec
```

* The dynamic cursor 'RECEIVED_CURSOR' is associated with the first result set.

* The received cursor is in the open state.

```
exec sql
      allocate 'RECEIVED_CURSOR' for procedure specific procedure
      GET_EMPLOYEE_INFO
end-exec
```

* The 'RECEIVED_CURSOR' cursor info is being described

```
exec sql
      describe cursor 'RECEIVED_CURSOR' structure
      using sql descriptor SQLDA-AREA
end-exec
```

* The COVERAGE info is being processed.

* The statement is executed in a loop until the SQLSTATE indicates *NO MORE DATA.*.

```
exec sql
      fetch 'RECEIVED_CURSOR' into :BUFFER-COVER
      using descriptor SQLDA-AREA
end-exec
```

* The dynamic cursor 'RECEIVED_CURSOR' is associated with the second result set.

* The received cursor is in the open state.

```
exec sql
      close 'RECEIVED_CURSOR'
end-exec
. .
```

* The 'RECEIVED_CURSOR' info is being described

```
exec sql
      describe cursor 'RECEIVED_CURSOR' structure
      using sql descriptor SQLDA-AREA
end-exec
. . .
```

* The BENEFITS info is being processed

* The statement is executed in a loop until the SQLSTATE indicates *NO MORE DATA*

```
exec sql
      fetch 'RECEIVED_CURSOR' into :BUFFER-BENEF
      using descriptor SQLDA-AREA
end-exec
```

* Close the cursor

```
exec sql
      close 'RECEIVED_CURSOR'
end-exec
```

More Information

- For more information about the SQL descriptor area, see SQL Descriptor Area.
- For more information about calling procedures with dynamic results sets, see CALL.
- For more information about allocating a cursor for a procedure, see ALLOCATE CURSOR.
- For more information about closing a received cursor, see CLOSE.

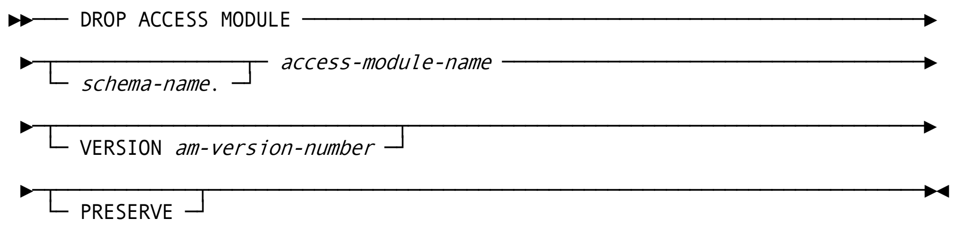
DROP ACCESS MODULE

The DROP ACCESS MODULE access module management statement deletes an access module and its definition from the dictionary. It is also a CA IDMS extension of the SQL standard.

Authorization

To issue a DROP ACCESS MODULE statement, you must hold the DROP privilege on or own the access module named in the statement.

Syntax



Parameters

access-module-name

Specifies the name of the access module being dropped. *Access-module-name* must identify an access module defined and stored in the dictionary.

schema-name

Identifies the schema associated with the specified version of the named access module.

If you do not specify *schema-name*, it defaults to the current schema associated with your SQL session.

VERSION *am-version-number*

Specifies the version number of the access module being dropped.

If VERSION is not specified, *am-version-number* defaults to 1.

PRESERVE

Directs CA IDMS to retain privileges held on the access module being dropped. If you subsequently create a new access module with the same name as the access module being dropped, the preserved privileges will apply to the new access module.

If you do not specify PRESERVE in a DROP ACCESS MODULE statement, CA IDMS deletes all privileges held on the access module if CA IDMS internal security is in effect.

Example

Dropping an Access Module

The following DROP ACCESS MODULE statement deletes version 1 of the SALES001 access module from the dictionary but retains privileges held on the access module:

```
drop access module test.sales001
   preserve;
```

More Information

- For more information about access modules, see ALTER ACCESS MODULE. and CREATE ACCESS MODULE (see page 320) or see the *CA IDMS Database Administration Guide*
- For more information about CA IDMS internal security, see the *CA IDMS Security Administration Guide*.

DROP CALC

The DROP CALC data description statement deletes the definition of a CALC key from the dictionary. It is also a CA IDMS extension of the SQL standard.

Authorization

To issue a DROP CALC statement, you must own or have the ALTER privilege on the table on which the CALC key is defined.

Syntax

```
►►─── DROP CALC key FROM ─┬─────────────────┬─ table-identifier ──────────►◄
                          └─ schema-name. ──┘
```

Parameters

FROM *table-identifier*

Specifies the name of the table associated with the CALC key being dropped. *Table-identifier* must identify a base table on which a CALC key has been defined in the dictionary. The named table cannot contain any data (that is, the table must be empty).

schema-name

Identifies the schema associated with the named table.

If you do not specify *schema-name*, it defaults to:

- The current schema associated with your SQL session, if the statement is entered through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

Usage

CALC Keys on Tables in the SYSTEM Schema

You cannot delete the definition of a CALC key on a table in the SYSTEM schema.

CALC Keys in the Implementation of Referential Constraints

You cannot drop a CALC key that is used in the implementation of a referential constraint if no existing index can be used in place of the CALC key.

Example

Dropping a CALC Key

The following DROP CALC statement deletes the definition of the CALC key associated with the COVERAGE table from the dictionary:

```
drop calc from coverage;
```

More Information

- For more information about defining CALC keys, see CREATE CALC.
- For more information about unlinked referential constraints, see CREATE CONSTRAINT.

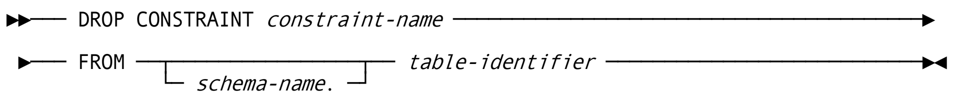
DROP CONSTRAINT

The DROP CONSTRAINT data description statement deletes the definition of a referential constraint from the dictionary. It is also a CA IDMS extension of the SQL standard.

Authorization

To issue a DROP CONSTRAINT statement, you must own or have the ALTER privilege on the referencing table in the constraint named in the statement.

Syntax



Parameters

constraint-name

Specifies the name of the referential constraint being dropped. *Constraint-name* must identify a referential constraint defined in the dictionary.

table-identifier

Specifies the referencing table in the constraint to be dropped.

schema-name

Identifies the schema with which the table is associated.

If you do not specify a *schema-name*, the default value is:

- The current schema associated with your SQL session, if the statement is entered through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

Usage

Referential Constraints Involving SYSTEM Tables

You cannot delete a constraint involving a table in the SYSTEM schema.

Implicitly Dropped Constraints

When you issue a DROP TABLE statement with the CASCADE parameter, CA IDMS deletes the definitions of all referential constraints in which the table being dropped is the referencing table or the referenced table.

Linked Constraints

When dropping a linked constraint, CA IDMS updates every row in the referenced and referencing tables to remove the physical links between the two tables.

Example

Dropping a Referential Constraint

The following DROP CONSTRAINT statement deletes the definition of the OFFICE_POOL_EMP constraint from the dictionary:

```
drop constraint office_pool_emp;
```

More Information

- For more information about defining referential constraints, see CREATE CONSTRAINT.
- For more information about implicitly dropping referential constraints, see DROP TABLE.

DROP FUNCTION

The DROP FUNCTION data description statement deletes the definition of the referenced function from the dictionary. For functions with language SQL, the statement removes the SQL routine body from the dictionary and the associated entities: access module (AM), relational command module (RCM), ADS premap process code, and dialog load module.

Authorization

To issue a DROP FUNCTION statement, you must own or have the DROP privilege on the function named in the statement.

Syntax

```
►►─── DROP FUNCTION ─┬──────────────┬─function-identifier ──────────────►
                     └ schema-name. ┘

►─────────┬───────────┬─────────────────────────────────────────────────►◄
          └─ CASCADE ─┘
```

Parameters

function-identifier

Specifies the name of the function to be dropped. Function-identifier must identify a function defined in the dictionary.

schema-name

Identifies the schema associated with the specified function.

If you do not specify a *schema-name*, the default value is:

- The current schema associated with your SQL session, if the statement is entered through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

CASCADE

Directs CA IDMS to delete any view definition that contains a reference to the function, either directly or nested within some other view reference.

Example

The following DROP FUNCTION statement removes the FIN.UDF_FUNBONUS function from the SQL catalog:

```
DROP FUNCTION FIN.UDF_FUNBONUS CASCADE;
```

More Information

- For more information about syntax for creating functions, see CREATE FUNCTION.
- For more information about using functions, see Expansion of User-defined-function.
- For more information about coding the external routines which process function invocations, see Defining and Using Functions.

DROP INDEX

The DROP INDEX data description statement deletes the definition of an index from the dictionary. It is also a CA IDMS extension of the SQL standard.

Authorization

To issue a DROP INDEX statement, you must own or have the ALTER privilege on the table on which the index is defined.

Syntax

```
►►── DROP INDEX index-name ─────────────────────────────────────────────►

 ►── FROM ─┬────────────────┬─ table-identifier ───────────────────────►◄
           └─ schema-name. ─┘
```

Parameters

index-name

Specifies the name of the index being dropped. *Index-name* must identify an index defined in the dictionary.

FROM *table-identifier*

Identifies the table on which the named index is defined.

schema-name

Identifies the schema associated with the named table.

If you do not specify a *schema-name*, the default value is:

- The current schema associated with your SQL session, if the statement is entered through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

Usage

Indexes on Tables in the SYSTEM Schema

You cannot delete the definition of an index on a table in the SYSTEM schema.

Indexes Used in the Implementation of Referential Constraints

You cannot drop an index that is used in the implementation of a referential constraint if no other existing index or CALC key can be used in place of the index.

Example

Dropping an Index

The following DROP INDEX statement deletes the definition of the BUDGET_DATE_INDEX index from the dictionary:

```
drop index budget_date_index
   from sales.monthly_budget;
```

More Information

- For more information about defining indexes, see CREATE INDEX.
- For more information about unlinked referential constraints, see CREATE CONSTRAINT.

DROP KEY

The DROP KEY statement deletes the definition of a procedure or table procedure key from the dictionary. It is also a CA IDMS extension of the SQL standard.

Authorization

To issue a DROP KEY statement, you must own or hold the ALTER privilege on the procedure or table procedure from which the key is being dropped.

Syntax

```
►►─── DROP KEY key-name ──────────────────────────────────────────────►

 ►─── FROM ─┬────────────────┬─┬─ procedure-identifier ───────┬──────►◄
            └─ schema-name. ─┘ └─ table-procedure-identifier ─┘
```

Parameters

key-name

Specifies the name of the key to be dropped. The *key-name* must identify a key defined in the dictionary.

FROM *table-procedure-identifier*

Specifies the table procedure from which the key is dropped.

procedure-identifier

Specifies the procedure from which the key drops.

schema-name

Identifies the schema associated with the named procedure or table procedure. If you do not specify a *schema-name*, it defaults to:

- The current schema associated with your SQL session, if the statement is entered through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

Example

Dropping a Key

The following DROP KEY statement deletes the definition of the ORG1 key from the dictionary:

```
drop key org1 from emp.org;
```

Note: For more information about defining keys, see CREATE KEY (see page 357).

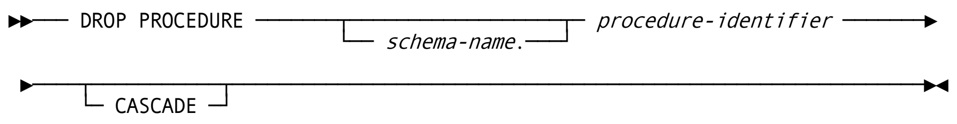
DROP PROCEDURE

The DROP PROCEDURE data description statement deletes the definition of the referenced procedure from the dictionary. For procedures with language SQL, the statement removes the SQL routine body from the dictionary and the associated entities: access module(AM), relational command module (RCM), ADS premap process code, and dialog load module.

Authorization

To issue a DROP PROCEDURE statement, you must own or have the DROP privilege on the procedure named in the statement.

Syntax



Parameters

procedure-identifier

Specifies the name of the procedure to be dropped. *Procedure-identifier* must identify a procedure defined in the dictionary.

schema-name

Identifies the schema associated with the specified procedure. If you do not specify a *schema-name*, the default value is:

- The current schema associated with your SQL session, if you specify the statement through the Command Facility or execute it dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

CASCADE

Directs CA IDMS to delete any view definition that contains a reference to the procedure, either directly or nested within some other view reference.

Example

The following DROP PROCEDURE statement example removes the EMP.GET_BONUS procedure from the SQL catalog.

```
drop procedure emp.get_bonus cascade
```

More Information

- For more information about syntax for creating procedures, see CREATE PROCEDURE.
- For more information about defining and using procedures, see Defining and Using Procedures.
- For more information about coding the external routines which process procedure references, see Defining and Using Procedures.

DROP SCHEMA

The DROP SCHEMA data description statement deletes a schema definition from the dictionary.

Authorization

To issue a DROP SCHEMA statement, you must have the DROP privilege on the schema named in the statement.

Note: You need no additional privileges to issue a DROP SCHEMA statement with the CASCADE parameter.

Syntax

```
►►─── DROP SCHEMA schema-name ─┬───────────┬──────────────────────────────►◄
                               └─ CASCADE ─┘
```

Parameters

schema-name

Specifies the name of the schema being dropped. *Schema-name* must identify a schema defined in the dictionary.

CASCADE

Directs CA IDMS to perform a DROP TABLE CASCADE, DROP VIEW CASCADE, DROP PROCEDURE CASCADE , DROP TABLE PROCEDURE CASCADE, or a DROP FUNCTION CASCADE for each table, view, procedure, table procedure and function associated with the named schema.

If you do not specify CASCADE in a DROP SCHEMA statement, the schema named in the statement cannot have any associated tables, views, functions, procedures and table procedures.

Usage

SYSTEM Schema

You cannot drop the SYSTEM schema.

Effect of the CASCADE Parameter

When you specify CASCADE in a DROP SCHEMA statement, CA IDMS deletes the following:

- The definition of each table, view, function, procedure and table procedure associated with the named schema
- The data stored in each table associated with the schema
- The definition of each referential constraint, index, and CALC key defined on the tables associated with the named schema
- The view definition of each view derived from one or more of the tables, views, functions, procedures or table procedures associated with the named schema
- For functions and procedures with language SQL, the statement removes the SQL routine body from the dictionary and the associated CA ADS entities and program structures: access module(AM), relational command module (RCM), ADS premap process code and dialog load module

Linked Constraints with Non-empty Tables in Other Schemas

If any tables in the schema to be dropped participate in linked referential constraints with non-empty tables in other schemas, CA IDMS also updates rows of those tables to remove the physical links with the tables being deleted.

Example

Dropping an Empty Schema

The following DROP SCHEMA statement deletes the definition of the SALES schema from the dictionary only if the schema has no associated tables, views, functions, procedures or table procedures:

```
drop schema sales;
```

Note: For more information about defining schemas, see ALTER SCHEMA and CREATE SCHEMA (see page 373).

DROP TABLE

The DROP TABLE data description statement deletes the definition of a base table from the dictionary.

When deleting a table definition, CA IDMS also deletes:

- The data contained in the table
- The CALC key, if any, defined on the table
- Any indexes defined on the table
- Optionally, referential constraints in which the table participates and views derived from the table

Authorization

To issue a DROP TABLE statement, you must own or have the DROP privilege on the table named in the statement.

Note: You need no additional privileges to issue a DROP TABLE statement with the CASCADE parameter.

Syntax

```
►►─── DROP TABLE ─┬──────────────┬─ table-identifier ──────────────►
                  └ schema-name. ┘

 ►─┬─────────┬─────────────────────────────────────────────────────►◄
   └ CASCADE ┘
```

Parameters

table-identifier

Specifies the name of the table being dropped. *Table-identifier* must identify a base table defined in the dictionary.

schema-name

Identifies the schema associated with the named table.

If you do not specify a *schema-name*, the default value is:

- The current schema associated with your SQL session, if the statement is entered through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

CASCADE

Directs CA IDMS to delete the definitions of:

- All referential constraints where the named table is the referencing table or the referenced table
- All views derived from the named table

If you specify CASCADE in a DROP TABLE statement for a table that participates in a linked referential constraint, CA IDMS updates the rows of the other table to remove the physical links with the table being dropped.

Usage

Tables in the SYSTEM Schema

You cannot delete the definition of a table in the SYSTEM schema.

Tables in Views or Referential Constraints

If you do not specify CASCADE in a DROP TABLE statement, the table named in the statement cannot participate in the definition of any view or referential constraint.

Example

Dropping a Table that Contains Data

The following DROP TABLE statement deletes the definition of the OFFICE_POOL table and any data associated with the table. If the table participates in any referential constraint or view definitions, CA IDMS returns an error.

```
drop table office_pool;
```

Note: For more information about defining tables, see ALTER TABLE and CREATE TABLE (see page 378).

DROP TABLE PROCEDURE

The DROP TABLE PROCEDURE data description statement deletes the definition of the referenced table procedure from the dictionary. It is also a CA IDMS extension of the SQL standard.

Authorization

To issue a DROP TABLE PROCEDURE statement, you must own or have the DROP privilege on the table procedure named in the statement.

Syntax

```
►►─── DROP TABLE PROCEDURE ─┬──────────────────┬─ table-procedure-identifier ─►
                            └── schema-name. ──┘

 ►─┬─────────────┬──────────────────────────────────────────────────────────►◄
   └── CASCADE ──┘
```

Parameters

table-procedure-identifier

Specifies the name of the table procedure to be dropped. *Table-procedure-identifier* must identify a table procedure defined in the dictionary.

schema-name

Identifies the schema associated with the specified table procedure. If you do not specify a *schema-name*, the default value is:

- The current schema associated with your SQL session, if the statement is specified through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

CASCADE

Directs CA IDMS to delete any view definition that contains a reference to the table procedure, either directly or nested within some other view reference.

Example

The following DROP TABLE PROCEDURE statement removes the EMP.ORG table procedure from the SQL catalog.

```
drop table procedure emp.org cascade
```

More Information

- For more information about syntax for creating table procedures, see CREATE TABLE PROCEDURE.
- For more information about defining and using table procedures, see Defining and Using Table Procedures.
- For more information about coding the external routines which process procedure references, see Defining and Using Table Procedures.

DROP VIEW

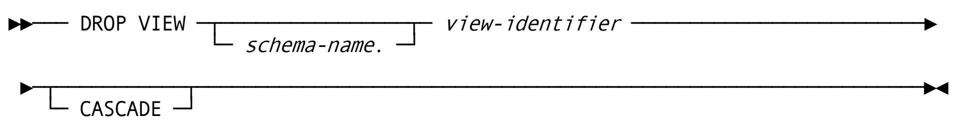
The DROP VIEW data description statement deletes the definition of a view from the dictionary.

Authorization

To issue a DROP VIEW statement, you must own or have the DROP privilege on the view named in the statement.

Note: You need no additional privileges to issue a DROP VIEW statement with the CASCADE parameter.

Syntax



Parameters

view-identifier

Specifies the name of the view being dropped. *View-identifier* must identify a view defined in the dictionary.

schema-name

Identifies the schema associated with the named view.

If you do not specify a *schema-name*, the default value is:

- The current schema associated with your SQL session, if the statement is entered through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

CASCADE

Directs CA IDMS to delete the definitions of all views derived from the named view.

Example

Dropping a View

The following DROP VIEW statement deletes the definitions of the EMP_VACATION view and all views derived from the EMP_VACATION view:

```
drop view emp_vacation cascade;
```

Views that Participate in Other Views

If you do not specify CASCADE in a DROP VIEW statement, the view named in the statement cannot participate in the definition of any other view.

Note: For more information about defining a view, see CREATE VIEW

END DECLARE SECTION

The END DECLARE SECTION statement is a precompiler directive that notifies the precompiler the SQL declare section has ended. You can use this statement only in SQL that is embedded in a program.

Authorization

None required.

Syntax

```
►►─ END DECLARE SECTION ─────────────────────────────────────────►◄
```

Parameter

END DECLARE SECTION.

Notifies the precompiler that the SQL declare section has ended. An SQL declare section contains the definition of one or more host variables.

Example

Beginning and Ending an SQL Declaration Section

In this example, BEGIN DECLARE SECTION begins an SQL declare section and END DECLARE SECTION ends it. The SQL declare section contains the definition of five host variables.

```
WORKING-STORAGE SECTION.
 .
 .
 .
 EXEC SQL BEGIN DECLARE SECTION END-EXEC
   01  HV-EMP-ID           PIC S9(8)     USAGE COMP.
   01  HV-EMP-LNAME        PIC X(20).
   01  HV-SALARY-AMOUNT    PIC S9(6)V(2) USAGE COMP-3.
   01  HV-PROMO-DATE       PIC X(10).
   01  HV-PROMO-DATE-I     PIC S9(4)     USAGE COMP.
 EXEC SQL END DECLARE SECTION END-EXEC
```

More Information

- For more information about beginning an SQL declare section, see BEGIN DECLARE SECTION.
- For more information about declaring host variables, see Host Variables or the *CA IDMS SQL Programming Guide*.

EXECUTE

The EXECUTE statement executes a dynamically-compiled SQL statement other than SELECT. You can use this statement only in SQL that is embedded in a program.

Authorization

None required.

Syntax

```
►►─ EXECUTE statement-name ───────────────────────────────────────────────────►

►─┬─────────────────────────────────────────────────────────────────────────┬─►◄
  └─ USING ─┬─┬────── , ──────────┬────────────────────────────────────────┘
            │ ▼                   │                                       │
            │ └┬─ host-variable ──┬┘                                      │
            │  ├─ local-variable ─┤                                       │
            │  └─ routine-parameter ┘                                     │
            ├─ :dyn-buff sql DESCRIPTOR descriptor-area-name ─────────────┤
            ├─ BULK :bulk-buffer bulk-options ────────────────────────────┤
            └─ BULK :dyn-buff dynamic-bulk-options1 ──────────────────────┘
```

Expansion of bulk-options

```
►►─┬─────────────────────────────────┬──────────────────────────────────────►
   └─ START :start-variable-name ─┘

 ►─┬────────────────────────────────────┬───────────────────────────────────►◄
   └─ ROWS :row-count-variable-name ─┘
```

Expansion of dynamic-bulk-options1

```
►►─┬─────────────────────────────────┬──────────────────────────────────────►
   └─ START :start-variable-name ─┘

 ►── ROWS :row-count-variable-name ─────────────────────────────────────────►

 ►── sql DESCRIPTOR descriptor-area-name ───────────────────────────────────►◄
```

Parameters

statement-name

Identifies the statement being executed.

For detailed information, see Expansion of Statement-name.

USING

Supplies values for the dynamic parameters embedded in the text of the statement.

host-variable

Identifies the host variables from which CA IDMS is to retrieve values for the dynamic parameters. CA IDMS assigns the value of the first host variable to the first dynamic parameter, the second host variable to the second dynamic parameter, and so on.

You must specify the same number of host variables in the USING parameter as the number of dynamic parameter markers in the statement text.

Note: In COBOL, **host-variable** can be an elementary data item or a non-bulk structure. If a non-bulk structure is specified, each sub-element of the structure is counted as a host variable.

Note: For detailed information, see Expansion of Host-variable (see page 79).

local-variable

routine-parameter

Identifies the local variable or routine parameter from which CA IDMS is to retrieve values for the dynamic parameters. CA IDMS assigns the value of the first local variable or routine parameter to the first dynamic parameter, the second local variable or routine parameter to the second dynamic parameter, and so on. You must specify the same number of local variables and routine parameters in the USING parameter as the number of dynamic parameter markers in the statement text.

:dyn-buff

Identifies the variable or bulk-buffer from which CA IDMS is to retrieve values for the dynamic parameters.

Dyn-buff must identify a variable previously declared in the host-language application program or SQL routine.

The size of *dyn-buff* must be sufficient to hold a complete set of dynamic parameter values for a single execution of the statement. If specified as part of the BULK parameter, *dyn-buff* must be sufficient to hold *row-count-variable* sets of dynamic parameters. The format of the data in *dyn-buff* must conform to the description in the SQL descriptor area specified by *descriptor-area-name*

BULK

Directs CA IDMS to execute the statement one or more times and to use a contiguous storage area to retrieve input values for the dynamic parameters. The specification of BULK is a CA IDMS extension of the SQL Standard.

Note: BULK may only be specified if the statement being executed is an INSERT statement.

:bulk-buffer

Identifies a variable from which CA IDMS is to retrieve one or more sets of input values. *Bulk-buffer* must identify a variable previously declared in the host-language application program or SQL routine.

Bulk-buffer must be defined as a multiple-occurring structure having the same number of sub-elements as there are dynamic parameters in the statement.

bulk-options

Optionally specify the location in *bulk-buffer* for the first row and the number of rows to be inserted. Expanded syntax for **bulk-options** immediately follows the statement syntax.

dynamic-bulk-options1

Provides specification for inserting one or more rows into a table.

Expanded syntax for **dynamic-bulk-options1** appears immediately following the expanded syntax for **bulk-options**. Descriptions of **dynamic-bulk-options1** parameters appear above.

Note: *dyn-buff*, *bulk-buffer*, *start-variable-name*, and *row-count-variable-name* are variables that can be host variables or when the statement is used in an SQL routine local variables or routine parameters. In this case, their names must not be preceded with a colon.

Parameters for Expansion of bulk-options

START :*start-variable-name*

Identifies a variable containing the relative position within the bulk buffer from which CA IDMS is to retrieve values for the first row to be inserted. Values in subsequent entries in the bulk buffer are retrieved sequentially, each set corresponding to a row to be inserted.

Start-variable-name must be a variable previously declared in the host-language application program or SQL routine. The value in the variable must be an integer in the natural range of subscripts for arrays in the language in which the application program is written.

If you do not specify the START parameter, CA IDMS retrieves the values from the first entry in the bulk buffer.

ROWS :*row-count-variable-name*

Identifies a variable that specifies the number of rows CA IDMS is to retrieve from the bulk buffer.

Row-count-variable-name must be a variable previously declared in the host-language application program or SQL routine. The value in the variable must be in the range 1 through the number of rows that will fit in the bulk buffer.

If you do not specify the ROWS parameter, CA IDMS retrieves rows from the array sequentially until reaching the end of the buffer.

Parameters for Expansion of dynamic-bulk-options1

An additional parameter is used with *dynamic-bulk-options1*.

SQL DESCRIPTOR

Specifies the SQL descriptor area that describes the format of the dynamic parameter values contained in *dyn-buff*.

descriptor-area-name

Directs CA IDMS to use the named area as the descriptor area. *Descriptor-area-name* must identify an SQL descriptor area.

Usage

Dynamically-compiled SELECT Statements

You cannot use the EXECUTE statement with a dynamically-compiled SELECT statement. To retrieve data using a dynamically-compiled SELECT statement, you must define a cursor and use the FETCH statement.

Use of the Descriptor Area

When describing the format of dynamic parameters with an SQL descriptor area, you can use the INPUT option of the DESCRIBE statement to determine the format of the parameters that CA IDMS has assumed based on the context in which they appear. You can alter the contents of the descriptor area provided that the data types remain compatible. However, all changes to the descriptor area must be made *before the first time the EXECUTE statement for the given dynamically-compiled statement is executed*. The contents of the descriptor area must remain unchanged for each subsequent execution.

Examples

Executing a Dynamically-compiled Statement

The following EXECUTE statement executes the dynamically-compiled statement named DYN_PROJ:

```
EXEC SQL
   EXECUTE DYN_PROJ
END EXEC
```

More Information

- For more information about the dynamic compilation of SQL statements, see the *CA IDMS SQL Programming Guide*.
- For more information about the layout of an SQL descriptor area, see SQL Descriptor Area.

EXECUTE IMMEDIATE

The EXECUTE IMMEDIATE statement dynamically compiles and executes an SQL statement. You can use this statement only in SQL that is embedded in a program.

Authorization

To issue an EXECUTE IMMEDIATE statement, you must have the privileges required to issue the statement being dynamically compiled and executed.

Syntax

```
►►── EXECUTE IMMEDIATE ─┬─ 'sql-statement' ───────────┬──────────────►◄
                        └─ :sql-statement-variable-name ┘
```

Parameters

'sql-statement'

Specifies an SQL statement that can be compiled and executed immediately. *Sql-statement* must be enclosed in single quotation marks. Do not include the SQL prefix or terminator within the statement text.

:sql-statement-variable-name

Identifies a host variable, local variable, or routine parameter containing the statement to be compiled and executed immediately. *Sql-statement-variable-name* must be a variable previously declared in the application program or SQL routine. It must be defined as an elementary data item with no sub-elements. If *sql-statement-variable-name* is a local variable or routine parameter, the colon must not be coded.

Usage

Statements Eligible for Immediate Execution

The following SQL statements can be compiled and executed immediately:

- All access module management, authorization, logical data description, session management, and transaction management statements
- DELETE
- INSERT
- UPDATE

Additionally, all CA IDMS utility and physical data description statements can be compiled and executed immediately.

No Host Variables, Local Variables, or Routine Parameters in a Dynamically Compiled Statement

An SQL statement that is to be compiled dynamically cannot include any host variables, local variables, or routine parameters.

No Dynamic Parameters

An SQL statement that is compiled using the EXECUTE IMMEDIATE statement cannot include any dynamic parameter markers.

Note: For more information about the dynamic compilation of SQL statements, see the *CA IDMS SQL Programming Guide*.

Example

Using a Variable in EXECUTE

The following EXECUTE IMMEDIATE statement directs CA IDMS to dynamically compile and execute the statement contained in the variable DYN-INSERT:

```
EXEC SQL
   EXECUTE IMMEDIATE :DYN-INSERT
END-EXEC
```

EXPLAIN

The EXPLAIN utility statement describes the strategy used to access data in the following statements:

- DECLARE CURSOR
- DELETE
- SELECT
- UPDATE
- INSERT that contains a query specification in its VALUES clause

The description is stored as rows in a table which you can retrieve using a SELECT statement.

The EXPLAIN statement is a CA IDMS extension of the SQL standard.

Authorization

To issue an EXPLAIN statement that specifies:

- An access module, you must own or have the DISPLAY privilege on the access module being explained
- A statement, you must have the privileges required to execute the statement to be explained

Additionally, if the table in which the access plan is to be stored is:

- Already defined in the dictionary, you must own or have the INSERT privilege on the table
- Not already defined in the dictionary, you must:
  - Own the schema associated with the table or have the CREATE and INSERT privileges on the table
  - Have the USE privilege on the area in which rows of the table is stored

Syntax

```
►►─── EXPLAIN ──────────────────────────────────────────────────────────►

►─┬─ access-module-specification ──────────────────────────────────┬──►
  └─ STATEMENT 'sql-statement' ─┬────────────────────────────────┬─┘
                                └─ STATEMENT NUMBER statement-number ─┘

►─┬──────────────────────────────────────────────────────────┬─────────►
  └─ INTO TABLE ─┬──────────────┬─ table-identifier ─┘
                 └─ schema-name. ─┘

►─┬──────────────────────────────────┬─────────────────────────────────►◄
  └─ IN segment-name.area-name ─┘
```

Expansion of access-module-specification

```
►►─── ACCESS MODULE access-module-name ─────────────────────────────────►

►─┬──────────────────────────────────┬─────────────────────────────────►
  └─ VERSION am-version-number ─┘

►─┬──────────────────────────┬─────────────────────────────────────────►◄
  │            ┌───── , ─────┐ │
  └─ MODULE ─▼─ rcm-name ──┴─┘
```

Parameters

access-module-specification

Identifies an access module to be explained. Expanded syntax for **access-module-specification** s presented immediately following the EXPLAIN syntax.

STATEMENT '*sql-statement*'

Directs CA IDMS to return the access strategy for the specified SQL statement. *Sql-statement* must be an explainable statement and must be enclosed in single quotation marks.

STATEMENT NUMBER *statement-number*

Assigns a reference number to the access plan for the statement specified in the STATEMENT parameter. The reference number is stored in the SECTION column in each row of the access plan.

Statement-number must be an integer in the range 0 through 32,767. If not specified, a value of 0 is returned.

INTO TABLE *table-identifier*

Specifies the table in which CA IDMS is to store the access plan. If you do not include the INTO TABLE parameter in an EXPLAIN statement, *table-identifier* is 'ACCESS_PLAN'.

If *table-identifier* does not exist, CA IDMS automatically defines it in the dictionary using the column definitions described in "Usage" following these parameter descriptions. If *table-identifier* identifies an existing table, the table must be defined with the appropriate columns for storing the access plan.

Important! Do not specify "EXPLAIN" as the *schema-name* or *table-identifier* where you will store the access plan. This produces an error message. The syntax parser interprets this as an attempt to perform a second EXPLAIN.

schema-name

Identifies the schema associated with the named table.

If you do not specify *schema-name*, it defaults to:

- The current schema associated with your SQL session, if the statement is entered through the Command Facility or executed dynamically
- The schema associated with the access module used at runtime, if the statement is embedded in an application program

IN *segment-name.area-name*

Identifies the area to be used for storing rows of the table named in the INTO TABLE parameter.

IN parameter information is used only when the INTO TABLE parameter identifies a table that does not exist.

If you do not specify the IN parameter, CA IDMS:

- Uses the default area, if any, for the schema associated with the table named in the INTO TABLE parameter
- Returns an error if the schema does not have a default area

Parameters for Expansion of access-module-specification

ACCESS MODULE *access-module-name*

Directs CA IDMS to describe the access strategy for all the explainable statements in the whole access module or in one or more specified RCMs in the access module.

Access-module-name must identify an access module stored in the DDLCATLOD area of the dictionary. Access modules in this area are represented in the SYSTEM.LOADHDR table.

Note: For more information about the SYSTEM.LOADHDR table, see SYSTEM.LOADHDR.

VERSION *am-version-number*

Specifies the version of the access module being explained.

If *am-version-number* is not specified, the version is 1.

MODULE *rcm-name*

Specifies one or more RCMs to be explained. CA IDMS will describe the access strategy for each explainable statement in each named RCM.

The SECTION value for the first explainable statement in the RCM is 0. The SECTION value for each succeeding explainable statement in the RCM is incremented by 1.

Rcm-name must identify an RCM included in the access module named in the ACCESS MODULE parameter. Multiple RCM names must be separated by commas.

If you do not specify the MODULE parameter with ACCESS MODULE, CA IDMS explains all the RCMs in the named access module.

Usage

Explainable Statements

The explainable statements are DECLARE CURSOR, DELETE, INSERT, SELECT, and UPDATE.

Table ACCESS_PLAN

The columns of the ACCESS_PLAN table are:

Column	Data type	Description
DBNAME	CHAR(8)	Dictionary connection for the session in which EXPLAIN is issued
ESTAMP	TIMESTAMP	Date and time EXPLAIN was issued
SCHEMA	CHAR(18)	Access module schema or, if explaining a statement, current schema for the SQL session
MODULE	CHAR(8)	Access module name or, if explaining a statement, IDMSEXPL
VERSION	SMALLINT	Access module version or, if explaining a statement, 0
STAMP	TIMESTAMP	Date and time access module was created, or, if explaining a statement, the same value as ESTAMP
PROGRAM	CHAR(8)	Program (RCM) name or, if explaining a statement, IDMSEXPL
PVERSION	SMALLINT	Program (RCM) version or, if explaining a statement, 0 (if explaining an access module, a version number of 0 indicates that no RCM version was specified the RCM when included in the access module)
PDICT	CHAR(8)	Program (RCM) dictionary or, if explaining a statement, blanks
PSTAMP	CHAR(20)	Date and time the program (RCM) was created or, if explaining a statement, blanks
SECTION	SMALLINT	Section number assigned to the SQLCSID field during program precompilation, or *statement-number* specified in the EXPLAIN statement

Column	Data type	Description
COMMAND	SMALLINT	Internal command code indicating the type of statement being explained: 8—DECLARE CURSOR 9—DELETE (searched) 10—DELETE (positioned) 17—INSERT 25—SELECT 29—UPDATE (searched) 30—UPDATE (positioned)
QBLOCK	SMALLINT	Query block number. Each query that the statement contains is assigned a block. Blocks are numbered beginning with 1.
STEP	SMALLINT	Step number. This number denotes the sequence of the processing step within the query block.
STYPE	SMALLINT	Step type. This denotes the type of processing for the step: 0—Null 1—Table access 2—Nested loop join 3—Merge join 4—Sort 5—Merge group 6—OR list
PBLOCK	SMALLINT	Parent block number. Parent block numbers indicate nesting of multiple query blocks in a section.
PSTEP	SMALLINT	Parent step number. Parent step numbers correlate rows of query blocks: ■ If a table scan row is owned by a sort or join row, PSTEP is the step number of the owning row. ■ PSTEP of the top row of each main query block is 0. ■ PSTEP of the top row of each subquery is the query block number of the main query block to which it is subordinate.

Column	Data type	Description
TSCHEMA	CHAR(18)	Schema-name qualifier of the accessed table or procedure.
TABLE	CHAR(18)	Name of the accessed table or procedure.
TSTAMP	TIMESTAMP	Date and time the accessed table or procedure was created or last altered, or the date and time the EXPLAIN was issued in case no table or procedure was accessed.
ACMODE	CHAR(1)	Mode of access to the database record underlying the table, when STYPE is 1: 'A'—Area 'C'—CALC 'I'—Index 'M'—Set member 'N'—Insert 'O'—Set owner 'P'—Table procedure 'S'—Sequential 'T'—(Temporary table)
ACNAME	CHAR(18)	Set or index name.
LFS	CHAR(1)	Leaf scan indicator, when ACMODE is I. This indicates whether data is retrieved by sequential access to index leaf pages. 'N'—No 'Y'—Yes
SORTC	CHAR(1)	Composite sort type. A nonblank value in this field indicates an actual sort is required (data cannot be accessed in sort order). 'D'—Distinct 'G'—Group 'M'—Merge join 'O'—Order by
SORTN	CHAR(1)	Inner sort type. This is an actual sort performed for the inner loop of a merge join. 'M'—Merge join
SUBQC	CHAR(1)	Subquery correlation. 'N'—Not correlated 'Y'—Correlated

Step types

Values in the STYPE column describe the type of processing:

Step type	Meaning
1 (Table access)	Access to a single table
2 (Nested loop join)	Join using linked constraint
3 (Merge join)	Join by scanning both tables and sorting the entire result
4 (Sort)	Sort required by an ORDER BY parameter
5 (Merge group)	Sorting required by an aggregate function on distinct column values with the grouped results
6 (OR list)	Sorting required by one or more OR operators in a WHERE clause

Alternatives to the Default ACCESS_PLAN Table

You can use SQL procedures to tailor the way you retrieve and present access strategy information. You can also:

- Create a table with the same column definitions (but, optionally, different column names) as in table ACCESS_PLAN and specify this table when you issue the EXPLAIN statement
- Use the ALTER TABLE statement to add columns to table ACCESS_PLAN, or include additional columns at the end of the column list when you create a table equivalent to ACCESS_PLAN
- Create one or more views of table ACCESS_PLAN

Managing the Contents of an ACCESS_PLAN Table

Each time an EXPLAIN statement is executed; it inserts rows into an ACCESS_PLAN table. Periodically, contents of the table should be deleted using the DELETE statement.

Enhancing the Presentation of Access Strategy Information

Enhancing the Presentation of Access Strategy Information contains an SQL script with the definitions and data for a view that returns the access strategy information in an easy-to-read and understandable format.

Examples

Explaining RCMs in an Access Module

The following EXPLAIN statement returns the access strategy for each explainable statement in the EMPDSP01, EMPDSP02, and EMPDSP03 RCMs in the EMPAM001 access module. CA IDMS stores the access strategy in a table named EMPAM001_ACCESS.

```
explain access module empam001
   module empdsp01, empdsp02, empdsp03
   into table empam001_access;
```

Explaining a Specified Statement

The following EXPLAIN statement returns an access strategy for the specified SELECT statement. The access plan is identified by the reference number 4. By default, CA IDMS stores the access strategy in the ACCESS_PLAN table.

```
explain statement 'select e1.emp_id
   from employee e1, position p1
   where e1.emp_id = p1.emp_id
      and p1.salary_amount >
         (select p2.salary_amount
            from employee e2, position p2
            where e1.emp_id = e2.emp_id
               and e2.manager_id = p2.emp_id)'
   statement number 4;
```

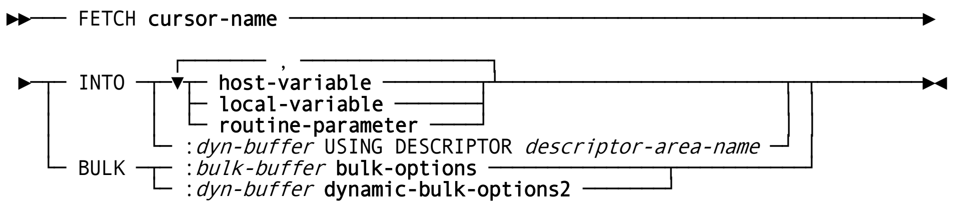
FETCH

The FETCH data manipulation statement retrieves values from the result table associated with a cursor. You can use this statement only in SQL that is embedded in a program.

Authorization

None required.

Syntax


FETCH cursor-name
INTO
,
host-variable
local-variable
routine-parameter
:dyn-buffer USING DESCRIPTOR descriptor-area-name
BULK
:bulk-buffer bulk-options
:dyn-buffer dynamic-bulk-options2

Expansion of bulk-options

```
►►─┬───────────────────────────────┬──────────────────────────────────►
   └─ START :start-variable-name ─┘

 ►─┬──────────────────────────────────┬──────────────────────────────►◄
   └─ ROWS :row-count-variable-name ─┘
```

Expansion of dynamic-bulk-options2

```
►►─┬───────────────────────────────┬──────────────────────────────────►
   └─ START :start-variable-name ─┘

 ►── ROWS :row-count-variable-name ──────────────────────────────────►

 ►── using sql DESCRIPTOR descriptor-area-name ──────────────────────►◄
```

Parameters

cursor-name

Specifies the cursor to be used for retrieving values. **Cursor-name** must identify an open cursor previously defined by a DECLARE CURSOR statement within the application program or by an ALLOCATE CURSOR statement executed within the same SQL transaction.

INTO

Directs CA IDMS to retrieve a single row from the result table associated with the named cursor and to return the column values into the specified locations.

Note: An INTO clause is required for SQL that is imbedded in host programs.

host-variable

Identifies the host variables to which CA IDMS is to assign values retrieved from a result table defined by a query expression. CA IDMS assigns the value in the first result column to the first host variable, the value in the second result column to the second host variable, and so on.

Host-variable must be a host variable declared previously in the host-language application program.

Note: In COBOL, **host-variable** can be a non-bulk structure. For more information, see the *CA IDMS SQL Programming Guide*.

You must specify the same number of host variables in the INTO parameter as the number of columns in the result table. Multiple host variables must be separated by commas. For expanded **host-variable** syntax, see Host Variables.

local-variable

routine-parameter

Identifies the local variable or routine parameter which CA IDMS is to assign values retrieved from a result table defined by a query expression. CA IDMS assigns the value in the first result column to the first local variable or routine parameter, the value in the second result column to the second local variable or routine parameter, and so on. You must specify the same number of local variables and routine parameters in the INTO parameter as the number of columns in the result table.

:*dyn-buffer*

Identifies a variable or a bulk buffer into which CA IDMS is to return all values retrieved from one or more rows of the result table associated with the named cursor.

Dyn-buffer must identify a variable previously declared in the host language application program or SQL routine.

The size of *dyn-buffer* must be sufficient to hold one row of the result table if specified as part of the INTO parameter or *row-count-variable* rows if specified as part of the BULK parameter. The format of the data returned into *dyn-buffer* is determined by the column descriptions in the SQL descriptor area specified in the USING DESCRIPTOR parameter.

USING DESCRIPTOR

Specifies the SQL descriptor area that describes the format in which the columns of the result table are to be returned to the host-language application program or SQL routine.

The specification of a descriptor area is a CA IDMS extension of the SQL standard.

descriptor-area-name

Directs CA IDMS to use the named area as the descriptor area. *Descriptor-area-name* must identify an SQL descriptor area.

For the layout of an SQL descriptor area, see SQL Descriptor Area.

BULK

Directs CA IDMS to retrieve one or more rows from the result table associated with the cursor and to return the column values into a contiguous storage area. The specification of BULK is a CA IDMS extension of the SQL standard.

:*bulk-buffer*

Identifies a variable to which CA IDMS is to assign values retrieved from one or more rows of the result table associated with the named cursor. *Bulk-buffer* must identify a variable previously declared in the host-language application program or SQL routine.

Bulk-buffer must be defined as a multiply-occurring structure having the same number of sub-elements in one occurrence as the number of columns in the result table.

bulk-options

Optionally specify the location in *bulk-buffer* for the first row fetched and/or the number of rows to be fetched from the result table associated with the cursor. Expanded syntax for **bulk-options** immediately follows the statement syntax.

dynamic-bulk-options2

Provides specifications for dynamically retrieving one or more rows from the result table associated with the named cursor.

Expanded syntax for **dynamic-bulk-options2** appears immediately following the expanded syntax for **bulk-options**. Descriptions of **dynamic-bulk-options2** parameters appear above.

Note: Dyn-buff, bulk-buffer, start-variable-name, and row-count-variable-name are variables that can be host variables or when the statement is used in an SQL routine, local variables or routine parameters. In this case, their names must not be preceded with a colon.

Parameters for Expansion of bulk-options

START :*start-variable-name*

Identifies a variable containing the relative position within the bulk buffer to which CA IDMS is to assign the values in the first row retrieved from the result table. Values in subsequent rows of the result table are assigned sequentially to subsequent positions in the bulk buffer.

Start-variable-name must be a variable previously declared in the host-language application program. The value in the variable must be an integer in the range 1 through the number of rows that fit in the bulk buffer.

For languages whose subscript values are relative to 0, the value for *start-variable-name* must be in the range 0 through one less than the number of entries which fit in the bulk buffer.

If you do not specify the START parameter, CA IDMS assigns the values in the first row of the result table to the first row of the array.

ROWS :*row-count-variable-name*

Identifies a variable that specifies the maximum number of rows in the result table CA IDMS is to assign to the bulk buffer.

Row-count-variable-name must be a variable previously declared in the host-language application program. The value in the variable must be an integer in the range 1 through the number of rows that fit in the bulk buffer.

The ROWS parameter must be specified if a USING DESCRIPTOR clause is specified in a BULK parameter.

If you do not specify the ROWS parameter, CA IDMS assigns the rows in the result table to the buffer sequentially until no more rows exist in the result table or the buffer has been filled.

Parameters for Expansion of dynamic-bulk-options2

The following additional parameter is used with *bulk-options* to create *dynamic-bulk-options2*:

descriptor-area-name

Directs CA IDMS to use the named area as the descriptor area. *Descriptor-area-name* must identify an SQL descriptor area.

Usage

Compatible Data Types

The data types of the values retrieved by the FETCH statement and the data types of the variables named in the INTO parameter must be compatible for assignment. If the values are assigned to a buffer defined as an array, the data types of the array elements must be compatible with the data types of the values.

FETCH Execution

When executing a FETCH statement, CA IDMS:

1. Positions a cursor on the next row following the current row
2. Retrieves one or more rows of values from the result table beginning with the new current row
3. Assigns the retrieved values to the specified variables
4. Leaves the cursor positioned on the last row retrieved

No More Rows

CA IDMS returns an SQLCODE value of 100 when any of the following is true:

- The result table associated with the cursor named in the FETCH statement is empty
- The result table associated with the cursor named in the FETCH statement is not empty, and the cursor is positioned after the last row before the statement is executed
- A bulk fetch operation retrieves fewer rows than are requested in the FETCH statement

In each case, CA IDMS leaves the cursor positioned after the last row.

Use of the Descriptor Area

When you use dynamic SQL to return data to a host-language application program in a form different from that in which it is stored in the database, you can modify the data characteristics in the SQL descriptor area named in the FETCH statement. You must make any changes to the descriptor area *before the first fetch operation*. You should not change the contents of the descriptor area after the first fetch operation and before the closing of the cursor.

Static and Dynamic Cursors

The format of the output of a static cursor is known at compile time. The format of the output of a dynamic cursor is often not known at compile time. Typically, you specify *dyn-buffer* when the cursor is dynamic, such as when the SELECT statement associated with the cursor is not known at compile time.

Examples

Fetching Multiple Rows

The following FETCH statement retrieves values from a result table defined by PROJ_CURSOR. Descriptions of the data in the output buffer are in a descriptor area named BUFF-1-SQLDA. The retrieved values are assigned to the CURSOR-BUFF-1 buffer, starting at the position in the buffer indicated by the value in BUFF-1-START. The value in BUFF-1-ROWS determines the number of rows retrieved.

```
EXEC SQL
   FETCH PROJ_CURSOR
      BULK :CURSOR-BUFF-1
         START :BUFF-1-START
         ROWS :BUFF-1-ROWS
         USING DESCRIPTOR BUFF-1-SQLDA
END-EXEC
```

Fetching a Single Row

The following FETCH statement retrieves values from one row of the BONUS_CURSOR cursor. The values are assigned to the host variables EMP-ID and BONUS-AMT which have an associated indicator variable.

```
EXEC SQL
   FETCH BONUS_CURSOR
      INTO :EMP-ID, :BONUS-AMT :BONUS-IND
END-EXEC
```

More Information

- For more information about defining and manipulating cursors, see CLOSE, DECLARE CURSOR, and OPEN.
- For more information about host variables, local variables or routine parameters, see Host Variables, Local Variables (see page 81) or Routine Parameters.
- For more information about compatible data types for assignment operations, see Comparison, Assignment, Arithmetic, and Concatenation Operations.
- For more information about the SQL descriptor area, see the *CA IDMS Navigational DML Programming Guide*.

GET DIAGNOSTICS

The GET DIAGNOSTICS statement extracts information on exception or completion conditions of the last executed SQL statement from the diagnostics area and returns it to the issuer. Use this statement in SQL that is embedded in a program.

Syntax

```
►─ GET DIAGNOSTICS ─┬─ statement-info ──────────────────────────────────────►◄
                    ├─ CONDITION ─┬─ condition-nr condition-info ─┘
                    └─ EXCEPTION ─┘
```

Expansion of statement-info

```
   ┌─────────────────────────────────── , ───────────────────────────────────┐
►─ ▼ ─┬─ routine-parameter ─────── = ────┬─ COMMAND_FUNCTION ──────────────┴──►◄
      ├─ host-variable ─────┤            ├─ COMMAND_FUNCTION_CODE ─────────┤
      └─ local-variable ────┘            ├─ DYNAMIC_FUNCTION ──────────────┤
                                         ├─ DYNAMIC_FUNCTION_CODE ─────────┤
                                         ├─ IDMS_RETURNED_RESULT_SETS ─────┤
                                         ├─ MORE ──────────────────────────┤
                                         ├─ NUMBER ────────────────────────┤
                                         └─ ROW_COUNT ─────────────────────┘
```

Expansion of condition-info

```
   ┌─────────────────────────────────── , ───────────────────────────────────┐
►─ ▼ ─┬─ routine-parameter ─────── = ────┬─ IDMS_MESSAGE_COMMENTS ─────────┴──►◄
      ├─ host-variable ─────┤            ├─ IDMS-MESSAGE_DEFINITION ───────┤
      └─ local-variable ────┘            ├─ IDMS_MESSAGE_ID ───────────────┤
                                         ├─ IDMS_MODULE_NUMBER ────────────┤
                                         ├─ IDMS_REASON_CODE ──────────────┤
                                         ├─ IDMS_SQLCODE ──────────────────┤
                                         ├─ IDMS_TASK_ID ──────────────────┤
                                         ├─ MESSAGE_LENGTH ────────────────┤
                                         ├─ MESSAGE_TEXT ──────────────────┤
                                         └─ RETURNED_SQLSTATE ─────────────┘
```

Parameters

A **routine-parameter**, **host-variable**, or **local-variable** must be specified for each statement-info or condition-info item.

statement-info

Identifies the type of statement information to be extracted and returned. **Statement-info** names that begin with 'IDMS_' are extensions to the SQL standard.

CONDITION

Requests diagnostic information for a condition.

condition-nr

Specifies the number of the completion or exception condition for which diagnostics information is being requested. An exception is raised if *condition-nr* does not refer to a valid condition number.

condition-info

Identifies the type of condition-related information to be extracted and returned. **Condition-info** names that begin with 'IDMS_' are extensions to the SQL standard.

EXCEPTION

Specifies a synonym for CONDITION. While it is part of the current SQL standard, its use is discouraged because it will not be in future SQL standards.

Parameters for Expansion of statement-info

routine-parameter

Identifies an SQL routine parameter that is to receive the value of the specified diagnostics item. **Routine-parameter** must be a parameter of the current SQL routine and must be compatible for assignment with the specified diagnostic item.

See Expansion of Routine-parameter for information about expanded syntax.

host-variable

Identifies a host variable that is to receive the value of the specified diagnostics item. **Host-variable** must be a host variable previously declared in the application program and must be compatible for assignment with the specified diagnostic item.

See Expansion of Host-variable for information about expanded syntax.

local-variable

Identifies a local variable of an SQL routine that is to receive the value of the specified diagnostics item. **Local-variable** must be a local variable declared in the current SQL routine and must be compatible for assignment with the specified diagnostic item.

See Expansion of Local-variable for information about expanded syntax.

COMMAND_FUNCTION

Returns a value with data type varchar (64) indicating the type of SQL command that was last executed. The values that may be returned are listed under the Statement Type column in Table Procedure Requests.

COMMAND_FUNCTION_CODE

Returns a value with data type integer indicating the type of SQL command that was last executed. The values that may be returned are listed under the Command Number column in Table Procedure Requests.

DYNAMIC_FUNCTION

Returns a value with data type varchar (64) indicating the type of SQL command that was prepared or dynamically executed by the last command. The values that may be returned are listed under the Statement Type column in Table Procedure Requests.

DYNAMIC_FUNCTION_CODE

Returns a value with data type integer indicating the type of SQL command that was prepared or dynamically executed by the last command. The values that may be returned are listed under the Command Number column in Table Procedure Requests.

IDMS_RETURNED_RESULT_SETS

Returns a value with data type integer indicating the number of result sets returned by a procedure invoked by the last command. This value is only valid if the diagnosed statement is a call or select of an SQL invoked procedure.

MORE

Returns a value with data type char(1). A value of 'Y' indicates that the execution of the previous SQL statement caused more conditions than have been set in the diagnostics area. A value of 'N' means that the diagnostics area contains information on all the completion and exception conditions.

NUMBER

Returns a value with data type integer indicating the number of the exceptions or completion conditions set by the execution of the previous SQL statement for which information is available in the diagnostics area.

ROW_COUNT

Returns a value with data type DEC(31). The value depends on the type of the previously executed statement:

- INSERT - Number of rows inserted
- DELETE - Number of rows deleted
- UPDATE - Number of rows updated
- BULK FETCH - Number of rows fetched
- FETCH - 1 or 0

Parameters for Expansion of condition-info

IDMS_MESSAGE_COMMENTS

Returns a value with data type varchar(4000) containing the comments in the message dictionary for the message associated with the condition.

IDMS_MESSAGE_DEFINITION

Returns a value with data type varchar(4000) containing the definition in the message dictionary of the message associated with the condition.

IDMS_MESSAGE_ID

Returns a value with data type char(8) containing the message ID in the message dictionary of the message associated with the condition.

IDMS_MODULE_NUMBER

Returns a value with data type integer containing the number of the module that detected the condition.

IDMS_REASON_CODE

Returns a value with data type integer containing the reason code of the condition.

IDMS_SQLCODE

Returns a value with data type integer containing the SQLCODE value associated with the condition.

IDMS_TASK_ID

Returns a value with data type integer containing the IDMS task ID of the task that encountered the condition.

MESSAGE_LENGTH

Returns a value with data type integer indicating the length of the message associated with the specified condition.

MESSAGE_TEXT

Returns a value with data type varchar(256) containing the message text associated with the specified condition.

RETURNED_SQLSTATE

Returns a value with data type char(5) indicating the SQLSTATE associated with the specified condition.

Example

The procedure TGETDIAG1 executes a SELECT statement that causes a number of string truncations. The first GET DIAGNOSTICS returns the number of conditions that the SELECT statement raised. A WHILE LOOP containing the second GET DIAGNOSTICS concatenates the message texts of all the raised conditions to the RESULT parameter of the procedure.

```
set options command delimiter '++';
create procedure SQLROUT.TGETDIAG1
  ( TITLE    varchar(10) with default
  , P_NAME   char(18)
  , P_NUMBER integer
  , RESULT   varchar(512)
  )
    EXTERNAL NAME TGETDIAG LANGUAGE SQL
begin not atomic
  declare L_NUMBER  integer      default 1;
  declare L_MESSAGE varchar(256) default ' ';
  select NAME into P_NAME from system.schema
   where cast(NAME as char(12)) = P_NAME;
  /* retrieve the number of conditions raised */
  get diagnostics P_NUMBER = NUMBER;
  while (L_NUMBER < = P_NUMBER)
    do
      /* retrieve the message text of the raised condition */
      get diagnostics condition L_NUMBER
        L_MESSAGE = MESSAGE_TEXT
      set RESULT = RESULT || ' ' || L_MESSAGE;
      set L_NUMBER = L_NUMBER + 1;
    end while;
end
++
commit++
set options command delimiter default++

call SQLROUT.TGETDIAG1('TGETDIAG1', 'SYSTEM');
*+
*+ TITLE      P_NAME                P_NUMBER
*+ -----      ------                --------
*+ TGETDIAG1  SYSTEM                       4
*+
*+ RESULT
*+ ------
*+ DB001043 T171 C1M322: String truncation DB001043 T171 C1M322:
*+ String truncation DB001043 T171 C1M322: String truncation
*+ DB001043 T171 C1M322: String truncation
```

GET STATISTICS

The GET STATISTICS statement returns statistical information for the current transaction. It is a CA IDMS extension to the SQL standard. Use this statement in SQL that is embedded in a program, in the SQL command facility, and in the command console of CA IDMS Visual DBA.

Syntax

```
►── GET STATISTICS ── transaction-info ─────────────────────────────────────►◄
```

Expansion of transaction-info

```
   ┌───────────────────────── , ─────────────────────────────────────┐
►─ ▼ ─┬──────────────────────────────────┬┬─ SQL_COMMANDS ────────────────┬┴──────────►◄
      ├─ routine-parameter ─────┬─ = ─┘├─ ROWS_FETCHED ────────────────┤
      ├─ host-variable ─────────┤      ├─ ROWS_INSERTED ───────────────┤
      └─ local-variable ────────┘      ├─ ROWS_UPDATED ────────────────┤
                                       ├─ ROWS_DELETED ────────────────┤
                                       ├─ SORT ────────────────────────┤
                                       ├─ ROWS_SORTED ─────────────────┤
                                       ├─ MIN_ROWS_SORTED ─────────────┤
                                       ├─ MAX_ROWS_SORTED ─────────────┤
                                       ├─ AM_RECOMPILES ───────────────┤
                                       ├─ PAGES_READ ──────────────────┤
                                       ├─ PAGES_WRITTEN ───────────────┤
                                       ├─ PAGES_REQUESTED ─────────────┤
                                       ├─ CALC_TARGET ─────────────────┤
                                       ├─ CALC_OVERFLOW ───────────────┤
                                       ├─ VIA_TARGET ──────────────────┤
                                       ├─ VIA_OVERFLOW ────────────────┤
                                       ├─ RECORDS_REQUESTED ───────────┤
                                       ├─ RECORDS_CURRENT ─────────────┤
                                       ├─ CALLS_DBMS ──────────────────┤
                                       ├─ FRAGMENTS_STORED ────────────┤
                                       ├─ RECORDS_RELOCATED ───────────┤
                                       ├─ TOTAL_LOCKS ─────────────────┤
                                       ├─ SHARE_LOCKS_HELD ────────────┤
                                       ├─ NON_SHARE_LOCKS_HELD ────────┤
                                       ├─ TOTAL_LOCKS_FREED ───────────┤
                                       ├─ SR8_SPLITS ──────────────────┤
                                       ├─ SR8_SPAWNS ──────────────────┤
                                       ├─ SR8_STORED ──────────────────┤
                                       ├─ SR8_ERASED ──────────────────┤
                                       ├─ SR7_STORED ──────────────────┤
                                       ├─ SR7_ERASED ──────────────────┤
                                       ├─ B_TREE_SEARCH ───────────────┤
                                       ├─ B_TREE_LEVELS_SEARCH ────────┤
                                       ├─ ORPHANS_ADOPTED ─────────────┤
                                       ├─ LEVELS_SEARCH_BEST_CASE ─────┤
                                       ├─ LEVELS_SEARCH_WORST_CAS ─────┤
                                       ├─ RECORDS_UPDATED ─────────────┤
                                       ├─ SHARE_LOCKS_ACQ_CALL ────────┤
                                       ├─ SHARE_LOCKS_FREED_CALL ──────┤
                                       ├─ NON_SHARE_LOCKS_ACQ_CALL ────┤
                                       ├─ NON_SHARE_LOCKS_FREED_CALL ──┤
                                       └──────────── * ────────────────┘
```

Parameters

routine-parameter

Identifies an SQL routine parameter that is to receive the value of the specified statistics item. **Routine-parameter** must be a parameter of the current SQL routine and must be compatible for assignment with the specified statistics item.

See Expansion of Routine-parameter for information about expanded syntax.

host-variable

Identifies a host variable that is to receive the value of the specified statistics item. **Host-variable** must be a host variable previously declared in the application program and must be compatible for assignment with the specified statistics item.

For more information about expanded syntax, see Expansion of Host-variable.

local-variable

Identifies a local variable of an SQL routine that is to receive the value of the specified statistics item. **Local-variable** must be a local variable declared in the SQL-invoked routine and must be compatible for assignment with the specified statistics item.

For more information about expanded syntax, see Expansion of Local-variable.

Note: A routine-parameter, host-variable or local-variable must be specified for each transaction-info when the statement is embedded in a program. Otherwise, these must not be specified.

transaction-info

Identifies the type of transaction information that is to be returned. Each item has an integer data type and represents statistical information for the current transaction.

Note: For more information about these items, see the DCMT DISPLAY STATISTICS SYSTEM and DCMT DISPLAY TRANSACTION commands in the *CA IDMS System Tasks and Operator Commands Guide*.

*****

Requests that all **transaction-info** items are to be retrieved. This is not allowed in combination with the specification of a **routine-parameter**, **host-variable**, or **local-variable** and therefore cannot be used in a program.

Example

The SQL procedure TGETSTA1 counts the number of rows of one of four tables:

- SYSTEM.TABLE
- SYSTEM.COLUMN
- SYSTEM.SCHEMA
- DEMOEMPL.EMPLOYEE

The actual table is selected through the value of the TITLE parameter. Besides returning the count of rows, the procedure also returns the values of a number of statistical information items for the transaction:

- SQL_COMMANDS
- PAGES_REQUESTED
- PAGES_READ
- CALLS_DBMS
- TOTAL_LOCKS

```
set options command delimiter '++';
drop procedure   SQLROUT.TGETSTA1++
create procedure SQLROUT.TGETSTA1
  ( TITLE            char(8) with default
  , P_COUNT          integer
  , P_SQL_COMMANDS   integer
  , P_PAGES_REQUESTED integer
  , P_PAGES_READ     integer
  , P_CALLS_DBMS     integer
  , P_TOTAL_LOCKS    integer
  )
    EXTERNAL NAME TGETSTA1 LANGUAGE SQL
Lab1: begin not atomic
 case TITLE
   when 'TABLE'
     then  select count(*) into P_COUNT
           from SYSTEM.TABLE;
   when 'COLUMN'
     then  select count(*) into P_COUNT
           from SYSTEM.COLUMN;
   when 'SCHEMA'
     then  select count(*) into P_COUNT
           from SYSTEM.SCHEMA;
   when 'EMPLOYEE'
     then  select count(*) into P_COUNT
           from DEMOEMPL.EMPLOYEE;
  end case;
 get statistics
    P_SQL_COMMANDS    = sql_commands
  , P_PAGES_REQUESTED = pages_requested
  , P_PAGES_READ      = pages_read
  , P_CALLS_DBMS      = calls_dbms
  , P_TOTAL_LOCKS     = total_locks;
end
++
set options command delimiter default ++

call sqlrout.TGETSTA1('TABLE');
*+
*+ TITLE        P_COUNT  P_SQL_COMMANDS  P_PAGES_REQUESTED  P_PAGES_READ
*+ -----        -------  --------------  -----------------  ------------
*+ TABLE            808               2                836             9
*+
*+ P_CALLS_DBMS  P_TOTAL_LOCKS
*+ ------------  -------------
*+          813           1673

call sqlrout.TGETSTA1('COLUMN');
*+
*+ TITLE        P_COUNT  P_SQL_COMMANDS  P_PAGES_REQUESTED   P_PAGES_READ
*+ -----        -------  --------------  -----------------   ------------
*+ COLUMN          6450               3               8953           1068
*+
*+ P_CALLS_DBMS  P_TOTAL_LOCKS
*+ ------------  -------------
*+         8071           8300

call sqlrout.TGETSTA1('SCHEMA');
*+
*+ TITLE        P_COUNT  P_SQL_COMMANDS  P_PAGES_REQUESTED   P_PAGES_READ
*+ -----        -------  --------------  -----------------   ------------
*+ SCHEMA            56               4                 59              2
*+
*+ P_CALLS_DBMS  P_TOTAL_LOCKS
*+ ------------  -------------
*+           61            130

call sqlrout.TGETSTA1('EMPLOYEE');
*+
*+ TITLE        P_COUNT  P_SQL_COMMANDS  P_PAGES_REQUESTED   P_PAGES_READ
*+ -----        -------  --------------  -----------------   ------------
*+ EMPLOYEE          55               5                 58              2
*+
*+ P_CALLS_DBMS  P_TOTAL_LOCKS
*+ ------------  -------------
*+           60            128
```

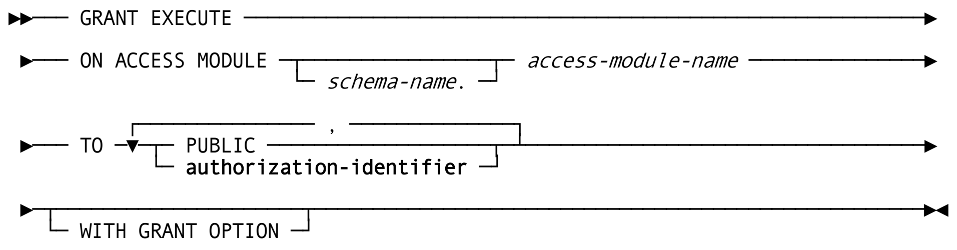
GRANT Access Module Execution Privilege

The GRANT Access Module Execution Privilege authorization statement gives one or more users or groups the privilege of executing a specified access module. The GRANT EXECUTE statement is a CA IDMS extension of the SQL standard.

Authorization

To grant access module execution privilege, you must own the access module, hold grantable privilege on the access module, or hold DBADMIN privilege on the dictionary that contains the access module.

Syntax



Parameters

ON ACCESS MODULE *access-module-name*

Specifies the access module to which the EXECUTE privilege applies.

schema-name

Identifies the schema associated with *access-module-name*.

If you do not specify *schema-name*, it defaults to the current schema in effect for your SQL session.

TO

Identifies the users to whom you are giving the EXECUTE privilege.

PUBLIC

Specifies all users.

authorization-identifier

Identifies a user or group. For expanded **authorization-identifier** syntax, see Expansion of Authorization-identifier.

WITH GRANT OPTION

Gives the privilege of granting the EXECUTE privilege on the named access module to the users identified in the TO parameter. The owner of the resource, a holder of the applicable DBADMIN privilege, or a holder of SYSADMIN privilege can specify WITH GRANT OPTION

A privilege granted with the WITH GRANT OPTION is called a grantable privilege.

Usage

Multiple Access Modules in One GRANT EXECUTE Statement

You can grant privileges on multiple access modules in a single GRANT statement by using an asterisk (*) as a wildcard character. A wildcard character represents one or more characters omitted from a string.

If used, the asterisk must be the last character in *access-module-name*. If *access-module-name* ends with an asterisk, the name represents all the access modules whose names match the pattern established.

For example, the access module name TST* in a GRANT EXECUTE statement represents all access modules whose names start with TST in the specified or current schema.

Duration of Privileges

Users hold the EXECUTE privilege granted on an access module until the privilege is explicitly taken away by means of the REVOKE EXECUTE statement.

Privileges Granted to Groups

When you grant a privilege to a group, each user in the group holds the privilege. If you subsequently add a user to the group, that user also holds the privilege. If you drop a user from the group, that user longer holds the privilege.

Access Modules in Categories

Although you can grant the EXECUTE privilege on a specified access module, the more typical method is to grant the privilege on a category that includes multiple access modules. The use of categories for granting the EXECUTE privilege reduces overhead and provides better performance in a multiuser environment.

Executing an Access Module

To execute an access module, the *owner* of the access module must have the authority to execute all statements in the access module.

To execute an access module, a user other than the owner must:

- Hold the EXECUTE privilege on the access module
- If CA IDMS internal security is in effect, the owner of the access module must have the right to grant the privileges necessary to execute the SQL statements in the access module
- If external security is in effect, the executing user must have the authority to execute statements in the access module

Example

Granting the EXECUTE Privilege

The following GRANT EXECUTE statement gives the EXECUTE privilege on all access modules in the HR schema that begin with EMP to the users in the groups PER_GRP_1 and PER_GRP_2:

```
grant execute
   on access module hr.emp*
   to per_grp_1, per_grp_2;
```

More Information

- For more information about revoking the EXECUTE privilege, see REVOKE Execution Privilege.
- For more information about CA IDMS internal security and about external security for CA IDMS resources, see the *CA IDMS Security Administration Guide*.

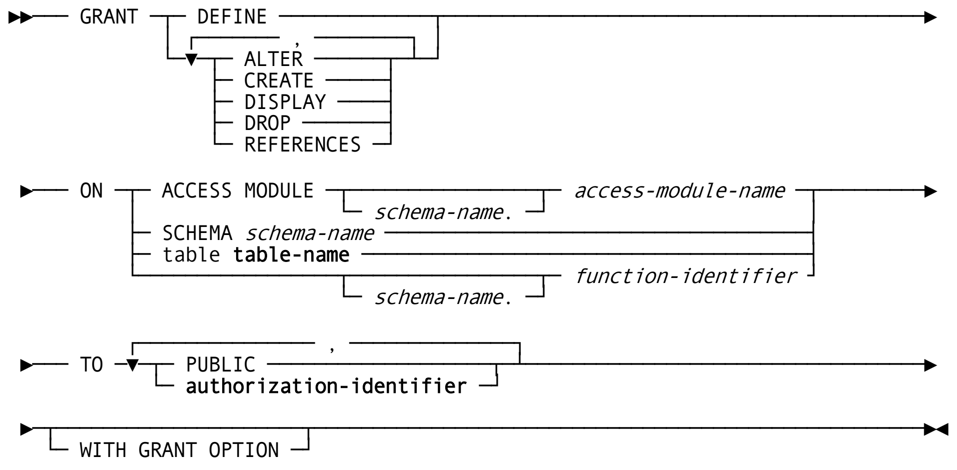
GRANT Definition Privileges

The GRANT Definition Privileges authorization statement gives one or more users the privilege of performing selected actions on a specified access module, schema, table, view, procedure or table procedure. It is also a CA IDMS extension of the SQL standard.

Authorization

To issue a GRANT statement for a definition privilege, you must own the resource, hold grantable privilege on the resource, or hold DBADMIN privilege on the dictionary containing the definition.

Syntax



Parameters

DEFINE

Gives the ALTER, CREATE, DISPLAY, DROP, and REFERENCES privileges, as applicable on the resource identified in the ON parameter to the users or groups identified in the TO parameter.

ALTER

Gives the ALTER privilege on resource identified in the ON parameter to the users or groups identified in the TO parameter.

The ALTER privilege on a resource allows you to modify the definition of the resource.

CREATE

Gives the CREATE privilege on the resource identified in the ON parameter to the users or groups identified in the TO parameter.

The CREATE privilege on a resource allows you to define the resource.

DISPLAY

Gives the DISPLAY privilege on the resource identified in the ON parameter to the users or groups identified in the TO parameter.

The DISPLAY privilege on an access module allows you to execute the EXPLAIN statement on the access module.

DROP

Gives the DROP privilege on the resource identified in the ON parameter to the users or groups identified in the TO parameter.

The DROP privilege on a resource allows you to delete the definition of the resource.

REFERENCES

Gives the REFERENCES privilege on the resource identified in the ON parameter to the users or groups identified in the TO parameter.

The REFERENCES privilege on a table allows a user to define referential constraints in which the table is the referenced table.

ON

Specifies the resource to which the definition privileges apply.

ACCESS MODULE *access-module-name*

Specifies that the privileges apply to any version of *access-module-name* in the associated schema.

schema-name

Identifies the schema associated with *access-module-name*.

If you do not specify *schema-name*, it defaults to the current schema in effect for your SQL session.

SCHEMA *schema-name*

Identifies an SQL schema.

table table-name

Identifies a table, view, procedure or table procedure.

If **table-name** does not include schema name qualifier, the schema name qualifier defaults to the current schema in effect for your SQL session.

schema-name

Specifies the schema with which the function identified by function-identifier is associated. If schema-name is not specified, the schema defaults to the current schema in effect for your SQL session.

function-identifier

Identifies the function.

TO

Identifies the users to whom you are giving the definition privileges.

PUBLIC

Specifies all users.

authorization-identifier

Identifies a user or group. For expanded **authorization-identifier** syntax, see Expansion of Authorization-identifier.

WITH GRANT OPTION

Gives the privilege of granting the specified definition privileges on the named resource to the users identified in the TO parameter. Only the owner of the resource or a user holding the DBADMIN privilege can specify WITH GRANT OPTION.

A privilege granted with the WITH GRANT OPTION is called a grantable privilege.

Usage

Multiple Entities in One GRANT Statement

You can grant privileges on multiple entities of the same type in a single GRANT statement by using an asterisk (*) as a wildcard character. A wildcard character represents one or more characters omitted from a string.

If used, the asterisk must be the last character in the resource name. The asterisk can replace all or part of:

- *Access-module-name*
- *Schema-name* on the SCHEMA parameter
- *Table-identifier*, *view-identifier*, *procedure-identifier* or *table-procedure-identifier* in **table-name**
- *Function-identifier*

A resource name with an asterisk represents all the entities of the same type whose names match the pattern established by the name with the asterisk. For example, the access module name ACC* in a GRANT statement represents all access modules whose names start with ACC in the specified or current schema.

The DEFINE Keyword

When you use the DEFINE keyword with a GRANT statement, you grant a set of definition privileges on a resource to one or more users or groups.

When you use the DEFINE keyword with a REVOKE statement, you revoke any definition privileges that have been previously granted on the resource from the specified users or groups.

This means that if you GRANT CREATE privilege on a table, you can revoke the privilege with a REVOKE SELECT statement or a REVOKE DEFINE statement. Using REVOKE DEFINE is an efficient technique when you intend to revoke all definition privileges on a table from a user or group, whether the privileges were granted singly or as a set.

Similarly, you can GRANT DEFINE on a table to a user and then REVOKE DELETE on the table from the same user as a way to grant all but one definition privilege.

Duration of Privileges

Users hold privileges granted on a resource until the privileges are explicitly taken away by means of the REVOKE statement.

Privileges Granted to Groups

When you grant a privilege to a group, each user in the group holds the privilege. If you subsequently add a user to the group, that user also holds the privilege. If you drop a user from the group, that user longer hold the privilege.

Example

Granting Privileges on a Schema

The following GRANT statement gives the ALTER, CREATE, DISPLAY, and DROP privileges on all schemas that begin with DSF to user DSF. The statement also gives user DSF the privilege of granting the same privileges to other users.

```
grant define
   on schema dsf*
   to dsf
   with grant option;
```

More Information

- For more information about definition privileges, see REVOKE SQL Definition Privileges.
- For more information about granting privileges, see your security administrator.

GRANT Table Access Privileges

The GRANT Table Access Privileges authorization statement gives one or more users or groups the privilege of performing selected actions on a specified table, view, function, procedure or table procedure.

Authorization

To issue a GRANT statement for a table privilege, you must own the table, view, function, procedure, or table procedure, hold the corresponding grantable privilege on the table, view, procedure or table procedure, or hold the DBADMIN privilege on the database that contains the table, view, function, procedure, or table procedure.

Syntax

```
►►── GRANT ──┬─ ACCESS ─────────────────────────────────────────────────────►
             │ ┌────── , ──────┐ │
             └─▼─┬─ DELETE ─┬──┘─┘
                 ├─ INSERT ─┤
                 ├─ SELECT ─┤
                 └─ UPDATE ─┘

►── ON table ─┬─ table-name ───────────────────────────────────────────────►
              └─┬─────────────────┴───────────────── function-identifier ┘
                └─ schema-name. ─┘

►── TO ─┬──────────── , ─────────────┐
        ▼─┬─ PUBLIC ─────────────────┤──────────────────────────────────────►
          └─ authorization-identifier ┘

►─┬─────────────────────┬───────────────────────────────────────────────────►◄
  └─ WITH GRANT OPTION ─┘
```

Parameters

ACCESS

Gives the DELETE, INSERT, SELECT, and UPDATE privileges on the table, view, function, procedure or table procedure identified in the ON parameter to the users or groups identified in the TO parameter.

The ACCESS parameter is a CA IDMS extension of the SQL standard.

DELETE

Gives the DELETE privilege on the table, view, or table procedure identified in the ON parameter to the users or groups identified in the TO parameter.

The DELETE privilege on a table, view, or table procedure allows you to delete rows from the table or view.

INSERT

Gives the INSERT privilege on the table, view, or table procedure identified in the ON parameter to the users or groups identified in the TO parameter.

The INSERT privilege on a table, view, or table procedure allows you to insert rows into the table or view.

SELECT

Gives the SELECT privilege on the table, view, function, procedure or table procedure identified in the ON parameter to the users or groups identified in the TO parameter.

The SELECT privilege on a table, view, function, procedure or table procedure allows you to:

- Retrieve data from the table, view, function, procedure or table procedure
- Name the table, view, function, procedure or table procedure in a subquery

UPDATE

Gives the UPDATE privilege on the table, view, or table procedure identified in the ON parameter to the users or groups identified in the TO parameter.

The UPDATE privilege on a table, view, or table procedure allows you to modify data in the table or through the view.

ON table table-name

Identifies the table, view, procedure or table procedure to which the table access privileges apply.

If **table-name** does not include schema name qualifier, the schema name qualifier defaults to the current schema in effect for your SQL session.

The optional keyword TABLE is a CA IDMS extension of the SQL standard. See Expansion of Table-name for expanded **table-name** syntax.

schema-name

Optional qualifier of the function-identifier. If not specified the schema name qualifier defaults to the current schema in effect for your SQL session.

function-identifier

Identifies the function to which the access privilege applies.

TO

Identifies the users to whom you are giving table access privileges.

PUBLIC

Specifies all users.

authorization-identifier

Identifies a user or group. For expanded **authorization-identifier** syntax, see Expansion of Authorization-identifier.

WITH GRANT OPTION

Gives the privilege of granting the specified privileges on the named table, view, procedure or table procedure to the users identified in the TO parameter. The owner of the resource, a holder of the applicable DBADMIN privilege, or a holder of SYSADMIN privilege can specify WITH GRANT OPTION.

A privilege granted with the WITH GRANT OPTION is called a grantable privilege.

Usage

Multiple Tables and Views in One GRANT Statement

You can grant privileges on multiple tables, views, functions, procedures and table procedures in a single GRANT statement by using an asterisk (*) as a wildcard character. A wildcard character represents one or more characters omitted from a string.

If used, the asterisk must be the last character in the table, view, function, procedure or table procedure identifier in **table-name** or **function-identifier**. A table, view, function, procedure or table procedure identifier with an asterisk represents all the tables, views, and table procedures whose identifiers match the pattern established by the identifier with the asterisk.

For example, the table, view, function, procedure or table procedure identifier EST* in a GRANT statement represents all tables, views, procedures and table procedures whose identifiers start with EST in the specified or current schema.

Duration of Privileges

Users hold privileges granted on a table, view, function, procedure or table procedure until the privileges are explicitly taken away by means of the REVOKE statement.

The ACCESS Keyword

When you use the ACCESS keyword with a GRANT statement, you grant a set of access privileges on a table, view, function, procedure or table procedure to one or more users or groups.

When you use the ACCESS keyword with a REVOKE statement, you revoke any access privileges that have been previously granted on the table, view, function, procedure or table procedure from the specified users or groups.

This means that if you GRANT SELECT privilege on a table, you can revoke the privilege with a REVOKE SELECT statement or a REVOKE ACCESS statement. Using REVOKE ACCESS is an efficient technique when you intend to revoke all access privileges on a table from a user or group, whether the privileges were granted singly or as a set.

Similarly, you can GRANT ACCESS on a table to a user and then REVOKE DELETE on the table from the same user as a way to grant all but one table access privilege.

Privileges Granted to Groups

When you grant a privilege to a group, each user in the group holds the privilege. If you subsequently add a user to the group, that user also holds the privilege. If you drop a user from the group, that user no longer holds the privilege.

Example

Granting Selected Privileges on a Table

The following GRANT statement gives the SELECT and UPDATE privileges on the EMPLOYEE table to users KRP, SAE, and PGD:

```
grant select, update
   on employee
   to krp, sae, pgd;
```

More Information

- For more information about revoking table access privileges, see REVOKE Table Access Privileges.
- For more information about granting privileges, see your security administrator.

INCLUDE

The INCLUDE precompiler directive statement directs the precompiler to create host variable definitions for a specified structure or table in the application program. You can use this statement only in SQL that is embedded in a program.

The INCLUDE statement is a CA IDMS extension of the SQL standard.

Authorization

To issue an INCLUDE statement that specifies:

- A table, you must own or have the SELECT privilege on the table
- SQLCA or SQLDA no privileges are required

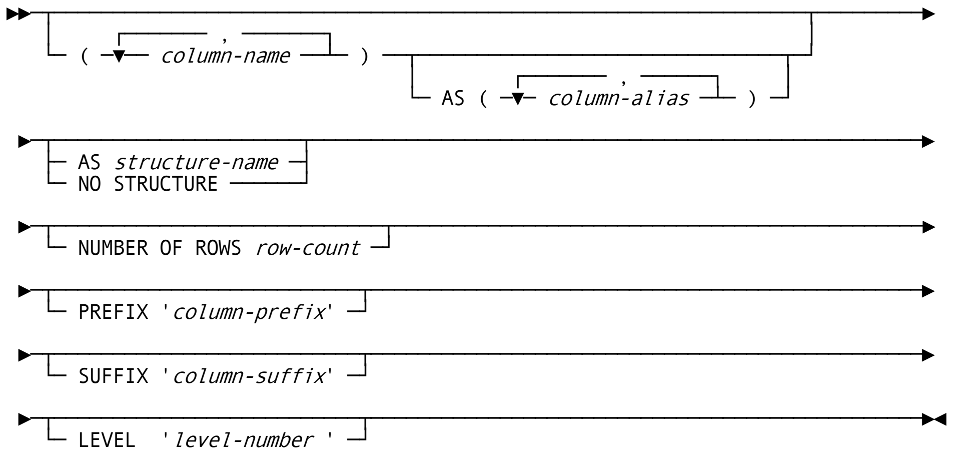
Syntax

```
►►── INCLUDE ─┬─ SQLCA ───────────────────────────────────────────────────┬─►◄
              ├─ SQLDA sqlda-options ─────────────────────────────────────┤
              ├─ TABLE table-name ─┬───────────────────┬──────────────────┤
              │                    └─ table-options ─┘                    │
              ├─┬───────────────────┬─ function-identifier ─┬───────────────┬┤
              │ └─ schema-name. ─┘                        └table-options─┘│
              └─ module-name ─────────────────────────────────────────────┘
```

Expansion of sqlda-options

```
►►─┬────────────────────────────────┬─┬───────────────────────────┬──────►◄
   └─ NUMBER OF COLUMNS column-count ─┘ └─ AS descriptor-area-name ─┘
```

Expansion of table-options



Parameters

SQLCA

Directs the precompiler to define host variables for the fields in the SQL Communication Area (SQLCA) in the application program.

SQLDA

Directs the precompiler to define host variables for the fields in the SQL descriptor area in the application program.

sqlda-options

Specifies additional characteristics for the SQL descriptor area. Expanded syntax for **sqlda-options** is shown immediately following the INCLUDE syntax and documented directly below.

NUMBER OF COLUMNS *column-count*

Directs CA IDMS to build an SQL descriptor area large enough to contain the specified number of columns.

Column-count must be an integer in the range 1 through 1,024. The default is 100.

AS *descriptor-area-name*

Assigns the specified name to the SQL descriptor area being defined. *Descriptor-area-name* must be unique within the application program and must follow the conventions for host variable names.

If you do not specify a name for the SQL descriptor area, the name of the descriptor area is SQLDA.

TABLE table-name

Directs the precompiler to define host variables corresponding to one or more columns in the named table, view, procedure or table procedure in the application program.

Table-name must identify a base table, view, procedure or table procedure defined in the dictionary.

If **table-name** does not include an explicit schema name, the precompiler:

- Uses the schema name specified in the schema precompiler option, if any
- Returns an error if the schema precompiler option is not specified

For expanded **table-name** syntax, see Expansion of Table-name.

schema-name

Specifies the schema with which the function identified by function-identifier is associated. If schema-name is not specified, the precompiler:

- Uses the schema name specified in the schema precompiler option, if any
- Returns an error if the schema precompiler option is not specified

function-identifier

Directs the precompiler to define host variables corresponding to one or more columns in the named function in the application program.

table-options

Specifies additional information about the host variables to be defined for the named table, view, function, procedure, or table procedure. Expanded syntax for **table-options** is shown above immediately following the expanded syntax for **sqlda-options** and documented directly below.

module-name

Includes source statements from a module stored in the data dictionary into the source program.

The unmodified module is placed into the program by the precompiler at the location of the request. The module can, but need not, contain SQL or navigational DML statements. Any such statements are examined and expanded within the context of the program as if they were coded directly.

Note: INCLUDE *module-name* is equivalent to COPY IDMS *module-name* as documented in the *CA IDMS DML Reference* manuals.

The version of the module that is included is established as follows:

The version defaults to the highest version number defined in the data dictionary for the language mode under which the program is being compiled (for example, BATCH or IDMS-DC).

If no mode-specific version exists for *module-name*, the non-mode-specific version, if present, is included. If neither a mode-specific entry or a non-mode-specific entry for *module-name* has been established, an error results. The same rules apply to the module's language where *version-number* defaults to the highest value defined in the data dictionary for the language in which the program is written.

Parameters for Expansion of sqlda-options

(*column-name*)

Specifies one or more columns for which the precompiler is to define host variables. *Column-name* must identify a column in the named table, view, function, procedure, or table procedure and must be unique within the list of column names.

If you specify one or more columns, the precompiler defines host variables only for the columns you name. If you do not specify any columns, the precompiler defines host variables for all the columns in the named table, view, or table procedure.

AS (*column-alias*)

Specifies names to be used for the host variables defined for the named columns. *Column-alias* must follow the conventions for host variable names.

You must specify no column aliases or the same number of column aliases as the number of host variables defined for columns in the named table, view, or table procedure.

If you do not specify any column aliases, the name used for each host variable is the name of the column for which the host variable is defined.

Parameters for Expansion of table-options

AS *structure-name*

Assigns the specified name to the data structure made up of the host variables corresponding to the columns in the named table, view, or table procedure. *Structure-name* must be a 1- through 31-character name that follows the conventions for host variable names.

If you do not specify a name for the data structure, and you do not specify NO STRUCTURE, the name of the structure is the name of the table or view used to define the structure.

NO STRUCTURE

Directs the precompiler not to group the host variable definitions together in a single data structure.

NUMBER OF ROWS *row-count*

Directs the precompiler to define an array, suitable for bulk processing, in which the host variables are sub-elements of a structure that occurs the specified number of times. *Row-count* should be an integer in the range from 2 to the largest number of entries supported for an array by the host language compiler. You must specify NUMBER OF ROWS to create a host variable array using INCLUDE.

If you specify NO STRUCTURE, NUMBER OF ROWS is ignored.

PREFIX '*column-prefix*'

Specifies a character string to be used as the first portion of the name of each host variable defined for a column in the named table, view, procedure or table procedure. *Column-prefix* must be a one- through seven-character string and must be enclosed in single quotation marks.

The column prefix concatenated with the column name or alias and the column suffix, if specified, must follow the conventions for host variable names.

SUFFIX '*column-suffix*'

Specifies a character string to be used as the last portion of the name of each host variable defined for a column in the named table, view, procedure or table procedure. *Column-suffix* must be a one- through seven-character string and must be enclosed in single quotation marks.

The column prefix, if specified, and the column name or alias concatenated with the column suffix must follow the conventions for host variable names.

LEVEL *level-number*

Directs the precompiler to assign the specified level number to the data structure as a whole or, when the INCLUDE statement specifies NO STRUCTURE, to each host variable defined for a column. *Level-number* must be an integer in the range 01 through 47.

If *level-number* is not specified, the default is 01.

Usage

SQLCA, SQLCODE, and SQLSTATE

An application program can contain an INCLUDE SQLCA statement or a host variable definition for SQLCODE and/or SQLSTATE within an SQL declaration section. In either case, the precompiler comments out the item and inserts the host variable definitions for the fields in the SQLCA.

If you include more than one of these items in an application program, the precompiler comments out all of them, inserts the host variable definitions for the fields in the SQLCA only once, and returns a warning.

If you do not include any of the items in a COBOL application program, the precompiler automatically creates the host variable definitions for the fields in the SQLCA if the application program contains SQL statements.

Note: This does not apply to PL/I application programs. A PL/I program must contain an INCLUDE SQLCA or a host variable definition for SQLCODE or SQLSTATE.

Multiple SQL Descriptor Areas

Each SQL descriptor area included in an application program must have a unique name. If you include multiple SQL descriptor areas, you can use the default name SQLDA for only one of the areas. You must use the AS parameter to specify a different name for each of the others.

Placement of INCLUDE TABLE

The INCLUDE TABLE statement may appear anywhere within the application program that variable declarations are allowed. However, to reference the generated variables as host variable in an SQL statement, you must place the INCLUDE TABLE statement within an SQL declaration section.

Column Names as Host Variable Names

You can use the names of the columns in an included table as host variable names only when the column names follow the conventions for host variable names. Otherwise, you must specify a column alias for each column for which you want to define a host variable.

Note: In a COBOL application program, the precompiler automatically converts underscores to hyphens in column names used as host variable names.

Indicator Variable Names

If a column within an included table is nullable, an indicator variable is generated for the column. The name of the indicator variable is the same as that of the data variable (column name or column alias) suffixed with '-I'.

Examples

Including the SQLCA

The following INCLUDE statement directs the precompiler to define host variables for the fields in the SQL Communication Area (SQLCA):

```
EXEC SQL
   INCLUDE SQLCA
END-EXEC
```

Including an SQL Descriptor Area

The following INCLUDE statement directs the precompiler to define host variables for the fields in an SQL descriptor area named BUFF-1-SQLDA. The maximum number of columns that can be described using BUFF-1-SQLDA is 30.

```
EXEC SQL
   INCLUDE SQLDA
      NUMBER OF COLUMNS 30
      AS BUFF-1-SQLDA
END-EXEC
```

Including a Table

The following INCLUDE statement directs the precompiler to define host variables corresponding to the named columns in the INSURANCE_PLAN table. The host variables are defined as a 10-row array named INS-COST-BUFFER.

```
EXEC SQL
   INCLUDE TABLE INSURANCE_PLAN
      AS INS-COST-BUFFER
      (PLAN_CODE, COMP_NAME, MAX_LIFE_COST, FAMILY_COST, DEP_COST)
         AS (PLANCODE, COMPNAME, MAXLIFE, FAMCOST, DEPCOST)
      NUMBER OF ROWS 10
END-EXEC
```

The previous statement generates COBOL variable declarations in this format:

```
01  INS-COST-BUFFER
  02  INS-COST-BUFFER-BULK OCCURS 10.
    03 PLANCODE ...
    03 COMPNAME ...
    03 MAXLIFE ...
    03 FAMCOST ...
    03 DEPCOST ...
```

More Information

- For more information about the SQLCA and the SQLDA, see SQL Communication Area and SQL Descriptor Area.
- For more information about host variables, see Host Variables.
- For more information about creating host variable array using INCLUDE, see the *CA IDMS SQL Programming Guide*.

INSERT

The INSERT data manipulation statement adds one or more rows to a table.

Authorization

To issue an INSERT statement, you must:

- Hold the INSERT privilege on or own the table, view, or table procedure named in the INTO parameter
- Hold the SELECT privilege on or own each table, function, view, and table procedure explicitly named in any query specification used in the INSERT statement

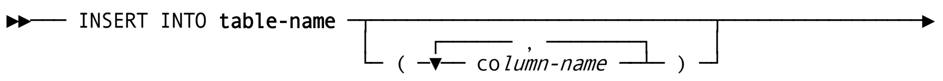
Additional authorization requirements apply to:

- A view named in the INTO parameter; each view named in the FROM parameter of such a view; each view named in the FROM parameters of those views, and so forth.

  For any such view, the owner of the view must own or have the grantable INSERT privilege on each table, view, and table procedure explicitly named in the view definition.
- Each view explicitly named in a query specification in the INSERT statement; each view explicitly named in the definition of such a view; each view explicitly named in the definition of those views, and so forth.

  For any such view, the owner of the view must own or have the grantable SELECT privilege on each table, view, and table procedure explicitly named in the view definition.

Syntax



```
              ┌──────────── , ───────────┐
►─┬─ VALUES ( ─▼─┬─ literal ─────────────┬┴─ ) ──────────────────────────►◄
  │              ├─ host-variable ───────┤                           │
  │              ├─ local-variable ──────┤                           │
  │              ├─ routine-parameter ───┤                           │
  │              ├─ special-register ────┤                           │
  │              └─ NULL ────────────────┘                           │
  ├─ query-specification ─────────────────────────────────────────────┤
  └─ BULK :bulk-buffer ─┬────────────────────┬────────────────────────┘
                        └─ bulk-options ─────┘
```

Expansion of bulk-options

```
►►─┬───────────────────────────────┬──────────────────────────────────►
   └─ START :start-variable-name ──┘

 ►─┬──────────────────────────────────┬───────────────────────────────►◄
   └─ ROWS :row-count-variable-name ──┘
```

Parameters

INTO table-name

Identifies the table, view, or table procedure to which new rows are being added. Table-name must not specify a procedure. If **table-name** identifies a view:

- The view must be updateable
- The applicable rows are inserted into the table from which the view is derived

For expanded **table-name** syntax, see Expansion of Table-name.

(*column-name*)

Specifies one or more columns for which values are being supplied. *Column-name* must identify a column in the table, view, or table procedure named in the INTO parameter and must be unique within the list of columns.

The list of column names must be enclosed in parentheses. Multiple column names must be separated by commas.

If you specify one or more but not all the columns in the named table, view, or table procedure, CA IDMS stores default or null values in the unspecified columns. If any unspecified column is defined as NOT NULL and does not have a default value, CA IDMS returns an error.

If you do not specify any column names, you must supply values for all columns in the rows being added in the order in which the columns were specified in the table, view, or table procedure definition.

VALUES

Indicates a single row with the specified values is to be added to the table, view, or table procedure named in the INTO parameter. You must provide the same number of values as the number of columns named in the INSERT statement or, if no columns are named, the number of columns in the table, view, or table procedure. The first value specified is stored in the first column named, the second value in the second column, and so on.

The list of values must be enclosed in parentheses. Multiple values must be separated by commas.

Important! You can specify limited types of value expressions within a VALUES clause. For example, you cannot specify scalar functions or expressions with multiple terms.

NULL

Directs CA IDMS to store a null value in the corresponding column in the new row. The column must be defined to allow null values.

query-specification

Specifies a result table whose rows are to be added to the table, view, or table procedure named in the INTO parameter. The specified result table must have the same number of columns as the number of columns named in the INSERT statement or, if no columns are named, the number of columns in the table, view, or table procedure.

For expanded **query-specification** syntax, see Expansion of Query-specification.

BULK :*bulk-buffer*

Identifies a variable defined as an array from which CA IDMS is to retrieve the values to be stored in one or more new rows.

Bulk-buffer must be a variable previously declared in the host-language application program or SQL routine. *Bulk-buffer* must have a subordinate structure which occurs multiple times and has the same number of sub-elements as the number of columns named in the INSERT statement or, if no columns are named, the number of columns in the table, view, or table procedure named in the INTO parameter.

You can specify the BULK parameter only when you embed the INSERT statement in an application program.

The BULK parameter is a CA IDMS extension of the SQL standard.

Parameters for Expansion of bulk-options

START :*start-variable-name*

Identifies a variable containing the relative position within the bulk buffer from which CA IDMS is to retrieve values for the first new row. Values in subsequent entries in the bulk buffer are retrieved sequentially for subsequent new rows.

Start-variable-name must be a variable previously declared in the host-language application program or SQL routine. The value in the host variable must be an integer in the natural range of subscripts for arrays in the language in which the application program is written.

If you do not specify the START parameter, CA IDMS retrieves the values from the first entry in the bulk buffer.

ROWS :*row-count-variable-name*

Identifies a variable that specifies the number of rows CA IDMS is to retrieve from the bulk buffer.

Row-count-variable-name must be a variable previously declared in the host-language application program or SQL routine. The value in the host variable must be an integer in the range 1 through the number of rows that fit in the bulk buffer.

If you do not specify the ROWS parameter, CA IDMS retrieves rows from the array sequentially until reaching the end of the buffer.

Note: The *bulk-buffer*, *start-variable-name*, *row-count-variable-name* variables can be host variables, or when the statement is used in an SQL routine, local variables or routine parameters. In this case, their names must not be preceded with a colon.

Usage

Restriction on table-name

The table, view, or table procedure named in the INTO parameter of an INSERT statement cannot also be named in the FROM parameter of a query specification in the same statement or in the FROM parameter of any subquery within the query specification. This means that you cannot INSERT into a table from which you are selecting directly or through a view.

Restriction for Tables in Constraints

If the table named in an INSERT statement is the referencing table in a constraint, the foreign-key columns in each row being inserted must satisfy either of the following conditions:

- The columns must be all or partially null
- The foreign-key-column values must match the referenced-column values in a row of the referenced table

Compatible Data Types

The data types of the columns named in the INSERT statement and their corresponding values represented by the VALUES, **query-specification**, or BULK parameter must be compatible for assignment.

Indicator Variables in the INSERT Statement

In an INSERT statement, you can use indicator variables with host variables and within arrays for bulk processing. A negative value in an indicator variable directs CA IDMS to store a null value in the column corresponding to the associated host variable or structure element. CA IDMS ignores an indicator value of 0 or higher.

Errors During Bulk Inserts

If an error occurs during a bulk insert, all rows inserted before the error occurred remain in the table. Subsequent rows, however, are not inserted into the table.

Satisfying Check Constraints

If a row to be inserted into a table does not satisfy the check constraints, if any, in the table definition, CA IDMS returns an error and does not insert the row.

Inserting into Views Having WITH CHECK OPTION

If the INTO parameter includes a view defined with WITH CHECK OPTION, any WHERE clause in the view definition, or in the definitions of any other views nested within its definition, is applied like a check constraint.

Examples

Supplying Explicit Values

The following INSERT statement adds a new row to the PROJECT table. Values (some null, some non-null) are provided for all columns in the table.

```
insert into project
   values ('P634', 'TV ads - WTVK', '1989-12-01',
      '1990-2-28', null, null, 320, null, 3411);
```

Using the Values in a Result Table

The following INSERT statement adds new rows to the temporary table TEMP_BUDGET. The values in the new rows come from the result table defined by the query specification in the INSERT statement. Values are provided only for two columns of the temporary table.

```
insert into temp_budget
   (dept_id, all_expenses)
   select dept_id, adv_exp + merch_exp + op_exp + misc_exp
      from proposed_budget;
```

Inserting Values from a Buffer

The following INSERT statement adds new rows to the CONSULTANT table. Values for the new rows come from the buffer CNSLT-BUFF. The number of rows added is determined by the value in the host variable BUFF-ROW-COUNT.

```
EXEC SQL
INSERT INTO CONSULTANT
   BULK :CNSLT-BUFF
   ROWS :BUFF-ROW-CNT
END-EXEC
```

More Information

- For more information about updateable views, see CREATE VIEW.
- For more information about host variables, see Host Variables.
- For more information about expanded host variable, local variable, or routine parameters syntax, see Expansion of Host-variable, Local Variables (see page 81), or Routine Parameters.
- For more information about compatible data types for assignment operations, see Comparison, Assignment, Arithmetic, and Concatenation Operations.
- For more information about null values, see Null Values.
- For more information about bulk processing in an application program, see the *CA IDMS SQL Programming Guide*.
- For more information about expanded **literal** syntax, see Expansion of Literal.
- For more information about expanded **special-register** syntax, see Expansion of Special-register.

OPEN

The OPEN data manipulation statement places a specified cursor in the open state. An open cursor represents a result table, an ordering of the rows in the result table, and a position relative to the ordering.

You can use this statement only in SQL that is embedded in a program.

Authorization

None required.

Syntax

```
►►─ OPEN cursor-name ──────────────────────────────────────────────►

 ►──────────────────────────────────────────────────────────────────►◄
    └─ USING ──┬─▼┬─ host-variable ─────┴────────────────────┘
               │  ├─ local-variable ─────┤                 │
               │  └─ routine-parameter ─┘                 │
               └─ :dyn-buff sql DESCRIPTOR descriptor-area-name ─┘
```

Parameters

cursor-name

Specifies the cursor to be opened. **Cursor-name** must identify a cursor previously defined by a DECLARE CURSOR statement within the application program or by an ALLOCATE CURSOR statement executed within the same SQL transaction.

USING

Supplies values for the dynamic parameters embedded in the text of the dynamically prepared statement with which the cursor is associated.

host-variable

Identifies the host variables from which CA IDMS is to retrieve values for the dynamic parameters. CA IDMS assigns the value of the first host variable to the first dynamic parameter, the second host variable to the second dynamic parameter, and so on.

You must specify the same number of host variables in the USING parameter as the number of dynamic parameter markers in the dynamically prepared statement with which the cursor is associated. See Expansion of Host-variable, for more information.

Note: In COBOL, **host-variable** can be an elementary data item or a non-bulk structure. If a non-bulk structure is specified, each sub-element of the structure is counted as a host variable.

local-variable

routine-parameter

Identifies the local variable or routine parameter from which CA IDMS is to retrieve values for the dynamic parameters. CA IDMS assigns the value of the first local variable or routine parameter to the first dynamic parameter, the second local variable or routine parameter to the second dynamic parameter, and so on. You must specify the same number of local variables and routine parameters in the USING parameter as the number of dynamic parameter markers in the dynamically prepared statement with which the cursor is associated.

:*dyn-buff*

Identifies the variable from which CA IDMS is to retrieve values for the dynamic parameters.

Dyn-buff must identify a variable previously declared in the host-language application program or SQL routine.

The size of *dyn-buff* must be sufficient to hold a complete set of dynamic parameter values. The format of the data in *dyn-buff* must conform to the description in the SQL descriptor area specified by *descriptor-area-name*.

SQL DESCRIPTOR

Specifies the SQL descriptor area that describes the format of the dynamic parameter values contained in *dyn-buff*.

descriptor-area-name

Directs CA IDMS to use the named area as the descriptor area. *Descriptor-name* must identify an SQL descriptor area.

Note: The *dyn-buff* variable can be a host variable, or when the statement is used in an SQL routine, a local variable or a routine parameter. In this case, its name must not be preceded with a colon.

For the layout of an SQL descriptor area, see SQL Descriptor Area.

Usage

Cursor Positions

At any time, the position of an open cursor is one of the following:

- Before a certain row
- About a certain row
- After the last row

A cursor can be before the first row or after the last row of a result table even if the table is empty.

When a cursor is first opened, its position is before the first row.

Effect on an Open Cursor

If the cursor named in an OPEN statement is already open, CA IDMS returns an error and continues processing.

Example

Opening a Cursor

The following OPEN statement places the cursor named ALL_EMP_CURSOR in the open state:

```
EXEC SQL
   OPEN ALL_EMP_CURSOR
END-EXEC
```

More Information

- For more information about defining and manipulating cursors, see ALLOCATE CURSOR, CLOSE, DECLARE CURSOR, and FETCH (see page 449).
- For more information about using cursors in an application program, see the *CA IDMS SQL Programming Guide*.
- For more information about the layout of the descriptor area, see SQL Descriptor Area.

PREPARE

The PREPARE dynamic compilation statement dynamically compiles an SQL statement for later execution in the application program.

You can use this statement only in SQL that is embedded in a program.

Authorization

To issue the PREPARE statement, you must have the privileges required to issue the statement being prepared.

Syntax

```
►►─ PREPARE statement-name FROM ─┬─ :statement-text ──┬────────────────►
                                 └─ 'statement-text' ─┘

►─┬──────────────────────────────┬──────────────────────────────────►◄
  ├─ describe-output-expression ─┤
  └─ describe-input-expression ──┘
```

Expansion of describe-output-expression

```
►►─ DESCRIBE output USING sql DESCRIPTOR descriptor-area-name1 ────────►

►─┬─────────────────────────────────────────────────┬───────────────►◄
  └─ INPUT USING sql DESCRIPTOR descriptor-area-name2 ─┘
```

Expansion of describe-input-expression

```
►►─ DESCRIBE INPUT USING sql DESCRIPTOR descriptor-area-name2 ─────────►

►─┬───────────────────────────────────────────────────┬─────────────►◄
  └─ OUTPUT USING sql DESCRIPTOR descriptor-area-name1 ─┘
```

Parameters

statement-name

Specifies the name to be assigned to the compiled statement. It must be unique within its associated scope.

Note: For more information, see Expansion of Statement-name.

FROM

Identifies the statement to be compiled.

:*statement-text*

Identifies a host variable, local variable, or a routine parameter containing a preparable SQL statement. *statement-text* must be previously declared in the application program or SQL routine. It must be defined as an elementary data item with no sub-elements. Do not specify the colon when *statement-text* is a local variable or routine parameter.

'*statement-text*'

Specifies a preparable SQL statement enclosed in single quotation marks. Do not include the SQL prefix or terminator within the statement.

Parameters for Expansion of describe-output-expression

DESCRIBE OUTPUT USING SQL DESCRIPTOR *descriptor-area-name1*

Specifies the SQL descriptor area in which CA IDMS is to return information about the output values to be returned when the dynamically-compiled statement is executed. *Descriptor-area-name1* is the name of the SQL descriptor area.

INPUT USING SQL DESCRIPTOR *descriptor-area-name2*

Specifies the SQL descriptor area in which CA IDMS is to return information about the dynamic parameters used within the statement.

Descriptor-area-name2 is the name of the SQL descriptor area.

Parameters for Expansion of describe-input-expression

DESCRIBE INPUT USING SQL DESCRIPTOR *descriptor-area-name2*

Specifies the SQL descriptor area in which CA IDMS is to return information about the dynamic parameters used within the statement.

Descriptor-area-name2 is the name of the SQL descriptor area.

OUTPUT USING SQL DESCRIPTOR *descriptor-area-name1*

Specifies the SQL descriptor area in which CA IDMS is to return information about the output values to be returned when the dynamically-compiled statement is executed. *Descriptor-area-name1* is the name of the SQL descriptor area.

Usage

Preparable Statements

The following SQL statements are preparable:

- All authorization and logical data description statements
- CALL
- COMMIT
- **cursor-specification**
- DELETE
- EXPLAIN
- INSERT
- RELEASE
- ROLLBACK
- SUSPEND SESSION
- UPDATE

Additionally, all CA IDMS utility and physical data description statements are preparable.

Specifying Dynamic Parameters

Dynamic parameters are variables whose values are supplied when the statement is executed, or in the case of a SELECT or a CALL statement, when its associated cursor is opened.

Dynamic parameters are specified as question marks (?) within the text of the SQL statement. They may appear wherever a host variable is permitted with certain exceptions.

Describing Dynamic Parameters

The INPUT option is used to return information about dynamic parameters that may be embedded in the SQL statement being described. The SQLD field of the descriptor area indicates the number of dynamic parameter that appear in the statement. If no dynamic parameters are used, this field is zero (0).

If dynamic parameters do appear in the statement, CA IDMS returns descriptions of the parameters in the descriptor area. The data type information is derived from the context in which the dynamic parameter appears.

Describing Output Values

The OUTPUT option is used to return information about values output from CA IDMS:

- For a SELECT or a CALL statement, CA IDMS returns a description of the result table defined by the statement. The SQLD field of the descriptor area indicates the number of columns in the result table.
- For a statement other than SELECT or CALL, CA IDMS returns the value zero (0) in the SQLD field of the descriptor area.

No Host Variables, Local Variables, or Routine Parameters in a Dynamically Compiled Statement

An SQL statement that is to be compiled dynamically cannot include any host variables, local variables, or routine parameters.

Re-executing a PREPARE Statement

When reexecuting a PREPARE statement, CA IDMS replaces the previously prepared statement with the statement currently identified in the PREPARE statement. If the previously prepared statement is a SELECT or a CALL statement associated with an open cursor, CA IDMS closes the cursor.

Duration of Dynamically Compiled Statements

Dynamically-compiled statements are available for execution until the transaction terminates or until destroyed using a DEALLOCATE PREPARE statement.

Specifying the Maximum Number of Column Entries

The application program must specify the maximum number of entries it can accept by setting the value of the SQLN field in the descriptor area before issuing the PREPARE statement. If the number of entries is insufficient, CA IDMS returns the number of entries needed into the SQLD field but does not return any descriptions.

Examples

Specifying the Statement Explicitly

The following PREPARE statement dynamically compiles the specified SELECT statement. A subsequent DESCRIBE statement must provide a descriptor area for the description of the result table before the dynamically compiled statement can be executed.

```
EXEC SQL
   PREPARE DYN_TMP_SEL_1
      FROM 'SELECT * FROM TEMP_BUDGET'
END-EXEC
```

Using a Host Variable

The following PREPARE statement dynamically compiles the statement contained in the host variable SELECT-BUFF. Information about the output from the dynamically compiled statement is returned in the descriptor area named BUFF-1-SQLDA.

```
EXEC SQL
   PREPARE DYN_PROJ_SELECT
      FROM :SELECT-BUFF
      DESCRIBE USING DESCRIPTOR BUFF-1-SQLDA
END-EXEC
```

More Information

- For more information about the dynamic compilation of SQL statements, see the *CA IDMS SQL Programming Guide*.
- For more information about the SQL descriptor area, see SQL Descriptor Area.
- For more information about destroying a dynamically-compiled statement, see DEALLOCATE PREPARE.
- For more information about the structure of the SQL descriptor area, see SQL Descriptor Area.
- For more information about dynamic parameters, see Dynamic Parameters.

RELEASE

The RELEASE session management statement releases a connection to a CA IDMS dictionary and ends the SQL session. It is also a CA IDMS extension of the SQL standard.

Authorization

None required.

Syntax

```
►►── RELEASE ─────────────────────────────────────────────────►◄
```

Usage

Ending an SQL Session

To end an SQL session established with the CONNECT statement, you must use one of the following statements:

- RELEASE
- COMMIT RELEASE
- ROLLBACK RELEASE

To end an SQL Session established automatically, you can use any of the above statements or COMMIT or ROLLBACK without the RELEASE parameter.

Automatic Rollback

When ending an SQL session, CA IDMS automatically rolls back any transaction that is still active.

Example

Releasing a Connection

The following RELEASE statement ends the current SQL session and releases the connection with the dictionary:

```
EXEC SQL
   RELEASE
END-EXEC
```

More Information

- For more information about establishing a database connection and beginning an SQL session, see CONNECT.
- For more information about managing SQL sessions, see the *CA IDMS SQL Programming Guide*.

RESUME SESSION

The RESUME SESSION management statement resumes a suspended SQL session. You use the RESUME SESSION statement primarily in pseudo conversational programming. It is also a CA IDMS extension of the SQL standard.

Authorization

None required.

Syntax

```
►►─── RESUME SESSION ────────────────────────────────────────────────────►◄
```

Usage

Effect of RESUME SESSION

When you resume an SQL session, CA IDMS re-establishes the session as it existed immediately before it was suspended.

Resuming a Suspended Session

The following RESUME SESSION statement resumes the current suspended SQL session:

```
EXEC SQL
   RESUME SESSION
END-EXEC
```

More Information

- For more information about suspending an SQL session, see SUSPEND SESSION.
- For more information about managing SQL sessions, see the *CA IDMS SQL Programming Guide*.

REVOKE All Table Privileges

The REVOKE All Table Privileges authorization statement removes from one or more users or groups all definition and access privileges on a specified table, view, function, procedure or table procedure.

Authorization

To issue the REVOKE ALL PRIVILEGES statement, one of the following must be true:

- You own the table, view, function, procedure or table procedure
- You hold all privileges on the table, view, function, procedure or table procedure as grantable
- You hold the DBADMIN privilege for the database that contains the table, view, function, procedure or table procedure

Syntax

```
►►── REVOKE ALL PRIVILEGES ──────────────────────────────────────────────►

►── ON table ─┬─ table-name ──────────────────────────────────────────┬──►
              └─────────────────────────────── function-identifier ─┘
                      └─ schema-name. ─┘

                ┌──────────────────────────────┐
►── FROM ─▼─┬─ PUBLIC ────────────────────┬────┴──────────────────────────►◄
            └─ authorization-identifier ─┘
```

Parameters

ALL PRIVILEGES

Removes the DELETE, INSERT, SELECT, UPDATE, ALTER, CREATE, DROP, and REFERENCES privileges, as applicable, on the table, view, function, procedure, or table procedure identified in the ON parameter from the users or groups identified in the FROM parameter.

ON table table-name

Identifies the table, view, function, procedure or table procedure to which the privileges apply.

If **table-name** does not include a schema name qualifier, the schema name qualifier defaults to the current schema in effect for your SQL session. For expanded **table-name** syntax, see Expansion of Table-name.

schema-name

Specifies the schema with which the function identified by function-identifier is associated. If schema-name is not specified, the schema qualifier defaults to the current schema in effect for your SQL session.

function-identifier

Identifies the function to which the privileges apply.

FROM

Specifies the users from whom you are removing the privileges.

PUBLIC

Specifies all users.

The privileges must have been previously given to PUBLIC by means of the GRANT statement.

authorization-identifier

Identifies a user or group.

The privileges must have been previously given to **authorization-identifier** by means of the GRANT statement. For expanded **authorization-identifier** syntax, see Expansion of Authorization-identifier.

Usage

Revoking Privileges

A user can hold a privilege on a resource through multiple resource names (for example, through the use of wildcards) or through multiple authorization identifiers (for example, through two different group identifiers). A REVOKE statement revokes the privileges specified in the statement only on the specified resource name and only from the specified authorization identifier.

For example, suppose:

- User PKB is in the group SALES_ADMIN
- PKB has been granted the SELECT privilege on the table SALES_SCH.SALES_FORECAST
- SALES_ADMIN has been granted the SELECT privilege on all tables named SALES_SCH.SALES* where * is a wildcard character

You can revoke the SELECT privilege on SALES_FORECAST from the user identifier PKB. However, PKB can still select data from the table because PKB is a member of SALES_ADMIN.

Example

Revoking All Privileges From All Users

The following statement removes all privileges on all tables, views, functions, procedures and table procedures in the TEST schema from the group PUBLIC:

```
revoke all privileges
   on test.*
   from public;
```

More Information

- For more information about table access privileges, see GRANT Table Access Privileges and REVOKE Table Access Privileges.
- For more information about table definition privileges, see GRANT Definition Privileges and REVOKE SQL Definition Privileges.
- For more information about granting privileges, see your security administrator.

REVOKE SQL Definition Privileges

The REVOKE SQL Definition Privileges authorization statement removes from one or more users or groups the privilege of performing selected actions on a specified access module, schema, table, view, function, procedure or table procedure. It is also a CA IDMS extension of the SQL standard.

Authorization

To issue a REVOKE statement for a definition privilege, you must own the resource, hold the corresponding grantable privilege on the resource, or hold DBADMIN privilege on the dictionary containing the definition.

Syntax

```
►►── REVOKE ─┬─ DEFINE ──────────────────┬──────────────────────────────────────►
             │ ┌────────── , ─────────┐  │
             └─▼─┬─ ALTER ──────────────┴──┘
                 ├─ CREATE ───────────┤
                 ├─ DISPLAY ──────────┤
                 ├─ DROP ─────────────┤
                 └─ REFERENCES ───────┘

►── ON ─┬─ ACCESS MODULE ─┬──────────────────┬─ access-module-name ─────┬──────►
        │                 └─ schema-name. ───┘                          │
        ├─ SCHEMA schema-name ──────────────────────────────────────────┤
        ├─ table table-name ────────────────────────────────────────────┤
        └──────┬───────────────────┬─function-identifier────────────────┘
               └─ schema-name. ────┘

►── FROM ─▼─┬─ PUBLIC ─────────────── , ──────┬─────────────────────────────────►◄
            └─ authorization-identifier ──────┘
```

Parameters

DEFINE

Removes the ALTER, CREATE, DISPLAY, DROP, and REFERENCES privileges, as applicable, on the resource identified in the ON parameter from the users or groups identified in the FROM parameter.

ALTER

Removes the ALTER privilege on the resource identified in the ON parameter from the users or groups identified in the FROM parameter.

CREATE

Removes the CREATE privilege on the resource identified in the ON parameter from the users or groups identified in the FROM parameter.

DISPLAY

Removes the DISPLAY privilege on the resource identified in the ON parameter from the users or groups identified in the FROM parameter.

DROP

Removes the DROP privilege on the resource identified in the ON parameter from the users or groups identified in the FROM parameter.

REFERENCES

Removes the REFERENCES privilege on the resource identified in the ON parameter from the users or groups identified in the FROM parameter.

ON

Identifies the resource to which the named privileges apply.

ACCESS MODULE *access-module-name*

Identifies an access module.

Privileges on any version of *access-module-name* in the associated schema are revoked.

schema-name

Identifies the schema associated with the named access module.

If you do not specify *schema-name*, it defaults to the current schema in effect for your SQL session.

SCHEMA *schema-name*

Identifies a schema.

table table-name

Identifies a table, view, procedure or table procedure.

If **table-name** does not include a schema name qualifier, the schema name qualifier defaults to the current schema in effect for your SQL session.

schema-name

Specifies the schema with which the function identified by function-identifier is associated. If schema-name is not specified, the schema defaults to the current schema in effect for your SQL session.

function-identifier

Identifies the function.

FROM

Identifies the users from whom you are removing the specified privileges.

PUBLIC

Specifies all users.

The privileges must have been previously given to PUBLIC by means of the GRANT statement.

authorization-identifier

Identifies a user or group.

The privileges must have been previously given to **authorization-identifier** by means of the GRANT statement. For expanded **authorization-identifier** syntax, see Expansion of Authorization-identifier.

Usage

Revoking Privileges

A user can hold a privilege on a resource through multiple resource names (for example, through the use of wildcards) or through multiple authorization identifiers (for example, through two different group identifiers). A REVOKE statement revokes the privileges specified in the statement only on the specified resource name and only from the specified authorization identifier.

For example, suppose:

- User PKB is in the group SALES_ADMIN
- PKB has been granted the CREATE privilege on the access module name SALES_SCH.SALESFCT
- SALES_ADMIN has been granted the CREATE privilege on all access modules named SALES_SCH.SALES* where * is a wildcard character

You can revoke the CREATE privilege on SALESFCT from the user identifier PKB. However, PKB can still create an access module by that name in the SALES_SCH schema because PKB is a member of SALES_ADMIN.

The DEFINE Keyword

When you use the DEFINE keyword with a GRANT statement, you grant a set of definition privileges on a resource to one or more users or groups.

When you use the DEFINE keyword with a REVOKE statement, you revoke any definition privileges that have been previously granted on the resource from the specified users or groups.

This means that if you GRANT CREATE privilege on a table, you can revoke the privilege with a REVOKE SELECT statement or a REVOKE DEFINE statement. Using REVOKE DEFINE is an efficient technique when you intend to revoke all definition privileges on a table from a user or group, whether the privileges were granted singly or as a set.

Similarly, you can GRANT DEFINE on a table to a user and then REVOKE DELETE on the table from the same user as a way to grant all but one definition privilege.

Example

Revoking Privileges on a Schema

The following REVOKE statement removes the ALTER, CREATE, DISPLAY, and DROP privileges on all schemas that begin with 'DSF' from user DSF:

```
revoke define
   on schema dsf*
   from dsf;
```

More Information

- For more information about granting definition privileges, see GRANT Definition Privileges.
- For more information about revoking privileges, see your security administrator.

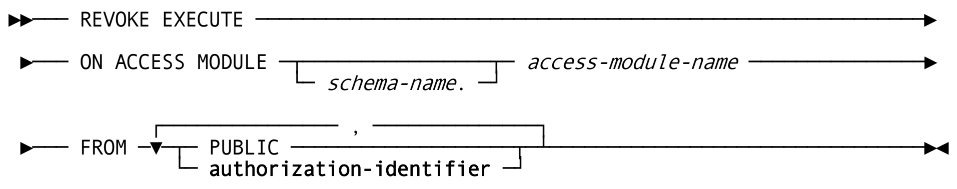
REVOKE Execution Privilege

The REVOKE Execution Privilege authorization statement removes from one or more users or groups the privilege of executing a specified access module. It is also a CA IDMS extension of the SQL standard.

Authorization

To revoke access module execution privilege, you must own the schema associated with the access module, hold grantable privilege on the access module, or hold DBADMIN privilege on the dictionary that contains the access module.

Syntax



Parameters

ON ACCESS MODULE *access-module-name*

Specifies the access module to which the EXECUTE privilege applies.

schema-name

Identifies the schema associated with *access-module-name*. If you do not specify *schema-name*, it defaults to the current schema in effect for your SQL session.

FROM

Identifies the users from whom you are removing the EXECUTE privilege.

PUBLIC

Specifies all users.

The privilege must previously have been granted to PUBLIC.

authorization-identifier

Identifies a user or group.

The privilege must previously have been granted to **authorization-identifier**. For expanded **authorization-identifier** syntax, see Expansion of Authorization-identifier.

Usage

Revoking Privileges

A user can hold a privilege on a resource through multiple resource names (for example, through the use of wildcards) or through multiple authorization identifiers (for example, through two different group identifiers). A REVOKE statement revokes the privileges specified in the statement only on the specified resource name and only from the specified authorization identifier.

For example, suppose:

- User PKB is in the group SALES_ADMIN
- PKB has been granted the EXECUTE privilege on the access module name SALES_SCH.SALESFCT
- SALES_ADMIN has been granted the EXECUTE privilege on all access module named SALES_SCH.SALES* where * is a wildcard character

You can revoke the EXECUTE privilege on SALESFCT from the user identifier PKB. However, PKB can still execute an access module by that name in the SALES_SCH schema because PKB is a member of SALES_ADMIN.

Example

Revoking the EXECUTE Privilege

The following REVOKE EXECUTE statement removes the EXECUTE privilege on all access modules associated with schema HR that begin with 'EMP' from the users in group PER_GRP_2:

```
revoke execute
   on access module hr.emp*
   from per_grp_2;
```

More Information

- For more information about granting the EXECUTE privilege, see GRANT Access Module Execution Privilege.
- For more information about revoking privileges, see your security administrator.

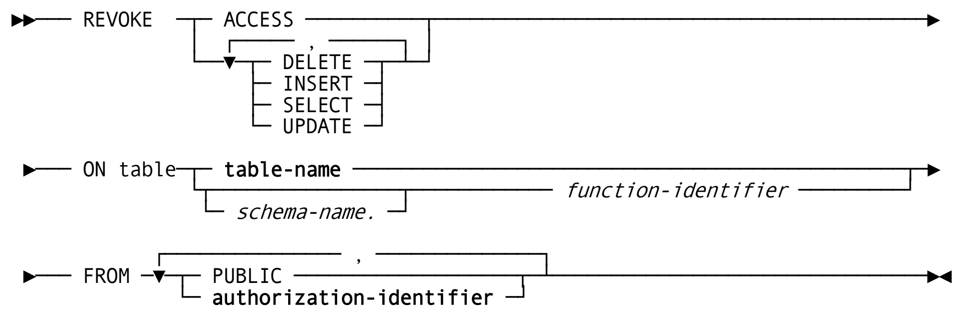
REVOKE Table Access Privileges

The REVOKE Table Access Privileges authorization statement removes from one or more users or groups the privilege of performing selected actions on a specified table, view, function, procedure or table procedure.

Authorization

To issue a REVOKE statement for a table, view, function, procedure or table procedure privilege, you must own, hold the corresponding grantable privilege on the table, view, function, procedure or table procedure, or hold the DBADMIN privilege on the database.

Syntax



Parameters

ACCESS

Removes the DELETE, INSERT, SELECT, and UPDATE privileges on the named table, view, function, procedure or table procedure from the users or groups identified in the FROM parameter.

DELETE

Removes the DELETE privilege on the table, view, or table procedure identified in the ON parameter from the users or groups identified in the FROM parameter.

INSERT

Removes the INSERT privilege on the table, view, or table procedure identified in the ON parameter from the users or groups identified in the FROM parameter.

SELECT

Removes the SELECT privilege on the table, view, function, procedure or table procedure identified in the ON parameter from the users or groups identified in the FROM parameter.

UPDATE

Removes the UPDATE privilege on the table, view, or table procedure identified in the ON parameter from the users or groups identified in the FROM parameter.

ON table table-name

Specifies the table, view, procedure or table procedure which the access privileges apply.

If **table-name** does not include a schema name qualifier, the schema name qualifier defaults to the current schema in effect for your SQL session. For expanded **table-name** syntax, see Expansion of Table-name.

schema-name

Specifies the schema with which the function identified by function-identifier is associated. If schema-name is not specified, the schema qualifier defaults to the current schema in effect for your SQL session.

function-identifier

Identifies the function to which the privileges apply.

FROM

Identifies the users from whom you are removing access privileges.

PUBLIC

Specifies all users.

The privileges must have been previously given to PUBLIC by means of the GRANT statement.

authorization-identifier

Identifies a user or group.

The privileges must have been previously given to **authorization-identifier** by means of the GRANT statement. For expanded **authorization-identifier** syntax, see Expansion of Authorization-identifier.

Usage

The ACCESS Keyword

When you use the ACCESS keyword with a GRANT statement, you grant a set of access privileges on a table, view, function, procedure or table procedure to one or more users or groups.

When you use the ACCESS keyword with a REVOKE statement, you revoke any access privileges that have been previously granted on the table, view, function, procedure or table procedure from the specified users or groups.

Therefore, if you GRANT SELECT privilege on a table, you can revoke the privilege with a REVOKE SELECT statement or a REVOKE ACCESS statement. Using REVOKE ACCESS is an efficient technique when you intend to revoke all access privileges on a table from a user or group, whether the privileges were granted singly or as a set.

Similarly, you can GRANT ACCESS on a table to a user and then REVOKE DELETE on the table from the same user as a way to grant all but one table access privilege.

Revoking Privileges

A user can hold a privilege on a resource through multiple resource names (for example, through the use of wildcards) or through multiple authorization identifiers (for example, through two different group identifiers). A REVOKE statement revokes the privileges specified in the statement only on the specified resource name and only from the specified authorization identifier.

For example, suppose:

- User PKB is in the group SALES_ADMIN
- PKB has been granted the SELECT privilege on the table name SALES_SCH.SALES_FORECAST
- SALES_ADMIN has been granted the SELECT privilege on all tables named SALES_SCH.SALES* where * is a wildcard character

You can revoke the SELECT privilege on SALES_FORECAST from the user identifier PKB. However, PKB can still select from the SALES_FORECAST table because PKB is a member of SALES_ADMIN.

Example

Revoking Selected Privileges on a Table

The following REVOKE statement removes the SELECT and UPDATE privileges on the EMPLOYEE table from users KRP, SAE, and PGD:

```
revoke select, update
   on employee
   from krp, sae, pgd;
```

More Information

- For more information about granting table access privileges, see GRANT Table Access Privileges.
- For more information about revoking privileges, see your security administrator.

ROLLBACK

The ROLLBACK transaction management statement performs the following tasks:

- Cancels changes made to the database during the current transaction
- Ends the transaction
- Optionally ends the SQL session

Authorization

None required.

Syntax

```
►►─── ROLLBACK work ─┬───────────┬──────────────────────────────────────────►◄
                     └─ RELEASE ─┘
```

Parameters

RELEASE

Directs CA IDMS to end the current SQL session and the current transaction after canceling the changes to the database.

The RELEASE parameter is a CA IDMS extension of the SQL standard.

Usage

Effect of a ROLLBACK on an SQL Session

A ROLLBACK statement has the following impact on the SQL session and its transaction:

- Rolls back all changes made by the session
- Releases all locks
- Closes all open cursors
- Drops all temporary tables
- Deletes all dynamically compiled statements
- Terminates the SQL session CA IDMS connected it automatically or if RELEASE is specified.

Effect of Transaction Sharing

If more than one database session is sharing the SQL session's transaction, the changes made by all sharing sessions are immediately rolled back. All sharing sessions other than the one through which the ROLLBACK statement was issued are flagged to indicate that they must also issue a ROLLBACK. If the next statement issued by each of these sessions is not a ROLLBACK, it will receive an error:

- For SQL, the application receives an SQLCODE of -5 (transaction failure) and an SQLRSN of 1088 (transaction forced to backout).
- For navigational DML, the run unit is terminated and an error status of xx19 is returned to the application.

Example

Canceling Database Changes

The following ROLLBACK statement cancels the uncommitted changes to the database made during the current transaction and ends both the transaction and the current SQL session:

```
EXEC SQL
   ROLLBACK RELEASE
END-EXEC
```

More Information

- For more information about committing changes to the database before ending a transaction, see COMMIT.
- For more information about ending an SQL session, see RELEASE.
- For more information about managing or sharing transactions, see the *CA IDMS SQL Programming Guide*.

SELECT

The SELECT data manipulation statement retrieves values from one or more tables, views, procedures and table procedures. CA IDMS returns the values in the form of a result table.

When the SELECT statement is:

- Submitted through the Command Facility, the values in the result table are displayed in tabular form
- Embedded in an application program or SQL routine, the values in the result table are stored in host variables, local variables, or routine parameters

Authorization

To issue a SELECT statement, you must own or have the SELECT privilege on each table, view, function, procedure and table procedure explicitly named in the statement.

Additional authorization requirements apply to each view explicitly named in the SELECT statement, to each view explicitly named in the definition of such a view, to each view explicitly named in the definition of those views, and so forth.

For any such view, the owner of the view must own or have the grantable SELECT privilege on each table, view, procedure and table procedure explicitly named in the view definition.

Syntax

```
►►─── SELECT ─┬──────────────┬───────────────────────────────────────────────►
              ├─ ALL ◄───────┤
              └─ DISTINCT ───┘

►─┬─ * ─────────────────────────────────────────────────────────────┬────────►
  │ ┌──────────────────────── , ────────────────────────┐            │
  └─▼─┬── value-expression ──┬───────────────────────────┬┴───────────┤
      │                      └─┬──────┬─ result-name ───┘            │
      │                        └─ AS ─┘                              │
      ├─ table-name.* ──────────────────────────────────────────────┤
      └─ alias.* ───────────────────────────────────────────────────┘

►─┬──────────────────────────────────────────────────────┬───────────────────►
  ├─ INTO ─▼┬─ host-variable ──────┬┴────────────────────┤
  │         │ ┌──── , ─────────────┐                      │
  │         ├─ local-variable ─────┤                      │
  │         └─ routine-parameter ──┘                      │
  └─ BULK :bulk-buffer ─┬─────────────────┬───────────────┘
                        └─ bulk-options ──┘
```

```
►── FROM ─▼┬─ table-reference ───┬─┬──────────── alias ─┘───────────────►
           └─ (query-expression) ┘ └─ AS ─┘

►──┬──────────────────────────────────────────────────┬──────────────────►
   └─ WHERE ──┬─ search-condition ─────────────────────┘
              └─ extended-search-condition ─┘

►──┬──────────────────────────────┬──────────────────────────────────────►
   └─ PRESERVE ─┬─ table-name ────┘
                └─ alias ───────┘

►──┬──────────────────────────────────────────────────┬──────────────────►
   │             ┌────────────── , ─────────────┐     │
   └─ GROUP BY ─▼┬────────────────── column-name ┴────┤
                 ├─ table-name. ─┤                     │
                 ├─ alias. ──────┘                     │
                 └─ rowid-pseudo-column ───────────────┘

►──┬──────────────────────────────┬──────────────────────────────────────►
   └─ HAVING search-condition ────┘

►──┬──────────────────────────────┬──────────────────────────────────────►
   └─ OPTIMIZE FOR literal ROWS ──┘

►──┬─────────────────────────────────────────────────┬───────────────────►
   │ ┌───────────────────────────────────────────────┤
   └▼─ UNION ──┬───────┬─ query-expression ──────────┘
               └─ ALL ─┘

                  ┌──────────────────── , ─────────────────────┐
►── ORDER BY ─▼┬─────────────────── column-name ─┬─┬─────────┬─┴──────►◄
               │  ├─ table-name. ─┤              │ ├─ ASC ◄──┤
               │  └─ alias. ──────┘              │ └─ DESC ──┘
               ├─ column-number ─────────────────┤
               ├─ result-name ───────────────────┤
               └─ rowid-pseudo-column ───────────┘
```

Expansion of bulk-options

```
►►──┬──────────────────────────────┬─────────────────────────────────────►
    └─ START :start-variable-name ─┘

►───┬──────────────────────────────────┬─────────────────────────────────►◄
    └─ ROWS :row-count-variable-name ──┘
```

Parameters

ALL

Directs CA IDMS to return all the rows, including duplicates, in the requested result table. The default value is ALL when you specify neither ALL nor DISTINCT.

DISTINCT

Directs CA IDMS to eliminate duplicate rows from the result table returned by the SELECT statement.

*****

Specifies that the result table is to include all columns in the tables, views, procedures and table procedures named in the FROM parameter of the SELECT statement. The columns in the tables, views, procedures and table procedures are concatenated in the order in which the tables, views, procedures and table procedures are specified in the FROM parameter.

value-expression

Identifies the values to be included in a result column. Typically, **value-expression** is a column reference, an arithmetic operation that includes a column reference, or an aggregate function that includes a column reference.

Each column reference in **value-expression** must identify a column in the table defined by the FROM parameter of the SELECT statement.

You can specify from 1 through 1,024 value expressions. Multiple value expressions must be separated by commas.

The number of columns in a result table is the same as the number of value expressions in the SELECT statement defining the result table. For expanded **value-expression** syntax, see Expansion of Value-expression.

AS *result-name*

Specifies a name for the result column identified by **value-expression**. When displaying the result table, the Command Facility uses the result name as the column header.

Result-name must be a 1- through 32-character name that follows the conventions for SQL identifiers.

table-name.*

Specifies that the result table is to include all columns in the table identified by **table-name**.

Table-name must match an occurrence of **table-name** in the FROM parameter.

alias*.

Specifies that the result table is to include all columns in the table identified by *alias*.

Alias must match an occurrence of *alias* in the FROM parameter.

INTO host-variable

local-variable

routine-parameter

Identifies the variables to which CA IDMS is to assign the values in the result table. CA IDMS assigns the value in the first result column to the first variable, the value in the second result column to the second variable, and so on. You use the INTO parameter when the result table will contain at most one row.

Host-variable must be a host variable previously declared in the application program.

Local-variable and **routine-parameter** must be defined previously in the SQL routine.

You must specify the same number of variables in the INTO parameter as the number of columns in the result table. Multiple variables must be separated by commas.

You can specify the INTO parameter only when you embed the SELECT statement in an application program or SQL routine. You must specify INTO or BULK when you embed a SELECT statement in a host program or SQL routine.

BULK :*bulk-buffer*

Identifies a variable defined as an array to which CA IDMS is to assign the values in the result table. The BULK parameter is a CA IDMS extension of the SQL standard. You use the BULK parameter when the result table may contain more than one row.

You can specify the BULK parameter only when you embed the SELECT statement in an application program. You must specify BULK or INTO when you embed a SELECT statement in a host program.

Bulk-buffer must be a variable previously declared in the host-language application program or SQL routine. *Bulk-buffer* must have a subordinate structure that occurs multiple times and has the same number of sub-elements as the number of columns in the result table.

bulk-options

Refers to optional parameters when BULK is specified. Syntax for **bulk-options** immediately follows the syntax for SELECT.

FROM table-reference

Identifies one or more tables, views, procedures and table procedures from which the result table is to be derived. For expanded **table-reference** syntax, see Expansion of Table-reference.

(query-expression)

Represents a table to be used in the evaluation of an SQL statement.

AS *alias*

Defines a new name to be used to identify the table, view, procedure, table procedure or **query-expression** within the SELECT statement. *Alias* must be a 1- through 18-character name that follows the conventions for SQL identifiers.

Note: CA IDMS supports keywords as identifiers as an extension of the SQL standard. However, if you use a keyword as an alias but do not code the optional parameter AS, you must delimit the keyword with double quotation marks or a syntax error will occur.

WHERE

Introduces criteria that a row must meet to be included in the result table.

search-condition

Specifies the set of values against which a row in the base table is tested:

- When the value of **search-condition** is true, the row is included in the result table
- When the value of **search-condition** is false or unknown, the row is not included in the result table

For expanded **search-condition** syntax, see Expansion of Search-condition.

extended-search-condition

Specifies a search condition that includes a set specification. For expanded **extended-search-condition** syntax, see Expansion of Extended-search Condition.

PRESERVE

Requests an outer join on the specified table, view, procedure, or table procedure. The PRESERVE parameter is a CA IDMS extension of the SQL standard.

To specify a more powerful outer join that is compatible with the SQL standard, use the **joined-table** construct as **table-reference**

table-name

Specifies by table name the table, view, procedure or table procedure to be preserved in an outer join. For expanded **table-name** syntax, see Expansion of Table-name.

alias

Specifies the table, view, procedure or table procedure to be preserved in an outer join by the alias defined for the table or view in the FROM parameter of the SELECT statement.

GROUP BY *column-name*

Groups the rows in the table defined by the FROM parameter by the values in the specified columns. Rows with the same value in each grouping column are grouped together.

Column-name must identify a column in a table, view, procedure or table procedure named in the FROM parameter of the SELECT statement.

table-name

Specifies the table, view, procedure or table procedure that includes the named column. For expanded **table-name** syntax, see Expansion of Table-name.

alias

Specifies the alias associated with the table, view, procedure or table procedure that includes the named column. *Alias* must be defined in the FROM parameter of the SELECT statement.

rowid-pseudo-column

Specifies a ROWID pseudo-column as a grouping column. See Expansion of rowid-pseudo-column for more information.

HAVING search-condition

Specifies criteria a group must meet to be included in the result table:

- When the value of **search-condition** is true, the group is included in the result table
- When the value of **search-condition** is false or unknown, the group is not included in the result table

For expanded **search-condition** syntax, see Expansion of Search-condition.

OPTIMIZE FOR literal ROWS

Specifies the expected number of output rows from this query-specification. It is used by the optimizer to generate the best possible access strategy for satisfying query-expression. "Literal" is an integer constant.

UNION query-expression

Specifies that:

- The result table is to include both the rows from the table defined in the FROM parameter of the SELECT statement and the rows from the table defined in **query-expression**.
- Duplicate rows are to be eliminated from the table resulting from the UNION operation, unless the ALL keyword is present.

You cannot include the UNION operator in a SELECT statement embedded in an application program.

See Expansion of Query-expression for:

- Expanded **query-expression** syntax
- A discussion of data type compatibility and the data type that results from the union of columns with compatible data types

ALL

Specifies that all rows resulting from the UNION operation are retained; duplicates are not discarded.

ORDER BY

Sorts the rows in the table defined by the FROM parameter in ascending or descending order by the values in the specified columns. Rows are ordered first by the first column specified, then by the second column specified within the ordering established by the first column, then by the third column specified, and so on.

column-name

Specifies a sort column by the column name. *Column-name* must identify a column in a table, view, procedure or table procedure named in the FROM parameter of the SELECT statement and must be included in the result table.

table-name

Specifies the table, view, procedure or table procedure that includes the named column. For expanded **table-name** syntax, see Expansion of Table-name.

alias

Specifies the alias associated with the table, view, procedure or table procedure that includes the named column. *Alias* must be defined in the FROM parameter of the SELECT statement.

column-number

Specifies a sort column by the position of the column in the result table. The first result column is in position 1.

Column-number must be an integer in the range 1 through the number of columns in the result table.

result-name

Specifies the sort column by the result name specified in the AS parameter of **query-expression**.

rowid-pseudo-column

Specifies a sort column as a ROWID pseudo-column. See Expansion of rowid-pseudo-column for more information.

ASC

Indicates that the values in the specified column are to be sorted in ascending order. ASC is the default when you specify neither ASC nor DESC.

DESC

Indicates that the values in the specified column are to be sorted in descending order.

Parameters for Expansion of bulk-options

START :*start-variable-name*

Identifies a variable containing the relative position within the bulk buffer to which CA IDMS is to assign the values in the first row of the result table. Values in subsequent rows of the result table are assigned sequentially to subsequent positions in the bulk buffer.

Start-variable-name must be a variable previously declared in the host-language application program or SQL routine. The value in the variable must be an integer in the natural range of subscripts for arrays in the language in which the application program is written.

If you do not specify the START parameter, CA IDMS assigns the values in the first row of the result table to the beginning of the bulk buffer.

ROWS :*row-count-variable-name*

Identifies a variable that specifies the maximum number of rows in the result table CA IDMS is to assign to the bulk buffer.

Row-count-variable-name must be a variable previously declared in the host-language application program or SQL routine. The value in the host variable must be an integer in the range 1 through the number of rows that will fit in the bulk buffer.

If you do not specify the ROWS parameter, CA IDMS assigns the rows in the result table to the bulk buffer sequentially until no more rows exist in the result table or the buffer is full.

Note: The *bulk-buffer*, *start-variable-name*, and *row-count-variable-name* variables can be host variables, or when the statement is used in an SQL routine, local variables or routine parameters. In this case, their names must not be preceded with a colon.

Usage

Value Expressions without Column References

If the value expression that identifies a result column does not include any column references, the result column contains the same value in each row. This value is derived directly from the value expression without reference to the table defined by the FROM parameter of the SELECT statement.

Use of BULK and INTO

You must specify the BULK parameter or the INTO parameter when you embed the SELECT statement in an application program, except when the statement is to be compiled dynamically.

You cannot specify either of these parameters when you submit the SELECT statement through the command facility or for dynamic compilation in an application program.

When you embed the SELECT statement in an application program and:

- You specify INTO, the result table must have at most one row
- You specify BULK, the result table must have no more rows than the number of entries in the bulk buffer (or the value of *row-count-variable-name*, if specified)

If neither of these conditions is met, CA IDMS returns a cardinality violation error.

Note: To select an undetermined number of rows, the SELECT statement must be associated with a cursor. You can fetch rows individually from the cursor.

Compatible Data Types

The data types of the result columns and their corresponding host variables in the BULK or INTO parameter must be compatible for assignment.

Uniqueness of Table Names

Each alias and each table name without an associated alias must be unique within the FROM parameter of a SELECT statement.

Column References in the WHERE Parameter

Each column reference directly included in the search condition in the WHERE parameter of a SELECT statement must identify a column in a table, view, procedure or table procedure specified in the FROM parameter of the SELECT statement, or be an outer reference.

Note: For more information about outer references, see Subqueries.

Aggregate Functions in the WHERE Parameter

The search condition in the WHERE parameter of a SELECT statement cannot directly include an aggregate function. However, you can use aggregate functions in subqueries within the search condition.

GROUP BY Parameter Requirements

When a SELECT statement includes the GROUP BY parameter, each column reference in the value expressions that identify the result columns must identify a column specified in the GROUP BY parameter or occur only in the argument of an aggregate function. If the result columns are identified by an asterisk (*), the GROUP BY parameter must include all the columns in the tables, views, procedures and table procedures specified in the FROM parameter.

SELECT Statements without the GROUP BY Parameter

If a SELECT statement does not include the GROUP BY parameter:

- If any column reference in a value expression that identifies a result column is included in the argument of an aggregate function, all column references in all the value expressions must be in aggregate functions
- The entire table defined by the FROM and WHERE parameters is treated as a single group

Column References in the HAVING Parameter

Each column reference included in the search condition in the HAVING parameter of a SELECT statement must identify a column specified in the GROUP BY parameter of the SELECT statement or occur in the argument of an aggregate function.

When to Use OPTIMIZE FOR Literal ROWS

Under some circumstances, the SQL optimizer may choose a less than optimal access strategy to satisfy a query expression. This typically happens with host program embedded SQL statements which contain WHERE clauses with host variable references, rather than explicit constants. For example, a BETWEEN clause involving host variables may induce the optimizer to assume many rows will be retrieved, causing it to choose an area sweep to satisfy the request. Without knowing the underlying values of the host variables, the optimizer cannot know if the BETWEEN will always qualify a small number of rows, thus possibly making an index retrieval much more efficient. The OPTIMIZE FOR literal ROWS clause is used to override the number of expected rows deduced by the optimizer. This allows it to generate better access strategies.

Result Column Names with the UNION Operator

When a SELECT statement includes the UNION operator, the names of the columns in the result table are the names established by the last UNION operand. These names are used as:

- Column headings when the online command facility displays the result table
- Column names in the SQL descriptor area when CA IDMS compiles the SELECT statement dynamically

Outer Join Using PRESERVE

Within a SELECT statement, PRESERVE can be used to request an outer join on one of the tables or views named in the FROM parameter. If PRESERVE is specified, the result table includes rows of the preserved table for which no matching row exists in the other tables used in the join operation.

If no matching row exists, the corresponding columns in the result table are set to null. Predicates in the WHERE clause other than those used to perform the outer join are evaluated *before* determining whether a matching row exists.

The following statement returns the names of all active employees. The name of the employee's spouse is also returned if found. The logic of the statement is that the result table will include the name of each active employee, whether the employee has a spouse:

```
select e.first_name, e.last_name,
       s.first_name, s.last_name
  from employee e, relation s
  where e.empid=s.empid
    and e.status='A'          -- active employee
    and s.relationship='S'    -- employee's spouse
  preserve e ;
```

Examples

Selecting a Single Row

The following SELECT statement retrieves information about a specific project from the PROJECT and EMPLOYEE tables. The value in each selected column is assigned to the corresponding host variable. The SELECT statement includes indicator variables for the ACT_START_DATE, ACT_END_DATE, EST_START_DATE, and EST_END_DATE columns.

```
EXEC SQL
   SELECT PROJ_ID, EMP_FNAME, EMP_LNAME, DEPT_ID, PROJ_DESC,
         ACT_START_DATE, ACT_END_DATE, EST_START_DATE, EST_END_DATE
      INTO :PROJ-ID, :EMP-FNAME, :EMP-LNAME, :DEPT-ID, :PROJ-DESC,
         :ACT-START-DATE :ACT-START-DATE-IND,
         :ACT-END-DATE :ACT-END-DATE-IND,
         :EST-START-DATE :EST-START-DATE-IND,
         :EST-END-DATE :EST-END-DATE-IND
      FROM PROJECT, EMPLOYEE
      WHERE PROJ_LEADER_ID = EMP_ID
         AND PROJ_ID = :PROJECT_NUMBER
END-EXEC
```

Retrieving Values through the Command Facility

The following SELECT statement retrieves project information for each employee and consultant in department 1100.

```
select e.proj_id, emp_lname, emp_fname, est_start_date, act_start_date
   from employee e, project p
   where e.proj_id = p.proj_id
      and dept_id = 1100
   union select c.proj_id as "Project ID",
         con_lname as "Last Name",
         con_fname as "First Name",
         est_start_date as "Estimated Start Date",
         act_start_date as "Actual Start Date"
      from consultant c, project p
      where c.proj_id = p.proj_id
         and dept_id = 1100
   order by 1, 2, 3;
```

Selecting Multiple Rows into a Buffer

The following SELECT statement returns information on the cost of insurance plans in Massachusetts into an array identified by the host variable :INS-COST-BUFFER:

```
EXEC SQL
   SELECT PLAN_CODE, COMP_NAME, MAX_LIFE_COST, FAMILY_COST, DEP_COST
      BULK :INS-COST-BUFFER
      FROM INSURANCE_PLAN
      WHERE STATE = 'MA'
END-EXEC
```

More Information

- For more information about host variables, local variables, or routine parameters, see Host Variables, Local Variables, or Routine Parameters (see page 84).
- For more information about compatible data types for assignment operations, see Comparison, Assignment, Arithmetic, and Concatenation Operations.
- For more information about outer joins, see Expansion of Joined-table, and Query Specifications.
- For more information about the UNION operator, see Expansion of Query-expression.
- For more information about bulk processing in an application program, see the *CA IDMS SQL Programming Guide*.

SET ACCESS MODULE

The SET ACCESS MODULE statement overrides the default access module to be used by a transaction. You can issue only one SET ACCESS MODULE statement in any given transaction. It is also a CA IDMS extension of the SQL standard. You can use this statement only in SQL that is embedded in a program.

Authorization

None required.

Syntax

```
►►─── SET ACCESS MODULE ─┬─ access-module-name ──────────┬────────────────────►◄
                         └─ :access-module-variable-name ┘
```

Parameters

access-module-name

Specifies the access module to be used by the current transaction. *Access-module-name* must identify an access module stored in the dictionary.

:*access-module-variable-name*

Identifies a host variable, local variable, or routine parameter containing the name of the access module to be used by the current transaction. *Access-module-variable-name* must be a variable previously defined in the application program or SQL routine.

If *access-module-variable-name* is a local variable or routine parameter, the colon must not be coded.

Usage

Order of Execution

If used, the SET ACCESS MODULE statement must be executed before any statement in the transaction *other than*:

- CONNECT
- SET SESSION
- SET TRANSACTION

Default Access Module

By default, a transaction uses the access module associated with the application program issuing the first SQL statement executed within the SQL session.

One Access Module for a Transaction

A transaction can use only one access module.

Example

Setting the Access Module

The following SET ACCESS MODULE specifies that the current transaction is to use the access module identified by the host variable TRANS-ACC-MOD:

```
EXEC SQL
   SET ACCESS MODULE :TRANS-ACC-MOD
END-EXEC
```

Note: For more information about setting the access module for a transaction, see the *CA IDMS SQL Programming Guide*.

SET host-variable Assignment

The SET host-variable statement enables directly assigning the results of an SQL value expression to a host variable. This statement can only be used in embedded SQL.

Syntax

```
►►─ SET ─── host-variable ───────── = ────┬─ value-expression ─┬──────────────►◄
                                          └─ NULL ─────────────┘
```

Parameters

host-variable

Identifies a **host-variable** that is to receive the value of the specified value expression or null. **Host-variable** must be a host variable previously declared in the application program.

value-expression

Specifies the value to be assigned to the destination or receiving field of the assignment statement.

NULL

Specifies that **host-variable** is set to the NULL value.

Usage

The rules for assignment are provided in Comparison, Assignment, Arithmetic, and Concatenation Operations.

Example

The **host-variable** COMB-NAME is constructed from the values in the **host-variable**s FIRST-NAME and LAST-NAME.

```
EXEC SQL
   set:COMB-NAME=trim(:FIRST-NAME) ||' '|| trim(:LAST-NAME);
END-EXEC
```

SET SESSION

The SET SESSION management statement establishes SQL session characteristics. Using the SET SESSION statement, you can perform the: following tasks:

- Specify whether subsequent SQL statements must comply with a particular SQL standard
- Change the current schema in effect for the SQL session
- Establish default transaction options
- Control SQL dynamic statement caching
- Specify the encoding of XML values

These session characteristics apply only to SQL submitted through the Command Facility or for dynamic compilation during the execution of an application program.

A SET SESSION statement must include at least one parameter and is a CA IDMS extension of the SQL standard.

Authorization

None required.

Syntax

```
►►─── SET SESSION ─────────────────────────────────────────────────────────────►

             ┌───────────────────────┐
 ►───────────▼─ session-attribute ───┴──────────────────────────────────────────►◄
```

Expansion of session-attribute

```
►──┬── CHECK SYNTAX ─┬─ SQL89 ─────────────────────────────────────────┬──────►◄
   │                 ├─ FIPS ─────────┤                                 │
   │                 └─ EXTENDED ─────┘                                 │
   ├── CURRENT SCHEMA ─┬─ schema-name ─┬─────────────────────────────────┤
   │                   └─ NULL ────────┘                                 │
   ├─┬─ CURSOR STABILITY ─┬──────────────────────────────────────────────┤
   │ └─ TRANSIENT READ ───┘                                              │
   │                                                                     │
   ├─┬─ READ ONLY ──┬────────────────────────────────────────────────────┤
   │ └─ READ WRITE ─┘                                                    │
   ├── SQL CACHING ─┬─ ON ───────────────────────────────────────────────┤
   │                ├─ OFF ──────┤                                       │
   │                └─ DEFAULT ◄─┘                                       │
   └── XML ENCODING ─┬─ UTF8 ──────┬─────────────────────────────────────┘
                     ├─ UTF16BE ───┤
                     ├─ UTF16LE ───┤
                     └─ EBCDIC ◄───┘
```

Parameters

Parameters for Expansion of session-attribute

CHECK SYNTAX

Specifies whether CA IDMS is to check subsequent SQL statements for compliance with a particular standard.

If CHECK SYNTAX is not specified, SQL statements are checked for compliance with CA IDMS Extended SQL.

SQL89

Directs CA IDMS to use ANSI X3.135-1989 (Rev), *Database Language SQL with integrity enhancement*, as the standard for compliance.

FIPS

Directs CA IDMS to use FIPS PUB 127-1, *Database Language SQL*, as the standard for compliance.

Note: The FIPS standard is based on ANSI X3.135-1989 (Rev). Specifying FIPS in the CHECK SYNTAX parameter has the same effect as specifying SQL89.

EXTENDED

Directs CA IDMS to check subsequent SQL statements for compliance with CA IDMS Extended SQL.

CURRENT SCHEMA

Changes the default schema specification for the SQL session.

schema-name

Specifies a schema to be used as the default for the SQL session. The specified schema overrides the default in effect for the user session.

NULL

Directs CA IDMS to use the default schema in effect for the user session as the default for the SQL session.

CURSOR STABILITY/TRANSIENT READ

Directs CA IDMS to set the default isolation level to that specified.

READ ONLY/READ WRITE

Directs CA IDMS to set the default transaction mode to that specified.

SQL CACHING

Enables you to control dynamic SQL statement caching.

ON

If SQL caching is globally enabled, the session will use caching until the session option is changed or until the caching is disabled at the system level.

OFF

Regardless of the global setting of SQL caching, the session will not use caching until the session option is changed.

DEFAULT

Same as ON.

XML ENCODING

Specifies the type of encoding to use for XML values.

XML ENCODING remains valid until the end of session or until a new SET SESSION command is executed.

UTF8

Specifies UTF-8 Unicode encoding.

UTF16BE

Specifies UTF-16 Big Endian Unicode encoding.

UTF16LE

Specifies UTF-16 Little Endian Unicode encoding.

EBCDIC

Specifies EBCDIC encoding. This is the default.

Usage

Default Schema for a User Session

The default schema in effect for a user session is established by a user profile, a system profile, or a DCUF SET PROFILE command.

Duration of SQL Session Characteristics

The SQL session characteristics established by the SET SESSION statement remain in effect until the end of the SQL session or until changed by a subsequent SET SESSION statement.

Precompiled Statements

The SET SESSION command does not cause CA IDMS to check precompiled SQL statements. Use the corresponding precompiler option to enable standards checking for embedded SQL statements.

Establishing Default Transaction Options

You can establish default transaction options for an SQL session using the SET SESSION statement. You can establish the default mode in which a database is accessed (READ ONLY or READ WRITE) and specify an isolation level (CURSOR STABILITY or TRANSIENT READ).

If you do not specify either of these options, the defaults are READ WRITE and CURSOR STABILITY, or the settings specified as part of the access module definition for embedded SQL. The default options may be overridden for an individual transaction by using the SET TRANSACTION statement.

If a transaction is active at the time these options are changed, they impact only subsequent transactions.

Note: For more information about transaction mode and isolation level, see CREATE ACCESS MODULE.

Examples

Checking Compliance with SQL Standard

The following SET SESSION statement which is embedded in an application program, directs CA IDMS to flag any subsequent statements submitted for dynamic compilation that do not comply with SQL standard 89:

```
EXEC SQL
   SET SESSION CHECK SYNTAX SQL89
END-EXEC
```

Setting a Default Schema

The following SET SESSION statement (submitted through the Command Facility) directs CA IDMS to use the SALES_SCH schema as the default schema for the remainder of the SQL session:

```
set session current schema sales_sch;
```

Encoding XML Values

The following examples illustrate EBCDIC and Unicode encoding.

Example 1 - EBCDIC encoding

```
set session XML ENCODING ebcdic ;
select cast(SLICE as BIN (27)) as EBCDIC
  from SYSCA.XMLSLICE
 where SLICESIZE = 27 and XMLVALUE =
 XMLCOMMENT('  0123456789ABCDEF  ');
```

The result looks like this:

```
*+ EBCDIC
*+ ------
*+ 4C5A60604040F0F1F2F3F4F5F6F7F8F9C1C2C3C4C5C6404060606E
```

Example 2 - UTF-8 encoding

```
set session XML ENCODING UTF8 ;
*+ Status = 0        SQLSTATE = 00000
select cast(SLICE as BIN (27)) as "UTF-8"
  from SYSCA.XMLSLICE
 where SLICESIZE = 27 and XMLVALUE =
 XMLCOMMENT('  0123456789ABCDEF  ');
```

The result looks like this:

```
*+ UTF-8
*+ -----
*+ 3C212D2D2020303132333435363738394142434445462020202D2D3E
```

Example 3 - UTF-16 Big Endian encoding

```
set session XML ENCODING UTF16BE ;
*+ Status = 0        SQLSTATE = 00000
select cast(SLICE as BIN (27)) as "UTF-16 BE"
  from SYSCA.XMLSLICE
 where SLICESIZE = 27 and XMLVALUE =
 XMLCOMMENT('  0123456789ABCDEF  ');
```

The result looks like this:

```
*+ UTF-16 BE
*+ ---------
*+ 003C0021002D002D00200020003000310032003300340035003600
*+ 370038003900410042004300440045004600200020002D002D003E
```

Example 4 - UTF-16 Little Endian encoding

```
set session XML ENCODING UTF16LE ;
*+ Status = 0        SQLSTATE = 00000
select cast(SLICE as BIN (27)) as "UTF-16 LE"
  from SYSCA.XMLSLICE
 where SLICESIZE = 27 and XMLVALUE =
XMLCOMMENT('  0123456789ABCDEF  ');
```

The result looks like this:

```
*+ UTF-16 LE
*+ ---------
*+ 3C0021002D002D00200020003000310032003300340035003600037
*+ 0038003900410042004300440045004600200020002D002D003E00
```

More Information

- For more information about CA IDMS compliance with SQL standard SQL, see Summary Comparison to SQL Standard.
- For more information about user profiles, see the *CA IDMS Security Administration Guide*.
- For more information about system profiles, see the *CA IDMS System Tasks and Operator Commands Guide*.
- For more information about the DCUF SET PROFILE command, see the *CA IDMS System Tasks and Operator Commands Guide*.
- For more information about managing SQL sessions, see the *CA IDMS SQL Programming Guide*.
- For more information about precompiler options, see the *CA IDMS SQL Programming Guide*.
- For more information about dynamic SQL statement caching, see SQL Cache Tables, and the *CA IDMS SQL Programming Guide*.

SET TRANSACTION

The SET TRANSACTION management statement overrides the default characteristics of a transaction. The default characteristics are established during access module compilation or, for transactions initiated by the Command Facility, by CA IDMS, and may subsequently have been overridden by a SET SESSION statement.

You can issue only one SET TRANSACTION statement in any given transaction.

Authorization

None required.

Syntax

```
►►─── SET TRANSACTION ──────────────────────────────────────────────────►

 ►─┬──────────────┬─────────────────────────────────────────────────────►
   ├─ READ ONLY  ─┤
   └─ READ WRITE ─┘

 ►─┬───────────────────┬───────────────────────────────────────────────►◄
   ├─ CURSOR STABILITY ─┤
   └─ TRANSIENT READ ───┘
```

Parameters

For the duration of the transaction in which the statement is executed, SET TRANSACTION parameters override the defaults. A SET TRANSACTION statement must specify at least one parameter; the combination of READ WRITE and TRANSIENT READ is invalid.

Usage

Order of Execution

If used, the SET TRANSACTION statement must be executed before any statement in the transaction *other than*:

- CONNECT
- SET ACCESS MODULE
- SET SESSION

Default Transaction Characteristics

Default transaction characteristics are initially established during access module compilation. If not specified as parameters on a CREATE or ALTER ACCESS MODULE statement, and for transactions initiated through the Command Facility, the default transaction characteristics are:

- READ WRITE
- CURSOR STABILITY

These initial defaults can be changed by issuing a SET SESSION statement.

Example

Setting Isolation Level

The following SET TRANSACTION statement specifies that the transaction has an isolation level of transient read:

```
EXEC SQL
   SET TRANSACTION
      TRANSIENT READ
END-EXEC
```

More Information

- For more information about isolation levels and SET TRANSACTION parameters, see CREATE ACCESS MODULE.
- For more information about managing transactions, see the *CA IDMS SQL Programming Guide*.

SUSPEND SESSION

The SUSPEND SESSION management statement suspends an SQL session and any transaction currently active within the session. You use the SUSPEND SESSION statement primarily in pseudoconversational programming. It is also a CA IDMS extension of the SQL standard.

Authorization

None required.

Syntax

```
►►── SUSPEND SESSION ─────────────────────────────────────────────────────►◄
```

Usage

Effect of SUSPEND SESSION

When you suspend an SQL session, CA IDMS releases all resources except those required to re-establish the session. Resources required to re-establish the session include locks held by any currently active transaction, cursor currencies, and temporary tables, and dynamically prepared statements.

The SUSPEND SESSION statement does *not* cause a commit or rollback of changes to the database.

Valid SQL Statement After SUSPEND SESSION

The first SQL statement you issue after SUSPEND SESSION must be RESUME SESSION.

Example

Suspending a Session

The following SUSPEND SESSION statement suspends the current SQL session:

```
EXEC SQL
   SUSPEND SESSION
END-EXEC
```

More Information

- For more information about resuming a suspended session, see RESUME SESSION.
- For more information about managing SQL sessions, see the *CA IDMS SQL Programming Guide*.

TRANSFER OWNERSHIP

The TRANSFER OWNERSHIP authorization statement passes ownership of a schema from one user or group of users to another. It is also a CA IDMS extension of the SQL standard.

Authorization

To issue a TRANSFER OWNERSHIP statement, you must own the schema named in the statement or hold the DBADMIN privilege on the database in which the schema is defined.

Syntax

```
►►─── TRANSFER OWNERSHIP OF SCHEMA schema-name ──────────────────────────►

 ►─── TO authorization-identifier ──────────────────────────────────────►◄
```

Parameters

OF SCHEMA *schema-name*

Specifies the schema whose ownership is being transferred. *Schema-name* must identify a schema defined in the dictionary.

TO authorization-identifier

Identifies the user or group of users to whom you are transferring ownership of the named schema. For expanded **authorization-identifier** syntax, see Expansion of Authorization-identifier.

Usage

Schema Ownership

At any given time, a schema can be owned by one user or group of users. The initial owner is the user who created the schema. When ownership of a schema is transferred to a group, each user in the group has all the privileges associated with ownership.

Ownership of Other Entities

Technically, schemas are the only database entities that users own. However, by association, the user or group that owns a schema is also said to own the entities in the schema.

Ownership Privileges

The owner of a schema has all applicable privileges on entities in the schema, as well as the privilege of granting those privileges to other users or groups. If you transfer ownership of a schema to another user or group, you no longer have any privileges on the entities in the schema.

Examples

Transferring Ownership to a Single User

The following TRANSFER OWNERSHIP statement transfers ownership of the PKE_SCH schema to user PKE:

```
transfer ownership of schema pke_sch
   to pke;
```

Transferring Ownership to a Group

The following TRANSFER OWNERSHIP statement transfers ownership of the SALES_SCH schema to the SALES_GRP group:

```
transfer ownership of schema sales
   to sales_grp;
```

More Information

- For more information about creating a schema, see CREATE SCHEMA.
- For more information about schema ownership, see your security administrator.

UPDATE

The UPDATE statement is a data manipulation statement that modifies the values in one or more rows of a table.

Authorization

To issue an UPDATE statement, you must:

- Hold the UPDATE privilege on or own the table, view, or table procedure named as the target of the update operation
- Hold the SELECT privilege on or own each table, view, function, procedure and table procedure explicitly named in a subquery in the search condition in the WHERE parameter

Additional authorization requirements apply to:

- A view named in **table-reference**; each view named in the FROM parameter of such a view; each view named in the FROM parameters of those views, and so forth.

  For any such view, the owner of the view must hold the grantable UPDATE privilege on or own the table, view, or table procedure named in the FROM parameter of the view definition.

- Each view named in the FROM parameter of a subquery in the search condition; each view named in the FROM parameter of such a view; each view named in the FROM parameters of those views, and so forth.

  For any such view, the owner of the view must hold the grantable SELECT privilege on or own each table, view, function, or table procedure named in the FROM parameter of the view definition.

Syntax

```
►►── UPDATE table-reference ─┬─────────┬──────────────────────────────────►
                             └─ alias ─┘

►── SELECT ─▼─ column-name ── = ─┬─ value-expression ───┬─┴───────────────►
    (SET)    └──────────────── , ─────────────────────────┘
                                 ├─ NULL ───────────────┤
                                 └─ (query-expression) ─┘

►─┬───────────────────────────────────────────────────────────────┬──────►◄
  └─ WHERE ─┬─ search-condition ─────────────────────────────────┤
            └─ CURRENT OF ─┬─ cursor-name ────────────────────────┤
                           └─ dynamic-name-clause ────────────────┘
```

Expansion of dynamic-name-clause

```
►►─┬──────────────┬─ cursor-name ─────────────────────────────────────────►◄
   ├─ LOCAL ◄ ────┤
   └─ GLOBAL ─────┘
```

Parameters

table-reference

Specifies the table, view, or table procedure whose rows are to be updated. Table-reference must not specify a procedure. If **table-reference** identifies a view:

- The view must be updateable
- The applicable rows are updated in the table from which the view is derived

For expanded **table-reference** syntax, see Expansion of Table-reference.

alias

Defines a new name to be used to identify the table, view or table procedure within the UPDATE statement. *Alias* must be a 1- through 18-character name that follows the conventions for SQL identifiers.

SET

Specifies the columns to be updated and the value to be stored in each column.

***column-name* =**

Identifies a column to be updated. *Column-name* must identify a column in the table, view, or table procedure named in the UPDATE statement.

Column-name must be unique within the SET parameter.

In an UPDATE statement that includes the WHERE CURRENT OF *cursor-name* parameter, *column-name* must identify a column specified in the FOR UPDATE parameter of the DECLARE CURSOR statement that defines the named cursor.

value-expression

Specifies the value to be stored in the named column. The data type of the value represented by **value-expression** must be compatible with the data type of the named column. For expanded **value-expression** syntax, see Expansion of Value-expression.

NULL

Directs CA IDMS to store a null value in the named column. The column must be defined to allow null values.

query-expression

Represents a value to be used for a column in an UPDATE column statement. The *query-expression* must return at most, one row and the result table of the *query-expression* must consist of a single column.

Note: For more information about expanded *query-expression* syntax, see Chapter 8:.

WHERE

Restricts the rows to be updated. If the UPDATE statement does not include the WHERE parameter, CA IDMS updates *all* rows in the specified table or view.

search-condition

Specifies criteria a row must meet to be updated:

- When the value of **search-condition** is true, the row is updated
- When the value of **search-condition** is false, the row is not updated

For expanded **search-condition** syntax, see Expansion of Search-condition.

CURRENT OF

Specifies that only the row that corresponds to the current row of the named cursor is to be updated.

cursor-name

Identifies the cursor whose current row will be updated. **Cursor-name** must identify an open cursor previously defined by a DECLARE CURSOR statement within the application program or by an ALLOCATE CURSOR statement executed within the same SQL transaction.

Note: This option may only be used in an UPDATE statement embedded in an application program.

dynamic-name-clause

Identifies the cursor whose current row will be updated.

Note: This option may only be used in an UPDATE statement dynamically compiled using a PREPARE or EXECUTE IMMEDIATE statement.

Parameters for Expansion of dynamic-name-clause

LOCAL

Indicates that the named cursor has a local scope and was defined using a DECLARE CURSOR statement or an ALLOCATE CURSOR statement. The default is LOCAL.

GLOBAL

Indicates that the named cursor was created by an ALLOCATE CURSOR statement and is global in scope.

cursor-name

Specifies the name of the cursor as an identifier. *Cursor-name* must identify an open cursor previously defined by a DECLARE CURSOR statement within the application program or by an ALLOCATE CURSOR statement executed within the same SQL transaction.

Usage

Searched Updates

An UPDATE statement that includes the WHERE **search-condition** parameter or does not include the WHERE parameter at all is called a searched update. Searched updates may be entered through the Command Facility, executed dynamically, and embedded within application programs.

Positioned Updates

An UPDATE statement that includes the WHERE CURRENT OF *cursor-name* parameter is called a positioned update. Positioned updates are valid only from within an application program.

Dynamic Positioned Updates

A dynamic positioned UPDATE statement is one that references a dynamic cursor. Such an UPDATE statement may be embedded within an application program or created dynamically using a PREPARE or EXECUTE IMMEDIATE statement.

A positioned UPDATE statement embedded in an application program may reference a static cursor or a dynamic cursor. A positioned UPDATE statement created dynamically using a PREPARE or EXECUTE IMMEDIATE statement can only reference a dynamic cursor.

Ambiguous Cursor References

When a dynamic positioned UPDATE statement is being created by a PREPARE or EXECUTE IMMEDIATE statement, it is possible that CA IDMS may not be able to determine which cursor is being referenced. This will occur if the application program contains a DECLARE CURSOR statement that defines a cursor having the referenced name and the program has also executed an ALLOCATE cursor statement that creates a cursor with the same name and a local scope. Under these conditions, CA IDMS cannot determine which of the two cursors is being referenced. To avoid such problems, it is advisable to use different names for cursors that are declared from those that are allocated with a local scope.

Restrictions on Table-reference

In a searched update, the table, view, or table procedure named in the UPDATE statement cannot also be named in the FROM parameter of any subquery included in the specified search condition; or, in the case of a view, in any search condition used in the view definition. The same restriction applies for any update that uses a subquery as the value to be stored in an updated column. Therefore, you cannot update data in a table from which you select in a subquery.

In a positioned update, the table, view, or table procedure named in the UPDATE statement must also be named in the FROM parameter of the query specification used in the definition of the named cursor.

Restriction on Value-expression

The value expression that specifies the value to be stored in a column cannot include any aggregate functions.

Cursor Position after a Positioned Update

After a positioned update, the position of the cursor named in the UPDATE statement remains unchanged.

Restrictions for Tables in Referential Constraints

If the table named in an UPDATE statement is the referencing table in a referential constraint, CA IDMS will update a row in the table only if, after the update operation, the foreign-key columns in the row satisfy either of the following conditions:

- The columns must be all or partially null
- The foreign-key values must match the referenced-column values in a row of the referenced table

If the table named in an UPDATE statement is the referenced table in a referential constraint, and the referencing table includes one or more rows whose foreign-key values match the referenced-column values of the row in the referenced table to be updated, CA IDMS will update the row only if the update operation does not change the values in the referenced columns.

Satisfying Check Constraints

If the updates to a row do not satisfy the check constraints, if any, in the table definition, CA IDMS returns an error and does not update the row.

Updating Through a View

If the target of the update statement is a view, the view must be updateable, and only rows that can be retrieved through the view can be updated through the view.

If the view being updated is defined with WITH CHECK OPTION, any WHERE clause in the view definition, or in the definitions of any other views nested within its definition, will be applied like a check constraint to restrict the update values.

Using a query-expression as a Source Value

If a query-expression used as the value stored in a column returns no rows, the column is set to the null value. If the column does not allow nulls, an exception is raised.

Examples

Requesting a Searched Update

The following UPDATE statement updates the MANAGER_ID column in the EMPLOYEE table for rows where the value in the column currently is 3222:

```
update employee
   set manager_id = 9847
   where manager_id = 3222;
```

Requesting a Positioned Update

The following UPDATE statement updates the BENEFITS table through the BONUS_CURSOR cursor. The statement stores the value in the host variable CALC-BONUS-AMT in the BONUS_AMOUNT column of the table row that corresponds to the current row of the cursor.

```
EXEC SQL
   UPDATE BENEFITS
      SET BONUS_AMOUNT = :CALC-BONUS-AMT
      WHERE CURRENT OF BONUS_CURSOR
END-EXEC
```

A Positioned UPDATE Referencing a DECLAREd Cursor

The following statement updates the current row of the cursor C1. C1 may be a dynamic or static cursor, but it must have been defined using a DECLARE CURSOR statement. Furthermore, the **cursor-specification** on which C1 is based must contain a FOR UPDATE option which directly or implicitly includes the EMP_LNAME column:

```
EXEC SQL
  UPDATE EMPLOYEE
     SET EMP_LNAME = :emp-name
     WHERE CURRENT OF C1
END-EXEC
```

A Positioned UPDATE Referencing an ALLOCATEd Cursor

The following statement updates the current row of a cursor whose name is specified in the variable CNAME. The referenced cursor must have been defined using an ALLOCATE CURSOR statement:

```
EXEC SQL
  UPDATE EMPLOYEE
    SET EMP_LNAME = :emp-name
    WHERE CURRENT OF GLOBAL :CNAME
END-EXEC
```

A Dynamically-compiled Positioned UPDATE Statement

The following statement updates the current row of local cursor C1. C1 may have been defined using either a DECLARE CURSOR statement or an ALLOCATE CURSOR statement. In either case, the cursor name in the UPDATE statement is specified as an identifier rather than as a literal or host variable:

```
EXEC SQL
  EXECUTE IMMEDIATE
  'UPDATE EMPLOYEE SET EMP_STATUS = "T"
      WHERE CURRENT OF LOCAL C1'
END-EXEC
```

Note: The keyword LOCAL is unnecessary since it is the default. Regardless of whether it is specified, if two local cursors named C1 have been defined, one using a DECLARE CURSOR statement and one using an ALLOCATE CURSOR statement, the EXECUTE IMMEDIATE statement will fail on an ambiguous cursor error.

Using query-expressions to Update Columns

The following example sets the value of the SALARY_BUDGET column in the DEPARTMENT table based on the current salaries of all employees in the department.

```
update department d
  set salary_budget =
     (select 1.1 * sum (salary) from employee e
      where e.deptid = d.deptid)
```

Updating All Rows

The following UPDATE statement modifies every row in the INSURANCE_PLAN table. The statement increases all the values in the FAMILY_COST column by 2 percent and all the values in the DEP_COST column by 1 percent:

```
update insurance_plan
   set family_cost = family_cost * 1.02,
      dep_cost = dep_cost * 1.01;
```

More Information

- For more information about updateable views, see CREATE VIEW.
- For more information about updateable result tables, see DECLARE CURSOR.
- For more information about compatible data types for assignment operations, see Comparison, Assignment, Arithmetic, and Concatenation Operations.
- For more information about null values, see Null Values.
- For more information about defining and manipulating cursors, see CLOSE, DECLARE CURSOR, FETCH, and OPEN (see page 494).
- For more information about referential constraints, see CREATE CONSTRAINT.

WHENEVER

The WHENEVER precompiler-directive statement specifies an action to be taken when the execution of an SQL statement results in a nonzero SQLCODE value. The WHENEVER statement directs the precompiler to insert the appropriate conditional code after each subsequent SQL statement that generates a call to CA IDMS

You can use this statement only in SQL that is embedded in a program.

Authorization

None required.

Syntax

```
►►─── WHENEVER ─┬─ NOT FOUND ──┬─┬─ CONTINUE ───────────────────────────────►◄
                ├─ SQLERROR ───┤ ├─┬─ GO TO ─┬─┬─ label ──┬───────────┘
                └─ SQLWARNING ─┘ │ └─ GOTO ──┘ └─ :label ─┘ │
                                 └─ CALL subroutine-name ───┘
```

Parameters

NOT FOUND

Directs CA IDMS to take the specified action when the execution of an SQL statement results in an SQLCODE value of 100.

SQLERROR

Directs CA IDMS to take the specified action when the execution of an SQL statement results in an SQLCODE value that is less than zero.

SQLWARNING

Directs CA IDMS to take the specified action when the execution of an SQL statement results in an SQLCODE value of 1.

SQLWARNING is a CA IDMS extension of the SQL standard.

CONTINUE

Specifies that processing is to continue with the next statement.

GO TO *label*/:*label*

Specifies that processing is to continue with the first statement at the named label. *Label* must be the name of a section or the unqualified name of a paragraph in the application program.

GO TO and GOTO are synonyms and can be used interchangeably. *Label* and :*label* are synonyms and can be used interchangeably.

The GO TO parameter is not valid in CA ADS application programs.

The specification of a label without a colon (:) is a CA IDMS extension of the SQL standard.

CALL *subroutine-name*

Specifies that processing control is to pass to the named subroutine. *Subroutine-name* must identify a subroutine subsequently defined in the process module.

The CALL parameter is valid only in CA ADS process modules.

The CALL parameter is a CA IDMS extension of the SQL standard.

Usage

Scope of the WHENEVER Statement

The WHENEVER statement for a specified condition applies to all subsequent SQL statements until the precompiler encounters another WHENEVER statement that names the same condition.

Example

Specifying Error Processing

The following WHENEVER statement specifies that control is to pass to the section or paragraph named SQLCODE-CHECK whenever CA IDMS returns a negative value in SQLCODE:

```
EXEC SQL
   WHENEVER SQLERROR
      GO TO :SQLCODE-CHECK
END-EXEC
```

More Information

- For more information about SQLCODE values, see SQLCODE Values.
- For more information about COBOL section and paragraph names, refer to the appropriate COBOL documentation.

Chapter 9: Control Statements

This section contains the following topics:

Overview

The statements defined in the Control category are the basis for the SQL procedural language used by SQL routines. An SQL routine usually contains procedural language statements and data manipulation statements. It can also use any statement as specified by the **procedure-statement** syntax.

Note: For more information, see CREATE PROCEDURE or CREATE FUNCTION.

The statements of the Control category include syntax to perform the following:

- Direct the flow of control
- Assign the result of expressions to variables and parameters
- Specify condition handlers to process various conditions
- Signal and resignal conditions
- Declare local cursors

The advantages for writing SQL routines in the SQL language include:

- Easy readable and simple but powerful programs
- Single Language to access and process data
- Native support for all the SQL data types makes handling of VARCHAR, DATE, TIME, and TIMESTAMP data a lot easier
- Built-in NULL support avoids the burden of having to define and manipulate NULL indicators for nullable data such as table columns or parameters of SQL routines which are always nullable
- Flexible handlers are able to process SQL events easily
- A single development and test platform fully integrated in all CA IDMS supported environments

SQL Control Statements

All SQL control statements are programmatic only. The following table provides a brief description of the SQL control statements.

Statement	**Purpose**
CALL	Invokes an SQL procedure. **Note:** The CALL statement is also a DML statement. The syntax and semantics of the CALL control statement are a subset of the CALL DML statement.
CASE	Determines the execution flow by the evaluation of one or more value-expressions.
Compound	Specifies a grouping of statements, with optional definitions of local variables, cursors, and handlers.
EXEC ADS	Starts a block of CA ADS code.
IF	Determines by evaluation of a search-condition, which block of statements are executed.
ITERATE	Begins a new iteration in a programmatic loop.

Statement	Purpose
LEAVE	Exits a programmatic loop.
LOOP	Defines a programmatic loop.
REPEAT	Defines a programmatic loop with an end condition.
RESIGNAL	Raises an SQL exception in a handler.
RETURN	Exits an SQL routine or compound statement, optionally returning a value.
SET Assignment	Assigns a value to a routine parameter, local variable, or host variable. **Note:** This statement can also be embedded in any SQL client program.
SIGNAL	Raises an SQL exception.
WHILE	Defines a programmatic, conditional loop.

CALL

The CALL control statement invokes SQL-invoked procedures. The syntax and semantics are a subset of the CALL DML statement.

Authorization

See Authorization.

Syntax

```
▶▶── CALL ── procedure-reference ──────────────────────────────▶◀
```

Parameter

procedure-reference

Identifies the procedure that is invoked, the input values that pass to the procedure and optionally the local variables and routine parameters for passing and returning values of input/output parameters.

Usage

See Usage.

Example

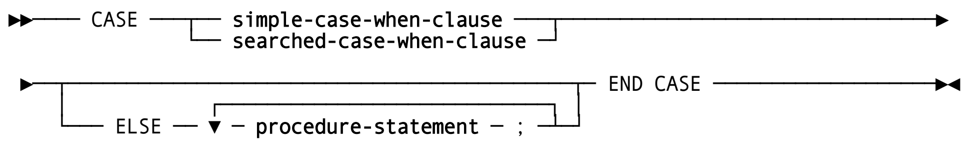
The function GET_NAME invokes the SQL procedure GET_FIRST_LAST to retrieve the first and last names of the employee's empid that is specified as the input parameter. The function then returns the combined and trimmed first and last names as one string.

```
set options command delimiter '++';
create procedure GET_FIRST_LAST
  ( P_EMPID NUMERIC(4)
  , P_FNAME char(20)
  , P_LNAME  char(30))
   EXTERNAL NAME DEMOGTFL LANGUAGE SQL
  /*
  ** Get first and last name of employee
  */
  Select EMP_FNAME, EMP_LNAME into P_FNAME, P_LNAME From DEMOEMPL.EMPLOYEE
    where EMP_ID = P_EMPID
++
commit++

create function GET_NAME
  (P_ID NUMERIC(4))  RETURNS varchar(40)
   EXTERNAL NAME DEMOGETN LANGUAGE SQL
begin not atomic
 /*
 ** Get name of employee
 */
 declare FNAME char(20);
 declare LNAME char(20);
 call GET_FIRST_LAST(P_ID, FNAME, LNAME);
 return trim(FNAME)|| ' ' || trim(LNAME);
end++
set options command delimiter default++
commit;

select GET_NAME(5008) from SYSCA.SINGLETON_NULL;
*+
*+ USER_FUNC
*+ -----------------------
*+ Timothy Fordman
*+
*+ 1 row processed
```

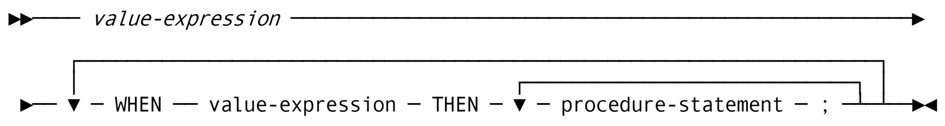
CASE

The CASE statement selects different execution paths depending on the evaluation of one or more *value-expressions*.

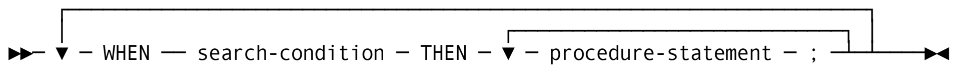
Syntax



Expansion of simple-case-when-clause



Expansion of searched-case-when-clause



Parameters

Parameters for Expansion of simple-case-when-clause

CASE value-expression

Specifies the value expression whose outcome is compared to the outcomes of the **value-expressions** in the WHEN clauses.

WHEN value-expression

Specifies a value expression whose outcome is compared to the outcome of the CASE **value-expression**. If the two values are equal, the group of statements specified in the corresponding THEN is executed.

THEN procedure-statement

Identifies the group of statements to be executed when the value expressions of the CASE and WHEN clauses are equal.

Parameters for Expansion of searched-case-when-clause

CASE WHEN

Identifies the CASE as a searched case.

WHEN search-condition

Specifies the search condition whose outcome, if true, results in the execution of the group of statements specified by the THEN clause.

THEN procedure-statement

Identifies the group of statements executed when the **search-condition** in the corresponding WHEN clause evaluates to true.

ELSE procedure-statement END CASE

Specifies the group of statements to be executed when none of the THEN group of statements has been executed because of the evaluation and comparison of the **value-expression**'s and **search-condition**'s. This clause can be specified for both simple and searched case statements.

Usage

SQL Exceptions

If an ELSE clause is not specified and none of the THEN group of statements has been executed because of the outcome of evaluation of the value expressions and search conditions, an SQL exception is raised.

Examples

The first example demonstrates the use of a **simple-case-when-clause**.

```
set options command delimiter '++';
create function USER01.TCASE1
  ( TITLE     varchar(40) with default
  , P_EMP_ID  unsigned numeric(4)
  ) RETURNS   varchar(30)
    external name TCASE1 language SQL
begin not atomic
  /*
  ** Function selects an employee with the given EMP_ID and swaps
  ** the first_name value 'James' with 'Jim'.
  ** Returns a message text with the outcome of the execution
  */
  declare MY_STATUS varchar(30);
  declare LOC_FNAME char(20) default ' ';

  select EMP_FNAME into LOC_FNAME
    from DEMOEMPL.EMPLOYEE
   where EMP_ID = P_EMP_ID;

  case LOC_FNAME
    when 'James'
      then update DEMOEMPL.EMPLOYEE set EMP_FNAME = 'Jim'
            where EMP_ID = P_EMP_ID;
           set MY_STATUS = 'James->JIM';
    when 'Jim'
      then update DEMOEMPL.EMPLOYEE set EMP_FNAME = 'James'
            where EMP_ID = P_EMP_ID;
           set MY_STATUS = 'Jim->James';

    when 'Thomas'
      then update DEMOEMPL.EMPLOYEE set EMP_FNAME = 'Thomas'
            where EMP_ID = P_EMP_ID;
           set MY_STATUS = 'Dummy update';
    else set MY_STATUS = 'No Changes';
  end case;
  return MY_STATUS;
end
++
set options command delimiter default++
commit;

select USER01.TCASE1('TCASE1', 1034)from SYSCA.SINGLETON_NULL;
*+
*+ USER_FUNC
*+ ---------
*+ Jim->James
```

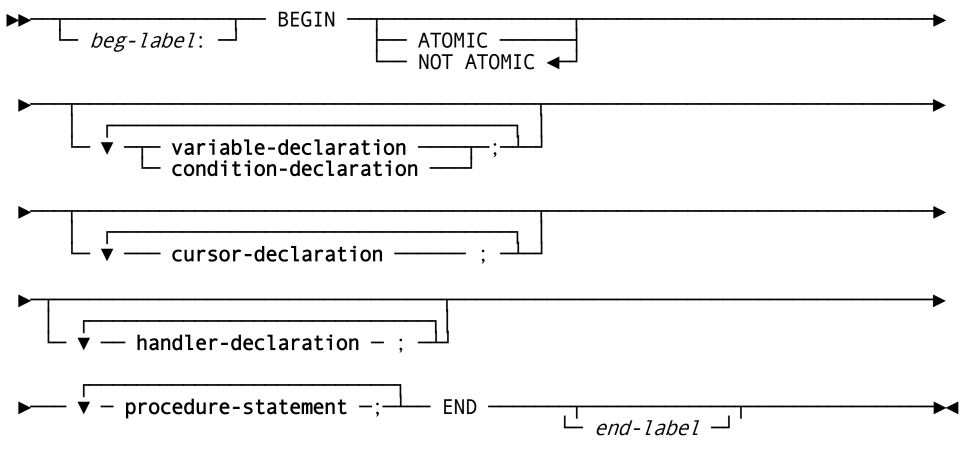
The second example demonstrates the **searched-case-when-clause**. It is functionally equivalent with the example of **simple-case-when-clause**.

```
set options command delimiter '++';
create function USER01.TCASESR1
  ( TITLE     varchar(40) with default
  , P_EMP_ID  unsigned numeric(4)
  ) RETURNS   varchar(30)
    external name TCASESR1 language SQL
begin not atomic
  /*
  ** Function selects an employee with the given EMP_ID and
  ** does some conditional updates.
  ** Returns a message text with the outcome of the execution
  */
  declare MY_STATUS varchar(30);
  declare LOC_FNAME char(20) default ' ';
  declare LOC_LNAME char(20) default ' ';

  select EMP_FNAME, EMP_LNAME into LOC_FNAME, LOC_LNAME
    from DEMOEMPL.EMPLOYEE where EMP_ID = P_EMP_ID;


  case
    when LOC_FNAME = 'James'
      then update DEMOEMPL.EMPLOYEE set EMP_FNAME = 'Jim'
            Where EMP_ID = P_EMP_ID;
           set MY_STATUS = 'James->JIM';
    when LOC_FNAME = 'Jim' and LOC_LNAME = 'Gallway'
      then update DEMOEMPL.EMPLOYEE set EMP_FNAME = 'James'
            Where EMP_ID = P_EMP_ID;
           set MY_STATUS = 'Jim->James';
    when LOC_LNAME = 'Van der Bilck'
      then update DEMOEMPL.EMPLOYEE set EMP_LNAME = 'Vanderbilck'
            Where EMP_ID = P_EMP_ID;
           set MY_STATUS = 'Van der Bilck->Vanderbilck';
    else set MY_STATUS = 'No Changes';
  end case;

  return MY_STATUS;
end
++
set options command delimiter default++
```

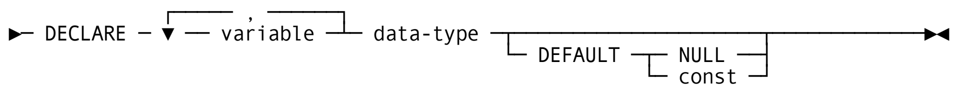
Compound Statement

The Compound statement defines a block of related SQL statements. In a compound block, local variables, condition names, cursors, and condition handlers can be defined.

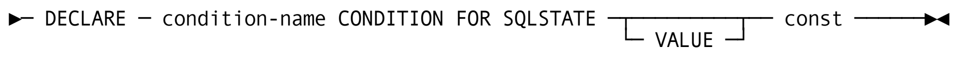
Syntax



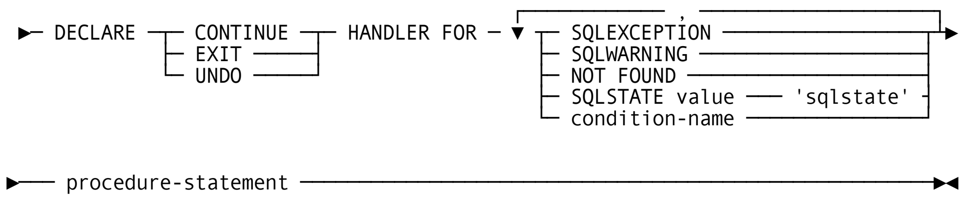
Expansion of variable-declaration



Expansion of condition-declaration



Expansion of handler-declaration



Parameters

beg-label:

Specifies a 1- through 32-character SQL identifier that labels the compound statement. The value must be different from any other label used in the compound statement.

ATOMIC

Specifies that an unhandled exception raised while executing the compound statement causes a rollback of the effects of the compound statement.

NOT ATOMIC

Specifies that an unhandled exception raised while executing the compound statement does not cause a rollback of the effects of the compound statement. This is the default.

variable-declaration

Defines a local variable.

condition-declaration

Defines a name for a condition for the purposes of referencing it in other statements.

cursor-declaration

Defines a local cursor for use within the compound statement. For a description of this clause, see DECLARE CURSOR.

handler-declaration

Defines a handler routine for SQL exception or completion conditions. A handler routine receives control when the execution of an SQL statement fails or terminates with a condition for which the handler has been defined. The three types of handlers (CONTINUE, EXIT, UNDO) and the conditions under which they are invoked are described in Parameters for Expansion of handler-declaration in this section.

procedure-statement

Defines the SQL procedure statement that is to be executed when the handler routine is invoked. *Procedure-statement* may be any statement except a compound statement.

end-label

Specifies an SQL identifier that labels the end of the compound statement. If specified, a *beg-label* must also have been specified and both labels must be equal.

Parameters for Expansion of variable-declaration

variable

Specifies the name of the local variable. *Variable* must be a 1- through 32-character name that follows the conventions for SQL identifiers. The names of all local variables declared within a compound statement must be unique.

data-type

Specifies a set of values that share processing characteristics. See Expansion of Data-type.

DEFAULT

Specifies the initial value of the local variable.

NULL

Initializes the local variable to NULL.

const

Initializes the local variable to the value of *const*. *Const* must be a literal whose value is compatible for assignment to the local variable.

Note: If DEFAULT is not specified, the local variable is not initialized.

Parameters for Expansion of condition-declaration

DECLARE *condition-name* FOR CONDITION SQLSTATE

Defines a name for a condition. This name can be used in other statements to refer to the condition.

condition-name

Specifies the name to be assigned to the condition. *Condition-name* must be a 1- through 32-character name that follows the conventions for SQL identifiers. The names of all conditions declared within a compound statement must be unique.

VALUE

Specifies an optional keyword without semantic meaning.

const

Specifies the value of SQLSTATE that constitutes the condition. *const* is a 5-character string-literal that consists of only digits (0-9) and capital alphabetic characters (A-Z). *const* cannot be '00000', the value of SQLSTATE for successful completion.

Parameters for Expansion of handler-declaration

CONTINUE

After executing the handler action, a CONTINUE handler returns control to the statement following the one that caused the event. If this statement is contained in an IF, CASE, LOOP, WHILE, or REPEAT statement, control is returned to the statement following the IF, CASE, LOOP, WHILE, or REPEAT statement.

EXIT

After executing the handler action, an EXIT handler returns control to the statement following the compound statement. If there is no statement following the compound statement, control is returned to the invoker of the routine.

UNDO

Before executing the handler action, an UNDO handler will rollback the database changes caused by the execution of the compound statement that caused the handler to be activated. After the handler actions have been executed, control is returned to the statement following the compound statement. If there is no statement after the compound statement, control is returned to the invoker of the routine. An UNDO handler requires its defining compound statement to be ATOMIC.

SQLEXCEPTION

Specifies that the handler is to be activated for all events except those of classes "Successful completion" (SQLSTATE = '00xxx'), "Completed with Warning" (SQLSTATE ='01xxx'), and "Completed with No Data" (SQLSTATE = '02xxx').

SQLWARNING

Specifies that the handler is to be activated for events of the class, "Completed with Warning" (SQLSTATE = '01xxx').

NOT FOUND

Specifies that the handler is to be activated for events of the class, "Completed with No Data" (SQLSTATE = '02xxx').

'*sqlstate*'

Specifies a value of SQLSTATE for which the handler is activated. *'Sqlstate'* must be a 5-character string-literal that consists of only digits (0-9) and capital alphabetic characters (A-Z). *'Sqlstate'* cannot be '00000', the value of SQLSTATE for successful completion.

condition-name

Specifies the name of a condition for which the handler is activated. *Condition-name* must identify a condition declared in the compound statement.

procedure-statement

Defines an SQL procedure statement to be included in the compound statement. *Procedure-statement* may be any statement including a compound statement. For more information, see the expansion for this syntax in CREATE FUNCTION (see page 341) or CREATE PROCEDURE (see page 361).

Usage

Variables, Parameters, and Column Names

When ambiguity exists in referencing local variables, parameters and column names, qualification is required to resolve the ambiguity.

Note: For more information, see Expansion of Local-variable and Expansion of Routine-parameter (see page 85).

Nesting of Compound Statement

A compound statement cannot contain other compound statements with the exception of handlers. A handler, which necessarily is contained in a compound statement, can have a compound statement as its procedure statement *procedure-statement*.

Handlers

When both a generic class handler (a handler for SQLEXCEPTION or SQLWARNING) and a specific handler cover the same event, the more specific handler is invoked when the event occurs.

Only one handler for a specific event can be defined.

Handlers cannot be defined with duplicate conditions.

If an SQL exception occurs in a compound statement for which there is no handler defined, control returns to the statement following the compound statement that caused the exception and an implicit RESIGNAL is executed. The exception is passed in the SQLSTATE. Database changes made by compound statements defined as ATOMIC will be rolled back before control returns.

Atomic Compound Statements

Compound statements defined as ATOMIC cannot contain the transaction management statements, COMMIT and ROLLBACK, or the session management statement, RELEASE.

Cursor state upon exiting from a compound statement

When execution of a compound statement ends, all cursors defined within the compound statement that are still open are automatically closed, except for returnable cursors.

Note: For more information about returnable cursors, see DECLARE CURSOR.

Example

The procedure USER01.TCOMP01 retrieves an employee for a given EMP_ID and returns a formatted name. An exit handler for NOT FOUND handles the NOT FOUND condition. An exit handler for SQLEXCEPTION handles generic database errors.

```
set options command delimiter '++';
create procedure USER01.TCOMP01
  ( P_ID     numeric(4)
  , P_NAME   char(30)
  , RESULT   varchar(30)
  )
    external name TCOMP01 language SQL

Label_400:
 /*
 ** Return formatted name of employee with given EMP_ID
 */
begin not atomic
  declare  L_FNAME   char(50);
  declare  L_LNAME   char(50);

  declare exit handler for SQLEXCEPTION
    label_8888:
      begin not atomic
        set RESULT = 'Unexpected SQLSTATE: ' || SQLSTATE;
        set P_NAME = '** Error **';
      end;

  declare exit handler for NOT FOUND
    set RESULT = 'No employee for EMP_ID: '
              || cast(P_ID as char(4));
```

```
   set RESULT = ' ';
   set P_NAME = ' ';

    select EMP_FNAME, EMP_LNAME into L_FNAME, L_LNAME
     from DEMOEMPL.EMPLOYEE
    where EMP_ID = P_ID;

   set P_NAME = trim(L_FNAME)  || ' ' || trim(L_LNAME);

   set RESULT = 'All OK';
 End label_400
 ++
set options command delimiter default++
commit;

 call user01.TCOMP01(1003);
 *+
 *+   P_ID  P_NAME                  RESULT
 *+   ----  ------                  ------
 *+   1003  Jim Baldwin             ALL OK

 call user01.TCOMP01(9);
 *+
 *+   P_ID  P_NAME                  RESULT
 *+   ----  ------                  ------
 *+      9                          NO EMPLOYEE FOR EMP_ID: 9
 call user01.TCOMP01(-2000);
 *+
 *+   P_ID  P_NAME                  RESULT
 *+   ----  ------                  ------
 *+  -2000  ** ERROR **             UNEXPECTED SQLSTATE: 22005
```

EXEC ADS

The EXEC ADS statement is a CA IDMS extension that enables inserting CA ADS code in SQL routines.

Syntax

```
                ┌─────────────────────┐
►►─── EXEC ADS ─▼─ ads-process-stmnt ─┴─ ; ──────────────────────────────►◄
```

Parameters

ads-process-stmnt

Specifies a CA ADS statement to be executed.

Usage

Allowable CA ADS statements

Only CA ADS statements that are allowed in a mapless dialog can be included in the body of an SQL routine.

Care should be taken in coding SQL transaction and session management statements because a ROLLBACK or COMMIT breaks the atomicity of a compound statement containing the EXEC ADS statement.

Referencing SQL-defined data

SQL-defined data can be referenced by respecting the mapping rules for identifiers and data types between SQL and CA ADS:

- Underscore characters are mapped to dashes.
- VARCHAR data are structures that start with a smallint field that holds the length of the character data, followed by the character data itself. The name of the structure is the mapped SQL identifier. The name of the length field is the mapped SQL identifier suffixed with "-LEN". The name of the data field is the mapped SQL identifier suffixed with "-TEXT".
- Nullable SQL data must have their NULL indicators managed properly. All SQL parameters and local variables are nullable.
- Date, time, and timestamp data types must be correctly processed.

Using IDD records and record elements from the dictionary

It is possible to use records and record elements that are defined as IDD records. This requires the specification of "ADD RECORD record name" in the ADS Compile Option of the CREATE PROCEDURE or CREATE FUNCTION statements. See the following example. For more information, see CREATE PROCEDURE and CREATE FUNCTION.

Using EXEC ADS for debugging

Some of the ADS utility commands can be used for debugging SQL routines. SNAP, TRACE, and WRITE TO LOG are of particular interest. See the second example below. All the SQL local variables and internal variables are contained in predefined ADS records. The name of these predefined records is constructed as follows: SQLLOCnnnnxxxxxxxx with xxxxxxxx representing the external name of the SQL routine and nnnn a four digit number with values starting from 0 for the internal variables to the total count of compound statements.

Assume an SQL routine with an associated external name of 'GETLNAME' containing two compound statements, then the content of all internal and SQL local variables can be dumped to the log as follows:

```
exec ADS snap record(SQLLOC0000GETLNAME
                  , SQLLOC0001GETLNAME
                  , SQLLOC0002GETLNAME).;
```

A complete report of the SQL routine, including the layout of all the records can be obtained by executing the batch utility ADSORPTS. For the SQL routine with external name GETLNAME, the control statement input for ADSORPTS would look like the following:

```
DIALOG=(GETLNAME),REPORTS=ALL
```

For the TRACE to be functional, the ADS dialog associated with the SQL routine needs to be compiled with symbol table information. This option can be turned on by specifying SYMBOL TABLE IS YES in the ADS Compile Option of the CREATE PROCEDURE or CREATE FUNCTION statements. See the next example. For more information, see CREATE PROCEDURE and CREATE FUNCTION (see page 341).

Example

Using EXEC ADS to obtain the current LTERM

The SQL function USER01.TEXECADS2 returns the LTERM ID of the LTERM on which the function is being executed.

```
set options command delimiter '++';
create function USER01.TEXECADS2
  ( P_DUMMY   char(1)
  ) returns   char(8)
    external name TEXECAD2 language SQL
begin not atomic
 /*
 ** SQL Function to return LTERM ID using EXEC ADS
 */
 declare L_LTERMID char (8) default ' ';
 exec ads
          ACCEPT LTERM ID INTO L-LTERMID. ;
 return L_LTERMID;
end
++
set options command delimiter default++
commit;

select USER01.TEXECADS2()
  from SYSCA.SINGLETON_NULL;
*+
*+ USER_FUNC
*+ ---------
*+ VL71001
```

Using EXEC ADS to debug a SQL routine

In the following example, the ADS COMPILE OPTION is used to add the ADSO-APPLICATION-GLOBAL-RECORD so that it can be accessed within the SQL function. Furthermore, the ADS dialog associated with the SQL function is compiled with diagnostics and symbol table so that debugging and diagnostic information is available at run time.

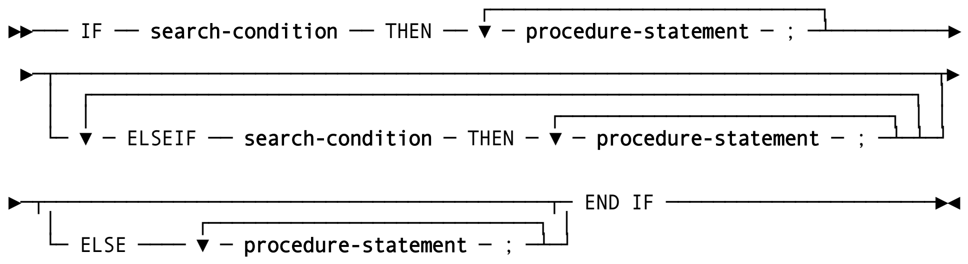
An EXEC ADS statement is placed as the very first executable statement of the SQL function to snap the local variables to the IDMS log to verify the initialization and to turn on ADS tracing. The EXEC ADS statement at the end, snaps the local variables and the ADSO-APPLICATION-GLOBALE-RECORD before returning to the invoker of the function. This statement also turns the ADS tracing off.

```
set options command delimiter '++';
create function GET_NAME
  (P_ID NUMERIC(4))  RETURNS varchar(40)
   EXTERNAL NAME DEMOGETN LANGUAGE SQL
   ADS COMPILE OPTION
    symbol table is yes
    diagnostic is yes
    add record ADSO-APPLICATION-GLOBAL-RECORD;
 begin not atomic
 /*
 ** Get name of employee
 */
  declare FNAME char(20) default ' ';
  declare LNAME char(20) default ' ';
  declare L_STATEMENT char(160);
  EXEC ADS snap record(SQLLOC0001DEMOGETN).
               trace all.;
  set L_STATEMENT =
     'select EMP_FNAME, EMP_LNAME' ||
     ' from DEMOEMPL.EMPLOYEE where EMP_ID = ?';
  prepare 'DYN1' from L_STATEMENT
    describe output using descriptor SQLDA;
  allocate 'CUR1' cursor for 'DYN1';
  open 'CUR1' using P_ID;
  fetch 'CUR1' into FNAME, LNAME;
  EXEC ADS snap record(SQLLOC0001DEMOGETN).
         snap record(ADSO-APPLICATION-GLOBAL-RECORD).
         trace off.;
  return trim(FNAME)|| ' ' || trim(LNAME);
end++
set options command delimiter default++
commit;
select GET_NAME(1003) from SYSCA.SINGLETON_NULL;
```

IF

The IF statement selects different execution paths depending on the evaluation of one or more truth value expressions, given as SQL search conditions.

Syntax



Parameters

IF search-condition

Specifies the truth value expression to be evaluated. The outcome of the evaluation determines the execution path.

THEN procedure-statement

Specifies the statements to be executed if the immediately preceding search condition is true.

ELSEIF search-condition

Specifies the truth value expression to be evaluated if the outcomes of all previously evaluated search conditions are false.

ELSE procedure-statement

Specifies the statements to be executed if all search conditions are false.

Usage

If no alternative execution path is given, execution continues with the next statement outside the IF.

Example

```
set options command delimiter '++';
create procedure USER01.TIF1
  ( TITLE   varchar(10) with default
  , P_LEFT    integer
  , P_RIGHT   real
  , RESULT  varchar(30)
  )
    EXTERNAL NAME TIF1 LANGUAGE SQL
Label_200:
begin not atomic
 /*
 ** Compare an integer value with a real value
 */
  if (P_LEFT > P_RIGHT)
    then set RESULT = 'p_left > p_right';
  elseif (P_LEFT = P_RIGHT)
    then set RESULT = 'p_left = p_right';
  elseif  (P_LEFT < P_RIGHT)
    then set RESULT = 'p_left < p_right';
  else   set RESULT = 'p_left and/or p_right NULL !';
  end if;
end
++
commit++
call user01.TIF1('Test IF >', 4, 2)++
*+
*+ TITLE           P_LEFT        P_RIGHT  RESULT
*+ -----           ------        -------  ------
*+ Test IF >            4   2.0000000E+00  P_LEFT >  P_RIGHT
call user01.TIF1('Test IF <', 4, 9)++
*+
*+ TITLE           P_LEFT        P_RIGHT  RESULT
*+ -----           ------        -------  ------
*+ Test IF <            4   9.0000000E+00  P_LEFT <  P_RIGHT

call user01.TIF1('Test IF =', 2, 2)++
*+
*+ TITLE           P_LEFT        P_RIGHT  RESULT
*+ -----           ------        -------  ------
*+ Test IF =            2   2.0000000E+00  P_LEFT = P_RIGHT

call user01.TIF1('Test IF ', 4)++
*+
*+ TITLE           P_LEFT        P_RIGHT  RESULT
*+ -----           ------        -------  ------
*+ Test IF              4          <null>  P_LEFT AND/OR P_RIGHT
NULL !
set options command delimiter default++
```

ITERATE

The ITERATE statement terminates execution of the current iteration of an iterated statement, such as LOOP, REPEAT or WHILE. If the iteration condition is true, a new iteration starts; otherwise, the statement following the iterated statement is executed.

Syntax

```
▶▶── ITERATE ── stmnt-label ─────────────────────────────────────▶◀
```

Parameters

stmnt-label

Specifies the begin label of the iterated statement.

Usage

Statements that may be iterated

The labeled statement referred in the ITERATE must be a LOOP, REPEAT, or WHILE statement that contains the ITERATE statement.

Example

The procedure USER01.TITERATE1 retrieves all rows of the DEMOEMPL.EMPLOYEE table three times. The first loop uses a WHILE, the second uses a REPEAT, and the third uses a LOOP statement.

```
set options command delimiter '++';
create procedure USER01.TITERATE1
  ( TITLE     varchar(10) with default
  , P_FNAME   char(20)
  , P_COUNT     integer
  , RESULT    varchar(10)
  )
    EXTERNAL NAME TITERATE LANGUAGE SQL

Label_600:
begin not atomic
  declare FNAME   char(20);
  declare LNAME   varchar(20);
  declare EMP1 CURSOR FOR
        Select EMP_FNAME, EMP_LNAME
          From DEMOEMPL.EMPLOYEE;
 /*
 ITERATE in WHILE
 */
  set RESULT = '?????';
  open EMP1;

  while_loop:
  while (9 = 9)
     do
      fetch EMP1 into FNAME, LNAME;
      if (SQLSTATE = '00000')
        then
           set P_COUNT = P_COUNT + 1;
           iterate while_loop;
      end if;

      if (SQLSTATE = 'abcde')
        then
           iterate while_loop;
      end if;

      set RESULT = SQLSTATE;
      leave while_loop;
  end while while_loop;

  close EMP1;
 /*
 ITERATE in REPEAT
 */
  set RESULT = '?????';
  open EMP1;

  repeat_loop:
  repeat
      fetch EMP1 into FNAME, LNAME;
      if (SQLSTATE = '00000')
        then
           set P_COUNT = P_COUNT + 1;
           iterate repeat_loop;
      end if;

      set RESULT = SQLSTATE;
      leave repeat_loop;
  until (9 = 0)
  end repeat repeat_loop;

  close EMP1;
 /*
 ITERATE in LOOP
 */
  set RESULT = '?????';
  open EMP1;

  loop_loop:
  loop
      fetch EMP1 into FNAME, LNAME;
      if (SQLSTATE = '00000')
        then
           set P_COUNT = P_COUNT + 1;
           iterate loop_loop;
      end if;

      set RESULT = SQLSTATE;
      leave loop_loop;
  end loop loop_loop;

  close EMP1;
end
++
commit++

call USER01.TITERATE1('TITERATE1','James  ',0,'U')++
*+
*+ TITLE      P_FNAME                  P_COUNT  RESULT
*+ -----      -------                  -------  ------
*+ TITERATE1   James                        165  02000
set options command delimiter default++
```

LEAVE

The LEAVE statement continues execution with the statement that immediately follows the specified labeled statement.

Syntax

```
▶▶── LEAVE ── stmnt-label ──────────────────────────────────────────▶◀
```

Parameters

stmnt-label

Specifies the begin label of a statement that contains the LEAVE statement, and identifies the statement that needs to be left.

Usage

Statements that may be left: The labeled statement referred in the LEAVE must be a LOOP, REPEAT, WHILE or compound statement that contains the LEAVE statement.

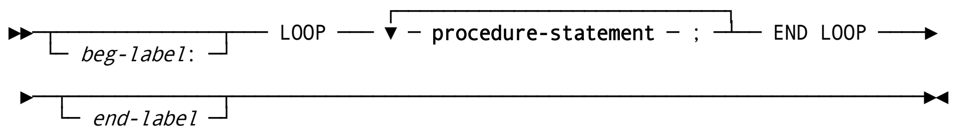
Example

```
set options command delimiter '++';
create procedure USER01.TLEAVE1
  ( TITLE     varchar(10) with default
  , P_FNAME   char(20)
  , P_COUNT   integer
  , RESULT    varchar(25)
  )
    EXTERNAL NAME TLEAVE1 LANGUAGE SQL
Label_700:
 /*
 ** Count number of employees with equal Firstname
 */
begin not atomic
  declare FNAME   char(20);
  declare LNAME   varchar(20);
  declare EMP1 CURSOR FOR
    Select EMP_FNAME, EMP_LNAME
      From DEMOEMPL.EMPLOYEE
     where EMP_FNAME = P_FNAME;

  open EMP1;
  fetch EMP1 into FNAME, LNAME;
  fetching_loop:
  loop
    if (SQLSTATE < > '00000')
      then leave fetching_loop;
    end if;
    set P_COUNT = P_COUNT + 1;
    fetch EMP1 into FNAME, LNAME;
  end loop fetching_loop;

  set RESULT = 'SQLSTATE: ' || SQLSTATE;
  close EMP1;
end
++
commit++
set options command delimiter default++

call USER01.TLEAVE1('TLEAVE1','Martin',0);
*+
*+ TITLE      P_FNAME                  P_COUNT  RESULT
*+ -----      -------                  -------  ------
*+ TLEAVE1    Martin                         3  SQLSTATE: 02000
```

LOOP

The LOOP statement repeats the execution of a statement or a group of statements.

Syntax



Parameters

beg-label:

Specifies a 1- through 32-character SQL identifier that labels the LOOP statement. The value must be different from any other label used in the compound statement if the LOOP statement is contained in a compound statement.

LOOP procedure-statement END LOOP

Specifies a statement or group of statements that are repeatedly executed.

end-label

Specifies an SQL identifier that labels the end of the LOOP statement. If specified, a *beg-label* must also have been specified and both labels must be equal.

Usage

How execution of a LOOP statement ends

To end the repeated execution of the *procedure-statement*s contained in a LOOP statement, a LEAVE statement can be used or an exit handler can be driven.

Example

See the example for the LEAVE statement. The procedure USER01.TLOOP1, is similar to USER01.TLEAVE1 but it uses an exit handler to terminate the LOOP.

```
set options command delimiter '++';
create procedure USER01.TLOOP1
  ( TITLE     varchar(10) with default
  , P_FNAME   char(20)
  , P_COUNT   integer
  , RESULT    varchar(30)
  )
    EXTERNAL NAME TLOOP1 LANGUAGE SQL
Label_700:
 /*
 ** Count number of employees with equal Firstname
 */
begin not atomic
  declare FNAME   char(20);
  declare LNAME   varchar(20);
  declare EMP1 CURSOR FOR
        Select EMP_FNAME, EMP_LNAME
          From DEMOEMPL.EMPLOYEE
         where EMP_FNAME = P_FNAME;
  declare exit handler for SQLEXCEPTION, SQLWARNING, NOT FOUND
      set RESULT = 'SQLSTATE: ' || SQLSTATE;
 /*
 ** Count number of employees with equal Firstname
 */
  open EMP1;
  fetch EMP1 into FNAME, LNAME;

  fetching_loop:
  loop
      set P_COUNT = P_COUNT + 1;
      fetch EMP1 into FNAME, LNAME;
    end loop fetching_loop;
end
++
commit++
set options command delimiter default++

call USER01.TLOOP1('TLOOP1','Martin ',0,'U');
*+
*+ TITLE      P_FNAME                  P_COUNT
*+ -----      -------                  -------
*+ TLOOP1     Martin                         3
*+
*+ RESULT
*+ ------
*+ SQLSTATE: 02000
```

REPEAT

The REPEAT statement repeats the execution of a statement or a group of statements until a condition is met.

Syntax

```
                                      ┌─────────────────────────────┐
►►─┬───────────────┬─ REPEAT ──── ▼ ─ procedure-statement ─ ; ─┴──────────►
   └─ beg-label: ─┘

►── UNTIL ── search-condition ── END REPEAT ─┬─────────────┬──────────►◄
                                              └─ end-label ─┘
```

Parameters

beg-label:

Specifies a 1- through 32-character SQL identifier that labels the REPEAT statement. The value must be different from any other label used in the compound statement if the REPEAT statement is contained in a compound statement.

REPEAT procedure-statement

Specifies the statement or group of statements that are repeatedly executed.

UNTIL search-condition

Specifies the search condition that is evaluated after each iteration. If the outcome is true, the statement following the REPEAT statement is executed. Otherwise, a new iteration starts.

end-label

Specifies an SQL identifier that labels the end of the REPEAT statement. If specified, a *beg-label* must also have been specified and both labels must be equal.

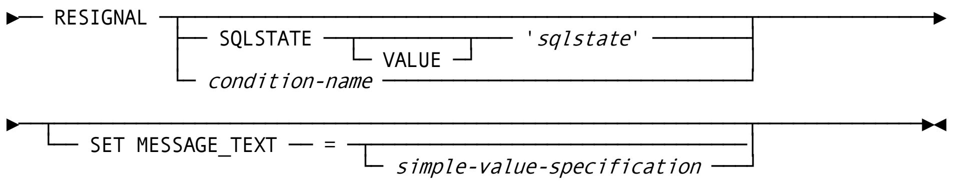
Example

```
set options command delimiter '++';
create procedure USER01.TREPEAT1
  ( TITLE     varchar(10) with default
  , P_FNAME   char(20)
  , P_COUNT   integer
  , RESULT    varchar(25)
  )
    EXTERNAL NAME TREPEAT1 LANGUAGE SQL
Label_700:
 /*
 ** Count number of employees with equal First name using REPEAT
 */
begin not atomic
  declare FNAME   char(20);
  declare LNAME   varchar(20);
  declare EMP1 CURSOR FOR
        Select EMP_FNAME, EMP_LNAME
          From DEMOEMPL.EMPLOYEE
         where EMP_FNAME = P_FNAME;

  open EMP1;

  fetching_loop:
  repeat
    fetch EMP1 into FNAME, LNAME;

    if (SQLSTATE = '00000')
      then set P_COUNT = P_COUNT + 1;
    end if;
  until SQLSTATE < > '00000'
  end repeat fetching_loop;
  set RESULT = 'SQLSTATE: ' || SQLSTATE;

  close EMP1;
end
++
commit++
set options command delimiter default++

call USER01.TREPEAT1('TREPEAT1','Martin',0,'U');
*+
*+ TITLE       P_FNAME                    P_COUNT  RESULT
*+ -----       -------                    -------  ------
*+ TREPEAT1    Martin                           3  SQLSTATE: 02000
```

RESIGNAL

The RESIGNAL statement resignals an SQL event or exception condition in a handler for the next higher level scope.

Syntax



Parameters

'sqlstate'

Specifies the value for SQLSTATE that is to be resignaled. *'Sqlstate'* is a 5-character string-literal that consists of only digits (0-9) and capital alphabetic characters (A-Z). *'Sqlstate'* cannot be '00000', the value of SQLSTATE for successful completion.

condition-name

Specifies the name of a condition whose SQLSTATE value is to be resignaled. *Condition-name* must identify a condition defined by a *condition-declaration* in a compound-statement containing the RESIGNAL statement. if more than one such *condition-declaration* has the specified *condition-name*, the one with the innermost scope is raised.

simple-value-specification

Specifies a character value to be added to the information item MESSAGE-TEXT. *simple-value-specification* must have a character data type.

Usage

Propagating the SQL Condition

The RESIGNAL statement can only be used in a handler to propagate an SQL condition to the scope that encloses the exception handler's scope. If the RESIGNAL is issued in a handler of a top level compound statement, control returns to the invoker of the SQL-invoked routine.

FLOW of CONTROL

If in the outer scope a handler exists for the raised exception or SQL event, the handler acquires control. After execution of the handler, control returns as with any other statement that causes a handler to activate.

SQLSTATE

There are no restrictions on the values that can be set for SQLSTATE, other than compliance with the syntactic rules for SQLSTATE values. We recommend using values in accordance with the classification of SQLSTATE values.

MESSAGE_TEXT

This is an information item of character type with a length of 80.

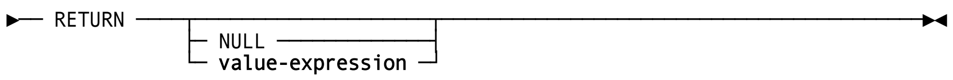
Example

```
set options command delimiter '++';
create procedure USER01.RESIGNAL1
  ( TITLE     varchar(10) with default
  , RESULT    varchar(120)
  )
    EXTERNAL NAME RESIGNA1 LANGUAGE SQL
Label_400:
 /*
 ** Resignal show case
 */

begin not atomic
  declare DEAD_LOCK condition for SQLSTATE '12000';
  declare NOT_FOUND condition for SQLSTATE '02000';
  declare exit handler for NOT FOUND
    begin not atomic
        set RESULT = RESULT || ' Not Found';
        resignal SQLSTATE '38607';
    end;

  set RESULT = 'Signal trace:';
  signal NOT_FOUND;

end label_400
++
commit;
set options command delimiter++

call user01.resignal1('Signal');

*+ Status = -4       SQLSTATE = 38000        Messages follow:
*+ DB001075 C-4M321: Procedure RESIGNA1 exception 38607
```

RETURN

The RETURN statement returns a value for an SQL function. As an extension to the SQL standard, a RETURN without parameters can also be used to exit a compound statement.

Syntax



Parameters

NULL

Specifies that the function return value is NULL.

value-expression

Specifies the function return value.

Usage

Compatible Data Types

The data type of the *value-expression* and the data type of the function return value named in the CREATE FUNCTION statement must be compatible for assignment.

Example

For an example, see CREATE FUNCTION.

SET Assignment

The SET Assignment statement assigns values to parameters and variables used in SQL routines.

Syntax

```
►►─ SET ──┬─ local-variable ────┬─ = ─┬─ value-expression ─┬──────────────►◄
          └─ routine-parameter ─┘     └─ NULL ─────────────┘
```

Parameters

local-variable

Identifies the local variable that is the target of the SET assignment statement. **Local-variable** must be the name of a local variable defined within the compound statement containing the SET statement.

routine-parameter

Identifies the SQL routine parameter that is the target of the SET assignment statement. **Routine-parameter** must be the name of a parameter of the routine containing the SET assignment statement.

value-expression

Specifies the value to be assigned to the target of the SET assignment statement.

NULL

Specifies that the null value is to be assigned to the target of the SET assignment statement.

Usage

Valid assignments

The rules for assignment are provided in Comparison, Assignment, Arithmetic, and Concatenation Operations.

Example

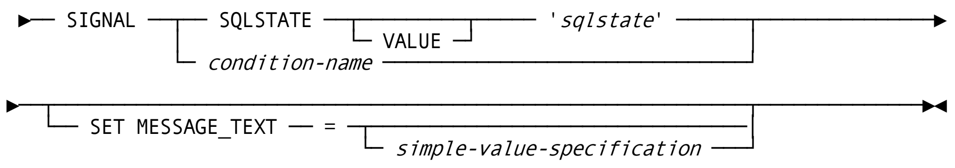
The procedure TSET3 creates a combined, edited name from a given first and last name. If the first or last name is null, or if the length of the last name is 0, the null value is returned for the edited name.

```
set options command delimiter '++';
create procedure SQLROUT.TSET3
  ( P_FNAME   varchar(20)
  , P_LNAME   varchar(20)
  , P _NAME   varchar(41)
  )
    EXTERNAL NAME TSET3 LANGUAGE SQL
 /*
 ** Return an edited name from the given Firstname and Lastname
 */
 if (LENGTH(P_LNAME) <= 0)
   then set P_NAME = null;
   else set P_NAME = trim(P_FNAME)  || ' ' || trim(P_NLNAME) ;
 end if
++
set options command delimiter default++

call SQLROUT.TSET3('James    ', 'Last   ');
*+
*+ P_FNAME              P_LNAME
*+ -------              -------
*+ James                Last
*+
*+ P_NAME
*+ ------
*+ James Last

call SQLROUT.TSET3('James    ', '');
*+
*+ P_FNAME              P_LNAME
*+ -------              -------
*+ James
*+
*+ P_NAME
*+ ------
*+ <null>
```

SIGNAL

The SIGNAL statement raises and signals an SQL event or exception condition.

Syntax



Parameters

'*sqlstate*'

Specifies the value for SQLSTATE that is to be signaled. *'sqlstate'* is a 5-character string-literal value that consists of only digits (0-9) and capital alphabetic characters (A-Z). *'Sqlstate'* cannot be '00000', the value of SQLSTATE for successful completion.

condition-name

Specifies the name of a condition whose SQLSTATE value is to be signaled. *Condition-name* must identify a condition defined by a condition declaration in a compound statement containing the SIGNAL statement. If more than one such condition declaration has the specified condition name, the one with the innermost scope is raised.

simple-value-specification

Specifies a character value to be added to the information item MESSAGE-TEXT. *simple-value-specification* must have a character data type.

Usage

FLOW of CONTROL

If a handler exists for the raised exception or SQL event, the handler acquires control. After execution of the handler, control returns as with any other statement that causes activation of a handler.

If no handler is activated, control goes to the end of the compound statement that contains the signal. If the signal is not in a compound statement of an exit handler, control returns to the invoker of the SQL routine. Otherwise, it returns to the statement after the SIGNAL statement, just as if a continue handler had been activated.

SQLSTATE

There are no restrictions on the values that can be set for SQLSTATE, other than compliance with the syntactic rules for SQLSTATE values. We recommend that values are used in accordance with the classification of SQLSTATE values.

Note: For more information, see SQLSTATE Values.

MESSAGE_TEXT

This is an information item of character type with a length of 80.

Example

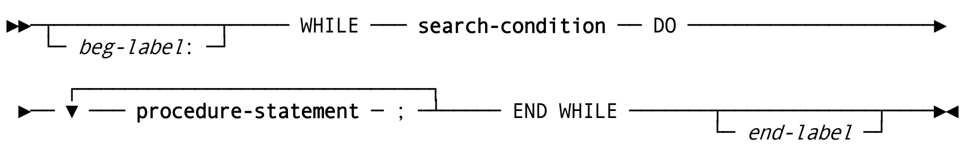
```
set options command delimiter '++';
create procedure USER01.TSIGNAL5
  ( TITLE     varchar(10) with default
  , RESULT    varchar(120)
  )
    EXTERNAL NAME TSIGNAL5 LANGUAGE SQL
Label_400:
 /*
 ** Trace execution of consecutive signal statements
 */

begin not atomic
  declare DEAD_LOCK condition for SQLSTATE '12000';
  declare NOT_FOUND condition for SQLSTATE '02000';

  declare continue HANDLER for SQLWARNING
    LABEL_9999:
      begin not atomic
        set RESULT = RESULT || ' Sqlwarning';
      end;
  declare continue handler for SQLEXCEPTION
    Label_8888:
      begin not atomic
        set RESULT = RESULT || ' Sqlexception';
      end;
  declare continue handler for SQLSTATE '23800'
        set RESULT = RESULT || ' 23800';
  declare continue handler for DEAD_LOCK
    LABEL_6666:
      begin not atomic
        set RESULT = RESULT || ' Deadlocked';
      end;
  declare continue handler for NOT FOUND
        set RESULT = RESULT || ' Not Found';
  set RESULT = 'Signal trace:';
  signal SQLSTATE '23800';
  signal NOT_FOUND;
  signal SQLSTATE '01200';
  signal SQLSTATE '72300';
  signal DEAD_LOCK;

end label_400
++
commit++
set options command delimiter default++
call user01.tsignal5('Signal');
```

```
*+
*+ TITLE
*+ -----
*+ Signal
*+
*+
*+ RESULT
*+ ------
*+ Signal trace: 23800 Not Found Sqlwarning Sqlexception
Deadlocked
*+
```

WHILE

The WHILE statement repeats the execution of a statement or a group of statements while a condition is met.

Syntax



Parameters

beg-label:

Specifies a 1- through 32-character SQL identifier that labels the WHILE statement. The value must be different from any other label used in the compound statement if the WHILE statement is contained in a compound statement.

WHILE *search-condition*

Specifies the search condition to be evaluated. If the outcome is false, the statement after the WHILE statement is executed. Otherwise, an iteration of the group of statements enclosed by DO and END WHILE is started.

DO procedure-statement END WHILE

Specifies the statement or group of statements that are repeatedly executed.

end-label

Specifies an SQL identifier that labels the end of the WHILE statement. If specified, a *beg-label* must also have been specified and both labels must be equal.

Example

```
set options command delimiter '++';
create procedure USER01.TWHILE2
  ( TITLE     varchar(10) with default
  , P_FNAME   char(20)
  , P_COUNT   integer
  )
    EXTERNAL NAME TWHILE2 LANGUAGE SQL
Label_700:
begin not atomic
 /*
 ** Count number of employees with equal first name
 */
  declare FNAME   char(20);
  declare LNAME   varchar(20);
  declare EMP1 CURSOR FOR
        Select EMP_FNAME, EMP_LNAME
          From DEMOEMPL.EMPLOYEE
         where EMP_FNAME = P_FNAME;
  set P_COUNT = 0;
  open EMP1;
  fetch EMP1 into FNAME, LNAME;
  fetching_loop_non_SQL:
  while (SQLSTATE = '00000')
    do
      set P_COUNT = P_COUNT + 1;
      fetch EMP1 into FNAME, LNAME;
    end while fetching_loop_non_SQL;

  close EMP1;
end
++
commit++
set options command delimiter default++

call USER01.TWHILE2('TWHILE2','Martin  ');
;
*+
*+ TITLE       P_FNAME                  P_COUNT
*+ -----       -------                  -------
*+ TWHILE2     Martin                         3
```

Chapter 10: Accessing Non-SQL-Defined Databases

This section contains the following topics:

Correspondence between SQL and Non-SQL-defined Entities

Procedure

Define an SQL SCHEMA using the CREATE SCHEMA statement containing a FOR NONSQL SCHEMA parameter. This causes a logical relationship to be established between the two schemas.

The records defined in the non-SQL schema can now be accessed as tables in SQL DML and CREATE VIEW statements. Each record element is represented as a column except as noted under Record Structure Considerations.

Table Names

The table name used when referring to a non-SQL defined record is always the name specified in the ADD RECORD statement of the non-SQL schema definition. If hyphens appear in the record name, the table name must be enclosed in double quotation marks.

Column Names

The column name used when referring to a record element depends on whether a synonym for LANGUAGE SQL has been defined for the record:

- If such a synonym has been defined, the column name is the element synonym name associated with the SQL record synonym.
- If no SQL synonym has been defined for the record, the column names are based on the names of record elements either defined in the schema RECORD statement or associated with the version of the record whose structure is shared by the schema record.

In either case, column names are transformed by replacing hyphens with underscores.

Elements occurring a fixed number of times are represented by multiple columns whose names are constructed from the element name appended with an underscore (_) and an occurrence count. For example:

```
02  MONTHLY-BUDGET OCCURS 12 TIMES ...
```

is represented as 12 columns whose names are:

```
MONTHLY_BUDGET_01
MONTHLY_BUDGET_02 etc.
```

The length of the suffix is one greater than the number of digits in the number of occurrences of the element.

Up to three levels of nesting are supported. For example:

```
02  ANNUAL-BUDGET OCCURS 4 TIMES.
   03  MONTHLY-BUDGET OCCURS 12 TIMES ...
```

is represented as 48 columns whose names are:

```
MONTHLY_BUDGET_1_01
MONTHLY_BUDGET_1_02
 .
 .
 .
MONTHLY_BUDGET_1_12
MONTHLY_BUDGET_2_01
MONTHLY_BUDGET_2_02 etc.
```

In constructing column names for multiply-occurring elements, if the length of the resulting name exceeds 32 characters, the record is not accessible through SQL. To overcome this, define a synonym for LANGUAGE SQL where the affected element names are shortened.

Record Structure Considerations

Not all record elements can be referred to as columns and, in some cases, a single record element is represented by multiple columns.

Elements, other than those whose usage is BIT, are handled as follows:

- Group elements are not represented by columns.
- FILLERs (elements with names of 'FIL nnnn') are not represented by columns.
- Level 88 elements (condition names) are not represented by columns.
- Redefining elements and elements subordinate to a redefining group are not represented by columns.
- Elements occurring a fixed number of times and elements subordinate to a group occurring a fixed number of times are represented by multiple columns, one for each occurrence of the element.
- Elements occurring a variable number of times and elements subordinate to a group occurring a variable number of times are not represented by columns.
- All other elements in the record are represented by columns.

USAGE BIT

Elements whose usage is BIT are not represented by columns except as noted following:

- Group elements where all subordinate elements have a usage of BIT and which start on a byte boundary are represented by columns with a data type of BINARY. The length of the column is the length in bytes from the start of the group element to the start of the next element at the same level which begins on a byte boundary. If groups are nested within groups, the group element with the lowest level number where all subordinate elements are BITs is the element represented by a column. Intervening and subordinate elements are not represented by columns.
- BIT elements occurring a fixed number of times and beginning on a byte boundary are represented by columns with a data type of BINARY. The length of the column is the length in bytes from the start of the element to the start of the next element at the same level which also begins on a byte boundary. Intervening elements are not represented by columns.
- Other BIT elements which begin on a byte boundary are represented by columns with a data type of BINARY. The length of the column is the length in bytes from the start of the element to the start of the next element at the same level which also begins on a byte boundary. Intervening elements are not represented by columns.

Data Type of Columns

The data type of a column representing a record element is derived from the picture and usage of the element:

Picture and usage	Data type
PIC X(*n*) usage DISPLAY	CHAR(*n*)
PIC A(*n*) usage DISPLAY	CHAR(*n*)
Numeric edited&sub1.	CHAR*(l)*, *l*=byte length
External floating point&sub2.	CHAR*(l)*, *l*=byte length
PIC G(*n*) usage DISPLAY	GRAPHIC(*n*)
PIC S9(*p*)V9(*s*) usage DISPLAY	NUMERIC(*p-s*,*s*)
PIC SP..9(*p*) usage DISPLAY&sub3.	NUMERIC(*p*,*p*)
PIC S9(*p*)P.. usage DISPLAY&sub3.	NUMERIC(*p*,0)
PIC 9(*p-s*)V9(*s*) usage DISPLAY	UNSIGNED NUMERIC(*p*,*s*)
PIC P..9(*p*) usage DISPLAY&sub3.	UNSIGNED NUMERIC(*p*,*p*)
PIC 9(*p*)P.. usage DISPLAY&sub3.	UNSIGNED NUMERIC(*p*,0)
PIC S9(*p-s*)V9(*s*) usage COMP-3	DECIMAL(*p*,*s*)
PIC SP..9(*p*) usage COMP-3&sub3.	DECIMAL(*p*,*p*)
PIC S9(*p*)P.. usage COMP-3&sub3.	DECIMAL(*p*,0)
PIC 9(*p-s*)V9(*s*) usage COMP-3	UNSIGNED DECIMAL(*p*,*s*)
PIC P..9(*p*) usage COMP-3&sub3.	UNSIGNED DECIMAL(*p*,*p*)
PIC 9(*p*)P.. usage COMP-3&sub3.	UNSIGNED DECIMAL(*p*,0)
PIC S9(*n*), *n*<5 usage COMP&sub4.	SMALLINT
PIC S9(*n*), 4<*n*<10 usage COMP&sub4.	INTEGER
PIC S9(*n*), 9<*n* usage COMP&sub4.	LONGINT
PIC 9(*n*) usage COMP&sub4.	BINARY*(l)*, *l*=byte length
PIC X(*n*) usage BIT	BINARY*(l)*, *l*=byte length
USAGE POINTER	BINARY(4)
USAGE COMP-1	REAL
USAGE COMP-2	DOUBLE PRECISION

Picture and usage	Data type
Note: 1. Numeric edited includes any element whose usage is DISPLAY and: Whose picture contains any of the editing symbols: + - Z B 0 $ CR DB . , * Whose picture clause contains only the symbols: 9 (n) V S P but whose element description also includes the SIGN LEADING or SEPARATE CHARACTER specification 2. External floating point includes any element whose usage is DISPLAY and whose picture is: +/- mantissa E +/- exponent 3. The scaling character "P" in a picture clause is ignored in value representations of associated columns. This has the effect of representing values of such columns as a power of 10 greater than or smaller than their actual value. For example, if an element is described as PIC S9(5)PPP, a value of 123000 is represented in SQL as 123. If an element is described as PIC SPPP9(5), a value of .000123 is represented in SQL as .123. 4. Computational elements also include those whose USAGE is BINARY and COMP-4. If the picture of a computational item includes an implied decimal point, it is ignored in determining the data type of the column. This has the effect of representing values of such columns as a power of 10 greater than their actual values. For example, if an element is described as PIC S9(5)V99 USAGE COMP, a value of 123.56 is represented in SQL as 12345. :etnote.	

SQL Schema Considerations

SQL Schemas and Non-SQL-defined Schemas

Typically, one SQL schema is defined for each non-SQL schema which describes data to be accessed through SQL. The SQL schema definition specifies the name of the segment or database containing the data described by the non-SQL schema.

However, a single non-SQL schema may describe multiple physical databases. In this case, one SQL schema can be used to access any of the physical implementations, or a separate SQL schema can be defined for each. To make the SQL schema independent of the physical implementation, omit the DBNAME specification from the schema definition.

If No DBNAME is Specified

If no DBNAME is specified in the SQL schema definition, only one physical instance of the non-SQL-defined database can be accessed within a single SQL transaction. The data accessed at runtime is determined by the database name to which your SQL session is connected. The database name must include the segments containing the data to be accessed.

DBNAME Specification and Access Modules

The way you choose to associate the non-SQL-defined schema with an SQL-defined schema has an impact on access modules:

- If the SQL schema does not contain a DBNAME specification, a single access module can be used against any of the physical databases because the application can specify the appropriate database name on a CONNECT statement (or the user can specify it in a DCUF or SYSIDMS DICTNAME parameter)
- If the SQL schema contains a DBNAME specification, each physical implementation must have its own set of access modules and the application must specify which one to use by issuing a SET ACCESS MODULE statement

Restriction

If two or more non-SQL-defined schemas describe the same physical data, it should be accessed under only one SQL schema within a transaction. For example, if the same physical employee information is described in two non-SQL-defined schemas referenced by the two SQL schemas HR and MFG, the employee records should either be accessed as HR tables or MFG tables, but not both.

Preventing Unpredictable Results

Unpredictable results occur (including possible database corruption) if the above restriction is violated.

To prevent unpredictable results, grant access to only one table for each non-SQL-defined record. In the above example, grant access to either the HR.EMPLOYEE table or the MFG.EMPLOYEE table but not both.

Definition Changes and Access Modules

Changes made to the non-SQL-defined schema do not cause access modules to be automatically recompiled (as is the case for SQL-defined entities). This is because there are no synchronization stamps that CA IDMS can use to detect definition changes for non-SQL-defined records. It is the DBA's responsibility to recompile the access modules when changes are made to the non-SQL-defined schema.

If an automatic recompile of the access module is desired, the RCM must be recreated through a recompile of the program to change the RCM synchronization stamps. Then when the access module is run, an access module recompile is triggered.

Other changes that may necessitate access module recompilation are:

- Changing the dictionary, name, or version number of the non-SQL-defined schema associated with an SQL-defined schema
- Changing the DBNAME parameter associated with the SQL-defined schema

To recompile affected access modules, use the ALTER ACCESS MODULE statement with the REPLACE ALL option. To determine which access modules are affected, query the SYSTEM.AM and SYSTEM.AMDEP tables in the dictionary.

Note: For more information, see ALTER ACCESS MODULE and SYSTEM Tables and SYSCA Views.

Definition Changes and Views

The deletion of records and changes made to the structure of records in a non-SQL-defined schema may necessitate the dropping and recreating of views referencing the non-SQL-defined tables representing those records. The following changes invalidate referencing views:

- Removal of the record from the schema
- Addition of record elements (record elements added to the end of the record structure invalidate only those views based on SELECT *)
- Re-ordering of record elements within the record
- Changing of an element's picture or usage

To determine which views are impacted by such changes, query the SYSCA.VIEWDEP table.

Note: For more information, see SYSTEM Tables and SYSCA Views.

SQL DML Statements Operating on Non-SQL-defined Records

INSERT

CA IDMS allows INSERT statements where the target table represents a non-SQL-defined record only if all sets with a membership option of AUTOMATIC in which the record participates as a member have been defined with a primary/foreign key declaration.

Note: For more information about primary and foreign keys in set definitions, see the *CA IDMS Database Administration Guide*.

Additionally, you cannot include the control field of an OCCURS DEPENDING ON structure in the insert column list. On an INSERT, its value is automatically set to 0.

Effect of INSERT on a Record

- Causes an occurrence of the record represented by the table named in the INTO parameter to be stored on the database
- Columns whose values are not supplied on the insert are given standard default values according to their data types (that is, 0 for numeric, spaces for character and binary zeros for binary)
- Has the following effect on system indexes defined on the record:
  - Connects the record into every such index defined as AUTOMATIC
  - Does not connect the record into any index defined as MANUAL
- Connects the record into every set for which the values of all columns representing foreign key fields of the set relationship are not null. The set occurrence to which the record is connected is that owned by the occurrence of the owner record whose primary key value matches the member's foreign key value.
- Returns an error if:
  - In attempting to connect the record into a set, no owner record occurrence can be found with a matching primary key value
  - A null value has been specified for any column other than one representing a nullable foreign key of some set where the record participates as a member
  - An invalid data value is detected during the operation
  - The operation attempts to store a duplicate row when duplicates are not allowed

UPDATE

UPDATE statements where the target table is a non-SQL-defined database record are allowed. Successful execution of an update operation, however, depends on both the definition options chosen and the current state of the database.

The control field of an OCCURS DEPENDING ON structure cannot be updated.

Effect of UPDATE on a Record

- Causes one or more occurrences of the record represented by the table to be modified
- Only fields represented by columns named in the SET parameter of the UPDATE statement for which the update value is not NULL are changed
- Has the following effect on system indexes defined on the record:
  - If a record occurrence being updated is connected to such an index and one or more index key fields are changed, the index is updated.
  - If a record occurrence being updated is not connected to such an index, the index is not updated.
- Has the following effect on sets where the record is a member:
  - If one or more foreign key fields of such a set are changed or are set to NULL, the following operations are performed:
    - The record occurrence is disconnected from its current owner if it participates as a member of the set.
    - The record occurrence is connected to a (new) owner if the value of all foreign key fields are not null and an occurrence of the owner record can be found with a matching primary key.
    - The record's set membership with owner records whose keys are defined in the member record as foreign keys will be affected regardless of the membership options of the set.
  - If one or more sort key fields of such a set are changed, and the record occurrence is a member of the set, the set occurrence is updated to maintain correct ordering.
- Returns an error if:
  - In attempting to connect the record into a set, no owner record occurrence can be found with a matching primary key value
  - The record being modified is an owner of a non-empty set that was defined with a primary/foreign key declaration and one or more of the primary key fields are changed
  - A null value is specified for a column other than one representing a nullable foreign key field of some set where the record participates as a member
  - An invalid data value is detected during the operation
  - The operation attempts to store a duplicate row when duplicates are not allowed

DELETE

DELETE statements where the target table represents a non-SQL-defined record, are allowed. Successful execution of such a statement depends both on the definition options chosen and the current state of the database.

Effect of DELETE on a Record

- Causes one or more occurrences of the record represented by the table to be erased from the database
- Disconnects a record occurrence from all indexes where it participates
- Disconnects a record occurrence from all sets where it participates as a member
- Returns an error if the record occurrence being erased participates as an owner in one or more non-empty sets

SELECT

SELECT statements where one or more tables named in the FROM parameter represent non-SQL defined records are always allowed.

Column values are established as follows:

- If the column represents a nullable foreign key field, its value is:
  - The value of the field in the record occurrence, if the record occurrence is a member of at least one set where the field is a foreign key field
  - Null if the record occurrence is not a member of any set where the field is a foreign key field
- Otherwise, the value of the column is the value of the record element it represents

  An exception is raised if a value in the result table is null and an indicator variable is not specified for the host-variable to which the value is to be returned.

SQL Access to Non-SQL Databases

This section provides a review of the transformations used by the SQL engine while reading the definitions of non-SQL record types. When SQL is used to access non-SQL record types, the entity names coded in the SQL syntax must follow the conventions described next.

Note: For more information about defining and using table procedures to process non-SQL-defined data in a relational way even if the data does not conform to the rules for such access, see Defining and Using Table Procedures.

SQL Schemas for Non-SQL Databases

SQL tables are referenced in SQL DML statements by coding the table name preceded by a schema name qualifier. For example, in SELECT * FROM DEMOSCH.SAMPLE, SAMPLE is the table name and DEMOSCH is the SQL schema where it is defined. The combination of schema name and table name allows the SQL compiler to look up the definition of the table in the SQL catalog.

To access a non-SQL record type from an SQL statement, you must code the record name in the same manner used for SQL tables. An SQL schema which maps onto the corresponding non-SQL schema must be defined in the SQL catalog. This SQL schema name is used to qualify all subsequent references to non-SQL record types in SQL DML statements. For example,

```
CREATE SCHEMA SQLNET FOR NONSQL SCHEMA PRODDICT.CUSTSCHM;
SELECT * FROM SQLNET."ORDER-NET";
```

Non-SQL Record and Set Name Transformations

Because hyphen is the subtraction operator in SQL, non-SQL record names containing embedded hyphens must be delimited by double quotes (for example, "CUST-REC-123"). Any non-SQL set names containing embedded hyphens must be delimited by double quotes before they can be used in an SQL statement (for example, "CUST-ORDER").

Non-SQL Element Name Transformations

Unlike hyphens embedded in record and set names, hyphens embedded in non-SQL element names are automatically transformed to underscores (_) during the definition loading phase of the SQL compiler. So, to access the CUST-NUMBER element in a non-SQL record type, you must code CUST_NUMBER in an SQL statement.

When a FOR LANGUAGE SQL synonym is defined for a non-SQL record type, the element synonyms are used for all SQL access. SQL synonyms are *only* used for element names. Defining SQL synonyms for non-SQL record types is sometimes the only way to overcome column name limitations within SQL.

Some non-SQL element names don't make satisfactory SQL column names, even after the hyphen-to-underscore transformation. For example, if a non-SQL element name starts with a numeric character, the double quote delimiter must again be used (123-ORD-NUM would be accessed using "123_ORD_NUM" in an SQL statement).

Group elements, redefines elements, FILLERS and OCCURS ... DEPENDING ON elements are simply not available for access by SQL. The SQL user views these elements as not being defined in the non-SQL record type. However, the subordinate elements of a group definition are available, as are the base elements to which a REDEFINES is directed.

Though OCCURS ... DEPENDING ON declarations are not available for SQL access, fixed OCCURS definitions are made available. The SQL user's perception of a fixed OCCURS element is that there is one column for each occurrence of the element. The name which is used to access each such occurrence is the original element name followed by an underscore and an occurrence number to make the column name distinct. If the element is declared with nested OCCURS clauses, the corresponding column names contain one underscore and one occurrence number for each "dimension" of the OCCURS declaration. For example, the element definition BUD-AMT OCCURS 12 TIMES generates the following column names: BUD_AMT_01, BUD_AMT_02, BUD_AMT_03, ..., BUD_AMT_12.

In the preceding example, the occurrence number appended to the column name is made large enough to hold the largest subscript from the corresponding element definition. If the base element name in combination with the appended occurrence information makes the generated column names larger than 32 characters, you receive an error when the SQL statement is compiled. In this situation, you *must* define an SQL synonym for the non-SQL record type. The synonym element names must be short enough so the appended occurrence information will not make the resulting column names larger than 32 characters.

Although the SQL implementation in CA IDMS allows 32 character column names, other SQL implementations restrict column names to 18 characters. In particular, some ODBC client software may require you to use SQL synonyms for non-SQL record types to limit the size of the transformed column name to 18 characters.

Definition Anomalies of Non-SQL Record Types

Certain definition anomalies of non-SQL record types can result in errors during attempts to access them with SQL. These anomalies pertain to the definition of CALC keys, system-owned index set keys, and user-owned sorted set keys. They result in a DB002024 error in Release 12.0 or a DB002038 error in later releases.

The DB002038 message includes both the set name and record type in question. The DB002024 message only includes the set name. The DB002024 message presents a problem if a CALC definition is the cause of the error. CALC is the set name, and if there are several CALC records involved in the SQL statement, or if you are compiling an access module with references to numerous CALC records, you may have to examine the definitions of all CALC records to locate the problem.

Another characteristic of the CA IDMS SQL engine can further complicate the process of finding such errors. The SQL compiler loads the definitions of all SQL tables and non-SQL record types explicitly referenced by the SQL statements being compiled. However, it also loads the definitions of the non-SQL record types which (through non-SQL set definitions) either own or are owned by the records which are explicitly referenced in the SQL statements, so that set-based access strategies can be considered when it optimizes each statement. This may result in a 2024 or 2038 error being generated for a record type which isn't even referenced by the SQL being compiled.

These errors have only two known causes, both of them easily fixed:

1. The control key definition of the CALC, INDEX, or sorted set includes a FILLER element. To overcome this problem, simply modify the non-SQL record definition to assign a name other than FILLER to the element in question.
2. The control key definition incorporates subordinate elements of a group level REDEFINES, and these elements are smaller in size than the base element being redefined. For example:

   ```
   02  ELEM1 PIC X(8).
   02  ELEM1REDEF REDEFINES ELEME1.
       03 ELEM1A PIC S9(8) COMP.
       03 ELEM1B PIC S9(8) COMP.
    .
    .
    .
   ```

   An error occurs if ELEM1A and ELEM1B are used in the control key definition; since they are smaller than the element which they redefine even though together they are as large as ELEM1. The solution to this error is to change the redefining group, which contains the smallest subordinate elements, into the base element definition. This base definition should be used in the control key specification. In the previous example, ELEM1REDEF should be the base element definition, and ELEM1 should be coded so that it redefines ELEM1REDEF.

Expansion of Extended-search Condition

The parameters used in the expansion of Extended-search Condition specify criteria used to select rows from tables.

Syntax

Expansion of extended-search-condition

```
►►─┬─ search-condition ───┬─┬──────────────────────────────────────────┬─►◄
   └─ set-specification ──┘ │ ┌──────────────────────────────────────┐ │
                            └─▼─ AND ──┬─ search-condition ───┬──────┴─┘
                                       └─ set-specification ──┘
```

Parameters

search-condition

Specifies a search condition whose value must be true for the row or rows to be included in the result table.

set-specification

Specifies that only rows participating as owner and member in the named set be included in the result table. For expanded **set-specification** syntax, see Expansion of Set-specification Statement.

Usage

Evaluation

The full search condition is satisfied when the value of all its operands are true. It is not satisfied when the value of any of its operands is either false or unknown.

Order of Evaluation

CA IDMS effectively evaluates from left to right after first evaluating each operand individually.

You can use parentheses to override the default order of evaluation. Operands in parentheses are evaluated first.

Expansion of Set-specification Statement

The parameters used in the expansion of the Set-specification statement specify join criteria for tables representing owner and member records of a non-SQL-defined set.

Syntax

Expansion of set-specification

```
►►─┬─────────┬─ set-name ─┬─────────────────────────────────────┬──────────►◄
   ├─ FIRST ─┤            │ ┌─────────────────────────────────┐ │
   └─ LAST ──┘            └─▼── . ──┬─ table-identifier ─┬──┘─┘
                                    └─ alias ────────────┘
```

Parameters

set-name

Specifies the name of the set to be used as the test criteria.

Set-name must follow the rules for identifiers. If hyphens appear in the name, it must be enclosed in double quotes.

table-identifier

Specifies the name of a table representing either the owner or member of the set. *Table-identifier* must appear in the FROM parameter of the containing query specification or SELECT statement.

At most, two table names or aliases can qualify the set name and if both appear, one must identify the owner and the other must identify a member of the set.

alias

Specifies the alias assigned to the table representing the owner or member of the set.

If the table has been assigned an alias in the FROM parameter of the query specification or SELECT statement where **set-specification** appears, the alias and not the original table name must be used to qualify the set.

FIRST

Specifies only the first member record occurrence from each occurrence of *set-name* is returned in the join.

LAST

Specifies only the last member record occurrence from each occurrence of *set-name* is returned in the join. For chained sets, this command is only valid when the set linkage includes prior pointers.

Note: For more information about coding considerations and set linkage, see *Chapter 3.3, Sets* in the *CA IDMS Navigational DML Programming Guide*.

Usage

Members without Foreign Keys

Joining rows from different tables specified in a SELECT statement is usually done with comparison operations on column values. The most typical approach for SQL-defined tables is to use equal comparisons of the matching primary/foreign key columns of a referential constraint definition.

However, in a non-SQL-defined database, member records may not contain the key values of their owner records. For example, it is not necessary for the EMPLOYEE record to contain the department ID of its associated DEPARTMENT record if the relationship between the EMPLOYEE and DEPARTMENT records is represented by a set.

In such cases, column-based comparison cannot be used to process a join; instead, the SELECT statement must identify the set in the WHERE parameter using **set-specification**.

Note: A system-owned index is not a set joining two records; therefore, it cannot be used in the WHERE clause.

Evaluation

Two table rows satisfy the **set-specification** criteria if one is a member of the other in the named set. The value of the set-specification is considered *true* when this condition is satisfied and *false* otherwise.

The tables representing the owner and member records must appear in the FROM parameter of the containing query specification or SELECT statement.

Inclusion of the *FIRST* and *LAST* keywords renders **set-specification** false for all member occurrences except for the first or last, respectively. This additional syntax is included for use with sets with an inherent first-in-first-out or last-in-first-out organization.

Qualification Requirements

Set-name must be qualified under the following conditions:

- More than one member of a multi-member set has been named as a table in the preceding FROM parameter
- A table representing either the owner or a member has been assigned an alias in the preceding FROM parameter

Improved Efficiency of Join Operations

A non-SQL-defined member record can contain the value of its owner's key. However, unless the set definition in the non-SQL-defined schema identifies this as a foreign key, CA IDMS will not use the set in its access strategy when performing join operations. This may result in the choice of a less-than-optimal access strategy.

This can be overcome by using **set-specification** as part of the selection criteria.

Chapter 11: Defining and Using Table Procedures

This section contains the following topics:

When to Use a Table Procedure

You can use a table procedure to process non-SQL-defined data in a relational way even though the data does not conform to the rules established for such access.

Table procedures allow you to perform the following tasks:

- Make processing of complex structures, such as bills-of-materials, easier for an end user. Since the details of access to the underlying records or tables are encapsulated within the procedure, less knowledge is required on behalf of the user to process the data.
- Access non-SQL-defined data which does not conform to the rules associated with SQL. For example, a procedure can enable access to the variable portion of a record or support INSERT on a record without embedded foreign keys.
- Access all segments of a segmented database within a single SQL transaction. Since a table procedure can open more than one run unit or SQL session simultaneously, it can access the appropriate segment based on the value of an input parameter. If no appropriate segment key is available, it can access each segment serially.
- Access remote data. This enables a single SQL transaction to access data distributed across different nodes within an IDMS network while hiding the knowledge of the location of the data within the procedure itself.

Defining a Table Procedure

You define a table procedure using the CREATE TABLE PROCEDURE statement. In the following example, the table procedure ORGANIZATION is named and associated with schema EMP. The name of the program to be called to service a DML request against the procedure, EMPORG, is specified in the EXTERNAL NAME parameter. The parameters to be passed to and from the procedure are listed. Each parameter definition consists of a name and a data type.

```
CREATE TABLE PROCEDURE EMP.ORGANIZATION
   (TOP_KEY        UNSIGNED NUMERIC(4),
    LEVEL          SMALLINT,
    MGR_ID         UNSIGNED NUMERIC(4),
    MGR_LNAME      CHAR(25),
    EMP_ID         UNSIGNED NUMERIC(4),
    EMP_LNAME      CHAR(25),
    START_DATE     CHAR(10),
    STRUCTURE_CODE CHAR(2))
    EXTERNAL NAME EMPORG;
```

More Information

- For more information about syntax and parameters used in defining table procedures, see CREATE TABLE PROCEDURE.
- For more information and a detailed example about using a CREATE TABLE PROCEDURE, see Sample COBOL Table Procedure.

Accessing a Table Procedure

You access table procedures using SQL DML statements, as with base tables and views. You can reference table procedures any place where a table reference is permitted. Whether a specific table procedure supports an SQL operation depends on the user-written program. The program might, for example, support only retrieval operations and disallow INSERT, UPDATE and DELETE by returning an error if such an operation is attempted.

Access to a table procedure is controlled in the same way as for a table. GRANT and REVOKE statements on a resource type of TABLE are used to give and remove SELECT, INSERT, UPDATE, DELETE or DEFINE privileges on a table procedure.

Table Procedure Parameters

The parameters associated with a table procedure are treated like columns of a table. You can specify them within the column list of a SELECT or INSERT statement, the SET clause of an UPDATE statement, the ORDER BY clause of a SELECT statement or the search criteria of a WHERE clause. Additionally, you can specify parameter values within the table procedure reference itself.

Column List, SET and ORDER BY References

Parameters referenced in	Specify
Column list of a SELECT statement	The columns that are returned to the invoking application
Column list of an INSERT statement	The columns having values that are supplied in the subsequent VALUES clause or query-specification
SET clause of an UPDATE statement	Columns which are assigned new values during the update operation
ORDER BY clause of a SELECT statement	The order the result rows of the procedure are returned to the requesting application

WHERE Clause References

WHERE clause references to parameters are used to filter the output of the table procedure. Each time a table procedure returns a set of output values, they are evaluated against the selection criteria specified in the WHERE clause and non-conforming "rows" are ignored.

The WHERE clause parameter references is used to pass input values to the table procedure. If the set of column values provided on a particular call to the table procedure matches the columns defined in a KEY on the same table procedure, the ESTIMATED ROWS and ESTIMATED I/OS specified for that KEY are used by the optimizer when the table procedure is joined with other tables or views. If you specify selection criteria in the form of an "=" comparison (that is, *parameter* = *value*), *value* is passed to the table procedure. Other types of selection criteria such as IN predicates or comparison predicates with > or < operators have no effect on the value of the parameters passed to the table procedure.

Note: For more information about defining keys, see CREATE KEY.

Specifically, a reference to a parameter in a WHERE clause results in an input value being passed to the table procedure only if:

- It appears within an equality test
- The equality test is not combined with other predicates in the WHERE clause through the use of the OR operator
- The equality test is not preceded by the NOT operator

WHERE Clause Parameter References

The following examples illustrate how a parameter reference in a WHERE clause affects the value passed to the table procedure:

```
WHERE clause               Parameter value
                            P1       P2
  P1 = 1                     1     -null-
  P1 < 1                   -null-  -null-
  P1 = C1                    C1    -null-
  P1 = 2 AND P2 = 3          2       3
  P1 = 2 AND P2 > 3          2     -null-
  P1 = 2 OR  P2 = 3        -null-  -null-
  P1 IN (2, 3, 8)          -null-  -null-
```

Parameters in Table Procedure References

You can also specify input parameter values within the table procedure reference itself. You can specify them on any reference to a table procedure except within an INSERT statement.

You specify parameter values supplied on a table procedure reference either positionally or as keyword/value pairs. You can combine them with WHERE clause references to form the set of values that are passed to the table procedure.

Examples of Specifying Parameter Values

The following example shows all the ways you can specify input parameter values.

```
SELECT * FROM EMP.ORG (MGR_ID = 7, EMP_ID = 127)
SELECT * FROM EMP.ORG (CAST(NULL AS NUM(4,0)),
                       CAST(NULL AS SMALLINT),
                       7,
                       CAST(NULL AS CHAR(25)),
                       127)
SELECT * FROM EMP.ORG (MGR_ID = 7) WHERE EMP_ID = 127
```

Difference Between Table Procedure Reference and WHERE Clause

One difference exists between parameter values specified through a WHERE clause and those specified within the table procedure reference. Parameter values specified within the table procedure reference are not used to filter the output from the table procedure as is the case for those specified within the WHERE clause. Parameter values specified within the table procedure reference affect only the input to the table procedure and not the output from the table procedure. Therefore, the above three select statements are equivalent only if the table procedure enforces the conditions specified through the table procedure reference.

Note: The sample table procedure in Sample COBOL Table Procedure does not enforce any criteria other than those that it uses to navigate the database.

Statistics and Optimization

Ideally, a table procedure should be written such that when certain sets of column values are provided (either through a WHERE clause or a procedure reference), the most efficient path can be used to access the data or join the table procedure to another data source.

If the set of column values provided on a particular call to the table procedure matches the columns defined in a KEY on the same table procedure, the ESTIMATED ROWS and ESTIMATED I/Os defined for that KEY are used during optimization; otherwise, if the ESTIMATED ROWS and ESTIMATED I/Os are defined for the table procedure, they are used. If the ESTIMATED ROWS and ESTIMATED I/Os are not specified, the optimizer defaults to 1000 and 100 respectively.

Normally, these statistics are used when the table procedure is the object a simple select statement. However, the optimizer also uses them internally when the table procedure is joined with other tables or views. If the nature of the join is such that the values for columns (defined as a keys) are passed to the table procedure, the statistics from the appropriate key are used when choosing an access plan.

Writing a Table Procedure

The program associated with a table procedure can be written in COBOL, PL/I, or Assembler. When called, the program is passed a fixed parameter list consisting of the parameters specified on the table procedure definition and additional parameters used for communication between CA IDMS and the table procedure.

Whenever a reference to a table procedure is made, CA IDMS calls the program associated with the table procedure to service the request. Part of the information passed to the table procedure is an indication of the type of action that the table procedure is to perform, such as "return the next result row" or "update the current row." The table procedure responds by performing the requested action or returning an error.

CA IDMS performs transaction and session management automatically in response to requests that the originating application issues. Changes to the database made by a table procedure are committed or rolled out together with other changes made within the SQL transaction. No special action is required of the table procedure to ensure this occurs.

The next section discusses writing a table procedure in detail.

For an example of a table procedure written in COBOL, see Sample Table Procedure Program.

Calling Arguments

The following sets of arguments are passed each time a table procedure is called:

- One argument for each of the parameters specified on the table procedure definition, passed in the order the parameters were declared
- One argument for each null indicator associated with a parameter specified in the table procedure definition, passed in the order the parameters were declared
- A set of common arguments used for communications between CA IDMS and the table procedure

The first two sets of arguments vary from one table procedure to another. They are used to pass selection criteria and insert/update values to the table procedure and result values from the table procedure.

The last set of arguments, shown in the next table, is the same for all table procedures.

Argument	Contents
Result Indicator (fullword)	Not used

Argument	Contents
SQLSTATE (CHAR (5))	Status code returned by the table procedure: ■ 00000—Indicates success ■ 01Hxx—Indicates a warning ■ 02000—Indicates no more rows ■ 38xxx—Indicates an error
Table Procedure Name (CHAR (18))	Name of the table procedure
Explicit Name	Not used
Message Text (CHAR (80))	Message text returned by the table procedure and displayed by CA IDMS in the event of an error or warning
SQL Command Code (fullword)	Code indicating the type of SQL request for which the table procedure is being called. See Table Procedure Requests for a list of valid command codes.
SQL Operation Code (fullword)	Code indicating the type of request being made of the table procedure. See Table Procedure Requests for a list of valid operation codes.
Instance Identifier (fullword)	A unique value identifying the scan on which the table procedure is to operate.
Local Work Area (User-defined)	A user-defined storage area maintained across calls to the table procedure.
Global Work Area (User-defined)	A user-defined storage area maintained across calls to the table procedure and capable of being shared by other SQL routines.

Table Procedure Requests

Part of the information passed to the table procedure is the type of request being made. This information is conveyed in two parameters:

- The first parameter contains a code indicating the type of SQL statement for which the request is issued (for example, INSERT, OPEN). The table following "SQL command codes" lists valid SQL command codes.
- The second parameter is an internal operation code indicating the type of action expected of the table procedure. The table following "Operation codes" lists possible operation codes.

SQL Command Codes

The following table lists SQL command code values.

Command number	Statement type
1	Logical DDL
3	CLOSE
4	COMMIT
5	COMMIT continue
6	COMMIT release
7	CONNECT
8	DECLARE
9	DELETE searched
10	DELETE positioned
11	DESCRIBE
12	EXECUTE
13	TERMINATE
14	EXECUTE IMMEDIATE
16	FETCH
17	INSERT
18	LOCK TABLE
19	OPEN
20	PREPARE
21	RESUME
22	RELEASE
23	ROLLBACK
24	ROLLBACK release
25	SELECT
26	SET ACCESS MODE
27	SET TRANSACTION
28	SUSPEND
29	UPDATE searched

Command number	Statement type
30	UPDATE positioned
31	SET COMPILE
32	SET SESSION

Operation Codes

The following table lists operation code values and their meanings:

Code	Value	Description
Open Scan &sub1.	Value 12	Requests the table procedure prepare itself for returning a set of result rows. Selection criteria specified in the WHERE clause or in the table procedure reference are passed as arguments to the table procedure.
Next Row	Value 16	Requests the table procedure return the next result row for the indicated scan. Next Row requests are repeated to return all the result rows for a scan. The table procedure can set an SQLSTATE value indicating that all rows have been returned.
Close Scan	Value 20	Informs the table procedure that no further Next Row requests will be issued for the scan. The table procedure may free resources in response to this request.
Update Row	Value 40	Requests the table procedure update the "current" row of the indicated scan using the values of the passed parameters as the update values. Update Row requests are issued in response to either searched or positioned UPDATE statements.
Delete Row	Value 36	Requests the table procedure delete the "current" row of the indicated scan. Delete Row requests are issued in response to either searched or positioned DELETE statements.
Insert Row	Value 32	Requests the table procedure insert a row into the database using the values of the passed parameters as the insert values.
Suspend Scan	Value 24	Informs the table procedure the SQL session is being suspended. The table procedure may release resources in response to this request.

Code	Value	Description
Resume Scan	Value 28	Informs the table procedure the indicated scan is being resumed following a suspend. The table procedure may re-establish its state if necessary. Note: The term **scan** refers to a set of related operations performed on behalf of one or more SQL statements. A SELECT statement is associated with a separate scan. Similarly, each searched UPDATE or searched DELETE statement is associated with a separate scan. However, all statements referencing the same cursor are associated with the same scan.

Both SELECT statements and OPEN/FETCH/CLOSE cursor requests result in the following set of calls to the table procedure:

```
Open Scan
  Next Row  (1 to n times)
Close Scan
```

A searched UPDATE statement results in the following:

```
Open Scan
  Next Row   \ (1 to n times)
  Update Row /
Close Scan
```

The table procedure is called repeatedly to return the next row to be updated based on the selection criteria passed on the Open Scan request. The results of the Next Row request are examined by the DBMS to determine whether they satisfy all the WHERE clause criteria specified on the searched update statement. If all criteria are satisfied, the table procedure is then called to update the row. If any criteria are not satisfied, the row is not updated and the table procedure is called instead to retrieve the next row.

A positioned UPDATE statement associated with an open cursor has a similar calling sequence except the invoking application determines whether to update the current row.

Searched and positioned DELETE statements result in similar calling sequences to those for searched and positioned UPDATE statements, except a Delete Row request is issued instead of an Update Row request.

INSERT statements result in a single call to the table procedure for each row to be inserted.

Parameter Arguments

On entry to the table procedure, the value of the arguments corresponding to the parameters defined on the CREATE TABLE PROCEDURE statement vary depending on the type of operation performed:

- On an Open Scan request, non-null parameters contain one of the following:
  - Selection criteria specified in the WHERE clause
  - Parameter values specified on the table procedure reference
  - Data type-specific default value if WITH DEFAULT was specified in the table procedure definition

  All other parameters contain nulls (that is, the null indicator for the parameter is negative).
- On an Update Row request, the parameters contain the values returned from the previous Next Row request, overlaid with the values specified in the SET clause of the UPDATE statement.
- On an Insert Row request, the parameters contain the values specified in the VALUES clause of the INSERT statement or the values returned by the SELECT associated with the INSERT statement. Unspecified values are either null or contain the parameter's default value.
- On other types of requests, the contents of the parameters are undefined on entry.

On exit from a Next Row request, the table procedure is expected either to have set the value of the parameter arguments and their indicators appropriately or to have set an SQLSTATE value indicating no-more-rows. If an indicator parameter is set to -1, CA IDMS ignores the value of the corresponding parameter.

Instance Identifier

On every call issued to a table procedure, a parameter is passed identifying the scan to which the request is directed. In the case of INSERT, this has no meaning. However, in all other cases (SELECT, UPDATE, DELETE, and cursor operations) the instance ID can be used to distinguish one scan from another.

Local Work Area

Another parameter passed on each call to a table procedure is a local work area where the table procedure may save information it wishes to preserve from one call to another. Each scan is allocated its own local work area so that values associated with processing an individual scan may be saved appropriately in a local work area. The types of information which you might need to preserve across calls include:

- Subschema control block for a run unit or the session identifier of an SQL session (for retrieval-only table procedures)
- Database position information
- Input parameter values used as selection criteria

CA IDMS allocates a local work area when a scan is opened and frees it when the scan is closed. Each scan receives its own local work area. When the local work area is allocated, it is initialized to binary zeros.

Global Work Area

A global work area is a storage area that can be shared across one or more table procedures or other SQL routines within a transaction. Each global work area has an associated key which is either:

- The four-character identifier specified on the GLOBAL WORK AREA clause
- The fully-qualified name of the table procedure if no identifier was specified

All SQL routines executing within a transaction and having the same global storage key share the same global work area.

Unless transaction sharing is in effect, all SQL routines within an invoking SQL transaction should update the database through only one run unit or SQL transaction to avoid deadlocking. Typically an update table procedure uses a global work area to share the subschema control or SQL session identifier with other SQL routines. A retrieval-only table procedure might instead use only a local work area for each scan, opening the run unit or SQL session on the Open Scan request and terminating it on the Close Scan request.

Chapter 12: Defining and Using Procedures

This section contains the following topics:

When to Use a Procedure

SQL-invoked procedures implement a remote procedure call paradigm. They have similar uses as table procedures, but generally cannot replace table procedures because of their inability to return many rows of a result table with the table procedure parameters as columns of a table. Instead, they return only 0 or 1 row of parameters. Procedures are much simpler to program and can be written in the SQL procedural language.

Procedures can be implemented for many uses which include but is not limited to the following:

- Reuse existing code
- Encapsulate complex code
- Standardize common business processes
- Reduce communication bandwidth
- Easier and faster deployment and control of applications
- Isolate user interface logic from database access
- Implement transparently segmented databases
- Access non-SQL defined databases

While procedures cannot return more than one row from a result table, made up from the procedure parameters, it is possible for the caller of a procedure to receive result sets created by the procedure. The caller can allocate and process dynamic cursors for all the result sets returned by the called procedure. This feature is called dynamic result sets. For more information, see CALL.

Defining a Procedure

How to define and deploy SQL-invoked procedures depends on the language of the procedure.

- For SQL procedures which are specified with LANGUAGE SQL, you define the procedure using the CREATE PROCEDURE statement with the **procedure-statement** clause. After the successful execution and commit of the CREATE PROCEDURE statement, the procedure can be called.
- For external procedures, not specified with LANGUAGE SQL, you must use the following steps:
  1. Define the procedure using the CREATE PROCEDURE statement.
  2. Write the procedure in COBOL, PL/I, Assembler, or CA ADS following the guidelines outlined below. You can also use an existing program as a procedure.
  3. Define the program to a CA IDMS system, if necessary
  4. Invoke the procedure with an SQL CALL statement or from within a query-specification or a SELECT statement.

In the following example, the procedure GET_BONUS is named and associated with schema EMP. The name of the program to be called to service a CALL request of the procedure, CALCSAL, is specified in the EXTERNAL NAME parameter. The PROTOCOL IDMS specifies that the procedure is defined and called using the IDMS protocol. The parameters that pass to and from the procedure are listed. Each parameter definition consists of a name and a data type.

```
 CREATE PROCEDURE EMP.GET_BONUS
( EMP_ID           UNSIGNED NUMERIC (4),
  START_DATE       DATE,
  SALARY             UNSIGNED NUMERIC (9))
EXTERNAL NAME CALCSAL
PROTOCOL IDMS;
```

More Information

- For more information about syntax and parameters used in defining procedures, see CREATE PROCEDURE.
- For more information and a more detailed example of using CREATE PROCEDURE, see Sample COBOL Procedure, and Sample CA ADS Procedure.
- For more information about procedures returning dynamic result sets, see CALL.

Invoking a Procedure

You invoke procedures using an SQL CALL statement or using a query-specification or a SELECT statement. During SQL CALL processing, CA IDMS issues a call to the corresponding routines. The output parameter values return as a result set.

You can also reference a procedure in the FROM clause of a query-specification or SELECT statement, in the same manner as references to SQL tables, views and table procedures.

If you reference a procedure in a FROM clause, then the parameters of the procedure act as columns in an SQL table or view. You can reference them in SELECT list expressions and WHERE clauses. A procedure returns exactly one row of output or no output. You can reference procedures any place that permits a table reference.

Access to a procedure is controlled in the same way as for a table procedure. GRANT and REVOKE statements on a resource type of TABLE are used to give and remove SELECT or DEFINE privileges on a procedure.

Procedure Parameters

Parameters in procedure references are covered in this section when used with or in the following:

- SQL CALL Statement
- Query-specifications and SELECT Statements
- WHERE Clause

Parameters in Procedure References of the SQL CALL Statement

The recommended and easiest way of specifying input parameter values is within the procedure reference itself in the SQL CALL statement. When invoked through the Command Facility, the CALL statement results in a set of output values, one for each parameter defined to the procedure. In embedded SQL a CALL statement results in an output value for each parameter specified as a host variable, a local variable or a routine parameter. For dynamically prepared CALL statements, only the parameters specified in the procedure reference of the CALL will be available as output values.

You specify parameter values supplied on a procedure reference either positionally or as keyword/value pairs. You can also combine them with WHERE clause references to form the set of values that pass to the procedure.

Examples of specifying parameter values

The example below shows different ways in which you can specify input parameter values using the SQL CALL statement.

```
CALL EMP.GET_BONUS (EMP_ID = 127, START_YEAR= '1998')
CALL EMP.GET_BONUS (127, '1998')
```

Parameters in Procedure References in Query-specifications and SELECT Statements

The parameters associated with a procedure are treated like columns of a table. You can specify them within the column list of a SELECT or a query-specification or the search criteria of a WHERE clause. Additionally, you can specify parameter values within the procedure reference itself.

Column list references

Parameters referenced in	Specify
Column list of a SELECT statement	The columns that return to the invoking application

WHERE Clause References

You use WHERE clause references to parameters to filter the output of the procedure. Each time a procedure returns a set of output values, they are evaluated against the selection criteria specified in the WHERE clause. A non-conforming "row" results in an SQLSTATE of No Data for the initiating SQL request.

Additionally, you can use WHERE clause parameter references to pass input values to the procedure. If you specify selection criteria in the form of an "=" comparison (that is, *parameter* = *value*), *value* passes to the procedure. Other types of selection criteria such as IN predicates or comparison predicates with > or < operators have no effect on the value of the parameters passed to the procedure.

Specifically, a reference to a parameter in a WHERE clause results in an input value passing to the procedure only if:

- It appears within an equality test
- The equality test is not combined with other predicates in the WHERE clause through the use of the OR operator
- The NOT operator does not precede the equality test

WHERE clause Parameter References

The examples below illustrate how a parameter reference in a WHERE clause affects the value passed to the procedure:

```
WHERE clause               Parameter value
                            P1      P2
  P1 = 1                     1     -null-
  P1 < 1                   -null-  -null-
  P1 = C1                    C1    -null-
  P1 = 2 AND P2 = 3          2       3
  P1 = 2 AND P2 > 3          2     -null-
  P1 = 2 OR  P2 = 3        -null-  -null-
  P1 IN (2, 3, 8)          -null-  -null-
```

Difference between procedure reference and WHERE clause

One difference exists between parameter values specified through a WHERE clause and those specified within the procedure reference. Parameter values specified within the procedure reference are not used to filter the output from the procedure as is the case for those specified within the WHERE clause. Parameter values specified within the procedure reference affect only the input to the procedure and not the output from the procedure. Therefore, the above three select statements are equivalent only if the procedure enforces the conditions specified through the procedure reference.

Writing an External Procedure in COBOL, PL/I or Assembler

You can write the program associated with an external procedure in COBOL, PL/I or Assembler. This requires the procedure to be defined with PROTOCOL IDMS. When called, the program is passed a fixed parameter list consisting of the parameters specified on the procedure definition as well as additional parameters used for communication between CA IDMS and the procedure.

Whenever you make a reference to a procedure, CA IDMS calls the program associated with the procedure to service the request. The procedure responds by processing the input parameters. You can optionally set an error condition in SQLSTATE.

CA IDMS performs transaction and session management automatically in response to requests that the originating application issues. Changes to the database made by a procedure are committed or rolled out together with other changes made within the SQL transaction. The procedure requires no special action to ensure this occurs.

The next section discusses writing a procedure in detail.

For an example of a procedure written in COBOL, see Sample COBOL Procedure.

Calling Arguments

The following sets of arguments pass each time you call a procedure:

- One argument for each of the parameters specified on the procedure definition, passes in the order you declare the parameters
- One argument for each null indicator associated with a parameter specified in the procedure definition, passes in the order you declare the parameters
- A set of common arguments used for communications between CA IDMS and the procedure

The first two sets of arguments vary from one procedure to another. They are used to pass selection criteria and insert/update values to the procedure and result values from the procedure.

The last set of arguments, shown in the table below, is the same for all procedures.

Argument	Contents
Result Indicator (fullword)	Not used

Argument	Contents
SQLSTATE (CHAR (5))	Status code returned by the procedure: The initial value is always 00000 ■ 00000—Indicates success ■ 01Hxx—Indicates a warning ■ 02000—Indicates no more rows ■ 38xxx—Indicates an error
Procedure Name (CHAR (18))	Name of the procedure
Explicit Name	Not used
Message Text (CHAR (80))	Message text returned by the procedure and displayed by CA IDMS in the event of an error or warning
SQL Command Code (fullword)	Always 16, indicating a Fetch SQL request.
SQL Operation Code (fullword)	Always 16, indicating a "next row" request.
Instance Identifier (fullword)	Not meaningful for procedures
Local Work Area (User-defined)	A user-defined working storage area
Global Work Area (User-defined)	A user-defined storage area that can be shared by other SQL routines within a transaction.

Parameter Arguments

On entry to the procedure, the value of the arguments corresponding to the parameters defined on the CREATE PROCEDURE statement are as follows:

Non-null parameters contain one of the following:

- The parameter values specified on the procedure reference
- The selection criteria specified in the WHERE clause
- The data type-specific default value if WITH DEFAULT was specified in the procedure definition

All other parameters contain nulls (that is, the null indicator for the parameter is negative).

On exit expect the procedure to either have set the value of the parameter arguments and their indicators appropriately or to have set an SQLSTATE value indicating no-more-rows. If you set an indicator parameter to -1, CA IDMS ignores the value of the corresponding parameter.

Local Work Area

Another parameter passed on each call to a procedure is a local work area.

CA IDMS allocates the local work area just before calling the procedure and frees it immediately after the procedure exits. When CA IDMS allocates the local work area, it is initialized to binary zeros.

Global Work Area

A global work area is a storage area that can be shared across one or more procedures or other SQL routines within a transaction. Each global work area has an associated key which is either:

- The four-character identifier specified on the GLOBAL WORK AREA clause
- The fully-qualified name of the procedure if you do not specify an identifier

All SQL routines executing within a transaction and having the same global storage key share the same global work area.

Unless transaction sharing is in effect, all SQL routines within an invoking SQL transaction should update the database through only one run unit or SQL transaction to avoid deadlocking. Typically, an update procedure uses a global work area to share the subschema control or SQL session identifier with other SQL routines. A retrieval-only procedure might instead use only a local work area opening the run unit or SQL session and terminating it on exit.

Writing External Procedures as CA ADS Mapless Dialogs

You can also code an SQL procedure as a CA ADS mapless dialog. This requires the procedure to be defined with PROTOCOL ADS and SYSTEM MODE. The name of the dialog that is loaded and run when the SQL procedure is invoked is specified in the EXTERNAL NAME clause of the CREATE/ALTER PROCEDURE statement.

Note: For more information about coding an SQL procedure as a CA ADS, see CREATE PROCEDURE and the examples given in Sample CA ADS Procedure.

Mapless Dialog

The ADS dialog that implements the SQL procedure must be mapless. The name of this mapless dialog is specified as external-routine-name in the external clause of the procedure definition.

To return to the SQL engine, the CA ADS premap process of the mapless dialog must issue a LEAVE ADS command.

Work Records

To access the procedure parameters, the dialog must include a work record whose name is schema-name.procedure-identifier. This record is not copied from the dictionary but instead is automatically constructed by the CA ADS dialog compiler (ADSC or ADSOBCOM) when it compiles the dialog. You can refer to the procedure parameters in the ADS process code in the same way as you refer to columns in any SQL table. Null indicator(s) (variables) can be referenced by appending "-I" to the relevant column name (see Usage).

When parameters of a procedure are dropped, added or altered, the dialog that implements the procedure must be recompiled. Failure to do so may result in a DC171066 error message when the procedure is next executed. The runtime validation producing this message is based solely on the size of the record.

Additional Records

Besides the pseudo-work record, schema-name.procedure-identifier, other records related to the procedure can be included.

ADSO-SQLPROC-COM-AREA is a system-supplied record. The record layout is given next:

```
ADD RECORD NAME ADSO-SQLPROC-COM-AREA.
  03 FILLER                    PIC S9(8) COMP SYNC.
  03 FILLER                    PIC X(3).
  03 SQLPROC-SQLSTATE          PIC X(5).
  03 SQLPROC-NAME              PIC X(18).
  03 SQLPROC-SPECIFIC-NAME     PIC X(18).
  03 SQLPROC-MSG-TEXT          PIC X(80).
  03 SQLPROC-COMMAND-CODE      PIC S9(8) COMP SYNC.
  03 SQLPROC-OPERATION-CODE    PIC S9(8) COMP SYNC.
  03 SQLPROC-INSTANCE-ID       PIC S9(8) COMP SYNC.
  03 FILLER                    OCCURS 2.
```

The non-FILLER elements of the ADSO-SQLPROC-COM-AREA record are the parameters that are common to all SQL procedures. For a description of these parameters, see Calling Arguments.

If the procedure definition contains a LOCAL or GLOBAL WORKAREA clause, you can define corresponding records in the dictionary. While the layout of these records is application dependent, the name must comply with the following rules in order for the ADS runtime to properly initialize these records:

- dialogname-SQLPROC-GLOBAL-AREA
- dialogname-SQLPROC-LOCAL-AREA

The *dialogname* is the name of the dialog, specified as external-routine-name in the external name clause of the procedure definition.

Note: For more information and examples, see Sample CA ADS Procedure.

Chapter 13: Defining and Using Functions

This section contains the following topics:

When to Use a User-Defined Function

You can use a user-defined SQL function just as you would use any SQL scalar function. A scalar function is a function whose argument includes zero or more value expressions on which the function operates. The result of a scalar function is a single value. This value is derived from the expression or expressions named in the arguments.

Defining a Function

How to define and deploy user-defined functions depends on the language of the function.

- For SQL functions, specified with LANGUAGE SQL, define the function using the CREATE FUNCTION statement with the procedure-statement clause. After the successful execution and commit of the create function statement, the function can be invoked.
- For external functions, not specified with LANGUAGE SQL, complete the following steps:
  1. Define the function using the CREATE FUNCTION statement.
  2. Write the function in COBOL, PL/I, Assembler, or CA ADS following the guidelines given in this chapter. You may also be able to use an existing program as a template for a function.
  3. Define the function to a CA IDMS system, if necessary.
  4. Invoke the function as needed by specifying it anywhere that a value-expression can be specified in an SQL statement.

Note: You invoke the SQL function in a way very similar to the way in which you invoke built-in functions.

An example is shown next:

```
CREATE FUNCTION DEFJE01.UDF_FUNBONUS
  ( EMP_ID         DECIMAL(4)    )
    RETURNS DECIMAL(10)
    EXTERNAL NAME FUNBONUS PROTOCOL IDMS
    DEFAULT DATABASE CURRENT
    USER MODE
    LOCAL WORK AREA 0
    ;
```

Similarly, use the ALTER FUNCTION and DROP FUNCTION statements to modify and delete the definition of existing functions.

More Information

- For more information about the syntax and parameters used in defining functions, see CREATE FUNCTION, ALTER FUNCTION, and DROP FUNCTION.
- For more information and detailed examples about using a CREATE FUNCTION, see Sample COBOL Function, and Sample CA ADS Function.

Invoking a Function

User-defined SQL functions are invoked using the user-defined-function invocation syntax.

Access to user-defined functions is controlled in the same way as for procedures. GRANT and REVOKE statements on a resource type of TABLE are used to give and remove SELECT or DEFINE privileges on a function.

Note: For more information about a user-defined-function, see Expansion of Value-expression and Expansion of User-defined-function.

Writing an External Function in COBOL, PL/I, or Assembler

You can write the program associated with a function in COBOL, PL/I or Assembler. This requires the function to be defined with PROTOCOL IDMS. When called, the program is passed a fixed parameter list consisting of the parameters specified in the function definition, as well as additional parameters used for communication between CA IDMS and the function.

Whenever a function is invoked, CA IDMS calls the program associated with the function to service the request. The function responds by processing the input parameters. An error condition can optionally be set in SQLSTATE.

CA IDMS performs transaction and session management automatically in response to requests that the originating application issues. Changes to the database made by a function are committed or rolled out together with other changes made within the SQL transaction. No special action is required of the function in order to ensure that this occurs.

The next section discusses writing a function in detail.

For an example of a function written in COBOL, see Sample COBOL Function.

Calling Arguments

The following sets of arguments are passed when a function is called:

- One argument for each of the parameters specified on the function definition, passed in the order in which the parameters were declared. These arguments vary from function to function; they are used to pass values to the function.
- One argument to contain the return value of the function. The implicit name for this argument is USER_FUNC.
- One argument for each null indicator associated with a parameter specified in the function definition, passed in the order in which the parameters were declared. These arguments vary from function to function; they are used to pass values to the function.
- One argument for the null indicator associated with the return value of the function (the null indicator for the USER_FUNC parameter).
- A set of common arguments used for communications between CA IDMS and the function. This set of arguments, shown in the following table, is the same for all functions.

Argument	**Contents**
Result Indicator (fullword)	Not used
SQLSTATE (CHAR (5))	Status code returned by the procedure: The initial value is always 00000 00000 Indicates success 01Hxx Indicates a warning 02000 Indicates no more rows 38xxx Indicates an error
Function Name (CHAR (18))	Name of the function
Explicit Name	Not used
Message Text (CHAR (80))	Message text returned by the function and displayed by CA IDMS in the event of an error or warning
SQL Command Code (fullword)	Always 16, indicating a Fetch SQL request
SQL Operation Code (fullword)	Always 16, indicating a "next row" request
Instance Identifier (fullword)	Not meaningful for functions
Local Work Area (user-defined)	A user-defined working storage area
Global Work Area (user-defined)	A user-defined storage area that can be shared by other SQL routines within a transaction.

Parameter Arguments

On entry to the program associated with a function, the value of the arguments corresponding to the parameters defined in the CREATE FUNCTION statement are as follows:

- Non-null parameters contain one of the following:
  - The parameter values specified on the function reference
  - The data type-specific default value if WITH DEFAULT was specified in the function definition, and no value was specified in the function invocation
- All other parameters contain nulls (that is, the null indicator for the parameter is negative).

On exit, the program associated with the function is expected either to have set the value of the parameter USER_FUNC, holding the functions return value and the corresponding indicator appropriately, or to have set an SQLSTATE value indicating no-more-rows. If the indicator parameter is set to -1, CA IDMS ignores the value of the USER_FUNC parameter.

Local Work Area

Another parameter passed on each call to a function is a local work area.

CA IDMS allocates the local work area just before calling the function and frees it immediately after the function exits. When the local work area is allocated, it is initialized to binary zeros.

Global Work Area

A global work area is a storage area that can be shared across one or more functions or other SQL routines within a transaction. Each global work area has an associated key that is one of the following:

- Four-character identifier specified on the GLOBAL WORK AREA clause
- Fully-qualified name of the function if no identifier was specified

All SQL routines executing within a transaction and having the same global storage key share the same global work area.

Writing External Functions as CA ADS Mapless Dialogs

You can also code an SQL function as a CA ADS mapless dialog. This requires the function to be defined with PROTOCOL ADS and SYSTEM MODE. The name of the dialog that is loaded and run when the SQL function is invoked is specified in the EXTERNAL NAME clause of the CREATE/ALTER FUNCTION statement.

Note: For more information, see CREATE FUNCTION and the examples given in Sample CA ADS Function.

Mapless Dialog

The ADS dialog that implements the SQL function must be mapless. The name of this mapless dialog is specified as external-routine-name in the external name clause of the function definition.

To return to the SQL engine, the CA ADS premap process of the mapless dialog must issue a LEAVE ADS.

Work Records

To access the function parameters and the result parameter USER_FUNC, the dialog must include a work record whose name is schema-name.function-identifier. This record is not copied from the dictionary but instead is automatically constructed by the CA ADS dialog compiler (ADSC or ADSOBCOM) when it compiles the dialog. You can refer to the function parameters and the result parameter USER_FUNC and the corresponding null indicators in the ADS process code in the same way as you refer to columns in any SQL table.

When parameters of a function are dropped, added or altered, the dialog that implements the SQL function must be recompiled. Failure to do so may result in a DC171066 error message when the function is next executed. The runtime validation producing this message is based solely on the size of the record.

Additional Records

Besides the pseudo-work-record, schema-name.function-identifier, other records related to the function can be included.

ADSO-SQLPROC-COM-AREA is a system-supplied record. The record layout is shown next:

```
ADD RECORD NAME ADSO-SQLPROC-COM-AREA.
  03 FILLER                    PIC S9(8) COMP SYNC.
  03 FILLER                    PIC X(3).
  03 SQLPROC-SQLSTATE          PIC X(5).
  03 SQLPROC-NAME              PIC X(18).
  03 SQLPROC-SPECIFIC-NAME     PIC X(18).
  03 SQLPROC-MSG-TEXT          PIC X(80).
  03 SQLPROC-COMMAND-CODE      PIC S9(8) COMP SYNC.
  03 SQLPROC-OPERATION-CODE    PIC S9(8) COMP SYNC.
  03 SQLPROC-INSTANCE-ID       PIC S9(8) COMP SYNC.
  03 FILLER            OCCURS 2.
```

The non-FILLER elements of the ADSO-SQLPROC-COM-AREA record are the parameters that are common to all SQL functions. For a description of these parameters, see Calling Arguments.

If the function definition contains a LOCAL or GLOBAL WORKAREA clause, you can define corresponding records in the dictionary. While the layout of these records is application dependent, the name must comply with the following rules for the ADS runtime to properly initialize these records:

- dialogname-SQLPROC-GLOBAL-AREA
- dialogname-SQLPROC-LOCAL-AREA

The *dialogname* is the name of the dialog, specified as external-routine-name in the external name clause of the function definition.

Chapter 14: Considerations for SQL-invoked External Routines

This section contains the following topics:

Special Considerations for SQL-invoked External Routines

This section discusses the following special considerations for table procedures, procedures and functions, commonly referred to as SQL-invoked external routines.

- Environment independence
- Transaction management
- Suspension/resumption of SQL-invoked external routines
- Error handling
- Datetime parameters
- Transaction mode

Environment Independence

Since it is likely an SQL-invoked external routine will execute within a batch address space because of local mode access and within the DC/UCF address space, it should be independent of the runtime environment.

If your SQL-invoked external routine issues only database requests, use a protocol mode of BATCH to ensure it executes in local mode and within the DC/UCF address space.

If an SQL-invoked external routine is executed in local mode (for example, through IDMSBCF), it must limit itself to database requests only or be written in Assembler (or use an Assembler subroutine for DC/UCF requests) or CA ADS.

Even if the SQL-invoked external routine is written in Assembler, many DC services such as Print, Queue and Terminal I/O are not supported in local mode and should not be used. Scratch and storage requests issued from an assembler program are supported in local mode. Terminal I/O services are not supported in local mode or within the DC/UCF address space.

If an SQL-invoked external routine is executed within DC/UCF, it should not contain statements that interfere with, or are prohibited from, that environment. For example, you should avoid DISPLAY statements in COBOL and GETMAIN requests in Assembler. Follow the rules specified in the appropriate *CA IDMS DML Reference Guide* when coding your SQL-invoked external routine.

When an SQL-invoked external routine is written as a mapless dialog in CA ADS, the CA ADS batch environment must have been configured resulting in an ADSOOPTI load module being available in the local mode load libraries.

Transaction Management

Run units and SQL transactions opened within an SQL-invoked external routine are managed automatically as part of the invoking SQL session's transaction. If the invoking application issues a COMMIT WORK, all subordinate transactions opened by SQL-invoked external routines are also committed. Similarly, if the invoking SQL session is rolled out, all subordinate transactions are also rolled out.

Although an SQL-invoked external routine is free to terminate its own transactions independently from the invoking SQL session, it should do so only if it made no changes to the database.

Terminating the invoking SQL transaction, either through a COMMIT or ROLLBACK operation, affects SQL-invoked external routines in the following ways:

- All open scans are closed. A Close Scan request is issued to each affected SQL-invoked external routine.
- All database transactions (SQL or non-SQL) started by the SQL-invoked external routine are either committed or rolled out and the corresponding sessions are terminated.
- All SQL-invoked external routine work areas are freed.

When the invoking SQL transaction is committed through a COMMIT CONTINUE operation, the only effect on SQL-invoked external routines is that database changes that the SQL-invoked external routine made are committed.

Suspend/Resume

If an SQL session which invokes an SQL-invoked external routine is suspended, the SQL-invoked external routine is also suspended, with the following results:

- Run units and SQL sessions started by the SQL-invoked external routine are suspended
- Database changes made by the SQL-invoked external routine (whether through SQL or native DML) are neither committed nor rolled out; instead the records remain locked and the changes are either committed or rolled out when the invoking SQL session is committed or rolled out
- Work areas associated with the SQL-invoked external routine are retained

In most cases, no special action is required of the SQL-invoked external routine during a suspend operation. The SQL-invoked external routine is called once for each open scan that exists at the time the session is suspended. If the SQL-invoked external routine has acquired temporary storage, it might need to save its contents somewhere else (such as in kept storage or in a scratch area) that is preserved across a pseudo-converse; otherwise, the SQL-invoked external routine may ignore Suspend Scan requests.

Similarly, the SQL-invoked external routine may ignore Resume Scan requests unless it needs to restore a temporary storage area. The first request to an SQL-invoked external routine after a resume is a Resume Scan, if the request involves a scan that was previously suspended. If the request does not involve a previously-suspended scan, the SQL-invoked external routine might not be aware that a suspend and resume has occurred. The contents of the SQL-invoked external routine's work areas are the same as before the suspend, and any run units or SQL sessions previously started by the SQL-invoked external routine resume automatically on the next database request.

Error Handling

The SQL-invoked external routine has two arguments to signal an exception condition back to CA IDMS. These arguments consist of a five-character SQLSTATE code and an 80-byte message area. The following table lists valid SQLSTATE codes and their descriptions.

Value	Description
00000	Request was successful
01H*xx*	Request was successful but the SQL-invoked external routine generated a warning message
02000	No more rows to be returned
38*xxx*	The SQL-invoked external routine has detected an error during processing

CA IDMS examines the SQLSTATE value to determine whether the operation was successful. An SQLSTATE value of 0200 indicates that all rows have been returned. It is meaningful only on a Next Row request and cannot be set while at the same time returning a row since CA IDMS ignores parameter arguments if an SQLSTATE value of 02000 is set.

If an SQLSTATE value indicates that an error or warning condition exists, CA IDMS embeds the message text returned by the SQL-invoked external routine in a standard DB message and returns it to the calling application through the message area of the SQLCA. It also translates the SQLSTATE value into one of the following SQLCODE values:

SQLSTATE Value	SQLCODE Value
00000	0
01H*xx*	1
02000	100
38*xxx*	-4

If the SQL-invoked external routine signals an error, CA IDMS automatically rolls out all database changes that the SQL-invoked external routine made while processing the SQL statement that caused the SQL-invoked external routine to be invoked. For example, if the invoking SQL statement was a searched update and ten rows had been updated before the error was detected, changes to all ten rows are rolled out automatically. Database changes made prior to the execution of the searched update statement are not rolled out.

Datetime Parameters

If an SQL-invoked external routine has a parameter with a data type of DATE, TIME, or TIMESTAMP, the values passed to and from the SQL-invoked external routine are in the eight-byte internal datetime format. To interpret incoming parameters, the SQL-invoked external routine must first convert them to external format using either the IDMSIN01 subroutine or the #XTRA macro. Similarly, before returning a datetime parameter value, the SQL-invoked external routine must convert the external format to the internal format again using either IDMSIN01 or #XTRA.

To avoid this type of conversion, you can define date/time parameters using a character data type which may then be converted to a DATE, TIME, or TIMESTAMP in DML statements using the CAST function. However, this method requires that the invoking application or end-user specify the CAST operation, and that the SQL-invoked external routine validate the datetime on update and insert values.

Note: For more information about datetime parameters, see "Calls to IDMSIN01" in the *CA IDMS Callable Services Guide*.

Transaction Mode

The transaction mode of an SQL session which invokes an SQL-invoked external routine is propagated to the subordinate transactions started by the SQL-invoked external routine. If the SQL-invoked external routine starts an SQL session, its default transaction mode is the same as the transaction mode associated with the invoking transaction. If the SQL-invoked external routine binds a run unit and the transaction mode of the invoking SQL transaction is READ ONLY, all update ready modes are converted automatically to SHARED RETRIEVAL. The net result is that an SQL-invoked external routine invoked by a transaction in a READ ONLY state is unable to update the database.

DC/UCF Program Definition

If the SQL-invoked external routine is executed within the DC/UCF address space, you must define the program to the DC/UCF system using one of the following:

- DCMT VARY DYNAMIC PROGRAM command
- ADD PROGRAM system generation statement

Compile and Link Options

Compile and link options vary depending on the language in which the SQL-invoked external routine is written and, in some cases, on the version of the compiler used. The following guidelines apply to compile and link options for SQL-invoked external routines:

- Programs should be reentrant or pseudo-reentrant.
- Programs should be linked with an AMODE of 31. If you do not do this, you must define all invoking tasks, including OCF, as **LOC=BELOW**.

COBOL Working Storage

You should not rely on the contents of COBOL working storage to be retained across calls, nor should you rely on initialization to establish values on the first request for a scan if the value might have been altered in a prior request.

The allocation and initialization of working storage varies depending on whether:

- The SQL-invoked external routine is invoked in local mode or within the DC/UCF address space
- Concurrent scans are being processed

Use working storage only for the following:

- Constants the SQL-invoked external routine will never change
- Variables that are initialized and used within a single call to the program

Other types of data, such as first-time flags or variables set in one call that are used within another, must be defined within either a local or global work area.

Debugging Procedures

The following techniques can help you debug your SQL-invoked external routines:

- Use WRITE TO LOG or SNAP requests to display trace information and key data structures to the log (available under DC/UCF only).
- Use COBOL or PL/I DISPLAY statements or write messages to a print file (available under local mode or with LE/370 support under DC)

  Note: If the program uses a VS COBOL compiler, even in local mode, you cannot use:

  – DISPLAY statements

  – STATE and FLOW compiler options
- Use SQLTRACE and DMLTRACE SYSIDMS parameters to trace the database calls made by the SQL-invoked external routine (available under local mode only).
- Use PROCTRACE in conjunction with SQLTRACE or DMLTRACE to trace the calls made into and out of the SQL-invoked external routine. This option displays the parameters both before and after the call (available under local mode only)

  Note: You enable SQL-invoked external routine tracing by including the following parameters in the SYSIDMS file:

  ```
  SQLTRACE=ON or DMLTRACE=ON
  PROCTRACE=ON
  ```

Database Name Inheritance

An SQL-invoked external routine can inherit the current database of the current session. The DEFAULT DATABASE attribute of the SQL-invoked external routine definition controls the inheritance of the default database as follows:

- DEFAULT DATABASE NULL guarantees compatibility with previous releases of CA IDMS.
- DEFAULT DATABASE CURRENT makes the current database the default database for any subordinate database session started by the SQL-invoked external routine.

Transaction Sharing

Transaction sharing allows multiple database sessions within a user session to share a single locking structure and recovery unit, thereby eliminating inter-session deadlocks.

Any access to a database from within an SQL-invoked external routine brings with it the potential for deadlocking if the same data is directly accessed from within the encompassing SQL session. By having both the SQL-invoked external routines and the encompassing SQL session all share a single transaction, the deadlock potential is eliminated.

Transaction sharing for SQL-invoked external routines is controlled by the TRANSACTION SHARING attribute of the SQL-invoked external routine definition. See the different SQL DDL statements for SQL-invoked external routines.

Chapter 15: XML Publishing Using SQL

This section contains the following topics:

XML Publishing

XML Publishing allows applications to generate XML data from data stored in a CA IDMS database easily and with high performance. Although the API is based on SQL, CA IDMS SQL supports SQL DML on non-SQL defined databases. Thus, also allowing non-SQL defined CA IDMS databases to be used as the data sources for XML Publishing.

XML Publishing is based on and implements a subset of the SQL/XML ISO standard as described in the ISO publication WD ISO/IEC 9075-14:2007 (E), titled "Information technology - Database languages - SQL - Part 14: XML-Related Specifications (SQL/XML)". A few extensions have been made available. These are indicated in the following section.

The XML Publishing capability is made available through a set of SQL functions, a new internal XML data type, an SQL table procedure, and an XML encoding session option.

SQL/XML Functions

The SQL/XML functions are not true SQL functions but pseudo functions. Some of the SQL/XML functions:

- have a variable number of arguments
- use "AS" to specify an alias for an expression as an argument
- have arguments that can be of any type
- support subqueries as arguments
- have arguments that can be SQL identifiers

Following is a list of the SQL/XML routines (all functions except for one table procedure) that can be used for XML Publishing purposes:

XML Value Functions

- **XMLAGG**—aggregates a set of XML values.
- **XMLATTRIBUTES**—function-like construct, only allowed as argument of XMLELEMENT. Generates XML attributes.
- **XMLCOMMENT**—generates an XML comment.
- **XMLCONCAT**—concatenates multiple XML values.
- **XMLELEMENT**—generates an XML element.
- **XMLFOREST**—generates a forest (collection) of XML elements.
- **XMLNAMESPACES**—function-like construct, only allowed as argument of XMLELEMENT or XMLFOREST. Generates XML namespaces.
- **XMLPARSE**—checks if an XML value is well-formed.
- **XMLPI**—generates an XML processing instruction, that is, an XML declaration or style sheet specification.
- **XMLROOT**—sets the XML version and standalone option in the XML declaration of a root XML element. If an XML declaration is not yet present, one is created with the ENCODING pseudo attribute set to the sessions current XML encoding.

CA IDMS Scalar Functions

- **XMLPOINTER**—returns a pointer to a character large object or CLOB, representing a serialized XML value. This CA IDMS extension can be used in programs, running in the same address space as CA IDMS.
- **XMLSERIALIZE**—returns a character or binary value with a maximum length of 30,000, representing a serialized XML value.

Table Procedure

- **XMLSLICE**—retrieves character or binary slices of equal length from the serialization of an XML value.

More Information

- For more information about detailed syntax and semantics of the SQL/XML routines, see XML Value Functions.
- For more information about detailed syntax and semantics of the XMLPOINTER and XMLSERIALIZE scalar functions, see CA IDMS Scalar Functions.
- For more information about detailed syntax and semantics of the XMLSLICE table procedure, see XMLSLICE Table Procedure.

XML Data Type and XML Values

The XML data type is an internal only data type that represents XML data. XML values are usually used as arguments to some of the SQL/XML functions.

The only way to produce an XML value is through the invocation of an XML value function, possibly indirectly through using a subquery that returns an XML value. The return value of all XML value functions is of the XML data type. A **subquery** used as an **XML-value-expression** must be of the XML data type, which implies that its SELECT list contains an XML value function.

Data of the XML type cannot be stored in a database or directly used in application programs using the standard SQL API. Programs running in the CA IDMS CV address space or in batch local mode can access serialized XML data using the **XMLPOINTER** function. After serialization and casting to CHAR or VARCHAR through the **XMLSERIALIZE** function, XML data can be accessed using any supported SQL API on any platform.

To bypass the 30,000 length limit of the character string returned by XMLSERIALIZE, use the **XMLSLICE** table procedure.

Examples of valid XML values are as follows:

- XML element
- Forest of XML elements
- Textual content of an XML element
- NULL value
- XML subquery (Select XMLAGG(XMLELEMENT(...)) from ATABLE where ...)

Syntax

No syntax is available. This is a special, internal only data type.

Mappings

SQL and XML are two different languages with their own specific language elements and grammar. When using SQL to produce XML, SQL language elements must be mapped to XML using appropriate rules.

This section describes the rules that are used for mapping of:

- Plain text SQL to XML
- SQL identifier to XML
- SQL data type values to XML schema data type values

Mapping Plain Text SQL to XML

This mapping is between the character set(s) of the SQL language and Unicode.

This feature supports mapping from the SQL character set (EBCDIC) to Unicode using encodings UTF-8, UTF-16-BE (big endian), and UTF-16-LE (little endian). This mapping is implemented using the standard CA IDMS code tables (RHDCCODE) and is controlled through the XML encoding session option. The default is not to map; the serialized XML values are encoded in EBCDIC.

Note: For more information about encoding XML values, see the XML encoding session option under SET SESSION.

Mapping SQL Identifier to XML

You can use a much greater range of characters in an SQL identifier than in an XML name. Any character can be used in an SQL identifier delimited by double quotes.

The normative definition of valid XML Name characters is found in the SQL/XML ISO standard. Valid first characters of XML Names are:

```
Letters, <underscore>, and <colon>
```

Valid XML Name characters, after the first character, are:

```
Letters, Digits, <period>, <minus sign>, <underscore>, <colon>,
CombiningChars, and Extenders
```

Note: The XML definition of Letter and Digit is broader than <simple Latin letter> and <digit> respectively.

There are two types of XML names: XML NCName and XML QName. An XML NCName is an XML non-colonized name and contains no colon (:) character. An XML QName is an XML-qualified name that consists of the XML namespace prefix and the local part of the name, separated by a colon (:) character. The namespace prefix and the local part of the name must be XML NCNames. For example, xsd:string is an XML Qname, where xsd is the namespace prefix which must have been declared for a namespace URI, and string is the local part of the name.

There are two types of mapping of SQL identifiers to XML: fully escaped and partially escaped. Fully escaped mapping is used for all SQL identifiers that are derived from an SQL column name, such as in the XMLATTRIBUTES and XMLFOREST functions. Partially escaped mapping is used in all the other cases, such as in the AS clause of the XMLATTRIBUTES, XMLFOREST, and XMLNAMESPACES functions, and in the NAME clause of the XMLELEMENT and XMLPI functions.

XML names that begin with the characters "xml" (in any combination) are reserved by W3C for use in future recommendations and cannot be used.

The following table shows some mapping examples:

SQL Identifier	**Fully Escaped XML Name**	**Partially Escaped XML Name**
department	DEPARTMENT	DEPARTMENT
"department"	department	department
"last name"	last_x0020_name	last_x0020_name
"last_xname"	last_x005F_name	last_x005F_name
"dept:id"	dept_x003A_id	dept:id
":id"	_x003A_id	_x003A_id
"xmlcolumn"	_x0078_mlcolumn	xmlcolumn
"Xmlcolumn"	_x0058_mlcolumn	Xmlcolumn
xmlcolumn	_x0058_MLCOLUMN	XMLCOLUMN

Mapping SQL Data Type Values to XML Schema Data Type Values

This feature supports mapping SQL data type values to XML schema data type values; however, mapping of GRAPHIC and VARGRAPHIC are not supported.

You can map null values using absence or xsi:nil="true".

The complete mapping rules are described in the SQL/XML ISO standard specification. As an oversimplification, mapping can be described as the result of the casting of the SQL data value to VARCHAR(max).

The following table shows some of the character value mappings:

SQL Character Value	**Mapped Value**
<	&lt .
>	&gt .
&	&amp .
Carriage Return	&#x0d .
'	&apos .
"	&quot .

This mapping does not apply to the characters belonging to an XML CDATA section; a CDATA section begins with the string "<![CDATA[" and ends with the string "]]>".

Example

In the following example, the use of many of the SQL/XML functions is shown. The result of the SELECT is an XML document that contains all the employees from the DEMOEMPL.EMPLOYEE table, grouped by department. The DEMOEMPL.EMPLOYEE and DEMOEMPL.DEPARTMENT tables are equi-joined on the DEPT_ID. To limit the size of the output, a WHERE clause is coded for the DEPT_ID column. Note how the SELECT statement clearly and naturally reflects the structure of the XML document.

```
select
  XMLSERIALIZE(CONTENT
    XMLCONCAT(
      XMLPI(NAME "xml"
       ,'version="1.0" encoding="UTF-8" standalone="yes"')
     ,XMLELEMENT(NAME "EmployeesByDepartment"
       ,XMLAGG
          XMLELEMENT(NAME "Department"
           ,XMLATTRIBUTES(DEPT_ID as "DeptId"
                         ,DEPT_NAME as "DeptName")
           ,select XMLAGG(
              XMLELEMENT(NAME "Employee"
               ,XMLATTRIBUTES(EMP_ID as "EmpId")
               ,e.EMP_FNAME
               ,e.EMP_LNAME
               ,XMLELEMENT(Name "Address"
                 ,XMLFOREST(
                    e.STREET as "Street"
                   ,e.CITY as "City"
                   ,e.STATE as "State"
                  )
                )
              )
            )
            from DEMOEMPL.EMPLOYEE e
            where d.DEPT_ID = e.DEPT_ID
           )
         )
       )
     )
   as VARCHAR(5000)
   )
 from DEMOEMPL.DEPARTMENT d
 where d.DEPT_ID < 1120
```

The result, which has been formatted for clarity, is similar to the following:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<EmployeesByDdpartment>
  <Department DeptId="1100" DeptName="PURCHASING - USED CARS">
    <Employee EmpId="5008">
      Timothy Fordman
      <Address>
       <Street>60 Boston Rd</Street>
       <City>Brookline</City>
       <State>MA</State>
      </Address>
    </Employee>
    <Employee Empid="4703">
      Martin Halloran
      <Address>
        <Street>27 Elm St</Street>
        <City>Brookline</City>
        <State>MA</State>
      </Address>
    </Employee>
    <Employee EmpId="2246">
      Marylou Hamel
      <Address>
        <Street>11 Main St</Street>
        <City>Medford</City>
        <State>MA</State>
      </Address>
    </Employee>
</Department>
<Department DeptId="1110" DeptName="PURCHASING - NEW CARS">
    <Employee EmpId="2106">
      Susan Widman
      <Address>
       <Street>43 Oak St</Street>
       <City>Medford</City>
       <State>MA</State>
      </Address>
    <Employee EmpId="1765">
      David Alexander
      <Address>
       <Street>18 Cross St</Street>
       <City>Grover</City>
       <State>MA</State>
      </Address>
    </Employee>
</Department>
</EmployeesByDepartment>
```

XMLSLICE Table Procedure

SYSCA.XMLSLICE is a table procedure used to retrieve character or binary slices of equal length from the serialization of an XML value. It is a CA IDMS extension that has been made available to allow any client program to process large serialized XML values. It is used when neither XMLSERIALIZE (limited to 30,000 characters) nor XMLPOINTER (requires client to run in same address space as CA IDMS) can be used.

Syntax

```
SELECT ── CAST── (── SLICE ─┬── AS BIN (slice-size) ───┬─ ) ───────►
                            └── AS CHAR (slice-size) ──┘

►─┬──────────────────┬─┬──────────────────┬─────────────────────────►
  └─,─ TOTLENGTH ────┘ └─,─ RESTLENGTH ───┘

►── FROM SYSCA.XMLSLICE ─┬──────────────────────────────────────┬───►
                         └─ (slice-size) ─┬────────────────┬─)──┘
                                          └─ , X'pad-hex' ─┘

►── WHERE ──────────────────────────────────────────────────────────►

►─┬───────────────────────────────────────────────────────────────┬─►
  └─ SLICESIZE = slice-size ─┬──────────────────────────────────┬─┘
                             └─ AND PADDING = X'pad-hex' ───────┘

►── XMLVALUE = XML-value-expression ───────────────────────────────►◄
```

Parameters

TOTLENGTH

Specifies the total length of the serialized XML value, without padding characters.

RESTLENGTH

Specifies the XML data length, without padding characters, that have not been returned yet.

SYSCA.XMLSLICE

Specifies a table procedure that slices **XML-value-expression**, after serialization, into slices of equal size, specified by *slice-size*. Each row returned by SYSCA.XMLSLICE represents a slice.

slice-size

Specifies an integer **value-expression**, with a positive value <= 8192. A *slice-size* must always be present, either as the first positional parameter of the table procedure or as the right operand in the equal predicate for SLICESIZE.

pad-hex

Specifies an optional two-byte hexadecimal literal that is used to pad the last slice of the serialized XML value. The default depends on the XML ENCODING parameter of the SQL SET SESSION statement. Two spaces are used for EBCDIC (X'4040') and UTF8 (X'2020'); one space is used for UTF16LE (X'2000') and UTF16BE (X'0020').

If **XML-value-expression** is specified as a **subquery**, it must be enclosed in parentheses.

The content of the slice is available in the SLICE column of the table procedure. Optionally, you can specify additional columns in the SELECT statement.

Examples

Example 1

In the following SELECT statement, all the employees in DEMOEMP.EMPLOYEE are aggregated in one XML value. This XML value is serialized, and each row returned is a 40-character slice of the serialized XML value.

```
select cast(slice as char(40)) from SYSCA.XMLSLICE
where slicesize = 40
  and xmlvalue =
(
  select xmlelement(name "employee",
                   xmlagg(xmlelement(name "Name",
                                     E.EMP_LNAME)))
  from DEMOEMPL.EMPLOYEE e
)
```

The result is similar to the following:

```
*+ (EXPR)
*+ ------
*+ <employee><Name>Albertini           </Na
*+ me><Name>Alexander           </Name><Nam
*+ e>Anderson            </Name><Name>Baldw
*+ in             </Name><Name>Bennett
*+         </Name><Name>Bradley
*+  </Name><Name>Brooks              </Name
*+ ><Name>Carlson             </Name><Name>
*+ Catlin              </Name><Name>Clark
*+              </Name><Name>Courtney
*+       </Name><Name>Crane               <
*+ /Name><Name>Cromwell            </Name><
*+ Name>Dexter              </Name><Name>Do
*+ nelson            </Name><Name>Ferguson
*+            </Name><Name>Ferndale
*+     </Name><Name>Fordman             </N
*+ ame><Name>Gallway             </Name><Na
*+ me>Griffin             </Name><Name>Hall
```

Example 2

This example shows the z/OS JCL for the batch command facility IDMSBCF and the SQL statements to create the z/OS dataset "CAIDMS.SAMPLE.XML" holding an XML document encoded in Unicode UTF-16 Little Endian.

The XML document contains the id and name of all employees as present in the DEMOEMPL.EMPLOYEE table.

With a binary file transfer, the dataset can be copied to other platforms for further processing. The use of the XMLSLICE table procedure allows for creating XML documents up to 2 GB.

```
//BCFLOCAL EXEC PGM=IDMSBCF,REGION=7500K
//STEPLIB  DD   DSN=CAIDMS.R160.LOADLIB,DISP=SHR
&invellip.
//SYSLST DD SYSOUT=A
//SYSOUT DD SYSOUT=A
//OUTPUT   DD  DSN=CAIDMS.SAMPLE.XML,DISP=(NEW,CATLG),
//             DCB=(RECFM=FB,LRECL=80,BLKSIZE=16000),
//             UNIT=SYSDA,SPACE=(TRK,(10,10))
//SYSIPT  DD *
set options OUTPUT to OUTPUT;    -- redirects output of BCF
set session XML Encoding utf16LE;-- requests UTF-16 LE encoding
select cast(slice as char(80))
  from sysca.xmlslice(80, X'2000')-- defines slices of 80 bytes
                              -- padding with space in UTF-16 LE
 where xmlvalue =
(select xmlroot(xmlelement(name "AllEmployees"
                         , xmlagg(xmlelement(name "Emp"
                                , xmlattributes(EMP_ID as "Id")
                                , EMP_FNAME ||EMP_LNAME)))
              , version '1.0')
  from DEMOEMPL.EMPLOYEE
)
```

Appendix A: Summary Comparison to SQL Standard

SQL Standard Basis

CA IDMS SQL is based on the ISO/IEC SQL Standards endorsed by ANSI.

Additional Statements in CA IDMS

CA IDMS supports the following SQL statements not included in the SQL standard:

Statement category	**CA IDMS extensions**
Access module management	ALTER ACCESS MODULE CREATE ACCESS MODULE DROP ACCESS MODULE EXPLAIN
Authorization	GRANT definition privileges GRANT EXECUTE REVOKE SQL definition privileges REVOKE EXECUTE TRANSFER OWNERSHIP
Data manipulation	DECLARE EXTERNAL CURSOR

Statement category	CA IDMS extensions
Logical data description	ALTER CATALOG ALTER INDEX ALTER SCHEMA ALTER TABLE PROCEDURE CREATE CALC CREATE CONSTRAINT CREATE INDEX CREATE KEY CREATE TABLE PROCEDURE CREATE TEMPORARY TABLE DROP CALC DROP CONSTRAINT DROP INDEX DROP KEY DROP TABLE PROCEDURE
Precompiler-directive	INCLUDE
Session management	RELEASE RESUME SESSION SET SESSION SUSPEND SESSION
Transaction management	SET ACCESS MODULE

Additional Parameters and Capabilities in CA IDMS

CA IDMS supports the following additional parameters and capabilities not included in the SQL standard:

Statement or component	CA IDMS extensions
Identifiers	■ Keywords as identifiers
Data-type	■ GRAPHIC data type ■ LONGINT data type ■ NUM as a synonym for NUMERIC ■ VARGRAPHIC data type
Literal	■ G'*double-byte-character-string-literal*'
rowid-pseudo-column	

Statement or component	CA IDMS extensions
SQL declaration sections	■ Support for coding delimiters across multiple lines
Special-register	■ GROUP ■ CURRENT DATE ■ CURRENT TIME ■ CURRENT TIMESTAMP ■ CURRENT DATABASE ■ CURRENT SCHEMA ■ CURRENT SQLID
Aggregate-function	■ *Column-name* without DISTINCT in the COUNT function
COMMIT WORK statement	■ CONTINUE parameter ■ RELEASE parameter
CREATE TABLE statement	■ IN parameter ■ COMPRESS parameter ■ ESTIMATED ROWS parameter
DECLARE CURSOR statement	■ GLOBAL parameter
FETCH statement	■ BULK parameter ■ *Buffer* specification in the INTO parameter
INSERT statement	■ BULK parameter
ROLLBACK WORK statement	■ RELEASE parameter
SELECT statement	■ PRESERVE parameter ■ BULK parameter
WHENEVER statement	■ *Label* without a colon ■ CALL parameter

Appendix B: Summary of Limits

Logical Data Limits

Item	Maximum allowed
Tables in a dictionary	Unlimited
Views in a dictionary	32,767
Tables in an area	32,767
Indexes in an area	32,767
Bytes in a row	32,760
Columns in a table or view	1,024
CALC keys on a table	1
Indexes on a table	Unlimited
Columns in a CALC, index, foreign, or sort key	32
Length of a CALC, index, foreign, or sort key **Note:** This includes length of the key columns, null indicators, and varchar length fields.	2000 bytes

Data Type Limits

Data type	Largest possible&sub1.	Smallest possible
BINARY	32,760 bytes	1 byte
CHARACTER	32,760 bytes	1 byte
DATE	'9999-12-31'	'0001-01-01'
DECIMAL	10&sub3.&sub1.-1	-(10&sub3.&sub1.-1)
Positive DOUBLE PRECISION	Approximately 7.2E+75	Approximately 5.4E-79
Negative DOUBLE PRECISION	Approximately -5.4E-79	Approximately -7.2E+75

Data type	Largest possible&sub1.	Smallest possible
Positive FLOAT	Approximately 7.2E+75	Approximately 5.4E-79
Negative FLOAT	Approximately -5.4E-79	Approximately -7.2E+75
GRAPHIC	16,380 double-byte characters	1 double-byte character
INTEGER	2,147,483,647	-2,147,483,648
LONGINT	9,223,372,036,854,775,807	-9,223,372,036,854,775,808
NUMERIC	10&sub3.&sub1.-1	-(10&sub3.&sub1.-1)
Positive REAL	Approximately 7.2E+75	Approximately 5.4E-79
Negative REAL	Approximately -5.4E-79	Approximately -7.2E+75
SMALLINT	32,767	-32,768
TIME	'23:59:59'	'00:00:00'
TIMESTAMP	'9999-12-31.23.59.59.999999'	'0001-01-01.00.00.00.000000'
UNSIGNED DECIMAL	10&sub3.&sub1.-1	0
UNSIGNED NUMERIC	10&sub3.&sub1.-1	0
VARCHAR	32,758 bytes	1 byte
VARGRAPHIC	16,379 double-byte characters	1 double-byte character

Note: A TIME value of 24.00.00 is accepted and treated as 00.00.00.

Note: The largest possible data type size is theoretical. The aggregate column size of a table cannot exceed the page size less bytes reserved for control information.

For more information, see the *CA IDMS Database Administration Guide*.

Host Variable Limits

Item	Maximum allowed
Host and indicator variables in an SQL statement	2,048
Total length of the host and indicator variables described by an SQLDA	32,767

Syntactic Limits

Item	Maximum allowed
Length of an identifier	32 bytes
Length of an embedded SQL statement	8,192 bytes
Columns in a result table	1,024
Columns in a GROUP BY parameter	255
Total length of the columns in a GROUP BY parameter	32,767 bytes
UNION operands in a query expression or SELECT statement	31
Columns in an ORDER BY parameter	254
Total length of the columns in an ORDER BY parameter	32,767 bytes
Value expressions in a query expression	1,024
Table names in a query specification	32
Query specifications in a query expression	32
Dynamic parameters used in a statement	1024
Subqueries and user-defined function invocations in a statement	1024
Number of arguments in user-defined function invocations. The actual limit depends on the data types and the complexity of expressions used in the function invocation.	620

Appendix C: SQL Communication Area

SQLCA

The SQL Communication Area (SQLCA) is a data structure used to return information regarding the success or failure of an SQL request.

Structure

Field	Meaning	Additional information
SQLCAID	Eye-catcher (SQLCA)	Initialized to SQLCA*.
SQLCODE	SQL error code	For SQLCODE values, see SQLCODE Values.
SQLCERC	Extended information error code	This field contains the reason code for error or warning conditions.
SQLCNRP	Number of rows processed by the SQL statement	
SQLCNRRS	Number of dynamic results sets returned by a called SQL-invoked procedure	This is a 2-byte integer value.
SQLCSER	Offset into the user-provided SQL statement buffer where a syntax error was recognized	
SQLCLNO	Source file line number from which the SQL statement was obtained	This field is maintained by the precompiler and is provided for use in forming error messages.
SQLCMCT	Count of messages issued for this request	
SQLCARC	Reserved	
SQLCFJB	Reserved	
SQLCERRML	Length of error message text in SQLERRMC	
SQLERRMC	Text of the error messages	This is a 256-byte field containing one or more messages. Each message is preceded by a one-byte binary field containing the length of the message text.

Field	Meaning	Additional information
SQLSTATE	SQL status code	For SQLSTATE values, see SQLSTATE Values

SQLSTATE

SQLSTATE is a five-character string where CA IDMS returns the status of the last SQL statement executed. It is divided into a two-character class and a three-character subclass. Standard values are associated with each class and subclass, which minimizes the need for vendors to define their own values and makes applications more portable from one environment to another.

SQLSTATE Values

The list of SQLSTATE values that CA IDMS can return appears next. The list is divided into sections based on the class (the first 2 characters of the SQLSTATE value). Each subclass (the last 3 characters of the SQLSTATE value) is listed under its associated class.

Standard -defined Values

Class and subclass values beginning with the characters A-H and 0-4 are established by the SQL standard organizations.

CA IDMS-defined Values

Class and subclass values beginning with the characters I-Z and 5-9 are vendor-defined; in this case, they are specific to CA IDMS. Any subclass value associated with a vendor-defined class is also defined by that vendor.

SQLSTATE Values

```
00 Successful completion
   000  No subclass

01 Warning
   000  No subclass
   004  String data, right truncation
   00C  SQL-invoked procedure returned result sets
   00D  Additional result sets returned
   00E  Attempt to return too many result sets
   010  Column cannot be mapped
   600  Inconsistent or invalid option
   602  Entity or association already exists
   605  Entity not defined in Catalog
   606  Invalid option for physical DDL
   607  Invalid option for DMCL
   608  Connecting to a dictionary which is missing either or
        or both of DDLCAT/DDLDML areas
   610  Database is inconsistent with request
   611  SQL routine parse error
   612  ADS compilation for an SQL routine failed
   613  Drop of SQL routine completed with warnings
   638  Warning returned from table procedure

02 No data
   000  No subclass

07 Dynamic SQL error
   000 No subclass
   001 USING clause does not match dynamic parameter specification
   002 USING clause does not match target specification
   003 Cursor specification cannot be executed
   004 USING clause required for dynamic parameters

08 Connection exception
   000  No subclass
   004  SQL-server rejected establishment of SQL-connection
   006  Connection failure

0M Invalid SQL-invoked procedure reference
   000  No subclass

0N SQL/XML Mapping Error
   000  No subclass
   001  Unmappable XML name
   002  Invalid XML character
```

```
21 Cardinality violation
   000  No subclass

22 Data Exception
   000  No subclass
   001  String data, right truncation
   002  Null value, no indicator parameter
   003  Numeric value out of range
   005  Error in assignment
   007  Invalid datetime format
   008  Datetime field overflow
   00J  Nonidentical notations with the same name
   00K  Nonidentical unparsed entities with the same name
   00L  Not an XML document
   00M  Invalid XML document
   00N  Invalid XML content
   00R  XML value overflow
   00S  Invalid comment
   00T  Invalid processing instruction
   011  Substring error
   012  Division by zero
   019  Invalid escape character

23 Constraint violation
   000  No subclass
   501  Duplicate key violation

24 Invalid cursor state
   000  No subclass

25 Invalid transaction state
   000  No subclass
   006  Read-only SQL-transaction

26 Invalid SQL statement name
   000  No subclass
```

```
28 Invalid authorization specification
   000  No subclass
   602  Entity or association already defined
   605  Entity or association not previously defined
   607  Authorization ids not specified

2C Invalid character set name
   000  No subclass

34 Invalid cursor name
   000  No subclass

37 Syntax error or access rule violation
   000  No subclass

38 External routine exception
   000  No subclass
   999  ADS dialog failed or dialog does not exist

39 External routine invocation exception
   000  No subclass

3F Invalid schema name
   000  No subclass

40 Transaction rollback
   000  No subclass
   001  Serialization failure
```

```
42 Syntax error or access rule violation
   000  No subclass
   500  Table not found
   501  Column not found
   502  Entity already defined
   503  Authorization failure
   504  Cursor not declared or previously declared
   505  Entity not found
   506  Invalid identifier
   507  Keyword used as identifier
   600  Invalid statement
   601  Statement not valid in this context
   603  Statement not valid for this schema
   604  Invalid data type
   606  Invalid statement option
   607  Missing statement option
   609  Invalid constraint definition
   610  Invalid number of columns

50 CA-defined errors
   000  No subclass
   002  Limit exceeded
   003  Space exceeded
   00B  Internal error
   00I  Schema mismatch
   00J  Invalid entity definition
   00K  Uncategorized error
   00L  Invalid calling parameters

60 CA IDMS specific errors
   000  No subclass
   001  Problem with load module or synchronization stamps
   002  Database error
   003  Rollback failed
   004  Failure while opening or describing a received cursor
   005  Unexpected error from GET/PUT SCRATCH

64 CA IDMS Physical DDL error
   000  No subclass

6U CA IDMS Utility error
   000  No subclass
```

SQLCODE

SQLCODE is a field in the SQLCA, the data structure that CA IDMS uses to return information about the execution of SQL statements. After CA IDMS processes an SQL statement SQL CODE contains a value that indicates the outcome of the processing.

An application program can check the value in SQLCODE after CA IDMS processes each SQL statement and can take appropriate action based on the value.

Note: For more information about the SQLCA, see the *CA IDMS SQL Programming Guide*.

SQLCODE Error Values

CA IDMS returns the following values in SQLCODE:

Value	Meaning
0	CA IDMS successfully executed the SQL statement.
>1	CA IDMS successfully executed the SQL statement but generated a warning in the process.
100	CA IDMS could find no row or no more rows to process.
-4	CA IDMS was unable to execute the SQL statement because errors were detected during processing. The transaction remains active.
-5	CA IDMS terminated the transaction abnormally to recover from a processing error. The session remains active unless it was automatically connected.
-6	CA IDMS has detected a condition that prevents further processing. The session is released.
-7	CA IDMS has detected an abnormal condition that prevents further processing. The SQL session is aborted.

SQLCODE and SQLCNRP Values

Result of bulk fetch	SQLCODE value	SQLCNRP value
No rows are returned	100	0

Result of bulk fetch	SQLCODE value	SQLCNRP value
At least one row is returned but fewer rows than the maximum allowed	100	Equals the number of rows returned
The number of rows returned matches the maximum allowed	0	Equals the number of rows returned

Result of bulk select	SQLCODE value	SQLCNRP value
No rows are returned	100	0
At least one row is returned but fewer rows than the maximum allowed	100	Greater than 0 and less than or equal to the maximum allowed
The number of rows returned exceeds the maximum allowed	Less than 0	Equal to the maximum allowed

Result of bulk insert	SQLCODE value	SQLCNRP value
Fewer rows than the number of rows specified are inserted because the insert failed on a row	Less than 0	Equal to the relative row number of the failing row
The number of rows inserted matches the number of rows specified	0	Equal to the number of rows inserted

COBOL/CA ADS SQLCA

```
01  SQLCA.
    02  SQLCAID                 PIC X(8).
    02  SQLCODE                 PIC S9(9) COMP.
    02  SQLCSID                 PIC X(8).
    02  SQLCINFO.
     03  SQLCERC                PIC S9(9) COMP.
     03  FILLER                 PIC S9(9) COMP.
     03  SQLCNRP                PIC S9(9) COMP.
     03  FILLER                 PIC S9(9) COMP.
     03  SQLCSER                PIC S9(9) COMP.
     03  FILLER                 PIC S9(9) COMP.
     03  SQLCLNO                PIC S9(9) COMP.
     03  SQLCMCT                PIC S9(9) COMP.
     03  SQLCARC                PIC S9(9) COMP.
     03  SQLCFJB                PIC S9(9) COMP.
     03  FILLER                 PIC S9(9) COMP.
     03  FILLER                 PIC S9(9) COMP.
    02  SQLCINF2 REDEFINES SQLCINFO.
     03  SQLERRD                PIC S9(9) COMP
                                OCCURS 12.
    02  SQLCMSG.
     03  SQLCERL                PIC S9(9) COMP.
     03  SQLERM                 PIC X(256).
    02  SQLCMSG2 REDEFINES SQLCMSG.
     03  FILLER                 PIC X(2).
     03  SQLERRM.
      04  SQLCERRML             PIC S9(4) COMP.
      04  SQLERRMC              PIC X(256).
    02  SQLSTATE                PIC X(5).
    02  SQLCRNF                 PIC X(1).
    02  SQLCNRRS                PIC S9(4) COMP.
    02  FILLLER                 PIC X(8).
                                       ────┐
    02  SQLWORK                 PIC X(16). │
    02  SQLCWRK2 REDEFINES SQLWORK.        │
     03  SQLERRP.                          │
      04  SQLCVAL               PIC X(5).  │  Included by the
      04  FILLER                PIC X(3).  │  precompiler for
     03  SQLWARN.                          │  DB2 compatibility;
      04  SQLWARN0              PIC X(1).  │  not used by CA IDMS
      04  SQLWARN1              PIC X(1).  │
      04  SQLWARN2              PIC X(1).  │
      04  SQLWARN3              PIC X(1).  │
      04  SQLWARN4              PIC X(1).  │
      04  SQLWARN5              PIC X(1).  │
      04  SQLWARN6              PIC X(1).  │
      04  SQLWARN7              PIC X(1).  │
                                       ────┘
```

PL/I SQLCA

```
DECLARE 1  SQLCA,
          2  SQLCAID          CHARACTER (8),
          2  SQLCODE          FIXED BINARY (31),
          2  SQLCSID          CHARACTER (8),
          2  SQLCINFO,
            3  SQLCERC        FIXED BINARY (31),
            3  FILLERnnnn     FIXED BINARY (31),
            3  SQLCNRP        FIXED BINARY (31),
            3  FILLERnnnn     FIXED BINARY (31),
            3  SQLCSER        FIXED BINARY (31),
            3  FILLERnnnn     FIXED BINARY (31),
            3  SQLCLNO        FIXED BINARY (31),
            3  SQLCMCT        FIXED BINARY (31),
            3  SQLCARC        FIXED BINARY (31),
            3  SQLCFJB        FIXED BINARY (31),
            3  FILLERnnnn     FIXED BINARY (31),
            3  FILLERnnnn     FIXED BINARY (31),
          2  SQLCMSG,
            3  SQLCERL        FIXED BINARY (31),
            3  SQLCERM        CHARACTER (256),
          2  SQLSTATE         CHARACTER (5),
          2  SQLCRNF          CHARACTER (1),
          2  SQLCNRRS         FIXED BINARY (15),
          2  FILLERnnnn       CHARACTER (8),
          2  SQLWORK          CHARACTER (16) ;

DECLARE 1 SQLCINF2 BASED (ADDR(SQLCINFO)),
          2  SQLERRD   FIXED BINARY (31),

DECLARE 1 SQLCMSG2 BASED(ADDR(SQLCMSG)),
          2  FILLERnnnn        CHARACTER (2),
          2  SQLERRM,
            3  SQLERRML        FIXED BINARY (15).
            3  SQLERRMC        CHARACTER (256) ;
                                                ────┐
DECLARE 1 SQLCWRK2 BASED(ADDR(SQLWORK)),            │
          2  SQLERRP,                               │
            3  SQLCVAL        CHARACTER (5),        │  Included by the
            3  FILLERnnnn     CHARACTER (3),        │  precompiler for
          2  SQLWARN,                               │  DB2 compatibility;
            3  SQLWARN0  CHARACTER (1),             │  not used by CA IDMS.
            3  SQLWARN1  CHARACTER (1),             │
            3  SQLWARN2  CHARACTER (1),             │
            3  SQLWARN3  CHARACTER (1),             │
            3  SQLWARN4  CHARACTER (1),             │
            3  SQLWARN5  CHARACTER (1),             │
            3  SQLWARN6  CHARACTER (1),             │
            3  SQLWARN7  CHARACTER (1) ;            │
                                                ────┘
```

Appendix D: SQL Descriptor Area

SQLDA

The SQL Descriptor Area (SQLDA) is a data structure used to describe variable data passed as part of a dynamic SQL statement.

SQLDA Fields

The SQLDA consists of the following fields:

Field	Data type	Meaning
SQLDAID	CHARACTER(8)	Set to SQLDA* on a DESCRIBE
SQLN	INTEGER	Maximum number of SQLVAR occurrences
SQLD	INTEGER	Actual number of SQLVAR occurrences: ■ **0**—Not a SELECT statement ■ **1 through SQLN**—Number of columns ■ **Greater than SQLN**—Not enough SQLVAR entries
SQLVAR		Structure occurring SQLN times

SQLVAR Fields

The structure SQLVAR in the SQLDA consists of the following fields:

Field	Data type	Meaning
SQLLEN	INTEGER	Length (Additional information provided under "SQLLEN")
SQLTYPE	SMALLINT	Column data type (Additional information provided under "SQLTYPE")

Field	Data type	Meaning
SQLSCALE	SMALLINT	Scale (for exact numeric data types) (Additional information provided under "SQLSCALE")
SQLPRECISION	SMALLINT	Precision (Additional information provided under "SQLPRECISION")
SQLALN	SMALLINT	Data alignment flag (Additional information provided under "SQLALN and SQLNALN ")
SQLNALN	SMALLINT	Null indicator alignment flag (Additional information provided under "SQLALN and SQLNALN ")
SQLNULL	SMALLINT	Length of null indicator (Additional information provided under "SQLNULL")
SQLNAME	CHARACTER(32)	Column name

Notes

The SQLDA can be used by an application program in the following ways:

- As output on a DESCRIBE or PREPARE statement as the location into which the DBMS returns the descriptions of selected columns.
- As input on a FETCH statement to describe the target area for selected columns.

SQLLEN

The definition of SQLLEN by data type is:

Data type	Definition of SQLLEN
CHARACTER	Number of characters
VARCHAR	Maximum number of characters
DATETIME	Length of the date/time column
BINARY	Number of bytes
GRAPHIC	Number of two-byte characters
VARGRAPHIC	Maximum number of two-byte characters

SQLTYPE

A code indicating the data type of the host variable. The codes from 1 through 127 are the same as those defined in the SQL standard. Codes greater than 127 were assigned before SQL standards existed for these datatypes.

Current SQL standard codes are:

Code	Meaning
1	CHARACTER
2	NUMERIC
3	DECIMAL
4	INTEGER (four bytes)
5	SMALLINT (two bytes)
6	FLOAT
7	REAL
8	DOUBLE PRECISION
9	Datetime (DATE, TIME, or TIMESTAMP)
10	Reserved
11	Reserved
12	VARCHAR

Current CA IDMS extensions are:

Code	Meaning
128	NUMERIC (UNSIGNED)
129	DECIMAL (UNSIGNED)
130	BIGINT or LONGINT (eight bytes)*
131	Reserved
132	GRAPHIC
133	VARGRAPHIC
134	Reserved for precompiler use (GROUP)
135	BINARY/SQLBIN*
136	TID or Tuple ID (eight bytes, used for ROWID)

Code	Meaning
140	Reserved
141	Filler field (entry is used to adjust subsequent alignments but is otherwise ignored)
142	Reserved for precompiler use (SQLIND)

* *SQL standard datatype but datatype code in CA IDMS differs from the SQL standard.*

SQLSCALE

The definition of SQLSCALE by data type is:

Data type	Definition of SQLSCALE
Exact numeric	Scale.
Datetime	Code indicating the precision of the date/time value. Permissible values in the first implementation are: ■ **1** for DATE ■ **2** for TIME ■ **3** for TIMESTAMP

SQLPRECISION

The definition of SQLPRECISION by data type is:

Data type	Definition of SQLPRECISION
Exact numeric	Precision.
Approximate numeric	Precision.
Datetime	Precision of the fraction field (0 or 6), if applicable. If passed on a dynamic FETCH statement, SQLPRECISION is ignored for date/time data types.

SQLALN and SQLNALN

SQLALN and SQLNALN are flags that indicate whether data (SQLALN) and the null indicator (SQLNALN) are aligned:

- **0**—Not aligned.
- **1**—Aligned based on natural alignment rules for the platform. For example, on both the System/370 and VMS environments, the natural alignment for the INTEGER data type is on a four-byte boundary.

On a DESCRIBE statement, the SQLALN and SQLNALN fields are set to 0.

SQLNULL

CA IDMS defines SQLNULL to be:

- **0**—No null indicator
- **1, 2, 4**—Null indicator length

A DESCRIBE statement returns 4 if nulls are allowed and 0 otherwise.

Appendix E: SYSTEM Tables and SYSCA Views

Overview

The catalog component of the dictionary comprises SYSTEM tables. SYSTEM tables contain logical definition information for a database defined with SQL DDL and information on the definition of the physical implementation of the database.

SYSCA views are views defined on a subset of SYSTEM tables. SYSCA views restrict information that the user can select from SYSTEM tables to data about tables for which the user holds SELECT privilege.

Important: SYSTEM tables are defined in segment SYSCAT. This segment is created as part of defining the SYSTEM schema. SYSCAT should not be used as a segment name, and no attempt should be made to alter or delete the SYSCAT segment definition.

SYSTEM.AM

Description

A row of SYSTEM.AM identifies an access module.

Column name	Column description	Data type	Null specifi- cation
NAME	Access module name	CHAR(8)	NOT NULL
VERSION	Access module version	SMALLINT	NOT NULL
SCHEMA	Access module schema	CHAR(18)	NOT NULL
CTIME	Date and time the access module was created	TIMESTAMP	NOT NULL
LENGTH	Length, in bytes, of the access module	INTEGER	NOT NULL
FILLER	Reserved for future use	BINARY(20)	NOT NULL

SYSTEM.AMDEP

Description

A row of SYSTEM.AMDEP identifies a table or view referenced in an access module.

Column name	Column description	Data type	Null specifi- cation
NAME	Access module name.	CHAR(8)	NOT NULL
VERSION	Access module version.	SMALLINT	NOT NULL
TABSCHEMA	Schema-name qualifier of the table.	CHAR(18)	NOT NULL
TABLE	Table or view name.	CHAR(18)	NOT NULL
STAMP	Date and time the table was created or last altered.	TIMESTAMP	NOT NULL
TYPE	Type of table: ■ T—Base table ■ V—View	CHAR(1)	NOT NULL
FILLER	Reserved for future use.	BINARY(25)	NOT NULL

SYSTEM.AREA

Description

A row of SYSTEM.AREA represents an area within a segment.

Column name	Column description	Data type	Null specification
SEGMENT	Segment name.	CHAR(8)	NOT NULL
NAME	Area name.	CHAR(18)	NOT NULL
CTIME	Date and time when the area was created.	TIMESTAMP	NOT NULL
UTIME	Date and time when the area was last updated.	TIMESTAMP	NOT NULL
CRITTIME	Date and time of the last critical change to the area.	TIMESTAMP	NOT NULL
TIMESTAMP	Definition date/time stamp for table validation.	TIMESTAMP	NOT NULL
CUSER	User ID of user who created the area.	TIMESTAMP	NOT NULL
UUSER	User ID of user who last updated the area.	CHAR(18)	NOT NULL

Column name	Column description	Data type	Null specification
TYPE	Area type: ■ N—Non-SQL area ■ R—SQL area	CHAR(1)	NOT NULL
STAMPLEVEL	Stamp indicator: ■ N—No stamp checking for a non-SQL area ■ T—Table-level stamping for an SQL area ■ S—Area-level stamping for an SQL area	CHAR(1)	NOT NULL
NUMFILEMAPS	Number of filemaps in the area.	SMALLINT	NOT NULL
NUMSYMBOLICS	Number of symbolics in the area.	SMALLINT	NOT NULL
DISPLACEMENT	Cluster displacement.	SMALLINT	NOT NULL
PAGEGROUP	The page group associated with the area.	SMALLINT	NOT NULL
LOWPAGE	Low page number of the area.	INTEGER	NOT NULL
HIGHPAGE	High page number of the area.	INTEGER	NOT NULL
CALCHIGHPAGE	Primary (calc) high page number of the area.	INTEGER	NOT NULL
MAXHIGHPAGE	Maximum high page number of the area.	INTEGER	NOT NULL
NUMPAGES	Number of pages	INTEGER	NOT NULL
PAGESIZE	Size, in bytes, of each page in the area.	INTEGER	NOT NULL
PAGERESERVE	Page reserve size, in bytes. This column indicates the number of bytes left unused on a page when new rows are stored so that space is available for the expansion of variable-length rows during update operations.	INTEGER	NOT NULL
ORIGPAGESIZE	Original page size of the area.	INTEGER	NOT NULL
NUMPAGESUSED	Number of nonempty pages in the area.	INTEGER	NOT NULL
NUMROWS	Number of rows in the area.	INTEGER	NOT NULL
PCTSPACEUSED	Percent of space used in the area.	REAL	NOT NULL
FILLER	Reserved for future use.	BINARY(40)	NOT NULL

SYSTEM.BUFFER

Description

A row of SYSTEM.BUFFER represents a DMCL buffer.

Column name	Column description	Data type	Null specifi- cation
DMCL	DMCL name.	CHAR(8)	NOT NULL
NAME	Buffer name.	CHAR(18)	NOT NULL
TYPE	Buffer type: ■ BC—Definition represents a standard buffer ■ JB—Definition represents a journal buffer	CHAR(2)	NOT NULL
CTIME	Date and time when the DMCL buffer was created.	TIMES TAMP	NOT NULL
UTIME	Date and time when the DMCL buffer was last updated.	TIMES TAMP	NOT NULL
CRITTIME	Date and time of the last critical change made to the DMCL buffer.	TIMES TAMP	NOT NULL
CUSER	User ID of user who created the DMCL buffer.	CHAR(18)	NOT NULL
UUSER	ID of the user who last updated the DMCL buffer.	CHAR(18)	NOT NULL
PAGESIZE	Size, in bytes, of pages in the buffer. For native VSAM data sets, this column indicates the control interval size.	INTEG ER	NOT NULL
LOCALPAGES	Number of pages in the local mode buffer.	INTEG ER	NOT NULL
CVPAGES	Initial number of pages in the central version mode buffer.	INTEG ER	NOT NULL
MAXPAGES	Maximum number of pages in the central version mode buffer.	INTEG ER	NOT NULL

Column name	Column description	Data type	Null specifi- cation
KEYLENGTH	The maximum sort-key or CALC-key length for native VSAM files.	SMALL INT	NOT NULL
BUFNI	Number of I/O buffers in the native VSAM non-shared resources (NSR) buffer that are used for index entries.	SMALL INT	NOT NULL
STRNO	Maximum number of concurrent requests permitted against an area assigned to the native VSAM buffer.	SMALL INT	NOT NULL
STGFLAG	Storage location indicator. ■ X'01'—IDMS storage used in local mode ■ X'02'—IDMS storage used in central version	BINAR Y(1)	NOT NULL
FLAG	Buffer flag; X'80'—Native VSAM LSR or NSR buffer	BINAR Y(1)	NOT NULL
FILLER	Reserved for future use.	BINAR Y(40)	NOT NULL

SYSTEM.COLUMN

Description

A row of SYSTEM.COLUMN represents a column in a table.

View SYSCA.COLUMN is defined on SYSTEM.COLUMN.

Note: For more information, see SYSCA Objects.

Column name	Column description	Data type	Null specifi- cation
NAME	Column name.	CHAR(32)	NOT NULL
NUMBER	Relative number of the column within the table.	SMALL INT	NOT NULL

Column name	Column description	Data type	Null specifi- cation
SCHEMA	Schema-name qualifier of the table or view that contains the column.	CHAR(18)	NOT NULL
TABLE	Name of the table or view that contains the column.	CHAR(18)	NOT NULL
TYPE	Column data type in character format.	CHAR(18)	NOT NULL
TYPECODE	Column data type in numeric format. For a description of values in this field, see SQLTYPE	SMALL INT	NOT NULL
PRECISION	Precision of numeric columns.	SMALL INT	NOT NULL
SCALE	Scale of exact numeric fields or code indicating the type of date/time column. For a description of values in this field, see SQLSCALE.	SMALL INT	NOT NULL
NULLS	Nulls allowed: ■ N—No ■ Y—Yes	CHAR(1)	NOT NULL
DEFAULT	Default value stored: ■ N—No ■ Y—Yes		
VOFFSET	Offset to column value within a row.	SMALL INT	NOT NULL
VLENGTH	Length of column value.	SMALL INT	NOT NULL
NOFFSET	Offset to NULL indicator for the column a row.	SMALL INT	NOT NULL
NLENGTH	Length of NULL indicator.	SMALL INT	NOT NULL
NUMVALUES	If the column is the first column in an index key, the number of unique values in the column when statistics were last updated.	INTEG ER	NOT NULL

Column name	Column description	Data type	Null specifi- cation
SECLOWVAL	If the column is the first column in an index key, the first eight bytes of the second lowest column value when statistics were last updated.	BINARY(8)	NOT NULL
SECHIGHVAL	If the column is the first column in an index key, the first eight bytes of the second highest column value when statistics were last updated.	BINARY(8)	NOT NULL
PROCPARMTYPE	Procedure parameter mode: ■ I—Input parameter ■ O—Output parameter ■ B—Both Input and Output	CHAR(1)	NOT NULL
FILLER	Reserved for future use.	BINARY(39)	NOT NULL

SYSTEM.CONSTKEY

Description

A row of SYSTEM.CONSTKEY represents the foreign key in a referential constraint defined with a CREATE CONSTRAINT statement.

View SYSCA.CONSTKEY is defined on SYSTEM.CONSTKEY.

Note: For more information, see SYSCA Objects.

Column name	Column description	Data type	Null specifi- cation
SCHEMA	Schema-name qualifier of the constraint.	CHAR(18)	NOT NULL
NAME	Constraint name.	CHAR(18)	NOT NULL
SEQUENCE	Key column sequence number.	SMALLINT	NOT NULL

Column name	Column description	Data type	Null specifi- cation
REFNUMBER	Column number of the key column in the referenced table.	SMALL INT	NOT NULL
REFCOLUMN	Column name of the key column in the referenced table.	CHAR(32)	NOT NULL
NUMBER	Number of the key column in the referencing table.	SMALL INT	NOT NULL
COLUMN	Column name of the key column in the referencing table.	CHAR(32)	NOT NULL
FILLER	Reserved for future use.	BINAR Y(38)	NOT NULL

SYSTEM.CONSTRAINT

Description

A row of SYSTEM.CONSTRAINT represents a referential constraint defined with a CREATE CONSTRAINT statement.

View SYSCA.CONSTRAINT is defined on SYSTEM.CONSTRAINT.

Note: For more information, see SYSCA Objects.

Column name	Column description	Data type	Null specifi- cation
SCHEMA	Schema-name qualifier of the constraint.	CHAR(18)	NOT NULL
NAME	Constraint name.	CHAR(18)	NOT NULL
REFSCHEMA	Schema-name qualifier of the referenced table.	CHAR(18)	NOT NULL
REFTABLE	Name of the referenced table.	CHAR(18)	NOT NULL
TABSCHEMA	Schema-name qualifier of the referencing table.	CHAR(18)	NOT NULL
TABLE	Name of the referencing table.	CHAR(18)	NOT NULL

Column name	Column description	Data type	Null specifi- cation
CTIME	Date and time the constraint was created.	TIMES TAMP	NOT NULL
NUMCOLUMNS	Number of columns in the constraint (foreign key).	SMALL INT	NOT NULL
REFCOLUMNS	Referenced table key column number array. Each eight bits contains the relative column number of a referenced column (for NUMCOLUMNS entries).	BINAR Y(64)	NOT NULL
COLUMNS	Referencing table foreign key column number array. Each eight bits contains the relative column number of a referencing column (for NUMCOLUMNS entries).	BINAR Y(64)	NOT NULL
NUMSORTCOLS	Number of columns in the sort key.	SMALL INT	NOT NULL
SORTCOLUMNS	Sort key column number array. Each eight bits contains the relative column number of a sort column (for NUMSORTCOLS entries).	BINAR Y(64)	NOT NULL
SORTORDER	Sort order indicator. Each byte indicates the order of a sort column (for NUMSORTCOLS entries): ■ A—Ascending ■ D—Descending	CHAR(32)	NOT NULL
CLUSTER	Referencing table cluster indicator: ■ Y—Clustered ■ N—Not clustered	CHAR(1)	NOT NULL
UNIQUE	Uniqueness indicator for sort key: ■ Y—Unique ■ N—Not unique	CHAR(1)	NOT NULL

Column name	Column description	Data type	Null specifi- cation
TYPE	Type of constraint: ■ L—Linked ■ U—Unlinked ■ X—Linked indexed	CHAR(1)	NOT NULL
COMPRESS	Index keys compressed: ■ Y—Yes ■ N—No	CHAR(1)	NOT NULL
IXBLKLENGTH	Index block (SR8) length.	SMALL INT	NOT NULL
IXBLKCONTAINS	Number of keys in index block.	SMALL INT	NOT NULL
DISPLACEMENT	Index displacement (the number of pages by which bottom-level SR8 records are displaced from the referenced row).	SMALL INT	NOT NULL
REFNEXT	Offset to next db-key pointer within the referenced table.	SMALL INT	NOT NULL
REFPRIOR	Offset to prior db-key pointer within the referenced table.	SMALL INT	NOT NULL
NEXT	Offset to next db-key pointer within the referencing table.	SMALL INT	NOT NULL
PRIOR	Offset to prior db-key pointer within the referencing table.	SMALL INT	NOT NULL
OWNER	Offset to owner db-key pointer within the referencing table.	SMALL INT	NOT NULL
NUMSETS	Number of referenced rows when statistics were last updated.	INTEG ER	NOT NULL
AVGMEMROWS	Average number of referencing rows per referenced row when statistics were last updated.	REAL	NOT NULL
LONGESTMEM	Highest number of referencing rows per referenced row when statistics were last updated.	INTEG ER	NOT NULL

Column name	Column description	Data type	Null specifi- cation
SECLONGMEM	Second highest number of referencing rows per referenced row when statistics were last updated.	INTEG ER	NOT NULL
NUMLONGMEM	Number of referenced rows having LONGESTMEM referencing rows when statistics were last updated.	INTEG ER	NOT NULL
AVGMEMPAGES	Average number of database pages containing referencing rows per referenced row when statistics were last updated. Rows accounted for in MAXMEMPAGES are not included in this average.	REAL	NOT NULL
MAXMEMPAGES	The number referenced rows whose referencing occupied more than 20 database pages when statistics were last updated. Rows accounted for in AVGMEMPAGES (above) are not included in this number.	INTEG ER	NOT NULL
AVGAMEMCLUSCNT	Average number of I/Os required to read all referencing rows associated with a referenced row when statistics were last updated, if one buffer page was available. This count includes I/O to read the bottom-level SR8.	REAL	NOT NULL
AVGBMEMCLUSCNT	Average number of I/Os required to read all referencing rows associated with a referenced row when statistics were last updated, if three buffer pages were available. This count includes I/O to read the bottom-level SR8.	REAL	NOT NULL

Column name	Column description	Data type	Null specifi- cation
AVGCMEMCLUSCNT	Average number of I/Os required to read all referencing rows associated with a referenced row when statistics were last updated, if five buffer pages were available. This count includes I/O to read the bottom-level SR8.	REAL	NOT NULL
AVGDMEMCLUSCNT	Average number of I/Os required to read all referencing rows associated with a referenced row when statistics were last updated, if 10 buffer pages were available. This count includes I/O to read the bottom-level SR8.	REAL	NOT NULL
AVGEMEMCLUSCNT	Average number of I/Os required to read all referencing rows associated with a referenced row when statistics were last updated, if 20 buffer pages were available. This count includes I/O to read the bottom-level SR8.	REAL	NOT NULL
AVGSR8ROWS	Average number of SR8s per referenced row in a linked indexed constraint when statistics were last updated.	REAL	NOT NULL
LONGESTSR8	Highest number of bottom-level SR8s per referenced row in a linked indexed constraint when statistics were last updated.	INTEG ER	NOT NULL
SECLONGSR8	Second highest number of bottom-level SR8s per referenced row in a linked indexed constraint when statistics were last updated.	INTEG ER	NOT NULL
NUMLONGSR8	Number of referenced rows in a linked indexed constraint having LONGESTSR8 SR8s when statistics were last updated.	INTEG ER	NOT NULL

Column name	Column description	Data type	Null specifi- cation
AVGSR8PAGES	Average number of pages containing bottom-level SR8s per referenced row in a linked indexed constraint when statistics were last updated. This average does not include pages accounted for in MAXSR8PAGES.	REAL	NOT NULL
MAXSR8PAGES	The number of referenced rows in a linked indexed constraint when statistics were last updated for which the number of pages containing bottom-level SR8s is greater than 20.	INTEG ER	NOT NULL
AVGSR8LEAFS	Average number of bottom-level SR8s per referenced row in a linked indexed constraint when statistics were last updated.	REAL	NOT NULL
AVGSR8LEVELS	The average high level number per referenced row in a linked indexed constraint when statistics were last updated. Level number refers to the number of levels above the bottom level.	REAL	NOT NULL
AVGASR8CLUSCNT	Average number of I/Os required to read all SR8s associated with a referenced row in a linked indexed constraint when statistics were last updated, if one buffer page was available.	REAL	NOT NULL
AVGBSR8CLUSCNT	Average number of I/Os required to read all SR8s associated with a referenced row in a linked indexed constraint when statistics were last updated, if three buffer pages were available.	REAL	NOT NULL

Column name	Column description	Data type	Null specifi- cation
AVGCSR8CLUSCNT	Average number of I/Os required to read all SR8s associated with a referenced row in a linked indexed constraint when statistics were last updated, if five buffer pages were available.	REAL	NOT NULL
AVGDSR8CLUSCNT	Average number of I/Os required to read all SR8s associated with a referenced row in a linked indexed constraint when statistics were last updated, if 10 buffer pages were available.	REAL	NOT NULL
AVGESR8CLUSCNT	Average number of I/Os required to read all SR8s associated with a referenced row in a linked indexed constraint when statistics were last updated, if 20 buffer pages were available.	REAL	NOT NULL
FILLER	Reserved for future use.	BINARY(40)	NOT NULL

SYSTEM.DBNAME

Description

DBNAME contains information about an entry in a database name table.

Column name	Column description	Data type	Null specifi- cation
DBTABLE	Name of database name table.	CHAR(8)	NOT NULL
NAME	Database name entry in the database name table. If this column contains *DEFAULT, the row represents the default subschema mapping for the database name table.	CHAR(8)	NOT NULL
DMCL	Reserved for future use.	CHAR(8)	NOT NULL

Column name	Column description	Data type	Null specifi- cation
NODE	Reserved for future use.	CHAR(8)	NOT NULL
LOADLIST	Reserved for future use.	CHAR(8)	NOT NULL
FLAG	Database name flag: ■ X'80'—Match on subschema name is required ■ X'40'—Mixed Page Groups are allowed ■ X'20'—Mixed Page Groups Verify is ON ■ X'01'—DB Group Name	BINAR Y(1)	NOT NULL
CTIME	Date and time when the database name was created.	TIMES TAMP	NOT NULL
UTIME	Date and time when the database name was last updated.	TIMES TAMP	NOT NULL
CUSER	ID of the user who created the database name.	CHAR(18)	NOT NULL
UUSER	ID of the user who last updated the database name.	CHAR(18)	NOT NULL
GROUPFLAG	DB Group flag: ■ E—Enabled at startup ■ D—Disabled at startup	CHAR(1)	NOT NULL
NUMSEGMENTS	Number of segments associated with the database name.	SMALL INT	NOT NULL
NUMSUBSCHEMAS	Number of subschemas associated with the database name.	SMALL INT	NOT NULL
USAGEFLAG	Indicates general use or utility use only. x'80' DBName for utility use only.	BINAR Y(1)	NOT NULL
FILLER	Reserved for future use.	BINAR Y(17)	NOT NULL

SYSTEM.DBSEGMENT

Description

DBSEGMENT associates the name of a segment with a database name in a database name table.

Column name	Column description	Data type	Null specifi- cation
DBTABLE	Database table name.	CHAR(8)	NOT NULL
DBNAME	Database name entry in the database table.	CHAR(8)	NOT NULL
NAME	Segment name.	CHAR(8)	NOT NULL
FILLER	Reserved for future use.	BINAR Y(20)	NOT NULL

SYSTEM.DBSSC

Description

DBSSC associates a subschema mapping with a database name in a database name table.

Column name	Column description	Data type	Null specifi- cation
DBTABLE	Name of the database table.	CHAR(8)	NOT NULL
DBNAME	Database name entry in the database name table.	CHAR(8)	NOT NULL
FROMSSC	Subschema name passed at run unit signon (FROM subschema).	CHAR(8)	NOT NULL
TOSSC	Name of the subschema to which the passed subschema name maps (TO subschema).&sub1.	CHAR(8)	NOT NULL
FOREIGNDBNAME	Database name to be accessed if no database name is specified.&sub1.	CHAR(8)	NOT NULL

Column name	Column description	Data type	Null specifi- cation
FILLER	Reserved for future use.	BINARY(20)	NOT NULL

Note:

1. A TOSSC value of spaces and a FOREIGNDBNAME of *DEFAULT indicates all matching subschemas should use DBNAME mapping rules.

SYSTEM.DBTABLE

Description

DBTABLE contains information about the database name table.

Column name	Column description	Data type	Null specifi- cation
NAME	Name of the database name table.	CHAR(8)	NOT NULL
CVSYSTEM	Reserved for future use.	SMALLINT	NOT NULL
CTIME	Date and time when the database name table was created.	TIMESTAMP	NOT NULL
UTIME	Date and time when the database name table was last updated.	TIMESTAMP	NOT NULL
CUSER	ID of the user who created the database name table.	CHAR(18)	NOT NULL
UUSER	ID of the user who last updated the database name table.	CHAR(18)	NOT NULL
NUMDBNAMES	Number of names in the database name table.	SMALLINT	NOT NULL
NUMSEGMENTS	Number of segments in the database name table.	SMALLINT	NOT NULL
NUMSUBSCHEMAS	Number of subschemas in the database name table.	SMALLINT	NOT NULL
NUMGROUPS	Number of DB Groups in the database name table.	SMALLINT	NOT NULL

Column name	Column description	Data type	Null specifi- cation
FILLER	Reserved for future use.	BINAR Y(18)	NOT NULL

SYSTEM.DMCL

Description

A row of SYSTEM.DMCL contains information about a DMCL.

Column name	Column description	Data type	Null specifi- cation
NAME	DMCL name.	CHAR(8)	NOT NULL
CTIME	Date and time when the DMCL was created.	TIMES TAMP	NOT NULL
UTIME	Date and time when the DMCL was last updated.	TIMES TAMP	NOT NULL
CRITTIME	Date and time of the last critical change made to the DMCL.	TIMES TAMP	NOT NULL
CUSER	ID of the user who created the DMCL.	CHAR(18)	NOT NULL
UUSER	ID of the user who last updated the DMCL.	CHAR(18)	NOT NULL
BUFFER	Default buffer for the DMCL.	CHAR(18)	NOT NULL
DBTABLE	Database name table for the DMCL.	CHAR(8)	NOT NULL
NUMBUFFERS	Number of buffers defined in the DMCL.	SMALL INT	NOT NULL
NUMJRNLBUFFERS	Number of journal buffers defined in the DMCL.	SMALL INT	NOT NULL
NUMJOURNALS	Number of journals defined in the DMCL.	SMALL INT	NOT NULL
SHAREDCACHE	Default shared cache.	CHAR(16)	NOT NULL

Column name	Column description	Data type	Null specifi- cation
LOCKENTRIES	Number of entries in the coupling facility lock table.	INTEG ER	NOT NULL
MEMBERS	Maximum number of members in the data sharing group.	BINAR Y(1)	NOT NULL
DATASHARE	Data sharing indicator. ■ 'Y' - data sharing attributes have been specified. ■ 'N' - data sharing attributes have not been specified.	CHAR(1)	NOT NULL
ONCONNECTLOSS	Connection loss indicator. ■ 'A' - Abend ■ 'N' - Noabend	CHAR(1)	NOT NULL
FILLER	Reserved for future use.	CHAR(17)	NOT NULL

SYSTEM.DMCLAREA

Description

A row of SYSTEM.DMCLAREA contains information about an area whose segment has been included in the DMCL.

Column name	Column description	Data type	Null specifi- cation
DMCL	DMCL name.	CHAR(8)	NOT NULL
SEGMENT	Name of the segment that contains the area.	CHAR(8)	NOT NULL
NAME	Area name.	CHAR(18)	NOT NULL
CTIME	Date and time when the area was created.	TIMES TAMP	NOT NULL
UTIME	Date and time when the area was last updated.	TIMES TAMP	NOT NULL

Column name	Column description	Data type	Null specifi- cation
CRITTIME	Date and time of the last critical change made to the area.	TIMES TAMP	NOT NULL
CUSER	ID of the user who created the area.	CHAR(18)	NOT NULL
UUSER	ID of the user who last updated the area.	CHAR(18)	NOT NULL
STARTUP	Startup indicator. This indicates the READY action to be taken when the system is started following an orderly shutdown. Values are: ■ U—Update ■ R—Retrieval ■ T—Transient retrieval ■ X—Set status offline	CHAR(1)	NOT NULL
WARMSTART	Warmstart indicator. This indicates the READY action to be taken when the system is started following an abnormal termination. Values are: ■ U—Update ■ R—Retrieval ■ T—Transient retrieval ■ X—Set status offline ■ C—Maintain current status	CHAR(1)	NOT NULL
PAGERESERVE	Page reserve. Number of bytes to be left unused on a page when new rows are stored on pages in the area. For this DMCL, the page reserve specification overrides the page reserve specification in the segment's area definition.	INTEG ER	NOT NULL

Column name	Column description	Data type	Null specifi- cation
DATASHARE	Data sharing indicator. ■ 'Y' - the area is eligible to be shared for update ■ 'N' - the area is not shared ■ 'D' - the area's sharability is determined by that of its segment	CHAR(1)	NOT NULL
FILLER	Reserved for future use.	CHAR(39)	NOT NULL

SYSTEM.DMCLFILE

Description

A row of SYSTEM.DMCLFILE contains information about a file override that has been included in the DMCL.

Column name	Column description	Data type	Null specifi- cation
DMCL	DMCL name.	CHAR(8)	NOT NULL
SEGMENT	Name of the segment associated with the file.	CHAR(8)	NOT NULL
NAME	File name.	CHAR(18)	NOT NULL
CTIME	Date and time when the file was created.	TIMESTAMP	NOT NULL
UTIME	Date and time when the file was last updated.	TIMESTAMP	NOT NULL
CRITTIME	Date and time of the last critical change made to the file.	TIMESTAMP	NOT NULL
CUSER	ID of the user who created the file.	CHAR(18)	NOT NULL
UUSER	ID of the user who last updated the file.	CHAR(18)	NOT NULL

Column name	Column description	Data type	Null specifi- cation
BUFFER	Name of the buffer defined within the DMCL which is used by the file. This specification overrides the default buffer established for the segment included in the DMCL and the default buffer established for the DMCL.	CHAR(18)	NOT NULL
DDNAME	Depending on the operating system, DDName (z/OS), filename (z/VSE), or linkname of the file. This specification overrides the specification in the segment's file definition.	CHAR(8)	NOT NULL
DISP	Dataset disposition (IBM) or shared update). This specification overrides the segment's file definition.	CHAR(4)	NOT NULL
DATASPACE	z/OS memory cache indicator: ■ N—Files will not use memory cache (Z-Storage or dataspace) ■ Y—Files will use memory cache (Z-Storage or dataspace)	CHAR(1)	NOT NULL
ESAREAD	Reserved for future use.	CHAR(1)	NOT NULL
ESAPRELOAD	Reserved for future use.	CHAR(1)	NOT NULL
SHAREDCACHE	Shared cache: ■ NO—Not used ■ AVAILABLE—Choose first available ■ Cache Name—Name of the cache to be used	CHAR(16)	NOT NULL
FILLER	Reserved for future use.	BINARY(21)	NOT NULL

SYSTEM.DMCLSEGMENT

Description

A row of SYSTEM.DMCLSEGMENT contains information about a segment definition and a DMCL where the segment has been included. DMCLSEGMENT contains information specific to the DMCL where the segment has been included.

Column name	Column description	Data type	Null specifi- cation
DMCL	DMCL name.	CHAR(8)	NOT NULL
NAME	Segment name.	CHAR(8)	NOT NULL
CTIME	Date and time when the segment was created.	TIMESTAMP	NOT NULL
UTIME	Date and time when the segment was last updated.	TIMESTAMP	NOT NULL
CRITTIME	Date and time of the last critical change made to the segment.	TIMESTAMP	NOT NULL
CUSER	ID of the user who created the segment.	CHAR(18)	NOT NULL
UUSER	ID of the user who last updated the segment.	CHAR(18)	NOT NULL
BUFFER	Name of the buffer within the DMCL which is the default for all files defined within the segment unless specifically overridden.	CHAR(18)	NOT NULL
STARTUP	Startup indicator. This indicates the READY action to be taken when the system is started following an orderly shutdown. Values are: ■ U—Update ■ R—Retrieval ■ T—Transient retrieval ■ X—Set status offline	CHAR(1)	NOT NULL

Column name	Column description	Data type	Null specifi- cation
WARMSTART	Warmstart indicator. This indicates the READY action to be taken when the system is started following an abnormal termination. Values are: ■ U—Update ■ R—Retrieval ■ T—Transient retrieval ■ X—Set status offline ■ C—Maintain current status	CHAR(1)	NOT NULL
DATASHARE	Data sharing indicator. ■ 'Y' - all areas in the segment are eligible to be shared for update ■ 'N' - no areas in the segment are shared	CHAR(1)	NOT NULL
SHAREDCACHE	Default shared cache.	CHAR(16)	NOT NULL
FILLER	Reserved for future use.	CHAR(23)	NOT NULL

SYSTEM.FILE

Description

A row of SYSTEM.FILE represents a file associated with a segment.

Column name	Column description	Data type	Null specifi- cation
SEGMENT	Segment name.	CHAR(8)	NOT NULL
NAME	File name.	CHAR(18)	NOT NULL
CTIME	Date and time when the file was created.	TIMES TAMP	NOT NULL

Column name	Column description	Data type	Null specifi- cation
UTIME	Date and time when the file was last updated.	TIMES TAMP	NOT NULL
CRITTIME	Date and time of the last critical change made to the file.	TIMES TAMP	NOT NULL
CUSER	The ID of the user who created the file.	CHAR(18)	NOT NULL
UUSER	The ID of the user who last updated the file.	CHAR(18)	NOT NULL
NUMFILEMAPS	The number of area page ranges mapped to the file.	SMALL INT	NOT NULL
BLOCKSIZE	Block size, in bytes, of the file. This is the largest page size of all areas mapped to the file.	INTEG ER	NOT NULL
DDNAME	Depending on the operating system, DDName (z/OS), or filename (z/VSE) of the file.	CHAR(8)	NOT NULL
ACCESSMETHOD	File access method.	CHAR(8)	NOT NULL
VMUSERID	In the z/VM environment, the user ID associated with the file.	CHAR(8)	NOT NULL
VMVIRTADDR	In the z/VM environment, the virtual address of the file.	INTEG ER	NOT NULL
FLAG	File flag:. ■ X'80'—Native VSAM FOR CALC file ■ X'40'—Native VSAM FOR SET file	BINAR Y(1)	NOT NULL
NVSAMSET	Native VSAM KSDS or PATH set name.	CHAR(18)	NOT NULL
DSNAME	Dataset name.	CHAR(54)	NOT NULL
DISP	Dataset disposition (IBM).	CHAR(4)	NOT NULL
FILLER	Reserved for future use.	BINAR Y(39)	NOT NULL

SYSTEM.FILEMAP

Description

A row of SYSTEM.FILEMAP relates page ranges of an area of a segment to block ranges of a file in the same segment (area-to-file mapping).

Column name	Column description	Data type	Null specifi- cation
SEGMENT	Segment name.	CHAR(8)	NOT NULL
AREA	Area name.	CHAR(18)	NOT NULL
FILE	File name.	CHAR(18)	NOT NULL
PAGESIZE	Size, in bytes, of each page in the area.	INTEGER	NOT NULL
LOWPAGE	Low page number of the area page range.	INTEGER	NOT NULL
HIGHPAGE	High page number of the area page range.	INTEGER	NOT NULL
LOWBLOCK	Low relative block number (RBN) of the range of file blocks to which the area page range is mapped.	INTEGER	NOT NULL
HIGHBLOCK	High relative block number (RBN) of the range of file blocks to which the area page range is mapped.	INTEGER	NOT NULL
ACCESSMETHOD	File access method.	CHAR(8)	NOT NULL
FLAG	File flag: ■ X'80'—Native VSAM FOR CALC file ■ X'40'—Native VSAM FOR SET file	BINARY(1)	NOT NULL
FILLER	Reserved for future use.	BINARY(39)	NOT NULL

SYSTEM.INDEX

Description

A row of SYSTEM.INDEX represents an index that has been defined on a table with a CREATE INDEX statement.

View SYSCA.INDEX is defined on SYSTEM.INDEX.

Note: For more information, see SYSCA Objects.

Column name	Column description	Data type	Null specifi- cation
NAME	Index name.	CHAR(18)	NOT NULL
SCHEMA	Schema-name qualifier for the indexed table.	CHAR(18)	NOT NULL
TABLE	Name of the indexed table.	CHAR(18)	NOT NULL
SEGMENT	Segment containing the area where index entries are stored.	CHAR(8)	NOT NULL
AREA	Area where index entries are stored.	CHAR(18)	
INDEXID	Internal index ID number. Index IDs are automatically assigned to each index and are unique within the index area.	SMALLINT	NOT NULL
CTIME	Date and time when the index was created.	TIMESTAMP	NOT NULL
NUMCOLUMNS	Number of columns in the index key.	SMALLINT	NOT NULL
IXCOLUMNS	Internal index key column number array. This array consists of 32 SMALLINT bytes.	BINARY(64)	NOT NULL
IXORDERS	Sort order indicator array consisting of 32 CHAR(1) bytes. Values are: ■ A—Ascending ■ D—Descending	CHAR(32)	NOT NULL

Column name	Column description	Data type	Null specifi- cation
UNIQUE	Unique key indicator: ■ Y—Unique index ■ N—Not unique	CHAR(1)	NOT NULL
CLUSTER	Cluster indicator: ■ Y—Clustered index ■ N—Not clustered	CHAR(1)	NOT NULL
COMPRESS	Index entry compression indicator: ■ Y—Compressed ■ N—Not compressed	CHAR(1)	NOT NULL
IXBLKLENGTH	Index block length.	SMALLINT	NOT NULL
IXBLKCONTAINS	Number of keys in an index block.	SMALLINT	NOT NULL
DISPLACEMENT	Distance, in number of pages, an index entry can be stored from the referenced row.	SMALLINT	NOT NULL
NEXT	Offset to next db-key pointer (CALC key).	SMALLINT	NOT NULL
PRIOR	Offset to prior db-key pointer (CALC key).	SMALLINT	NOT NULL
NUMSETS	For non-CALC indexes, this value is: ■ 1, if the number of rows in the indexed table was greater than zero when statistics were last updated. ■ 0, if there were no rows in the indexed table when statistics were last updated. For CALC indexes, this value is the number of target pages for indexed rows when statistics were last updated.	INTEGER	NOT NULL

Column name	Column description	Data type	Null specifi- cation
AVGMEMROWS	For non-CALC indexes, this value is the same as the NUMROWS column value in the SYSTEM.TABLE row for the indexed table when statistics were last updated. For CALC indexes, this value is the average number of indexed rows for each target page in the CALC index when statistics were last updated.	REAL	NOT NULL
LONGESTMEM	For non-CALC indexes, this value is the same as the NUMROWS column value in the SYSTEM.TABLE row for the indexed table when statistics were last updated. For CALC indexes, this value is the highest number of indexed rows for the same target page when statistics were last updated.	INTEG ER	NOT NULL
SECLONGMEM	For non-CALC indexes, this value is always 0. For CALC indexes, this value is the second highest number of indexed rows for the same target page when statistics were last updated.	INTEG ER	NOT NULL
NUMLONGMEM	For non-CALC indexes, this value is always 1. For CALC indexes, this value is the number of target pages with LONGESTMEM indexed rows targeted to the page when statistics were last updated.	INTEG ER	NOT NULL

Column name	Column description	Data type	Null specifi- cation
AVGMEMPAGES	For non-CALC indexes, this value is the same as the NUMPAGES column value in the SYSTEM.TABLE row for the indexed table when statistics were last updated. For CALC indexes, this value is the average number of distinct pages occupied by indexed rows that target to the same page when statistics were last updated. This average does not include pages accounted for in MAXMEMPAGES. The nearer this value is to 1, the greater the efficiency of the index.	REAL	NOT NULL
MAXMEMPAGES	For non-CALC indexes, this value is: ■ 0, if AVGMEMPAGES was 20 or less when statistics were last updated ■ 0, if AVGMEMPAGES was more than 20 when statistics were last updated For CALC indexes, this value is the number of target pages where the number of pages occupied by indexed rows that target to the same page occupied more than 20 pages when statistics were last updated. This average does not include pages accounted for in AVGMEMPAGES (above).	INTEG ER	NOT NULL

Column name	Column description	Data type	Null specifi- cation
AVGAMEMCLUSCNT	For a non-CALC index, the average number of I/Os required to read all rows of the indexed table associated with a referenced row when statistics were last updated, if one buffer page was available. This count includes I/O to read the bottom-level SR8. For a CALC index, this value is 0.	REAL	NOT NULL
AVGBMEMCLUSCNT	For a non-CALC index, the average number of I/Os required to read all rows of the indexed table associated with a referenced row when statistics were last updated, if three buffer pages were available. This count includes I/O to read the bottom-level SR8. For a CALC index, this value is 0.	REAL	NOT NULL
AVGCMEMCLUSCNT	For a non-CALC index, the average number of I/Os required to read all rows of the indexed table associated with a referenced row if when statistics were last updated, if five buffer pages were available. This count includes I/O to read the bottom-level SR8. For a CALC index, this value is 0.	REAL	NOT NULL
AVGDMEMCLUSCNT	For a non-CALC index, the average number of I/Os required to read all rows of the indexed table associated with a referenced row when statistics were last updated, if 10 buffer pages were available. This count includes I/O to read the bottom-level SR8. For a CALC index, this value is 0.		

Column name	Column description	Data type	Null specifi- cation
AVGEMEMCLUSCNT	For a non-CALC index, the average number of I/Os required to read all rows of the indexed table associated with a referenced row when statistics were last updated, if 20 buffer pages were available. This count includes I/O to read the bottom-level SR8. For a CALC index, this value is 0.	REAL	NOT NULL
AVGSR8ROWS	For a non-CALC index, the number of SR8s in the index when statistics were last updated. For a CALC index, this value is 0.	REAL	NOT NULL
LONGESTSR8	For a non-CALC index, the number of bottom-level SR8s in the index. For a CALC index, this value is 0.	INTEG ER	NOT NULL
SECLONGSR8	This value is always 0.	INTEG ER	NOT NULL
NUMLONGSR8	For a non-CALC index, this value is 1. For a CALC index, this value is 0.	INTEG ER	NOT NULL
AVGSR8PAGES	For a non-CALC index, the average number of distinct pages occupied by bottom-level SR8s for the index when statistics were last updated, if the average is 1 to 20. If the average is more than 20, the value in this column is 0. For a CALC index, this value is 0.	REAL	NOT NULL
MAXSR8PAGES	For a non-CALC index, if AVGSR8PAGES is more than 20, the value in this column is 1. Otherwise the value is 0. For a CALC index, this value is 0.	INTEG ER	NOT NULL

Column name	Column description	Data type	Null specifi- cation
AVGSR8LEAFS	For a non-CALC index, the average number of bottom-level SR8s in the index when statistics were last updated. For a CALC index, this value is 0.	REAL	NOT NULL
AVGSR8LEVELS	For a non-CALC index, the average highest level number in the index when statistics were last updated. Level number refers to the number of levels above the bottom level. For a CALC index, this value is 0.	REAL	NOT NULL
AVGASR8CLUSCNT	For a non-CALC index, the average number of I/Os required to read all bottom-level SR8s in the index when statistics were last updated, if one buffer page was available. For a CALC index, this value is 0.	REAL	NOT NULL
AVGBSR8CLUSCNT	For a non-CALC index, the average number of I/Os required to read all bottom-level SR8s in the index when statistics were last updated, if three buffer pages were available. For a CALC index, this value is 0.	REAL	NOT NULL
AVGCSR8CLUSCNT	For a non-CALC index, the average number of I/Os required to read all bottom-level SR8s in the index when statistics were last updated, if five buffer pages were available. For a CALC index, this value is 0.	REAL	NOT NULL
AVGDSR8CLUSCNT	For a non-CALC index, the average number of I/Os required to read all bottom-level SR8s in the index when statistics were last updated, if 10 buffer pages were available. For a CALC index, this value is 0.	REAL	NOT NULL

Column name	Column description	Data type	Null specifi- cation
AVGESR8CLUSCNT	For a non-CALC index, the average number of I/Os required to read all bottom-level SR8s in the index when statistics were last updated, if 20 buffer pages were available. For a CALC index, this value is 0.	REAL	NOT NULL
NUMUNIQKEYS	The number of distinct key values in the index when statistics were last updated. For a unique index, this number should match NUMROWS in the SYSTEM.TABLE row for the underlying table.	INTEG ER	NOT NULL
NUMNULLKEYS	Number of rows where all the index key columns in the row contained null key values when statistics were last updated.	INTEG ER	NOT NULL
NUMLONGKEYS	Number of distinct index key values for which all referencing rows with the same key value the indexed table occupied more than 20 pages when statistics were last updated. This situation can occur only when referencing rows can contain duplicate key values.	INTEG ER	NOT NULL
AVGDUPSPERKEY	For each distinct index key value, the average number of duplicate values when statistics were last updated. For a unique index, this is 1.	REAL	NOT NULL
AVGPAGESPERKEY	For each distinct index key value, the average number of pages containing rows of the indexed table with the key value when statistics were last updated. This average does not include pages accounted for in NUMLONGKEYS (above).	REAL	NOT NULL
PROCKEY	Table procedure key: ■ P—If procedure key	CHAR(1)	NOT NULL

Column name	Column description	Data type	Null specifi- cation
PRIMEKEY	Primary key flag: ■ Y—If primary key	CHAR(1)	NOT NULL
FILLER	Reserved for future use.	BINARY(38)	NOT NULL

SYSTEM.INDEXKEY

Description

A row of SYSTEM.INDEXKEY identifies a key column defined in an index. This information is for documentation and is not used in internal processing.

View SYSCA.INDEXKEY is defined on SYSTEM.INDEXKEY.

Note: For more information, see SYSCA Objects.

Column name	Column description	Data type	Null specifi- cation
NAME	Index name.	CHAR(18)	NOT NULL
SCHEMA	Schema-name qualifier for the indexed table.	CHAR(18)	NOT NULL
TABLE	Name of the indexed table.	CHAR(18)	NOT NULL
SEQUENCE	Internal index key sequence number.	SMALLINT	NOT NULL
NUMBER	Column number of the key column.	SMALLINT	NOT NULL
COLUMN	Column name of the key column.		
SORTORDER	Index key sort order: ■ A—Ascending ■ D—Descending	CHAR(1)	NOT NULL
FILLER	Reserved for future use.	BINARY(37)	NOT NULL

SYSTEM.JOURNAL

Description

A row of SYSTEM.JOURNAL represents a journal file defined in the DMCL.

Column name	Column description	Data type	Null specifi- cation
DMCL	DMCL name.	CHAR(8)	NOT NULL
NAME	Journal name.	CHAR(18)	NOT NULL
TYPE	Journal type: ■ DISK ■ ARCH ■ TAPE	CHAR(4)	NOT NULL
CTIME	Date and time stamp when the journal was created.	TIMESTAMP	NOT NULL
UTIME	Date and time stamp when the journal was last updated.	TIMESTAMP	NOT NULL
CRITTIME	Date and time stamp of the last critical change made to the journal.	TIMESTAMP	NOT NULL
CUSER	ID of the user who created the journal.	CHAR(18)	NOT NULL
UUSER	ID of the user who last updated the journal.	CHAR(18)	NOT NULL
FILLER	Reserved for future use.	CHAR(2)	NOT NULL
NUMBLOCKS	Number of blocks (pages) in a disk journal file.	INTEGER	NOT NULL
BLOCKSIZE	Archive journal block size, in bytes.	INTEGER	NOT NULL
DDNAME	Depending on the operating system, DDName (z/OS), filename (z/VSE), or linkname of the journal file.	CHAR(8)	NOT NULL

Column name	Column description	Data type	Null specifi- cation
ACCESSMETHOD	Journal file access method.	CHAR(8)	NOT NULL
DATASPACE	Dataspace option: ■ N—No ■ Y—Yes	CHAR(1)	NOT NULL
ESAREAD	Dataspace read: ■ B—Block ■ T—Track ■ C—Cylinder ■ Blank—Dataspace no	CHAR(1)	NOT NULL
ESAPRELOAD	Dataspace preload. ■ N—No ■ Y—Yes ■ Blank—Dataspace no	CHAR(1)	NOT NULL
DSNAME	Dataset name.	CHAR(44)	NOT NULL
DISP	Dataset disposition.	CHAR(4)	NOT NULL
VMUSERID	In the z/VM environment, the user ID associated with the file.	CHAR(8)	NOT NULL
VMVIRTADDR	In the z/VM environment, the virtual address of the file.	INTEGER	NOT NULL
FILLER	Reserved for future use.	BINARY(41)	NOT NULL

SYSTEM.LOADHDR

Description

A row of SYSTEM.LOADHDR represents a load module. Each row of SYSTEM.LOADHDR contains global information about a load module that resides in the DDLDCLOD or DDLCATLOD area of the dictionary.

Column name	Column description	Data type	Null specifi- cation
NAME	Load module name.	CHAR(8)	NOT NULL
VERSION	Load module version number.	SMALLINT	NOT NULL
RLDS	Number of entries in the relocation dictionary (RLD) for the load module.	SMALLINT	NOT NULL
EPA	Entry point address (offset).	BINARY(4)	NOT NULL
LENGTH	Length, in bytes, of the object text for the load module.	INTEGER	NOT NULL
DATE	Date when the load module was created (*mm/dd/yy*).	CHAR(8)	NOT NULL
TIME	Time when the load module was created (*hhmmss*).	CHAR(6)	NOT NULL
TYPE	Flag byte for load module status and type. ■ X'80'—Logically deleted module ■ X'40'—Subschema ■ X'28'—Map help ■ X'20'—Map ■ X'10'—CA ADS dialog ■ X'08'—Table ■ X'04'—Mainline dialog ■ X'02'—Access module ■ X'01'—RCM	BINARY(1)	NOT NULL

Column name	Column description	Data type	Null specifi- cation
SEC	Security class.	BINARY(1)	NOT NULL
STLENGTH	Reserved.	INTEGER	NOT NULL
MODE	Reserved.	BINARY(1)	NOT NULL
STLEVEL	X'02'—Module supports SQL schema names.	BINARY(1)	NOT NULL
SCHEMA	SQL schema name for access module.	CHAR(18)	NOT NULL

SYSTEM.ORDERKEY

Description

A row of SYSTEM.ORDERKEY represents a column that is a sort key in a linked constraint. This is a column in the referencing table. This information is for documentation and is not used in internal processing.

View SYSCA.ORDERKEY is defined on SYSTEM.ORDERKEY.

Note: For more information, see SYSCA Objects.

Column name	Column description	Data type	Null specifi- cation
SCHEMA	Schema name of the constraint (that is, of the referencing table).	CHAR(18)	NOT NULL
CONSTRAINT	Constraint name.	CHAR(18)	NOT NULL
SEQUENCE	Order key column sequence number.	SMALLINT	NOT NULL
NUMBER	Column number of the sort column in the referencing table.	SMALLINT	NOT NULL
COLUMN	Column name of the sort column in the referencing table.	CHAR(32)	NOT NULL

Column name	Column description	Data type	Null specifi- cation
SORTORDER	Sort order: ■ A—Ascending ■ D—Descending	CHAR(1)	NOT NULL
FILLER	Reserved for future use.	BINARY(39)	NOT NULL

SYSTEM.SCHEMA

Description

A row of SYSTEM.SCHEMA represents an SQL schema.

Column name	Column description	Data type	Null specifi- cation
NAME	Schema name.	CHAR(18)	NOT NULL
CTIME	Date and time when the schema was created.	TIMESTAMP	NOT NULL
UTIME	Date and time when the schema was last altered.	TIMESTAMP	NOT NULL
CUSER	ID of the user who created the schema.	CHAR(18)	NOT NULL
UUSER	The ID of the user who last altered the schema.	CHAR(18)	NOT NULL
TYPE	Type of schema: ■ N—Represents non-SQL schema ■ R—SQL schema	CHAR(1)	NOT NULL

Column name	Column description	Data type	Null specifi- cation
SEGMENT	■ When TYPE is N, the segment(specified in CREATE SCHEMA) that contains the data described by the non-SQL schema. If this column is blank and TYPE is N, a segment is chosen from the database name table at runtime. ■ When TYPE is R, the segment that contains the default area. If this column and the AREA column are blank and TYPE is R, the storage area for a table associated with this schema is identified in SYSTEM.TABLE.	CHAR(8)	NOT NULL
AREA	When TYPE is R, the default area for storing rows of tables associated with the schema.	CHAR(18)	NOT NULL
NODE	If it was specified when the SQL schema was created, node name of the dictionary that contains the non-SQL-defined schema (when TYPE is N).	CHAR(8)	NOT NULL
DICTIONARY	If it was specified when the SQL schema was created, name of the dictionary that contains the non-SQL-defined schema (when TYPE is N).	CHAR(8)	NOT NULL
NTWKSCHEMA	Name of the non-SQL schema.	CHAR(8)	NOT NULL
VERSION	Version number of the non-SQL schema.	SMALL INT	NOT NULL
CHARSET	Default character set for all columns in the catalog.	CHAR(18)	NOT NULL
REFDSQLSCHEMA	Name of referenced SQL schema.	CHAR(18)	NOT NULL

Column name	Column description	Data type	Null specifi- cation
FILLER	Reserved for future use.	BINARY(4)	NOT NULL

SYSTEM.SECTION

Description

A row of SYSTEM.SECTION describes part or all the tree form (the form input to the optimizer) of either a search condition that defines a check constraint or a SELECT statement that defines a view. If more than one row is needed to return the entire section, the order of the section portions is represented in column SEQUENCE.

View SYSCA.SECTION is defined on SYSTEM.SECTION.

Note: For more information, see SYSCA Objects.

Column name	Column description	Data type	Null specifi- cation
SCHEMA	Schema-name qualifier of the table or view.	CHAR(18)	NOT NULL
TABLE	Table or view name.	CHAR(18)	NOT NULL
TYPE	Section type: ■ C—Check constraint definition ■ V—View definition	CHAR(1)	NOT NULL
FORMAT	Section format; Value is I (I-tree)	CHAR(1)	NOT NULL
SEQUENCE	Sequence number of this portion of the section.	SMALLINT	NOT NULL
TEXT	Text of the section representing the check constraint or view definition.	BINARY(512)	NOT NULL

SYSTEM.SEGMENT

Description

A row of SYSTEM.SEGMENT represents a definition of a database segment.

Column name	Column description	Data type	Null specifi- cation
NAME	Segment name.	CHAR(8)	NOT NULL
CTIME	Date and time stamp when the segment was created.	TIMESTAMP	NOT NULL
UTIME	Date and time stamp when the segment was last updated.	TIMESTAMP	NOT NULL
CRITTIME	Date and time stamp of the last critical change made to the segment.	TIMESTAMP	NOT NULL
CUSER	ID of the user who created the segment.	CHAR(18)	NOT NULL
UUSER	ID of the user who last updated the segment.	CHAR(18)	NOT NULL
SCHEMA	Name of the SQL schema, if any, that is associated with the segment. If an SQL schema name is associated with the segment, only tables whose names are qualified by the SQL schema name can be stored in areas associated with the segment.	CHAR(18)	NOT NULL
PAGEGROUP	Identifier of the page group that contains the areas associated with the segment.	SMALLINT	NOT NULL
RECSPERPAGE	Maximum number of rows that can be stored on a single page. The value in this column is equal to the value supplied by the user, rounded up to the nearest power of 2, minus 1.	INTEGER	NOT NULL
NUMAREAS	Number of areas associated with the segment.	SMALLINT	NOT NULL

Column name	Column description	Data type	Null specifi- cation
NUMFILES	Number of files associated with the segment.	SMALL INT	NOT NULL
NUMDADS	Number of files associated with this segment that contain dynamic allocation (DAD) information.	SMALL INT	NOT NULL
NUMFILEMAPS	Number of files to which the segment maps.	SMALL INT	NOT NULL
NUMSYMBOLICS	Number of symbolics in the segment.	SMALL INT	NOT NULL
STAMPLEVEL	Data definition stamp level: ■ N—No stamp checking ■ T—Table stamping ■ S—Area stamping	CHAR(1)	NOT NULL
TYPE	Segment type: ■ N—Non-SQL segment ■ R—SQL (Relational) segment	CHAR(1)	NOT NULL
FILLER	Reserved for future use.	BINARY(40)	NOT NULL

SYSTEM.SYMBOL

Description

SYMBOL represents a named symbol within an area whose values are used at runtime to resolve symbolic parameters named in logical definitions.

Column name	Column description	Data type	Null specifi- cation
TYPE	Symbolic type. ■ 01—Subarea ■ 02—Symbolic displacement ■ 03—Symbolic index	SMALL INT	NOT NULL
NAME	Symbolic name	CHAR(18)	NOT NULL

Column name	Column description	Data type	Null specifi- cation
SEGMENT	Segment name.	CHAR(8)	NOT NULL
AREA	Area name.	CHAR(18)	NOT NULL
CTIME	Date and time stamp when the symbolic was created.	TIMESTAMP	NOT NULL
UTIME	Date and time stamp when the symbolic was last updated.	TIMESTAMP	NOT NULL
CRITTIME	Date and time stamp of the last critical change to the symbolic.	TIMESTAMP	NOT NULL
CUSER	ID of the user who created the area.	CHAR(18)	NOT NULL
UUSER	ID of the user who last updated the area.	CHAR(18)	NOT NULL
FLAG	Symbolic type flag; if column TYPE=: ■ 01, values are: ■ X'80'—Subarea offset ■ X'40'—VALUE1 is a percent ■ X'20'—VALUE2 is a percent ■ X'10'—Subarea space ■ 02, value is X'80'—(Displacement) ■ 03: ■ X'80'—Index block contains ■ X'40'—Index size ■ X'20'—Index sorted key	BINARY(1)	NOT NULL
FILLER	Reserved for future use.	CHAR(1)	NOT NULL
VALUE1	Symbolic value 1.	INTEGER	NOT NULL
VALUE2	Symbolic value 2.	INTEGER	NOT NULL
FILLER	Reserved for future use.	BINARY(40)	NOT NULL

SYSTEM.SYNTAX

Description

A row of SYSTEM.SYNTAX represents the syntax for a CREATE or ALTER TABLE statement that includes a check constraint, the syntax of a CREATE VIEW statement, or the syntax of an SQL routine. If more than one row is needed to return all the syntax, the order of the syntax portions is represented in column SEQUENCE.

View SYSCA.SYNTAX is defined on SYSTEM.SYNTAX.

Note: For more information, see SYSCA Objects.

Column name	Column description	Data type	Null specifi- cation
SCHEMA	Schema-name qualifier of the table or view.	CHAR(18)	NOT NULL
TABLE	Table or view name.	CHAR(18)	NOT NULL
TYPE	Syntax usage: ■ C—Check constraint definition ■ V—View definition (SELECT statement) ■ S—SQL routine definition	CHAR(1)	NOT NULL
SEQUENCE	Sequence number of this portion of the syntax.	SMALL INT	NOT NULL
SYNTAX	The check constraint syntax or the syntax of the query expression in the view definition.	CHAR(80)	NOT NULL

SYSTEM.TABLE

Description

A row of SYSTEM.TABLE represents the definition of a table, view, function, procedure, table procedure or owner of local variables of an SQL routine, or refers to a database record in a non-SQL-defined schema referenced by a view definition (for which only SCHEMA and NAME information appears).

View SYSCA.TABLE is defined on SYSTEM.TABLE.

Note: For more information, see SYSCA Objects.

Column name	Column description	Data type	Null specification
SCHEMA	Schema-name qualifier of the table or view.	CHAR(18)	NOT NULL
NAME	Name of the table or view.	CHAR(18)	NOT NULL
SEGMENT	Segment that contains the area where table rows are stored.	CHAR(8)	
AREA	Area where table rows are stored.	CHAR(18)	
TABLEID	Internal record ID of the database record underlying the table.	SMALLINT	NOT NULL
TYPE	Type of table: ■ A—View on referencing SQL schema table ■ F—Function ■ L—Owner of local variables of a routine ■ N—Record in a non-SQL-defined schema ■ P—Table procedure ■ R—Procedure ■ T—Base table ■ V—View	CHAR(1)	NOT NULL

Column name	Column description	Data type	Null specification
LOCMODE	Storage location mode for a table: ■ C—Clustered ■ D—Direct ■ H—CALC ■ R—Row ID index ■ U—Unique calc Global storage allocation option for a table procedure: ■ N—Non-keyed global storage ■ K—Keyed global storage	CHAR(1)	NOT NULL
COMPRESS	Compression indicator: ■ Y—Compressed ■ N—Uncompressed ■ P—Compressed with CA IDMS Presspack For TYPE = R (procedure) or F (function), this is the protocol: ■ I—IDMS ■ A—ADS	CHAR(1)	NOT NULL
FORMAT	Format of the database record underlying the table: ■ F—Fixed length ■ V—Variable length	CHAR(1)	NOT NULL
UPDATABLE	When TYPE is V, updatable view indicator: ■ Y—Updatable ■ N—Not updatable ■ Blank—Not known at definition time	CHAR(1)	NOT NULL

Column name	Column description	Data type	Null specifi-cation
CHECKOPT	When TYPE is V, WITH CHECK OPTION indicator: ■ Y—View defined with WITH CHECK OPTION ■ N—View defined without WITH CHECK OPTION	CHAR(1)	NOT NULL
TIMESTAMP	Table timestamp, used for synchronization with access module definitions,	TIMESTAMP	NOT NULL
CTIME	Date and time when the table or view was created.	TIMESTAMP	NOT NULL
UTIME	Date and time when the table or view was last altered.	TIMESTAMP	NOT NULL
CUSER	ID of the user who created the table or view.	CHAR(18)	NOT NULL
UUSER	ID of the user who last altered the table or view.	CHAR(18)	NOT NULL
PUTROUTINE	■ When TYPE = T: CA IDMS Presspack data characteristic table (DCT) name. ■ When TYPE = P or R or F: external program or dialog name	CHAR(8)	NOT NULL
GETROUTINE	Reserved for a table. Global storage key for a procedure.	CHAR(8)	NOT NULL
LENGTH	Internal length of underlying database record, including prefix.	SMALLINT	NOT NULL
DATALENGTH	Internal length of the data portion of the underlying database record (including four-byte RDW for a compressed table).	SMALLINT	NOT NULL

Column name	Column description	Data type	Null specification
PREFIXLENGTH	Internal length of the prefix portion of the underlying database record for a table. Length of the local work area for a procedure.	SMALLINT	NOT NULL
CTRLENGTH	Internal length of the control portion (without the prefix) of the underlying database record for a table. Length of the global work area for a procedure.	SMALLINT	NOT NULL
FIXLENGTH	Internal length of the fixed portion (without the prefix) of the underlying database record.	SMALLINT	NOT NULL
SECLENGTH	Length of the I-tree stored in the associated section table rows, for a view or check constraint.	SMALLINT	NOT NULL
NUMSYNTAX	Number of rows in the syntax table for a view or check constraint.	SMALLINT	NOT NULL
NUMCOLS	Number of columns in the table or view.	SMALLINT	NOT NULL
NUMINDEXES	Number of indexes on the table.	SMALLINT	NOT NULL
NUMREFERENCED	Number of constraints where the table is the referenced table.	SMALLINT	NOT NULL
NUMREFERENCING	Number of constraints where the table is the referencing table.	SMALLINT	NOT NULL
DISPLACEMENT	Displacement, in pages, from cluster index or constraint for a table. Estimated number of I/Os for a procedure.	INTEGER	NOT NULL
ESTROWS	Estimated number of rows in the table.	INTEGER	NOT NULL

Column name	Column description	Data type	Null specification
NUMPAGES	Number of pages containing rows of the table when statistics were last updated.	INTEGER	NOT NULL
NUMROWS	Actual number of rows in the table when statistics were last updated.	INTEGER	NOT NULL
ROWSPERPAGE	Number of table rows per page when statistics were last updated.	INTEGER	NOT NULL
AVGROWLENGTH	Average length of a table row when statistics were last updated.	REAL	NOT NULL
PCTSPACEUSED	Percentage of space used in the area where table rows are stored when statistics were last updated.	REAL	NOT NULL
PCTFRAGROWS	Percentage of rows fragmented in storage when statistics were last updated.	REAL	NOT NULL
NUMIO01	Number of IOs required to read all rows with 1 buffer, when statistics were last updated.	REAL	NOT NULL
NUMIO03	Number of IOs required to read all rows with 3 buffers, when statistics were last updated.	REAL	NOT NULL
NUMIO05	Number of IOs required to read all rows with 5 buffers, when statistics were last updated.	REAL	NOT NULL
NUMIO10	Number of IOs required to read all rows with 10 buffers, when statistics were last updated.	REAL	NOT NULL
NUMIO20	Number of IOs required to read all rows with 20 buffers, when statistics were last updated.	REAL	NOT NULL
PROCMODE	Execution mode for a table procedure: ■ U—User mode ■ S—System mode	CHAR(1)	NOT NULL

Column name	Column description	Data type	Null specifi- cation
TXNSHARNG	Transaction sharing: ■ Y—Yes ■ N—No ■ D—Default	CHAR(1)	NOT NULL
PROCDBNAME	Default Database: ■ P—Current ■ not P—Null	CHAR(1)	NOT NULL
DEFAULTINDEX	When TYPE is T, Row ID index indicator: ■ Y—Yes ■ N—No	CHAR(1)	NOT NULL
SECLENGTH2	Length of syntax for views and check constraints.	INTEGER	NOT NULL
LANGUAGE	Language of an SQL-invoked routine.	CHAR3	
FILLER3	Reserved for future use.	BINARY(1)	NOT NULL
DYNRESULTSETS	Number of dynamic results sets of an SQL-invoked procedure.	SMALLINT	NOT NULL
FILLER	Reserved for future use.	BINARY(18)	NOT NULL

SYSTEM.VIEWDEP

Description

A row of SYSTEM.VIEWDEP identifies a table or view referenced by a view.

View SYSCA.VIEWDEP is defined on SYSTEM.VIEWDEP.

Note: For more information, see SYSCA Objects.

Column name	Column description	Data type	Null specifi- cation
SCHEMA	Schema-name qualifier of the dependent view.	CHAR(18)	NOT NULL

Column name	Column description	Data type	Null specifi- cation
NAME	Dependent view name.	CHAR(18)	NOT NULL
SEQUENCE	Sequence number of the table or view referenced in the dependent view.	SMALL INT	NOT NULL
REFSCHEMA	Schema-name qualifier of the table or view referenced in the dependent view.	CHAR(18)	NOT NULL
REFTABLE	Name of the table or view referenced in the dependent view.	CHAR(18)	NOT NULL
REFTYPE	Type of the table or view referenced in the dependent view: ■ F—Function ■ N—Record in a non-SQL-defined schema ■ P—Table procedure ■ R—Procedure ■ T—Base table ■ V—View	CHAR(1)	NOT NULL
FILLER	Reserved for future use.	BINAR Y(5)	NOT NULL

SYSCA Objects

SYSCA Views

SYSCA views are views defined on a subset of SYSTEM tables. They restrict information that the user can select from the SYSTEM tables to data about tables for which the user holds SELECT privilege.

If you hold SELECT privilege on the SYSCA views but not on SYSTEM tables, you can see definitions of the tables from which you are authorized to select data, but you cannot see definitions of any other tables defined in the catalog component of the dictionary.

Tables that You Can Access

SYSCA.ACCESSIBLE_TABLES is a view you can use to list the tables for which you hold a SELECT privilege. The result table of this view contains the schema name, table name, and type of table (T for base table, V for view, N for non-SQL-defined table, P for table procedure), as in this example:

```
SELECT * FROM SYSCA.ACCESSIBLE_TABLES;
*+
*+ SCHEMA       TABLE            TYPE
*+ ------       -----            ----
*+ DEMOEMPL     EMP_WORK_INFO    V
*+ DEMOEMPL     JOB              T
*+ DEMOPROJ     EXPERTISE        T
*+ DEMOPROJ     PROJECT          T
*+ DEMOPROJ     SKILL            T
*+ EMPDEMO      INSURANCE-PLAN   N
*+ SYSCA        ACCESSIBLE_TABLES V
*+ SYSCA        COLUMN           V
*+ SYSCA        SECTION          V
*+ SYSCA        SYNTAX           V
*+ SYSCA        TABLE            V
```

Non-SQL defined tables are visible through the SYSCA.ACCESSIBLE_TABLES view only if the dictionary name where the non-SQL-defined schema resides exactly matches the dictionary to which the SQL session is connected.

SYSCA View Names

In addition to SYSCA.ACCESSIBLE_TABLES, these SYSCA views are defined. The view name matches the name of the SYSTEM table on which it is defined, and the view column names match the SYSTEM table column names.

- SYSCA.COLUMN
- SYSCA.CONSTKEY
- SYSCA.CONSTRAINT
- SYSCA.INDEX
- SYSCA.INDEXKEY
- SYSCA.ORDERKEY
- SYSCA.SECTION
- SYSCA.SYNTAX
- SYSCA.TABLE
- SYSCA.VIEWDEP

Example

In this example, columns from SYSCA.TABLE are selected. The column values in the result table represent information about tables for which the issuing user holds SELECT privilege:

```
SET OPTIONS COMPRESS ON;
*+ Status = 0
SELECT SCHEMA, NAME, SEGMENT, AREA, TYPE, UPDATABLE
FROM SYSCA.TABLE
WHERE SCHEMA <> 'SYSCA'
ORDER BY 1, 2, 3, 4, 5;
*+
*+ SCHEMA      NAME          SEGMENT  AREA        TYPE UPDATABLE
*+ ------      ----          -------  ----        ---- ---------
*+ DEMOEMPL    EMP_WORK_INFO  SYSCAT   DDLCATX       V    Y
*+ DEMOEMPL    JOB            SQLDEMO  INFOAREA      T
*+ DEMOPROJ    EXPERTISE      PROJSEG  PROJAREA      T
*+ DEMOPROJ    PROJECT        PROJSEG  PROJAREA      T
*+ DEMOPROJ    SKILL          PROJSEG  PROJAREA      T
```

Note: The SYSCA.TABLE view excludes tables of type N because most columns of SYSTEM.TABLE do not contain meaningful values for non-SQL-defined tables.

SYSCA Other Objects

A number of table-like objects such as views, table procedures, functions, and procedures are created in the schema SYSCA. These objects are needed by CA IDMS for miscellaneous purposes, or provide for generally useful procedures or functions.

SYSCA Pseudo Table SINGLETON_NULL

The SYSCA.SINGLETON_NULL is a pseudo table that can be used to return the results of expressions whose parameters are constants. It is defined to have one row and no columns. This table is a pseudo table because it does not exist in the catalog. However, it can be queried through a SELECT statement. Used internally by CA IDMS, it is also useful when evaluating SQL functions and other expressions with constant parameters.

Example

```
select USER01.TLANG1('James    ', 'Last   ')
  from SYSCA.SINGLETON_NULL;

*+
*+ USER_FUNC
*+ ---------
*+ James Last
```

Appendix F: Index Calculations

INDEX BLOCK CONTAINS

The following steps are used to calculate *key-count* for the INDEX BLOCK CONTAINS parameter of the CREATE INDEX statement:

1. Obtain the maximum number of index entries in an SR8 (this formula assumes 3 SR8s per page):

   - Compute the maximum size of the variable portion of an SR8:

     ```
     ( (Page-size - Page-reserve - 32) / 3 ) - 40 = SR8-variable-size
     ```

   - Compute the maximum number of index entries in an SR8:

     ```
     (SR8-variable-size / ( 8 + Key-length) ) - 2
     ```

   If the resulting number of SR8 entries is less than 3, set it to 3; if greater than 8180, set it to 8180.

2. Establish the number of rows to be indexed using the greater of;

   - The estimated number of rows for the table (ESTROWS column in SYSTEM.TABLE)
   - The actual number of rows in the table (NUMROWS column in SYSTEM.TABLE)

   If both values are 0, use 1000.

3. Estimate the number of entries per SR8 for a 3-level index by finding the first entry in the following table whose Number of Rows column is greater than or equal to the value established in Step 2:

Number of Rows	Number of SR8 Entries
1,000	10
15,625	25
125,000	50
512,000	80
1,000,000	100
2,000,376	126
3,375,000	150
5,359,375	175
8,000,000	200
15,625,000	250
-1	8180

4. Determine the INDEX BLOCK CONTAINS value by using the *lesser* of the Number of SR8 Entries from the table and the value obtained in Step 1.

   Use this value in the INDEX BLOCK CONTAINS *key-count* parameter of the definition and for IBC-key-count in calculations for DISPLACEMENT *page-count*.

DISPLACEMENT

Index Displacement

The following steps are used to calculate *page-count* for the DISPLACEMENT parameter of the CREATE INDEX statement:

1. Calculate number of bottom-level and higher-level SR8s:

```
Set N              = #-of-rows
High-level-SR8s    = 0
Bottom-level-SR8s = 1

Repeat

  N = (N + IBC-key-count - 1) / IBC-key-count (truncate)

  If N = 1, exit

  If High-level-SR8s = 0,
        High-level-SR8s   = 1
        Bottom-level-SR8s = N
  Else  High-level-SR8s = High-level-SR8s + N

Set Total-SR8s = High-level-SR8s + Bottom-level-SR8s
```

2. Determine the number of SR8s per page:

   - Calculate size of an SR8:

     ```
     SR8-size = 32 + (IBC-key-count + 2) * (Key-length + 8)
     ```

   - Calculate number of SR8s per page:

     ```
     (Page-size - Page-reserve - 32) / (SR8-size + 8)
     ```

3. Establish the INDEX DISPLACEMENT:

   - If the number of higher-level SR8's is less than 2, set the DISPLACEMENT = High-level-SR8s. (For a one- or two-level index, displacement is 0 or 1 respectively).

   - If the number of higher-level SR8s is greater than 1, compute the displacement page count:

     ```
     (High-level-SR8s + SR8s-per-page - 1)
     -------------------------------------  +  1 (truncate)
                 SR8s-per-page
     ```

     If the calculated displacement is greater than the number of pages in the area containing the index, then:

     ```
     Displacement-page-count = Number-of-pages-in-area / 2
     ```

Table Displacement

Table displacement is the number of pages that the rows of a table are displaced from the index around which they are clustered. The table displacement is 0 if the table and index reside in different areas. It is calculated as described below if they reside in the same area:

- If the total number of SR8s is less than 2, set the table's displacement to 0.
- If the total number of SR8s is greater than 1, the table's displacement is:

  ```
  (Total-SR8s + SR8s-per-page - 1)
  -------------------------------------  +  1 (truncate)
           SR8s-per-page
  ```

  If the calculated displacement is greater than the number of pages in the area containing the index, then:

  ```
  Table-displacement = Number-of-pages-in-area * 3 / 4
  ```

Appendix G: Sample COBOL Table Procedure

Sample Table Procedure Definition

The following example shows a table procedure definition.

```
create table procedure emp.org
   (top_key          unsigned numeric(4),
   level             smallint,
   mgr_id            unsigned numeric(4),
   mgr_lname         char(25)
   emp_id            unsigned numeric (4),
   emp_lname         char(25)
   start_date        DATE,
   structure_code    char(2))
   external name procorgu
   local work area 800
   global work area 600 key emp
   estimated ios 50
   estimated rows 50;
create primary key org1
   on emp.org (mgr_id, start_date, emp_id)
   estimated rows 1
   estimated ios 5;
create key org2
   on emp.org (mgr_id)
   estimated rows 5
   estimated ios 5;
create key org3
   on emp.org (emp_id)
   estimated rows 5
   estimated ios 5;
```

Sample Table Procedure Program

The following sample program is included on the CA IDMS installation media. This program requires the employee demo database.

```
*RETRIEVAL
*NO-ACTIVITY-LOG
*DMLIST
 IDENTIFICATION DIVISION.
 PROGRAM-ID.    PROCORGU.

 ENVIRONMENT DIVISION.
     IDMS-CONTROL SECTION.
     PROTOCOL. MODE IS BATCH DEBUG
         IDMS-RECORDS MANUAL.

 DATA DIVISION.

 SCHEMA SECTION.
 DB EMPSS01 WITHIN EMPSCHM VERSION 100.

 WORKING-STORAGE SECTION.
 01  WORK-FIELDS.
     02  IN01-RPB              PIC X(36).
     02  IN01-REQUEST.
         03  IN01-REQUEST-CODE  PIC S9(8) COMP SYNC.
         03  IN01-RETURN        PIC S9(8) COMP SYNC.
     02  IN01-DATE-FORMAT       PIC S9(8) COMP SYNC.
     02  I                      PIC S9(4) COMP SYNC.
     02  ROW-FOUND-FLAG         PIC X.
         88 ROW-FOUND           VALUE '1'.
 01  COPY IDMS SUBSCHEMA-NAMES.
 01  WK-DBKEYS.
     02  WK-NEW-MGR-DBKEY   PIC S9(8) COMP SYNC.
     02  WK-NEW-EMP-DBKEY   PIC S9(8) COMP SYNC.
     02  WK-MGR-DBKEY       PIC S9(8) COMP SYNC.
     02  WK-EMP-DBKEY       PIC S9(8) COMP SYNC.
     02  WK-PRIOR-DBKEY     PIC S9(8) COMP SYNC.
     02  WK-STRUCT-DBKEY    PIC S9(8) COMP SYNC.
 01  WK-DATE-TIME.
     02  WK-DATE.
         03  FILLER         PIC 99 VALUE 19.
         03  WK-YY          PIC 99.
         03  FILLER         PIC X VALUE '-'.
         03  WK-MM          PIC 99.
         03  FILLER         PIC X VALUE '-'.
         03  WK-DD          PIC 99.
     02  WK-TIME            PIC X(16) VALUE '-00.00.00.000000'.
 01  WK-NEW-DATE.
     02  WK-NEW-YY          PIC 99.
     02  WK-NEW-MM          PIC 99.
     02  WK-NEW-DD          PIC 99.
 01  DB-MSG.
     02  FILLER             PIC X(22) VALUE
         'Database error status '.
     02  DB-STAT            PIC X(4).
     02  FILLER             PIC X(16) VALUE ', during: '.
     02  DB-VERB            PIC X(12).

 01  INVDELSEQ-MSG.
     02  FILLER             PIC X(43) VALUE
         'Internal sequence error during delete for: '.
     02  DEL-PROC          PIC X(18).

 01  INVUPDSEQ-MSG.
     02  FILLER             PIC X(43) VALUE
         'Internal sequence error during update for: '.
     02  UPD-PROC          PIC X(18).

 01  EMPID-MSG.
     02  FILLER             PIC X(28) VALUE
         'EMP_ID is missing or invalid'.
 01  MGRID-MSG.
     02  FILLER             PIC X(28) VALUE
         'MGR_ID is missing or invalid'.

 01  STRUCTCD-MSG.
     02  FILLER             PIC X(36) VALUE
         'STRUCTURE_CODE is missing or invalid'.

 LINKAGE SECTION.

*  PROCEDURE PARAMETERS
 77  TOP-KEY              PIC 9(4).
 77  LEVEL-NO             PIC S9(4) COMP SYNC.
 77  MGR-ID               PIC 9(4).
 77  MGR-LNAME            PIC X(25).
 77  EMP-ID               PIC 9(4).
 77  EMP-LNAME            PIC X(25).
 77  START-DATE           PIC X(10).
 77  STRUCTURE-CODE       PIC XX.

*  PROCEDURE PARAMETER INDICATORS
 77  TOP-KEY-I            PIC S9(4) COMP SYNC.
 77  LEVEL-NO-I           PIC S9(4) COMP SYNC.
 77  MGR-ID-I             PIC S9(4) COMP SYNC.
 77  MGR-LNAME-I          PIC S9(4) COMP SYNC.
 77  EMP-ID-I             PIC S9(4) COMP SYNC.
 77  EMP-LNAME-I          PIC S9(4) COMP SYNC.
 77  START-DATE-I         PIC S9(4) COMP SYNC.
 77  STRUCTURE-CODE-I     PIC S9(4) COMP SYNC.
*  CONTROL PARAMETERS
 77  RESULT-IND           PIC S9(4) USAGE COMP SYNC.
 01  SQLSTATE.
   02  SQLSTATE-CLASS     PIC XX.
   02  SQLSTATE-SUBCLASS  PIC XXX.
 77  PROCEDURE-NAME       PIC X(18).
 77  SPECIFIC-NAME        PIC X(8).
 77  MESSAGE-TEXT         PIC X(80).
 01  SQL-COMMAND-CODE     PIC S9(8) USAGE COMP SYNC.
 01  SQL-OP-CODE          PIC S9(8) USAGE COMP SYNC.
     88  SQL-OPEN-SCAN    VALUE +12.
     88  SQL-NEXT-ROW     VALUE +16.
     88  SQL-CLOSE-SCAN   VALUE +20.
     88  SQL-SUSPEND-SCAN VALUE +24.
     88  SQL-RESUME-SCAN  VALUE +28.
     88  SQL-INSERT-ROW   VALUE +32.
     88  SQL-DELETE-ROW   VALUE +36.
     88  SQL-UPDATE-ROW   VALUE +40.
 01  INSTANCE-ID          PIC S9(8) USAGE COMP SYNC.
 01  LOCAL-WORK-AREA.
     02  SCAN-INFO.
       03  SCAN-MGR-DBKEY PIC S9(8) USAGE COMP SYNC.
       03  SCAN-TOP-DBKEY PIC S9(8) USAGE COMP SYNC.
       03  SCAN-STACK-STRDBKEY OCCURS 50 TIMES
                          PIC S9(8) USAGE COMP SYNC.
       03  SCAN-STACK-EMPDBKEY OCCURS 50 TIMES
                          PIC S9(8) USAGE COMP SYNC.
       03  SCAN-TYPE      PIC S9(4) USAGE COMP SYNC.
       03  SCAN-LEVEL     PIC S9(4) USAGE COMP SYNC.
       03  SCAN-MAX-LEVEL PIC S9(4) USAGE COMP SYNC.
       03  SCAN-TOP-KEY   PIC 9(4).
       03  SCAN-MGR-KEY   PIC 9(4).
       03  SCAN-MGR-NAME  PIC X(25).
 01  GLOBAL-WORK-AREA.
     02  COPY IDMS SUBSCHEMA-CTRL.
     02  COPY IDMS RECORD EMPLOYEE.
     02  COPY IDMS RECORD STRUCTURE.
     02  RUN-UNIT-FLAG    PIC X.
       88  RUN-UNIT-BOUND VALUE '1'.

*********************************************************
```

```
 PROCEDURE DIVISION USING
     TOP-KEY
     LEVEL-NO
     MGR-ID
     MGR-LNAME
     EMP-ID
     EMP-LNAME
     START-DATE
     STRUCTURE-CODE
     TOP-KEY-I
     LEVEL-NO-I
     MGR-ID-I
     MGR-LNAME-I
     EMP-ID-I
     EMP-LNAME-I
     START-DATE-I
     STRUCTURE-CODE-I
     RESULT-IND
     SQLSTATE
     PROCEDURE-NAME
     SPECIFIC-NAME
     MESSAGE-TEXT
     SQL-COMMAND-CODE
     SQL-OP-CODE
     INSTANCE-ID
     LOCAL-WORK-AREA
     GLOBAL-WORK-AREA.
 MAINLINE SECTION.
*
*  PROCESS DML-ONLY OPERATIONS
*
     IF      SQL-NEXT-ROW
        PERFORM NEXT-ROW
     ELSE IF SQL-OPEN-SCAN
        PERFORM OPEN-SCAN
     ELSE IF SQL-INSERT-ROW
        PERFORM INSERT-ROW
     ELSE IF SQL-UPDATE-ROW
        PERFORM UPDATE-ROW
     ELSE IF SQL-DELETE-ROW
        PERFORM DELETE-ROW.
     GOBACK.
```

```
*************************************************************
****           FUNCTION MAINLINE ROUTINES               ****
*************************************************************


 DELETE-ROW SECTION.
*
*  DELETE MUST HAVE BEEN PRECEDED BY A "NEXT ROW"
*    CALL RETRIEVING THE ROW TO BE DELETED
*  DELETE "CURRENT" ROW AND
*            RESET CURRENCY TO ITS PRIOR IN SET
*
     MOVE SCAN-LEVEL TO I.
     FIND STRUCTURE DB-KEY SCAN-STACK-STRDBKEY (I)
     IF ERROR-STATUS NOT = '0000'
        PERFORM INVDELSEQ-ERROR
        GO TO DELETE-ROW-X
     MOVE 'ACCEPT PRIO' TO DB-VERB.
     IF SCAN-TYPE = 3
        ACCEPT SCAN-STACK-STRDBKEY (I) FROM
                           REPORTS-TO PRIOR CURRENCY
     ELSE
        ACCEPT SCAN-STACK-STRDBKEY (I) FROM
                           MANAGES PRIOR CURRENCY.
     IF ERROR-STATUS = '0000'
        MOVE 'ERASE' TO DB-VERB
        ERASE STRUCTURE.
     IF ERROR-STATUS NOT = '0000'
        PERFORM DB-ERROR.
 DELETE-ROW-X.
     EXIT.
 INSERT-ROW SECTION.
*
*  MAKE SURE RUNUNIT IS BOUND BEFORE STORING ROW
*
     PERFORM RU-BIND.
     IF SQLSTATE NOT = '00000'
        GO TO INSERT-ROW-X.
     PERFORM VALIDATE-INPUT.
     IF SQLSTATE NOT = '00000'
        GO TO INSERT-ROW-X.
     MOVE 'FIND DBKEY' TO DB-VERB.
     FIND DB-KEY WK-NEW-MGR-DBKEY.
     IF ERROR-STATUS = '0000'
        MOVE WK-NEW-DATE TO STRUCTURE-DATE-0460
        MOVE STRUCTURE-CODE TO STRUCTURE-CODE-0460
        MOVE 'STORE' TO DB-VERB
        STORE STRUCTURE.
     IF ERROR-STATUS = '0000'
```

```
        MOVE 'FIND DBKEY' TO DB-VERB
        FIND DB-KEY WK-NEW-EMP-DBKEY
        IF ERROR-STATUS = '0000'
           MOVE 'CONNECT' TO DB-VERB
           CONNECT STRUCTURE TO REPORTS-TO.
     IF ERROR-STATUS NOT = '0000'
        PERFORM DB-ERROR.
 INSERT-ROW-X.
     EXIT.
 OPEN-SCAN SECTION.
*
*  DETERMINE TYPE OF SCAN TO DO.  CHOICES:
*     1) BOM EXPLOSION BASED ON TOP KEY
*     2) DIRECT EMPLOYEES OF A GIVEN MANAGER
*     3) DIRECT MANAGERS OF A GIVEN EMPLOYEE
*     4) AREA SWEEP OF ALL MANAGERS
*
     MOVE 1 TO SCAN-MAX-LEVEL.
     IF MGR-ID-I = 0
        MOVE MGR-ID TO SCAN-TOP-KEY
        MOVE 2 TO SCAN-TYPE
     ELSE IF EMP-ID-I = 0
        MOVE EMP-ID TO SCAN-TOP-KEY
        MOVE 3 TO SCAN-TYPE
     ELSE IF TOP-KEY-I = 0
        MOVE TOP-KEY TO SCAN-TOP-KEY
        MOVE 1 TO SCAN-TYPE
        MOVE 50 TO SCAN-MAX-LEVEL
     ELSE
        MOVE 4 TO SCAN-TYPE.
     MOVE -1 TO SCAN-LEVEL.
     PERFORM RU-BIND.
 OPEN-SCAN-X.
     EXIT.
 NEXT-ROW SECTION.
*
*  THE FIRST TIME THRU, SCAN-LEVEL = -1
*      WE MUST POSITION OURSELVES ON THE APPROPRIATE EMPLOYEE
*  ON SUBSEQUENT ENTRY, SCAN-LEVEL >= 0
*
     MOVE '0' TO ROW-FOUND-FLAG.
     IF SCAN-LEVEL = -1
        MOVE 0 TO SCAN-LEVEL
        PERFORM POSITION-FIRST-TIME.
     IF SQLSTATE = '00000'
        PERFORM GET-FIRST-WORKER
        IF SQLSTATE = '02000'
        AND SCAN-TYPE = 4
           MOVE '00000' TO SQLSTATE
```

```
PERFORM PROCESS-NEXT-MGR UNTIL SQLSTATE NOT = '00000'
   OR ROW-FOUND.
```

```
*  FILL IN OUTPUT VALUES IF SUCCESSFULLY RETRIEVED ROW
*
     IF ROW-FOUND
        MOVE SCAN-LEVEL TO LEVEL-NO
        IF SCAN-TYPE = 3
           MOVE SCAN-MGR-KEY TO EMP-ID
           MOVE SCAN-MGR-NAME TO EMP-LNAME
           MOVE EMP-ID-0415 TO MGR-ID
           MOVE EMP-LAST-NAME-0415 TO MGR-LNAME
        ELSE
           MOVE SCAN-MGR-KEY TO MGR-ID
           MOVE SCAN-MGR-NAME TO MGR-LNAME
           MOVE EMP-ID-0415 TO EMP-ID
           MOVE EMP-LAST-NAME-0415 TO EMP-LNAME
        END-IF
        MOVE STRUCTURE-YEAR-0460  TO WK-YY
        MOVE STRUCTURE-MONTH-0460 TO WK-MM
        MOVE STRUCTURE-DAY-0460   TO WK-DD
        MOVE 5 TO IN01-REQUEST-CODE
        MOVE 2 TO IN01-DATE-FORMAT
        CALL 'IDMSIN01' USING IN01-RPB
                              IN01-REQUEST
                              IN01-DATE-FORMAT
                              WK-DATE-TIME
                              START-DATE
        MOVE STRUCTURE-CODE-0460  TO STRUCTURE-CODE
        MOVE 0 TO LEVEL-NO-I
        MOVE 0 TO MGR-ID-I
        MOVE 0 TO MGR-LNAME-I
        MOVE 0 TO EMP-ID-I
        MOVE 0 TO EMP-LNAME-I
        MOVE 0 TO START-DATE-I
        MOVE 0 TO STRUCTURE-CODE-I
        IF SCAN-TYPE = 1
           MOVE 0 TO TOP-KEY-I
           MOVE SCAN-TOP-KEY TO TOP-KEY
        ELSE
           MOVE -1 TO TOP-KEY-I.
 NEXT-ROW-X.
     EXIT.
 UPDATE-ROW SECTION.
*
*  UPDATE MUST HAVE BEEN PRECEDED BY A "NEXT ROW"
*    CALL RETRIEVING THE ROW TO BE UPDATED
*  UPDATE "CURRENT" ROW
*            IF CHANGING OWNERS (MANAGER OR EMPLOYEE)
*               ADJUST SET CONNECTIONS APPROPRIATELY
*
     PERFORM VALIDATE-INPUT.
```

```
    IF SQLSTATE NOT = '00000'
       GO TO UPDATE-ROW-X.
    MOVE SCAN-LEVEL TO I.
    OBTAIN STRUCTURE DB-KEY SCAN-STACK-STRDBKEY (I)
    IF ERROR-STATUS NOT = '0000'
       PERFORM INVUPDSEQ-ERROR
       GO TO UPDATE-ROW-X.
    MOVE 'ACCEPT OWNR' TO DB-VERB.
    ACCEPT WK-MGR-DBKEY FROM MANAGES OWNER CURRENCY.
    IF ERROR-STATUS = '0000'
       ACCEPT WK-EMP-DBKEY FROM REPORTS-TO OWNER CURRENCY.
    IF ERROR-STATUS = '0000'
    AND WK-MGR-DBKEY NOT = WK-NEW-MGR-DBKEY
       PERFORM SWITCH-MANAGERS.
    IF ERROR-STATUS = '0000'
    AND SQLSTATE = '00000'
    AND WK-EMP-DBKEY NOT = WK-NEW-EMP-DBKEY
       PERFORM SWITCH-EMPLOYEES.
    IF ERROR-STATUS = '0000'
    AND SQLSTATE = '00000'
    AND (STRUCTURE-CODE NOT = STRUCTURE-CODE-0460
     OR  WK-NEW-DATE NOT = STRUCTURE-DATE-0460)
       MOVE WK-NEW-DATE TO STRUCTURE-DATE-0460
       MOVE STRUCTURE-CODE TO STRUCTURE-CODE-0460
       MOVE 'MODIFY' TO DB-VERB
       MODIFY STRUCTURE.
    IF ERROR-STATUS NOT = '0000'
    AND SQLSTATE = '00000'
       PERFORM DB-ERROR.
UPDATE-ROW-X.
    EXIT.
```

```
***************************************************************
****        SUBROUTINES                                    ****
***************************************************************

 CHECK-CYCLE SECTION.
*
*  COMPARE CURRENT EMPLOYEE DBKEY WITH DBKEYS FROM
*  ALL PRIOR LEVELS.  IF A MATCH IS FOUND, THEN WE
*  HAVE A CYCLE.
*  ON EXIT I = 0, IF NO CYCLE DETECTED
*          I > 0, IF A CYCLE EXISTS
*
     IF SCAN-LEVEL > 0
        IF DBKEY = SCAN-TOP-DBKEY
           MOVE 99 TO I
        ELSE
           SUBTRACT 1 FROM SCAN-LEVEL GIVING I
           IF I > 0
              PERFORM DECR-I UNTIL I = 0
                   OR SCAN-STACK-EMPDBKEY (I) = DBKEY
           END-IF
        END-IF
     ELSE
        MOVE 0 TO I.

 DECR-I SECTION.
     SUBTRACT 1 FROM I.
 GET-FIRST-WORKER SECTION.
*
*  WE ARE POSITIONED ON A WORKER WHO MAY OR MAY NOT ALSO
*  BE A MANAGER.  IF THEY ARE A MANAGER, THEN WE MUST
*  RETURN THEIR FIRST WORKER AS A ROW AND ALSO PUSH
*  THEM ONTO THE STACK.  BEFORE PUTTING THEM ON THE
*  STACK, WE MUST CHECK FOR A CYCLE.  IF ONE EXISTS,
*  THEN WE WILL TREAT IT AS IF IT WEREN'T A MANAGER.
*
     MOVE 'OBTAIN DBKEY' TO DB-VERB.
     OBTAIN EMPLOYEE DB-KEY SCAN-MGR-DBKEY.
     IF ERROR-STATUS = '0000'
        PERFORM CHECK-CYCLE.
     IF ERROR-STATUS = '0000'
     AND I = 0
        MOVE 'OBTAIN FIRST' TO DB-VERB
        IF SCAN-TYPE = 3
           OBTAIN FIRST STRUCTURE WITHIN REPORTS-TO
        ELSE
           OBTAIN FIRST STRUCTURE WITHIN MANAGES.
```

```
          IF ERROR-STATUS = '0000'
          AND SCAN-LEVEL < SCAN-MAX-LEVEL
          AND I = 0
             PERFORM PUSH-STACK
             PERFORM GET-WORKER-INFO
          ELSE
             IF I = 0
             AND ERROR-STATUS NOT = '0307'
             AND ERROR-STATUS NOT = '0000'
                PERFORM DB-ERROR
             ELSE
                PERFORM GET-NEXT-ROW UNTIL SQLSTATE NOT = '00000'
                   OR  ROW-FOUND.
      GET-NEXT-ROW SECTION.
     *
     *  IF THE STACK IS EMPTY, WE'VE PROCESSED ALL THE ROWS
     *  OTHERWISE REPOSITION ON THE RECORD WHOSE DBKEY IS AT THE
     *  TOP OF THE STACK AND OBTAIN THE NEXT IN SET.
     *  IF END-OF-SET IS ENCOUNTERED,
     *  WE'VE PROCESSED ALL THE WORKERS AT THIS
     *  LEVEL AND WE MUST MOVE UP A LEVEL TO CONTINUE
     *
          IF SCAN-LEVEL = 0
             MOVE '02000' TO SQLSTATE
          ELSE
             MOVE 'FIND DBKEY' TO DB-VERB
             MOVE SCAN-LEVEL TO I
             FIND DB-KEY SCAN-STACK-STRDBKEY (I)
             IF ERROR-STATUS = '0000'
                MOVE 'OBTAIN NEXT' TO DB-VERB
                IF SCAN-TYPE = 3
                   OBTAIN NEXT STRUCTURE WITHIN REPORTS-TO
                ELSE
                   OBTAIN NEXT STRUCTURE WITHIN MANAGES
                END-IF
             END-IF
             IF ERROR-STATUS = '0000'
                PERFORM GET-WORKER-INFO
             ELSE IF ERROR-STATUS = '0307'
                PERFORM POP-STACK
             ELSE
                PERFORM DB-ERROR.
      GET-WORKER-INFO SECTION.
     *
     *  SAVE THE CURRENT DBKEY ON THE STACK
     *  RETRIEVE THE NAME OF THE CURRENT WORKER
     *
          MOVE SCAN-LEVEL TO I.
          MOVE DBKEY TO SCAN-STACK-STRDBKEY (I).
          MOVE 'OBTAIN OWNER' TO DB-VERB.
          IF SCAN-TYPE = 3
             OBTAIN OWNER WITHIN MANAGES
          ELSE
             OBTAIN OWNER WITHIN REPORTS-TO.
          IF ERROR-STATUS = '0000'
             MOVE DBKEY TO SCAN-MGR-DBKEY
             MOVE DBKEY TO SCAN-STACK-EMPDBKEY (I)
             MOVE '1' TO ROW-FOUND-FLAG
          ELSE
             PERFORM DB-ERROR.
      POP-STACK SECTION.
     *
     *  WHEN WE POP THE STACK, WE ARE CHANGING MANAGERS ALSO
     *
          SUBTRACT 1 FROM SCAN-LEVEL.
          IF SCAN-LEVEL > 0
             MOVE 'OBTAIN DBKEY' TO DB-VERB
             MOVE SCAN-LEVEL TO I
             FIND DB-KEY SCAN-STACK-STRDBKEY (I)
             IF ERROR-STATUS = '0000'
                MOVE 'OBTAIN OWNER' TO DB-VERB
                IF SCAN-TYPE = 3
                    OBTAIN OWNER WITHIN REPORTS-TO
                ELSE
                    OBTAIN OWNER WITHIN MANAGES
                END-IF
             END-IF
             IF ERROR-STATUS = '0000'
                MOVE EMP-ID-0415 TO SCAN-MGR-KEY
                MOVE EMP-LAST-NAME-0415 TO SCAN-MGR-NAME
             ELSE
                PERFORM DB-ERROR.
      POSITION-FIRST-TIME SECTION.
     *
     *  ON FIRST "NEXT-ROW" REQUEST AFTER OPEN, POSITION
     *     ON FIRST EMPLOYEE FOR SCAN
     *
          IF SCAN-TYPE = 1
          OR SCAN-TYPE = 2
          OR SCAN-TYPE = 3
             MOVE SCAN-TOP-KEY TO EMP-ID-0415
             OBTAIN CALC EMPLOYEE
          ELSE
             OBTAIN FIRST EMPLOYEE WITHIN EMP-DEMO-REGION
             IF ERROR-STATUS = '0000'
                MOVE EMP-ID-0415 TO SCAN-TOP-KEY.
          IF ERROR-STATUS = '0000'
             MOVE DBKEY TO SCAN-MGR-DBKEY
```

```
            MOVE DBKEY TO SCAN-TOP-DBKEY
         ELSE
            MOVE '02000' TO SQLSTATE.
     PROCESS-NEXT-MGR    SECTION.
    *
    *  CONTINUE WITH AREA SWEEP ON MANAGERS...
    *  FIND NEXT EMPLOYEE IN AREA AND RETURN ALL THEIR
    *  DIRECT EMPLOYEES.
    *  ON EXIT, SQLSTATE = '02000' IF LAST EMPLOYEE PROCESSED
    *                      '00000' IF MORE EMPLOYEES TO PROCESS
    *                      '38XXX' IF ERROR
    *
         FIND EMPLOYEE DB-KEY SCAN-TOP-DBKEY.
         IF ERROR-STATUS = '0000'
            OBTAIN NEXT EMPLOYEE WITHIN EMP-DEMO-REGION.
         IF ERROR-STATUS = '0000'
            MOVE EMP-ID-0415 TO SCAN-TOP-KEY
            MOVE DBKEY TO SCAN-MGR-DBKEY
            MOVE DBKEY TO SCAN-TOP-DBKEY
            PERFORM GET-FIRST-WORKER
            IF SQLSTATE = '02000'
               MOVE '00000' TO SQLSTATE
            END-IF
         ELSE
            MOVE '02000' TO SQLSTATE.
     PUSH-STACK SECTION.
    *
    *  WHEN WE PUSH THE STACK, WE ALSO HAVE A NEW MANAGER
    *
         MOVE EMP-ID-0415 TO SCAN-MGR-KEY
         MOVE EMP-LAST-NAME-0415 TO SCAN-MGR-NAME
         ADD 1 TO SCAN-LEVEL.


     RU-BIND SECTION.
    *
    *  BIND RUNUNIT AND READY AREA...
    *      IF RUNUNIT ALREADY BOUND, IGNORE.  IT JUST MEANS
    *      ANOTHER SCAN HAD CAUSED IT TO BE BOUND PREVIOUSLY.
    *
         IF RUN-UNIT-BOUND
            GO TO RU-BINDX.
         MOVE 'BIND RUNUNIT' TO DB-VERB
         BIND RUN-UNIT DBNAME 'EMPDEMO '.
         IF ERROR-STATUS = '0000'
            MOVE '1' TO RUN-UNIT-FLAG
            BIND EMPLOYEE
            BIND STRUCTURE
            MOVE 'READY AREA' TO DB-VERB
```

```
          READY EMP-DEMO-REGION USAGE-MODE UPDATE
       ELSE
          IF ERROR-STATUS = '1477'
          OR ERROR-STATUS = '0077'
             MOVE '0000' TO ERROR-STATUS.
       IF ERROR-STATUS NOT = '0000'
          PERFORM DB-ERROR.
   RU-BINDX. EXIT.

   SWITCH-EMPLOYEES SECTION.
       IF SCAN-TYPE = 3
          MOVE 'ACCEPT PRIO' TO DB-VERB
          ACCEPT SCAN-STACK-STRDBKEY (I) FROM
                          REPORTS-TO PRIOR CURRENCY.
       MOVE DBKEY TO WK-STRUCT-DBKEY.
       IF ERROR-STATUS = '0000'
          MOVE 'DISCONNECT' TO DB-VERB
          DISCONNECT STRUCTURE FROM REPORTS-TO.
       IF ERROR-STATUS = '0000'
          FIND DB-KEY WK-NEW-EMP-DBKEY
          FIND DB-KEY WK-STRUCT-DBKEY
          MOVE 'CONNECT' TO DB-VERB
          CONNECT STRUCTURE TO REPORTS-TO.
       IF ERROR-STATUS NOT = '0000'
          PERFORM DB-ERROR.

   SWITCH-MANAGERS SECTION.
       MOVE 'ACCEPT PRIO' TO DB-VERB
       ACCEPT WK-PRIOR-DBKEY FROM
                          REPORTS-TO PRIOR CURRENCY.
       IF SCAN-TYPE NOT = 3
       AND ERROR-STATUS = '0000'
          ACCEPT SCAN-STACK-STRDBKEY (I) FROM
                          MANAGES PRIOR CURRENCY.
       IF ERROR-STATUS = '0000'
          MOVE 'ERASE' TO DB-VERB
          ERASE STRUCTURE.
       IF ERROR-STATUS = '0000'
          FIND DB-KEY WK-NEW-MGR-DBKEY
          MOVE 'STORE' TO DB-VERB
          STORE STRUCTURE
          MOVE DBKEY TO WK-STRUCT-DBKEY.
       IF ERROR-STATUS = '0000'
          FIND DB-KEY WK-PRIOR-DBKEY
          FIND DB-KEY WK-STRUCT-DBKEY
          MOVE 'CONNECT' TO DB-VERB
          CONNECT STRUCTURE TO REPORTS-TO.
       IF ERROR-STATUS NOT = '0000'
          PERFORM DB-ERROR.
```

```
 VALIDATE-INPUT SECTION.
*  VALIDATE EMPLOYEE-ID
     IF EMP-ID-I = 0
        MOVE EMP-ID TO EMP-ID-0415
        OBTAIN CALC EMPLOYEE.
     IF ERROR-STATUS = '0326'
     OR EMP-ID-I NOT = 0
        PERFORM EMPID-ERROR
        GO TO VALIDATE-X.
     IF ERROR-STATUS NOT = '0000'
        MOVE 'OBTAIN CALC' TO DB-VERB
        PERFORM DB-ERROR
        GO TO VALIDATE-X.
     MOVE DBKEY TO WK-NEW-EMP-DBKEY.
*  VALIDATE MANAGER-ID
     IF MGR-ID-I = 0
        MOVE MGR-ID TO EMP-ID-0415
        OBTAIN CALC EMPLOYEE.
     IF ERROR-STATUS = '0326'
     OR MGR-ID-I NOT = 0
        PERFORM MGRID-ERROR
        GO TO VALIDATE-X.
     IF ERROR-STATUS NOT = '0000'
        MOVE 'OBTAIN CALC' TO DB-VERB
        PERFORM DB-ERROR
        GO TO VALIDATE-X.
     MOVE DBKEY TO WK-NEW-MGR-DBKEY.
*  VALIDATE STRUCTURE-CODE & DATE
     MOVE STRUCTURE-CODE TO STRUCTURE-CODE-0460.
     IF (ADMIN-0460
     OR PROJECT-0460)
     AND STRUCTURE-CODE-I = 0
        NEXT SENTENCE
     ELSE
        PERFORM STRUCTCD-ERROR.
     IF START-DATE-I = 0
        MOVE 5 TO IN01-REQUEST-CODE
        MOVE 0 TO IN01-DATE-FORMAT
        CALL 'IDMSIN01' USING IN01-RPB
                              IN01-REQUEST
                              IN01-DATE-FORMAT
                              START-DATE
                              WK-DATE-TIME
        MOVE WK-YY TO WK-NEW-YY
        MOVE WK-DD TO WK-NEW-DD
        MOVE WK-MM TO WK-NEW-MM
     ELSE
        ACCEPT WK-NEW-DATE FROM DATE.
 VALIDATE-X.
```

```
     EXIT.
****************************************************************
****        ERROR ROUTINES                                  ****
****************************************************************
 DB-ERROR SECTION.
     MOVE '38001' TO SQLSTATE.
     MOVE ERROR-STATUS TO DB-STAT.
     MOVE DB-MSG TO MESSAGE-TEXT.


 INVDELSEQ-ERROR SECTION.
     MOVE '38006' TO SQLSTATE.
     MOVE PROCEDURE-NAME TO DEL-PROC.
     MOVE INVDELSEQ-MSG TO MESSAGE-TEXT.


 INVUPDSEQ-ERROR SECTION.
     MOVE '38007' TO SQLSTATE.
     MOVE PROCEDURE-NAME TO UPD-PROC.
     MOVE INVUPDSEQ-MSG TO MESSAGE-TEXT.


 EMPID-ERROR SECTION.
     MOVE '38008' TO SQLSTATE.
     MOVE EMPID-MSG TO MESSAGE-TEXT.


 MGRID-ERROR SECTION.
     MOVE '38009' TO SQLSTATE.
     MOVE MGRID-MSG TO MESSAGE-TEXT.


 STRUCTCD-ERROR SECTION.
     MOVE '38010' TO SQLSTATE.
     MOVE STRUCTCD-MSG TO MESSAGE-TEXT.
```

Appendix H: DISPLAY and PUNCH Syntax

DISPLAY and PUNCH Syntax

The following entity type options can be specified:

- ACCESS MODULE
- CALC KEY
- CONSTRAINT
- FUNCTION
- INDEX
- KEY
- PROCEDURE
- SCHEMA
- TABLE
- TABLE PROCEDURE
- VIEW

DISPLAY/PUNCH ALL syntax for SQL DDL entities is presented first, followed by DISPLAY/PUNCH statements for each entity type.

DISPLAY and PUNCH Operations

The DISPLAY and PUNCH operations produce as output the SQL statements that describe the named entity. DISPLAY and PUNCH operations do not update the entity description. You can choose to display or punch all the entity occurrences defined within an entity or only specific entity occurrences.

The location of the output depends on which verb is used and whether you are using the online or batch command facility:

- **DISPLAY** displays online output at the terminal and lists batch output in the command facility's activity listing.
- **PUNCH** writes the output to the system punch file. All punched output is also listed in the command facility's activity listing.

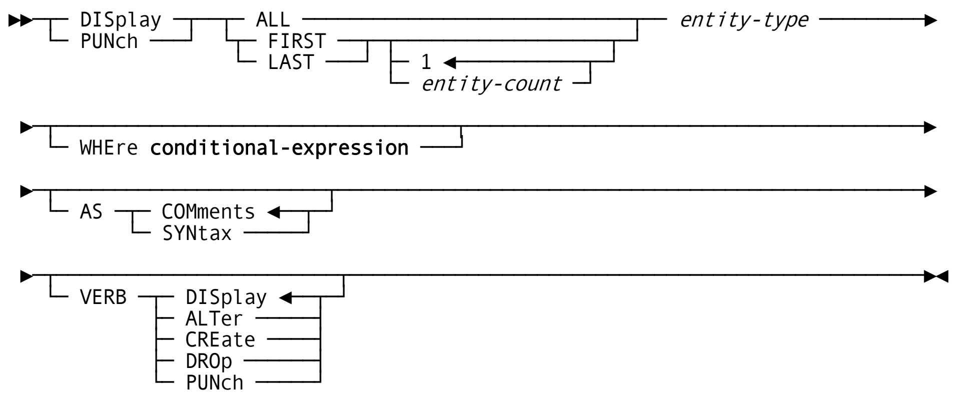
Benefit

With the DISPLAY and PUNCH support for SQL DDL entities, you can easily display or punch entity definitions and change them, or migrate their definitions from one environment to another. For example, you can migrate definitions from one schema to another in the same catalog, and from one catalog to another in the same or different Central Version.

DISPLAY/PUNCH ALL Statement

The DISPLAY/PUNCH ALL statement displays all occurrences of an entity type. The basic syntax for each entity type is the same. The entity-option keywords vary by entity type and are presented in a table in "Usage" later in this section.

Syntax



Expansion of conditional-expression

```
►►─┬─ mask-comparison ────────────────────────┬──────────────────────────────►
   ├─ value-comparison ───────────────────────┤
   └─┬───────┬─ ( ─┬─ mask-comparison ──┬─ ) ─┘
     └─ NOT ─┘     └─ value-comparison ─┘

 ►─┬──────────────────────────────────────────────────────────────────────┬──►◄
   │ ┌────────────────────────────────────────────────────────────────────┐│
   └─▼─┬─ AND ─┬─┬─ mask-comparison ───────────────────────────────────┬──┘┘
       └─ OR ──┘ ├─ value-comparison ──────────────────────────────────┤
                 └─┬───────┬─ ( ─┬─ mask-comparison ──┬─ ) ────────────┘
                   └─ NOT ─┘     └─ value-comparison ─┘
```

Expansion of mask-comparison

```
►►─── entity-option-keyword ─────────────────────────────────────────────►

 ►─┬─ CONTAINs ─┬─ 'mask-value' ───────────────────────────────────────►◄
   └─ MATCHES ──┘
```

Expansion of value-comparison

```
►►─┬─ 'character-string-literal' ─┬───────────────────────────────────────►
   ├─ numeric-literal ────────────┤
   └─ entity-option-keyword ──────┘

 ►─┬─ IS ──┬───────┬──────────────────┬─┬─ 'character-string-literal' ─┬──►◄
   │       └─ NOT ─┘                  │ ├─ numeric-literal ────────────┤
   ├─ NE ─────────────────────────────┤ └─ entity-option-keyword ──────┘
   └─┬───────┬─┬─┬─ EQ ─┬─┬───────────┘
     └─ NOT ─┘ │ └─ = ──┘ │
               ├─┬─ GT ─┬─┤
               │ └─ > ──┘ │
               ├─┬─ LT ─┬─┤
               │ └─ < ──┘ │
               ├─ GE ─────┤
               └─ LE ─────┘
```

Parameters

ALL

Lists all occurrences of the requested entity type that the current user is authorized to display.

Note: For online users: with many entity occurrences, ALL may slow response time.

FIRst

Lists the first occurrence of the named entity type.

LASt

Lists the last occurrence of the named entity type.

entity-count

Specifies the number of occurrences of the named entity type to list. 1 is the default.

entity-type

Identifies the entity type that is the object of the DISPLAY/PUNCH ALL request. Valid values appear in the table under "Usage" in this section.

WHEre conditional-expression

Specifies criteria to be used in selecting occurrences of the requested entity type.

The outcome of a test for the condition determines which occurrences of the named entity type are selected for display.

mask-comparison

Compares an entity type operand with a mask value.

entity-option-keyword

Identifies the left operand as a syntax option associated with the named entity type. The table under "Usage" in this section, lists valid options for each entity type.

CONTAINs

Searches the left operand for an occurrence of the right operand. The length of the right operand must be less than or equal to the length of the left operand. If the right operand is not contained entirely in the left operand, the outcome of the condition is false.

MATCHES

Compares the left operand with the right operand one character at a time, beginning with the leftmost character in each operand. When a character in the left operand does not match a character in the right operand, the outcome of the condition is false.

'*mask-value*'

Identifies the right operand as a character string; the specified value must be enclosed in quotation marks. *Mask-value* can contain the following special characters:

@	Matches any alphabetic character in *entity-option-keyword*.
#	Matches any numeric character in *entity-option-keyword*.
*	Matches any character in *entity-option-keyword*.

value-comparison

Compares values contained in the left and right operands based on the specified comparison operator.

'*character-string-literal*'

Identifies a character string enclosed in quotes.

numeric-literal

Identifies a numeric value.

entity-option-keyword

Identifies a syntax option associated with the named entity type; valid options for each entity type are listed in the table presented under "Usage" in this section.

IS

Specifies that the left operand must equal the right operand for the condition to be true.

NE

Specifies that the left operand must *not* equal the right operand for the condition to be true.

EQ/=

Specifies that the left operand must equal the right operand for the condition to be true.

GT/>

Specifies that the left operand must be greater than the right operand for the condition to be true.

LT/<

Specifies that the left operand must be less than the right operand for the condition to be true.

GE

Specifies that the left operand must be greater than or equal to the right operand for the condition to be true.

LE

Specifies that the left operand must be less than or equal to the right operand for the condition to be true.

NOT

Specifies that the opposite of the condition fulfills the test requirements. If NOT is specified, the condition must be enclosed in parentheses.

AND

Indicates the expression is true only if the outcome of both test conditions is true.

OR

Indicates the expression is true if the outcome of either one or both test conditions is true.

AS COMments

Outputs access module syntax as comments with the characters *+ preceding the text of the statement. AS COMMENTS is the default.

AS SYNtax

Outputs access module syntax which can be edited and resubmitted to the command facility.

VERB DISplay/ALTer/CREate/DROp/PUNch

Specifies the verb with which the entity statement is to be displayed or punched. For example, if VERB CREATE is specified, the output of the DISPLAY/PUNCH statement is a CREATE statement; if VERB ALTER is specified, the output is an ALTER statement; and so on. The default is VERB DISPLAY.

Usage

Output Contains only enough Information to DISPLAY/PUNCH Entity

Output produced by DISPLAY or PUNCH ALL consists only of the information necessary to execute a DISPLAY/PUNCH request for each entity occurrence.

Valid Entity Option Keywords for Conditional Expressions

The following table lists entity type options that you can specify in a conditional expression.

Entity type	Entity-option keyword	Selects based on
All entity types	entity-type NAMe	Unqualified name &sub1.
	entity-type	Unqualified name &sub1.
	FULl entity-type NAMe	Qualified name &sub1.
	DATe CREated	Date (MM/DD/YY) occurrence created
	MONth CREated	Month occurrence created
	DAY CREated	Day occurrence created
	YEAr CREated	Year occurrence created
	DATe last UPDated	Date (MM/DD/YY) occurrence last updated**
	MONth last UPDated	Month occurrence last updated**
	DAY last UPDated	Day occurrence last updated**
	YEAr last UPDated	Year occurrence last updated**
	CREated by	User who created occurrence**
	PREpared by	User who created occurrence**
	REVised by	User who last updated occurrence**
	LASt UPDated by	User who last updated occurrence**

Entity type	Entity-option keyword	Selects based on
ACCESS MODULE	AM name	Unqualified access module name &sub1.
	SCHema name	Name of access module's schema
	Version	Version number
	FULl TABle NAMe	Qualified name of a table referenced by the access module
	TABle SCHema name	Schema name of a table referenced by the access module
	TABle name	Unqualified name of a table referenced by the access module
	DATe COMpiled	Date (MM/DD/YY) access module compiled
	COMpiled	Date (MM/DD/YY) access module compiled
	MONth COMpiled	Month access module compiled
	DAY COMpiled	Day access module compiled
	YEAr COMpiled	Year access module compiled
CALC KEY	SCHema name	Schema name of the table containing the CALC key
	TABle name	Unqualified name of table containing the CALC key

Entity type	Entity-option keyword	Selects based on
CONSTRAINT	SCHema name	Schema name of the constraint
	REFERENCEd FULl TABle NAMe	Qualified name of the referenced table
	REFERENCEd table SCHema name	Schema name of the referenced table
	REFERENCEd TABle name	Unqualified name of the referenced table
	REFERENCIng FULl TABle NAMe	Qualified name of the referencing table
	REFERENCIng table SCHema name	Schema name of the referencing table
	REFERENCIng TABle name	Unqualified name of the referencing table
FUNCTION	SCHema name	Schema name of the function
	EXTernal NAMe	Name of the program or dialog to process the function
INDEX	SCHema name	Schema name of the indexed table
	TABle name	Unqualified name of the indexed table
	FULl AREa NAMe	Qualified name of the area containing the index
	SEGment name	Segment name of the area containing the index
	AREa name	Unqualified name of the area containing the index

Entity type	**Entity-option keyword**	**Selects based on**
KEY	SCHema name	Schema name of the keyed table procedure
	TABle PROcedure name	Unqualified name of the keyed table procedure
	FULl TABle PROcedure NAMe	Qualified name of the keyed table procedure
PROCEDURE	SCHema name	Schema name of the procedure
	EXTernal NAMe	Name of the program or dialog called to process the procedure
SCHEMA	TYPe	Type of Schema (NONSQL or SQL)
	full DICtname	NonSQL Schema Dictionary name
	DBName	NonSQL Schema DBName
	NODe name	NonSQL Schema Node Name
	NODename	NonSQL Schema Node Name
	NONsql SCHema	Name of the NonSQL Schema
	nonsql schema Version	Version of the NonSQL Schema
	DEFault FULl AREA NAMe	Qualified area name of the Schema's default area
	default SEGment name	Segment name of Schema's default area
	default AREa name	Unqualified area name of the Schema's default area

Entity type	Entity-option keyword	Selects based on
TABLE	SCHema name	Schema name of the table
	FULl AREA NAMe	Qualified area name containing the table
	SEGment name	Segment name of the area containing the table
	AREa name	Unqualified name of the area containing the table
TABLE PROCEDURE	SCHema name	Schema name of the table procedure
	EXTernal NAMe	Name of the program called to process the table procedure
VIEW	SCHema name	Schema name of the View
	REFerenced FULl TABle NAMe	Qualified name of a table referenced by the View
	REFerenced table SCHema NAMe	Schema name of a table(s) referenced by the View
	REFerenced TABle name	Unqualified name of a table referenced by the View :tnote. Note: Unqualified name selections are based on the primary name of the entity occurrence only. To select based on the fully qualified occurrence name, token FULL NAME must be specified. SQL components with qualified names are specified in the table below. **You can specify this keyword option only when using SCHEMA, TABLE, FUNCTION, PROCEDURE, TABLE PROCEDURE, and VIEW entities. :etnote.

Fully Qualified Names of SQL Components

The fully qualified names of SQL components are listed in the following table:

Resource	**Fully qualified name**
ACCESS MODULE	*schema-name.access-module-name*
FUNCTION	*schema-name.function-name*
PROCEDURE	*schema-name.procedure-name*
TABLE	*schema-name.table-name*
TABLE PROCEDURE	*schema-name.table-procedure-name*
VIEW	*schema-name.view-name*

Date and Year 2000 Support in DISPLAY/PUNCH Statements

You can use date selection criteria as well as year 2000 support in DISPLAY ALL statements to display SQL entities.

You implement date selection criteria in these WHERE clause options:

- DATE CREATED
- DATE LAST UPDATED

You can specify the date as a *value-comparison* string in the form 'MM/DD/YY' in the right-hand side of the conditional expression. CA IDMS extracts it in CCMMDDYY form to accurately determine the relationship of dates. The following DISPLAY ALL statement example establishes a search criteria to identify the schemas whose DATE CREATED values are greater than the specified string.

```
DISPLAY ALL SCHEMAS WHERE DATE CREATED > '01/01/96';
```

The DISPLAY ALL process determines that the date '01/01/96' is greater than the date '12/31/95'.

Alternatively, you may specify the *value-comparison* string on either side of the conditional expression in the form 'CCYYMMDD' to achieve the same results.

You can also substitute day, month, or year for each of these WHERE clause options. For example, this DISPLAY ALL statement specifies a search condition that is based on month and year:

```
DISPLAY ALL VIEWS
   WHERE MONTH CREATED = '01'
   AND YEAR CREATED > '95';
```

Default Order of Precedence Applied to Logical Operators

Conditional expressions can contain a single condition, or two or more conditions combined with the logical operators AND or OR. The logical operator NOT specifies the opposite of the condition. The command facility evaluates operators in a conditional expression 1 at a time, from left to right, in order of precedence. The default order of precedence is as follows:

- MATCHES or CONTAINS keywords
- EQ, NE, GT, LT, GE, LE operators
- NOT
- AND
- OR

If parentheses are used to override the default order of precedence, the command facility evaluates the expression within the innermost parentheses first.

Example

The following example displays all ACCESS MODULES compiled since June 1, 1995:

```
DISPLAY ALL ACCESS MODULES
  WHERE DATE CREATED GT '06/01/95'
  AS SYNTAX.
```

DISPLAY/PUNCH ACCESS MODULE

The ACCESS MODULE, DISPLAY/PUNCH statement displays or punches an access module.

Authorization

To issue a DISPLAY/PUNCH ACCESS MODULE statement, you must have the DISPLAY privilege on the requested access module.

Syntax

```
►►─┬─ DISplay ─┬─┬─ ACCess MODule is ─┬─┬────────────────┬─ access-module-name ─►
   └─ PUNch ───┘ └─ AM ───────────────┘ └─ schema-name. ─┘

 ►─┬─────────────────────────────────────────────────────────────────────────►
   └─ Version ──┬─ 1 ◄──────────────┬─┘
                ├─ version-number ──┤
                ├─ HIGhest ─────────┤
                └─ LOWest ──────────┘

 ►─┬─────────────────────────────────────────────────────────────────────────►
   └──┬─ WITh ─────────┬──┬─ ALL ─────────────┬─ AS ─┬─ COMments ◄─┬─┘
      ├─ ALSo WITh ────┤  ├─ NONe ────────────┤      └─ SYNtax ────┘
      ├─ WITHOut ──────┤  ├─ DETails ─────────┤
      └─ ALSo WITHOut ─┘  ├─ HIStory ─────────┤
                          └─ TABles ──────────┘

 ►─┬────────────────────────────────────────────────────────────────────────►◄
   └─ VERb ──┬─ CREate ◄─┬─┘
             ├─ ALTer ───┤
             └─ DROp ────┘
```

Parameters

schema-name.

Specifies the schema for the access module. *Schema-name* must identify the schema associated with the version of the access module being modified. If ou do not specify *schema-name*, the value used by the command facility is the current schema for your SQL session.

access-module-name

Specifies the name of the access module to display or punch. *Access-module-name* must identify an access module defined and stored in the dictionary.

Version is *version-number*

Specifies the version number of the access module. *Version-number* is a unique integer in the range 1 through 9999. 1 is the default.

HIGhest

Specifies the highest version number associated with the access module.

LOWest

Specifies the lowest version number associated with the access module.

WITh

Lists the requested information, in addition to the information that is always included, such as the entity occurrence name.

WITHOut

Does *not* list the specified options. *Other* options in effect through the WITH or ALSO WITH clauses in the current DISPLAY statement are displayed.

ALSo WITh

Lists the requested information, in addition to the information requested in previously issued DISPLAY WITH and DISPLAY ALSO WITH statements for the named entity.

ALSo WITHOut

Does *not* list the specified options.

ALL

Specifies the display of all the information associated with the requested entity occurrence.

NONe

Specifies the display of the name of the requested entity occurrence. NONE is meaningful only when the WITH clause is specified.

DETails

Specifies the display of entity-specific descriptions.

HIStory

Specifies the display of the date the access module was compiled.

TABles

Specifies the display of all tables associated with the requested access module.

AS COMments

Outputs access module syntax as comments with the characters *+ preceding the text of the statement. AS COMMENTS is the default.

AS SYNtax

Outputs access module syntax which can be edited and resubmitted to the command facility.

VERB CREate/ALTer/DROp

Specifies the verb with which the entity statement is to be displayed or punched. For example, if VERB CREATE is specified, the output of the DISPLAY/PUNCH statement is a CREATE statement; if VERB ALTER is specified, the output is an ALTER statement; and so on. The default is VERB CREATE.

DISPLAY/PUNCH CALC KEY

The DISPLAY/PUNCH CALC KEY statement displays or punches a CALC key definition in the dictionary.

Authorization

To issue a DISPLAY/PUNCH CALC KEY statement, you must either own or have the ALTER privilege on the table on which the CALC key is defined.

Syntax

```
►►─┬─ DISplay ─┬── CALc key ON ─┬─────────────────┬─ table-name ──────────►
   └─ PUNch ───┘                └─ schema-name. ──┘

►─┬──────────────────────────────────────────────────────────────────────┬─►
  └───┬─ WITh ──────────┬──┬─ ALL ────────────────┬─ AS ─┬─ COMments ◄──┤
      ├─ WITHOut ───────┤  ├─ NONe ───────────────┤      └─ SYNtax ─────┘
      ├─ ALSo WITh ─────┤  ├─ DETails ────────────┤
      └─ ALSo WITHOut ──┘  └─ HIStory ────────────┘

►─┬───────────────────────────┬──────────────────────────────────────────►◄
  └─ VERb ──┬─ CREate ◄──────┤
            ├─ DISplay ─────┤
            ├─ DROp ────────┤
            └─ PUNch ───────┘
```

Parameters

schema-name.

Identifies the schema associated with the named table.

If you do not specify *schema-name*, it defaults to the current schema associated with your SQL session, if the statement is entered through the command facility or executed dynamically.

table-name

Specifies the name of the table on which the CALC key is defined. *Table-name* must be the name of a table defined in the dictionary.

WITh

Lists the requested information, in addition to the information that is always included, such as the entity occurrence name.

WITHOut

Does *not* list the specified options. *Other* options in effect through the WITH or ALSO WITH clauses in the current DISPLAY statement are displayed.

ALSo WITh

Lists the requested information, in addition to the information requested in previously issued DISPLAY WITH and DISPLAY ALSO WITH statements for the named entity.

ALSo WITHOut

Does *not* list the specified options.

ALL

Specifies the display of all the information associated with the CALC key.

NONe

Specifies the display of the name of the CALC key. NONE is meaningful only when the WITH clause is specified.

DETails

Specifies the display of CALC key-specific descriptions.

HIStory

Specifies the display of the date the CALC key was defined.

AS COMments

Outputs CALC key syntax as comments with the characters *+ preceding the text of the statement. AS COMMENTS is the default.

AS SYNtax

Outputs CALC key syntax which can be edited and resubmitted to the command facility.

VERB CREate/DISplay/DROp/PUNch

Specifies the verb with which the entity statement is to be displayed or punched. For example, if VERB CREATE is specified, the output of the DISPLAY/PUNCH statement is a CREATE statement; if VERB ALTER is specified, the output is an ALTER statement; and so on. The default is VERB CREATE.

DISPLAY/PUNCH CONSTRAINT

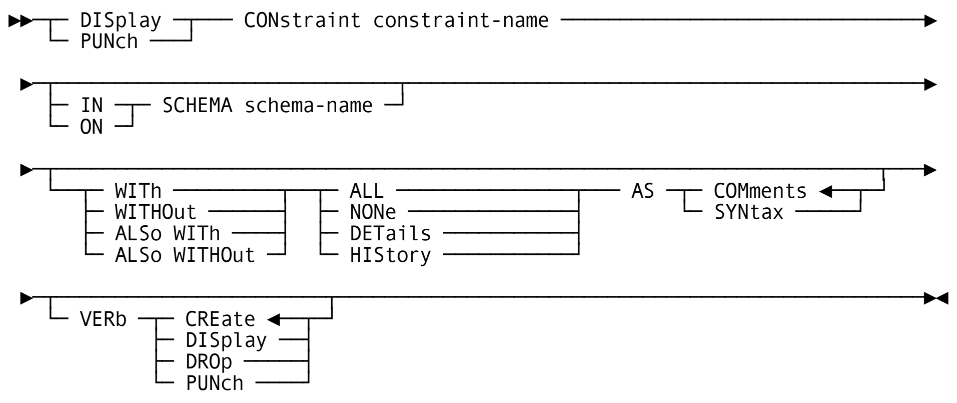
The DISPLAY/PUNCH CONSTRAINT statement displays or punches a referential constraint in the dictionary.

Authorization

To issue a DISPLAY/PUNCH CONSTRAINT statement, you must:

- Either hold the DISPLAY privilege on or own the referencing table in the constraint
- Hold the REFERENCES privilege on the referenced table in the constraint

Syntax



Parameters

constraint-name

Specifies the name of the referential constraint, within the current schema associated with your SQL session (if any), to display or punch.

IN SCHEMA *schema-name*

Specifies the name of the schema for the referential constraint if no schema is assigned with your SQL session.

WITh

Lists the requested information, in addition to the information that is always included, such as the entity occurrence name.

WITHOut

Does *not* list the specified options. *Other* options in effect through the WITH or ALSO WITH clauses in the current DISPLAY statement are displayed.

ALSo WITh

Lists the requested information, in addition to the information requested in previously issued DISPLAY WITH and DISPLAY ALSO WITH statements for the named entity.

ALSo WITHOut

Does *not* list the specified options.

ALL

Specifies the display of all the information associated with the requested entity occurrence.

NONe

Specifies the display of the name of the requested entity occurrence. NONE is meaningful only when the WITH clause is specified.

DETails

Specifies the display of constraint-specific descriptions.

HIStory

Specifies the display of the date the constraint was created.

AS COMments

Outputs constraint syntax as comments with the characters *+ preceding the text of the statement. AS COMMENTS is the default.

AS SYNtax

Outputs constraint syntax which can be edited and resubmitted to the command facility.

VERB CREate/DISplay/DROp/PUNch

Specifies the verb with which the entity statement is to be displayed or punched. For example, if VERB CREATE is specified, the output of the DISPLAY/PUNCH statement is a CREATE statement; if VERB ALTER is specified, the output is an ALTER statement; and so on. The default is VERB CREATE.

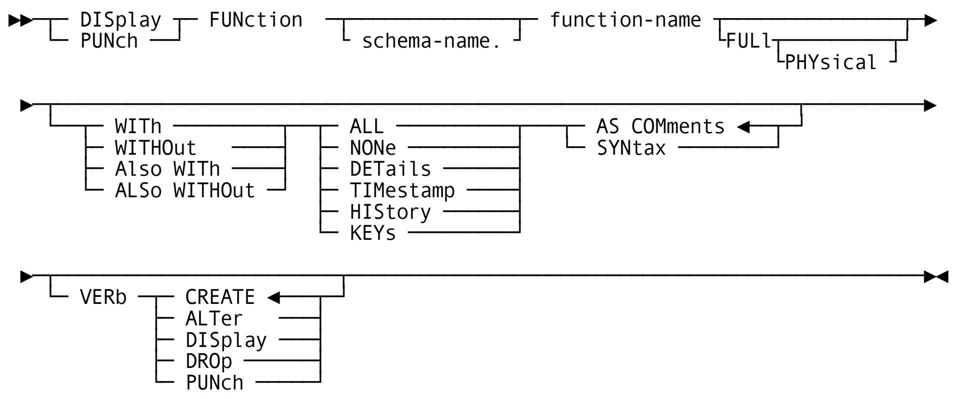
DISPLAY/PUNCH FUNCTION

The DISPLAY/PUNCH FUNCTION statement lets you display or punch a function.

Authorization

To issue a DISPLAY/PUNCH FUNCTION statement, you must hold the DISPLAY privilege for the named function.

Syntax



Parameters

schema-name.

Identifies the SQL schema associated with the named function.

If you do not specify *schema-name*, then it defaults to the current schema associated with your SQL session, if you enter the statement through the command facility or execute it dynamically.

function-name

Specifies the name of the function to display or punch. *function-name* must be the name of a function defined in the dictionary.

FULl

Directs CA IDMS to display all attributes of the function except physical attributes.

PHYsical

Directs CA IDMS to display all attributes of the function including its physical attributes. This includes the function's synchronization timestamp.

WITh

Lists the requested information, in addition to the information that is always included, such as the entity occurrence name.

WITHOut

Does *not* list the specified options. *Other* options in effect through the WITH or ALSO WITH clauses in the current DISPLAY statement display.

ALSo WITh

Lists the requested information, in addition to the information requested in previously issued DISPLAY WITH and DISPLAY ALSO WITH statements for the named entity.

ALSo WITHOut

Does *not* list the specified options.

ALL

Specifies the display of all the information associated with the requested entity occurrence.

NONe

Specifies the display of the name of the requested entity occurrence. NONE is meaningful only when you specify the WITH clause.

DETails

Specifies the display of entity-specific descriptions; for example, the length of a table.

TIMestamp

Specifies the display of the synchronization timestamp associated with the function.

HIStory

Specifies the display of the chronological account of an entity's existence, including PREPARED/REVISED BY specifications, date created, and date last updated.

KEYs

Specifies the display of all keys associated with the requested function.

AS COMments

Outputs procedure syntax as comments with the characters *+ preceding the text of the statement. AS COMMENTS is the default.

AS SYNtax

Outputs function syntax which you can edit and resubmit to the command facility.

VERB CREate/ALTer/DISplay/DROp/PUNch

Specifies the verb with which the entity statement is to be displayed or punched. For example, if VERB CREATE is specified, the output of the DISPLAY/PUNCH statement is a CREATE statement; if VERB ALTER is specified, the output is an ALTER statement; and so on. The default is VERB CREATE.

Example

```
DISPLAY FUNCTION FIN.UDF_FUNBONUS FULL PHYSICAL;
```

DISPLAY/PUNCH INDEX

The DISPLAY/PUNCH INDEX statement displays or punches an index from the dictionary.

Authorization

To issue a DISPLAY/PUNCH INDEX statement, you must either own or have the DISPLAY privilege on the table on which the index is defined.

Syntax

```
►►─┬─ DISplay ─┬── INDex index-name ── ON ─┬──────────────┬─ table-name ────────►
   └─ PUNch ───┘                            └schema-name.─┘

 ►─┬──────────────────────────────────────────────────────────────────────────┬──►
   └─── WITh ─────────────┬── ALL ─────────────────── AS ─┬COMments ◄─┬──┘
     ├─ ALSo WITh ───────┤  ├─ NONe ─────────────┤        └ SYNtax ───┘
     ├─ WITHOut ─────────┤  ├─ DETails ──────────┤
     └─ ALSo WITHOut ────┘  ├─ HIStory ──────────┤
                            └─ TABles ───────────┘

 ►─┬──────────────────────────────┬───────────────────────────────────────────────►
   └─ VERB ──┬─ CREate ◄─────┬─┘
             ├─ DISplay ─────┤
             ├─ DROp ────────┤
             └─ PUNch ───────┘

 ►─┬──────────────────────────────┬──────────────────────────────────────────────►◄
   └─ FULl ──┬─────────────────┬─┘
             └── PHYsical ─────┘
```

Parameters

index-name

Specifies the name of an index to display or punch. *Index-name* must be the name of an index in the dictionary.

ON *table-name*

Specifies the table on which the named index is defined.

schema-name.

Identifies the schema associated with the named table.

If you do not specify *schema-name*, it defaults to the current schema associated with your SQL session, if the statement is entered through the command facility or executed dynamically.

WITh

Lists the requested information, in addition to the information that is always included, such as the entity occurrence name.

WITHOut

Does *not* list the specified options. *Other* options in effect through the WITH or ALSO WITH clauses in the current DISPLAY statement are displayed.

ALSo WITh

Lists the requested information, in addition to the information requested in previously issued DISPLAY WITH and DISPLAY ALSO WITH statements for the named entity.

ALSo WITHOut

Does *not* list the specified options.

ALL

Specifies the display of all the information associated with the requested index.

NONe

Specifies the display of the name of the requested index. NONE is meaningful only when the WITH clause is specified.

DETails

Specifies the display of index-specific descriptions.

HIStory

Specifies the display of the date the index was created.

AS COMments

Outputs index syntax as comments with the characters *+ preceding the text of the statement. AS COMMENTS is the default.

AS SYNtax

Outputs index syntax which can be edited and resubmitted to the command facility.

VERB CREate/DISplay/DROp/PUNch

Specifies the verb with which the entity statement is to be displayed or punched. For example, if VERB CREATE is specified, the output of the DISPLAY/PUNCH statement is a CREATE statement; if VERB ALTER is specified, the output is an ALTER statement; and so on. The default is VERB CREATE.

FULl

Directs CA IDMS to display all attributes of the function except physical attributes.

PHYsical

Directs CA IDMS to display all attributes of the function including its physical attributes. This includes the function's synchronization timestamp.

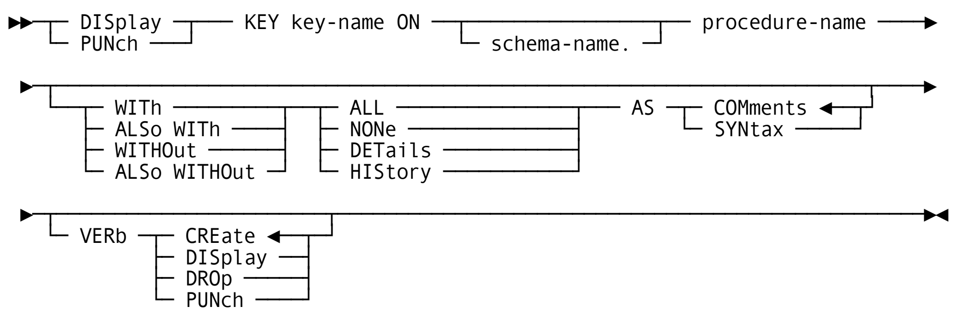
DISPLAY/PUNCH KEY

The DISPLAY/PUNCH KEY statement displays a table procedure key definition stored in the dictionary.

Authorization

To issue a DISPLAY KEY statement, you must either own or hold the ALTER privilege on the table procedure on which the key being displayed or punched is defined.

Syntax



Parameters

key-name

Specifies the name of a key on a table procedure.

schema-name.

Identifies the schema associated with the table procedure.

If you do not specify a *schema-name* it defaults to the current schema associated with your SQL session, if the statement is entered through the Command Facility or executed dynamically.

procedure-name

Specifies the name of the procedure or table procedure on which the key is defined. The *procedure-name* must identify a procedure or table procedure defined in the dictionary.

WITh

Lists the requested information, in addition to the information that is always included, such as the entity occurrence name.

WITHOut

Does *not* list the specified options. *Other* options in effect through the WITH or ALSO WITH clauses in the current DISPLAY statement are displayed.

ALSo WITh

Lists the requested information, in addition to the information requested in previously issued DISPLAY WITH and DISPLAY ALSO WITH statements for the key.

ALSo WITHOut

Does *not* list the specified options.

ALL

Specifies the display of all the information associated with the requested key.

NONe

Specifies the display of the name of the requested key. NONE is meaningful only when the WITH clause is specified.

DETails

Specifies the display of key-specific descriptions.

HIStory

Specifies the display of the date the key was created.

AS COMments

Outputs key syntax as comments with the characters *+ preceding the text of the statement. AS COMMENTS is the default.

AS SYNtax

Outputs key syntax which can be edited and resubmitted to the command facility.

VERB CREate/DISplay/DROp/PUNch

Specifies the verb with which the key statement is to be displayed or punched. For example, if VERB CREATE is specified, the output of the DISPLAY/PUNCH statement is a CREATE statement; if VERB ALTER is specified, the output is an ALTER statement; and so on. The default is VERB CREATE.

DISPLAY/PUNCH PROCEDURE

The DISPLAY/PUNCH PROCEDURE statement displays or punches a procedure.

Authorization

To issue a DISPLAY PROCEDURE statement, you must have the DISPLAY privilege for the named procedure.

Syntax

```
►►─┬─ DISplay ─┬─ PROCedure ─┬────────────────┬─ proc-name ─┬──────────────────┬──►
   └─ PUNch ───┘             └─ schema-name. ─┘             └─FULl─┬──────────┬┘
                                                                   └─PHYsical ┘

►──┬──────────────────────────────────────────────────────────────────────┬─────►
   └──┬─ WITh ─────────┬──┬─ ALL ─────────┬──┬─ AS COMments ◄─┬─┘
      ├─ ALSo WITh ────┤  ├─ NONe ────────┤  └─ SYNtax ───────┘
      ├─ WITHOut ──────┤  ├─ DETails ─────┤
      └─ ALSo WITHOut ─┘  ├─ HIStory ─────┤
                          ├─ TIMestamp ───┤
                          └─ KEYs ────────┘

►──┬─────────────────────────────┬──────────────────────────────────────────────►◄
   └─ VERb ──┬─ CREATE ◄──┬──┘
             ├─ DISplay ──┤
             ├─ DROp ─────┤
             └─ PUNch ────┘
```

Parameters

schema-name.

Identifies the SQL schema associated with the named procedure.

If you do not specify *schema-name*, then it defaults to the current schema associated with your SQL session, if you enter the statement through the command facility or execute it dynamically.

procedure-name

Specifies the name of the procedure to display or punch. *Procedure-name* must be the name of a procedure defined in the dictionary.

FULl

Directs CA IDMS to display all attributes of the procedure except physical attributes.

PHYsical

Directs CA IDMS to display all attributes of the procedure including its physical attributes. This includes the procedure's synchronization timestamp.

WITh

Lists the requested information, in addition to the information that is always included, such as the entity occurrence name.

WITHOut

Does *not* list the specified options. *Other* options in effect through the WITH or ALSO WITH clauses in the current DISPLAY statement display.

ALSo WITh

Lists the requested information, in addition to the information requested in previously issued DISPLAY WITH and DISPLAY ALSO WITH statements for the named entity.

ALSo WITHOut

Does *not* list the specified options.

ALL

Specifies the display of all the information associated with the requested entity occurrence.

NONe

Specifies the display of the name of the requested entity occurrence. NONE is meaningful only when you specify the WITH clause.

DETails

Specifies the display of entity-specific descriptions; for example, the length of a table.

HIStory

Specifies the display of the chronological account of an entity's existence, including PREPARED/REVISED BY specifications, date created, and date last updated.

TIMestamp

Specifies the display of the synchronization timestamp for the procedure.

KEYs

Specifies the display of all keys associated with the requested procedure.

AS COMments

Outputs procedure syntax as comments with the characters *+ preceding the text of the statement. AS COMMENTS is the default.

AS SYNtax

Outputs procedure syntax which you can edit and resubmit to the command facility.

VERB CREate/DISplay/DROp/PUNch

Specifies the verb with which the entity statement is to be displayed or punched. For example, if VERB CREATE is specified, the output of the DISPLAY/PUNCH statement is a CREATE statement; if VERB ALTER is specified, the output is an ALTER statement; and so on. The default is VERB CREATE.

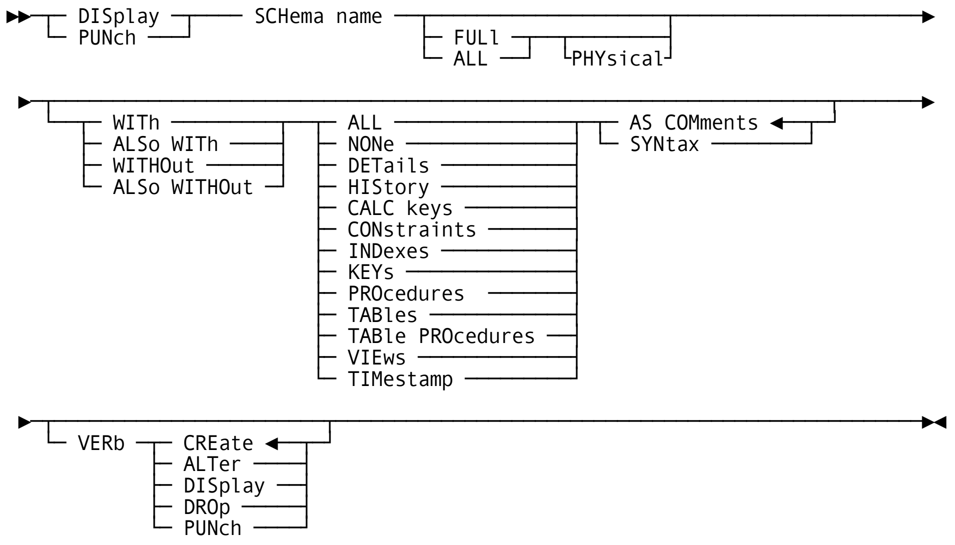
DISPLAY/PUNCH SCHEMA

The DISPLAY/PUNCH SCHEMA statement displays or punches an SQL schema in the dictionary.

Authorization

To issue a DISPLAY/PUNCH SCHEMA statement, you must have the DISPLAY privilege on the requested SQL schema.

Syntax



Parameters

SCHema name

Specifies the SQL schema to display or punch.

Schema-name must be the name of the an SQL schema in the dictionary.

FULl or ALL

Directs CA IDMS to display all attributes of the schema except physical attributes.

PHYsical

Directs CA IDMS to display all attributes of the schema including its physical attributes. This includes table IDs, index IDs, and synchronization timestamps for functions, procedures, tables, table procedures, and views.

WITh

Lists the requested information, in addition to the information that is always included, such as the entity occurrence name.

WITHOut

Does *not* list the specified options. *Other* options in effect through the WITH or ALSO WITH clauses in the current DISPLAY statement are displayed.

ALSo WITh

Lists the requested information, in addition to the information requested in previously issued DISPLAY WITH and DISPLAY ALSO WITH statements for the named entity.

ALSo WITHOut

Does *not* list the specified options.

ALL

Specifies the display of all the information associated with the requested entity occurrence.

NONe

Specifies the display of the name of the requested entity occurrence. NONE is meaningful only when the WITH clause is specified.

DETails

Specifies the display of SQL schema-specific descriptions.

HIStory

Specifies the display of the chronological account of an entity's existence, including PREPARED/REVISED BY specifications, date created, and date last updated.

CALC keys

Specifies the display of all CALC keys associated with the requested SQL schema.

CONstraints

Specifies the display of all constraints associated with the requested SQL schema.

INDexes

Specifies the display of all indexes associated with the requested SQL schema.

KEYs

Specifies the display of all table procedure keys associated with the requested SQL schema.

TABles

Specifies the display of all tables associated with the requested SQL schema.

TABle PROcedures

Specifies the display of all table procedures associated with the requested SQL schema.

VIEws

Specifies the display of all views associated with the requested SQL schema.

TIMestamp

Specifies the display of the synchronization timestamps for the schema entities.

AS COMments

Outputs SQL schema syntax as comments with the characters *+ preceding the text of the statement. AS COMMENTS is the default.

AS SYNtax

Outputs SQL schema syntax which can be edited and resubmitted to the command facility.

VERB CREate/ALTer/DISplay/DROp/PUNch

Specifies the verb with which the entity statement is to be displayed or punched. For example, if VERB CREATE is specified, the output of the DISPLAY/PUNCH statement is a CREATE statement; if VERB ALTER is specified, the output is an ALTER statement; and so on. The default is VERB CREATE.

DISPLAY/PUNCH TABLE

The DISPLAY/PUNCH TABLE statement displays or punches the definition of a base table from the dictionary.

Authorization

To issue a DISPLAY/PUNCH TABLE statement, you must either own or have the DISPLAY privilege on the named table.

Syntax

```
►►─┬─ DISplay ─┬─ TABle ─┬──────────────────┬─ table-name ─┬──────────────────────┬──►
   └─ PUNch ───┘         └─ schema-name. ───┘               └FULl┬────────────────┬┘
                                                                 └PHYsical────────┘

►─┬───────────────────────────────────────────────────────────────────────────┬──►
  └──┬─ WITh ───────────┬──┬─ ALL ─────────────┬──┬─ AS COMments ◄─┬┘
     ├─ WITHOut ────────┤  ├─ NONe ────────────┤  └─ SYNtax ───────┘
     ├─ ALSo WITh ──────┤  ├─ DETails ─────────┤
     └─ ALSo WITHOut ───┘  ├─ HIStory ─────────┤
                           ├─ CALc keys ───────┤
                           ├─ COLumns ─────────┤
                           ├─ CONstraints ─────┤
                           ├─ INDexes ─────────┤
                           ├─TIMestamp ────────┤
                           └─VIEws ────────────┘

►─┬──────────────────────────────────────────────────────────────────────────┬──►◄
  └─ VERb ──┬─ CREate ◄─┬┘
            ├─ ALTer ───┤
            ├─ DISplay ─┤
            ├─ DROp ────┤
            └─ PUNch ───┘
```

In IDD Record Format with COBOL Elements

```
►►─┬─ DISplay ─┬──── TABle ─┬──────────────────┬─ table-name ──────────────►
   └─ PUNch ───┘            └─ schema-name.────┘

►── LIKe RECord ───────────────────────────────────────────────────────────►

►─┬──────────────────────────────────────────────────────────────────────┬─►◄
  └──┬─ WITh ───────────┬──┬─ ALL ───────────────────┬──┬─ AS COMments ◄─┬┘
     ├─ WITHOut ────────┤  ├─ null INDIcators ───────┤  └─ SYNtax ───────┘
     ├─ ALSo WITh ──────┤  ├─ record ELEments ───────┤
     └─ ALSo WITHOut ───┘  └─ record SYNonyms ───────┘
```

Parameters

TABle *table-name*

Specifies the name of the table to display or punch. *table-name* must be the name of a table defined in the dictionary.

schema-name.

Identifies the SQL schema associated with the named table.

If you do not specify *schema-name*, it defaults to the current schema associated with your SQL session, if the statement is entered through the command facility or executed dynamically.

FULl

Directs CA IDMS to display all attributes of the table except physical attributes.

PHYsical

Directs CA IDMS to display all attributes of the table including physical attributes. This includes the table's synchronization timestamp and table ID.

WITh

Lists the requested information, in addition to the information that is always included, such as the entity occurrence name.

WITHOut

Does *not* list the specified options. *Other* options in effect through the WITH or ALSO WITH clauses in the current DISPLAY statement are displayed.

ALSo WITh

Lists the requested information, in addition to the information requested in previously issued DISPLAY WITH and DISPLAY ALSO WITH statements for the named entity.

ALSo WITHOut

Does *not* list the specified options.

ALL

Specifies the display of all the information associated with the requested table.

NONe

Specifies the display of the name of the requested table. NONE is meaningful only when the WITH clause is specified.

DETails

Specifies the display of table-specific descriptions; for example, the length of a table.

HIStory

Specifies the display of the chronological account of a table's existence, including PREPARED/REVISED BY specifications, date created, and date last updated.

CALc keys

Specifies the display of a CALC key associated with the requested table occurrence.

COLumns

Specifies the display of all columns associated with the requested table occurrence.

CONstraints

Specifies the display of all constraints where the requested table occurrence has been named.

INDexes

Specifies the display of all indexes associated with the requested table occurrence.

TIMestamp

Specifies the display of the synchronization timestamp for the table.

VIEws

Specifies the display of all views where the requested table occurrence participates.

AS COMments

Outputs table syntax as comments with the characters *+ preceding the text of the statement. AS COMMENTS is the default.

AS SYNtax

Outputs table syntax which can be edited and resubmitted to the command facility.

VERB CREate/ALTer/DISplay/DROp/PUNch

Specifies the verb with which the entity statement is to be displayed or punched. For example, if VERB CREATE is specified, the output of the DISPLAY/PUNCH statement is a CREATE statement; if VERB ALTER is specified, the output is an ALTER statement; and so on. The default is VERB CREATE.

With COBOL Elements Parameters

LIKe RECord

Specifies that you want IDD RECORD syntax, with its COBOL elements, listed for the named table. For sample uses, see "Usage" later in this section.

null INDIcators

Specifies the display of COBOL elements defining NULL indicators for nullable columns.

record ELEments

Specifies the display of elements for the record syntax for the named table.

record SYNonyms

Specifies the display of record synonyms for the record syntax for the named table.

Usage

Using the LIKE RECORD Parameter

You can use the LIKE RECORD parameter to produce IDD record syntax for a named table, and then add the record syntax to a dictionary.

With the IDD record syntax for a table in the dictionary, CA ADS dialogs can include a work record definition for the table. This same record definition can be included in a map definition.

DISPLAY/PUNCH TABLE PROCEDURE

The DISPLAY/PUNCH TABLE PROCEDURE statement displays or punches a table procedure.

Authorization

To issue a DISPLAY TABLE PROCEDURE statement, you must have the DISPLAY privilege for the named table procedure.

Syntax

```
►►─┬ DISplay ┬TABle PROcedure┬─────────────┬table-proc-name┬───────────────┬───►
   └ PUNch ──┘               └ schema-name ┘               └FULl┬──────────┤
                                                                └PHYsical──┘

►─┬────────────────────────────────────────────────────────────────────────────►
  └─────┬─ WITh ─────────┬──┬─ ALL ─────────┬──┬ AS COMments ◄─┤
        ├─ ALSo WITh ────┤  ├─ NONe ────────┤  └ SYNtax ───────┘
        ├─ WITHOut ──────┤  ├─ DETails ─────┤
        └─ ALSo WITHOut ─┘  ├─ HIStory ─────┤
                            ├─ TIMestamp ───┤
                            └─ KEYs ────────┘

►─┬────────────────────────────────────────────────────────────────────────────►◄
  └─ VERb ──┬─ CREATE ◄─┤
            ├─ DISplay ─┤
            ├─ DROp ────┤
            └─ PUNch ───┘
```

Parameters

schema-name.

Identifies the SQL schema associated with the named table procedure.

If you do not specify *schema-name*, it defaults to the current schema associated with your SQL session, if the statement is entered through the command facility or executed dynamically.

table-procedure-name

Specifies the name of the table procedure to display or punch. *Table-procedure-name* must be the name of a table procedure defined in the dictionary.

FULl

Directs CA IDMS to display all attributes of the procedure except physical attributes.

PHYsical

Directs CA IDMS to display all attributes of the procedure including its physical attributes. This includes the procedure's synchronization timestamp.

WITh

Lists the requested information, in addition to the information that is always included, such as the entity occurrence name.

WITHOut

Does *not* list the specified options. *Other* options in effect through the WITH or ALSO WITH clauses in the current DISPLAY statement are displayed.

ALSo WITh

Lists the requested information, in addition to the information requested in previously issued DISPLAY WITH and DISPLAY ALSO WITH statements for the named entity.

ALSo WITHOut

Does *not* list the specified options.

ALL

Specifies the display of all the information associated with the requested entity occurrence.

NONe

Specifies the display of the name of the requested entity occurrence. NONE is meaningful only when the WITH clause is specified.

DETails

Specifies the display of entity-specific descriptions; for example, the length of a table.

HIStory

Specifies the display of the chronological account of an entity's existence, including PREPARED/REVISED BY specifications, date created, and date last updated.

TIMestamp

Specifies the display of the synchronization timestamp for the table procedure.

KEYs

Specifies the display of all keys associated with the requested table procedure.

AS COMments

Outputs table procedure syntax as comments with the characters *+ preceding the text of the statement. AS COMMENTS is the default.

AS SYNtax

Outputs table procedure syntax which can be edited and resubmitted to the command facility.

VERB CREate/DISplay/DROp/PUNch

Specifies the verb with which the entity statement is to be displayed or punched. For example, if VERB CREATE is specified, the output of the DISPLAY/PUNCH statement is a CREATE statement; if VERB ALTER is specified, the output is an ALTER statement; and so on. The default is VERB CREATE.

DISPLAY/PUNCH VIEW

The DISPLAY/PUNCH VIEW statement displays or punches a view.

Authorization

To issue a DISPLAY VIEW statement, you must either own the SQL schema where the view is defined or hold the DISPLAY privilege on the named view.

Syntax

```
►►─┬─ DISplay ─┬─  VIEw ─┬──────────────────┬─view-name─┬──────────────────┬───►
   └─ PUNch ───┘         └─ schema-name. ───┘           └FULl─┬──────────┬─┘
                                                              └PHYsical ─┘

 ►─┬───────────────────────────────────────────────────────────────────────────►
   └───┬─ WITh ──────────┬──┬─ ALL ─────────┬──┬─ AS COMments ◄─┬─┘
       ├─ WITHOut ───────┤  ├─ NONe ────────┤  └─ SYNtax ───────┘
       ├─ ALSo WITh ─────┤  ├─ DETails ─────┤
       └─ ALSo WITHOut ──┘  ├─ HIStory ─────┤
                            └─ TIMestamp ───┘

 ►─┬────────────────────────────────────────────────────────────────────────►◄
   └─ VERb ──┬─ CREate ◄─┬─┘
             ├─ DISplay ─┤
             ├─ DROp ────┤
             └─ PUNch ───┘
```

In IDD Record Format with COBOL Elements

```
►►─┬─ DISplay ─┬──── VIEW ─┬────────────────────┬─ view-name ─────────────────►
   └─ PUNch ───┘           └─ schema-name. ─────┘

 ►── LIKe RECord ─────────────────────────────────────────────────────────────►

 ►─┬───────────────────────────────────────────────────────────────────────────►
   └───┬─ WITh ──────────┬──┬─ ALL ──────────────────┬──┬─ AS COMments ◄─┬─┘
       ├─ WITHOut ───────┤  ├─ null INDIcators ──────┤  └─ SYNtax ───────┘
       ├─ ALSo WITh ─────┤  ├─ record ELEments ──────┤
       └─ ALSo WITHOut ──┘  └─ record SYNonyms ──────┘

 ►─┬────────────────────────────────────────────────────────────────────────►◄
   └─ VERb ──┬─ CREate ◄─┬─┘
             ├─ ALTer ───┤
             ├─ DISplay ─┤
             ├─ DROp ────┤
             └─ PUNch ───┘
```

Parameters

VIEW *view-name*

Specifies the name of the view to display or punch.

schema-name.

Identifies the SQL schema associated with the named view.

If you do not specify *schema-name*, it defaults to the current schema associated with your SQL session, if the statement is entered through the command facility or executed dynamically.

FULl

Directs CA IDMS to display all attributes of the view except physical attributes.

PHYsical

Directs CA IDMS to display all attributes of the view including its physical attributes. This includes the view's synchronization timestamp.

WITh

Lists the requested information, in addition to the information that is always included, such as the entity occurrence name.

WITHOut

Does *not* list the specified options. *Other* options in effect through the WITH or ALSO WITH clauses in the current DISPLAY statement are displayed.

ALSo WITh

Lists the requested information, in addition to the information requested in previously issued DISPLAY WITH and DISPLAY ALSO WITH statements for the named entity.

ALSo WITHOut

Does *not* list the specified options.

ALL

Specifies the display of all the information associated with the requested entity occurrence.

NONe

Specifies the display of the name of the requested entity occurrence. NONE is meaningful only when the WITH clause is specified.

DETails

Specifies the display of entity-specific descriptions; for example, the length of a table.

HIStory

Specifies the display of the chronological account of an entity's existence, including PREPARED/REVISED BY specifications, date created, and date last updated.

TIMestamp

Specifies the display of the synchronization timestamp for the view.

AS COMments

Outputs view syntax as comments with the characters *+ preceding the text of the statement. AS COMMENTS is the default.

AS SYNtax

Outputs view syntax which can be edited and resubmitted to the command facility.

VERB CREate/DISplay/DROp/PUNch

Specifies the verb with which the entity statement is to be displayed or punched. For example, if VERB CREATE is specified, the output of the DISPLAY/PUNCH statement is a CREATE statement; if VERB ALTER is specified, the output is an ALTER statement; and so on. The default is VERB CREATE.

With COBOL Elements Parameters

LIKe RECord

Specifies that you want IDD RECORD syntax, with its columns as COBOL elements, listed for the named view. For sample uses, see "Usage" later in this section.

null INDIcators

Specifies the display of COBOL elements defining NULL indicators for nullable columns.

record ELEments

Specifies the display of elements for the record syntax for the named view.

record SYNonyms

Specifies the display of record synonyms for the record syntax for the named view.

Usage

Using the LIKE RECORD Parameter

The LIKE RECORD parameter produces IDD record syntax for the named view.

You can use this syntax to define a record definition for a view in the dictionary. CA ADS dialogs can then include it as a work record definition for the view. This same record definition can be included in a map definition.

Appendix I: Sample COBOL Procedure

Sample Procedure Definition

The following example shows an SQL-invoked procedure definition.

```
create procedure demoempl.get_bonus
 ( emp_id          unsigned numeric(4)        with default,
   bonus           unsigned numeric(10)       with default,
   currency_bonus char (3)                    with default )
 external name getbonus
 protocol idms;
```

Sample Procedure Program

The following example shows a sample procedure program written in COBOL. This program requires the SQL employee demo database.

```
*COBOL PGM SOURCE FOR GETBONUS
*RETRIEVAL
*DMLIST
 IDENTIFICATION DIVISION.
 PROGRAM-ID.             GETBONUS.
 AUTHOR                  DEFJE01.
 INSTALLATION.           SYSTEM71.
 DATE-WRITTEN            06/25/99
*---------------------------------------------------------------*
*                                                               *
* GETBONUS will return the sum of all bonus amounts for a       *
* given employee.                                               *
*  Parameters:                                                  *
* EMP_ID:    : input parameter must contain employee id         *
* BONUS      : output parameter returns sum of bonus            *
* CURRENCY-BONUS : output parameter returns currency symbol     *
*          or 'ERR' in case of an error condition               *
* These parameters are assumed to have been defined             *
* 'WITH DEFAULT' in the procedure definition, so that null      *
* indicators do not need to be defined and processed            *
*---------------------------------------------------------------*
 ENVIRONMENT DIVISION.
*
 CONFIGURATION SECTION.
*SOURCE-COMPUTER.                IBM WITH DEBUGGING MODE.
*
```

```
 DATA DIVISION.
*
 WORKING-STORAGE SECTION.
 01 ERROR-STATUS                             PIC X(4).
*--------------------------------------------------------------*
*                                                              *
*--------------------------------------------------------------*
 LINKAGE SECTION.
* Procedure parameters
  EXEC SQL BEGIN DECLARE SECTION END-EXEC.
  77 EMP-ID                      PIC 9(4).
  77 BONUS                       PIC 9(10).
  EXEC SQL END DECLARE SECTION END-EXEC.
  77 CURRENCY-BONUS              PIC X(3).
* Other parameters do not need to be specified
*--------------------------------------------------------------*
  PROCEDURE DIVISION USING EMP-ID, BONUS, CURRENCY-BONUS.
  0000-MAINLINE.

     MOVE '$' TO CURRENCY-BONUS.

     EXEC SQL
      SELECT SUM(BONUS_AMOUNT) INTO :BONUS
       FROM DEMOEMPL.BENEFITS
       WHERE EMP_ID = :EMP-ID
     END-EXEC

     IF SQLSTATE NOT = '00000'
       MOVE 'ERR' TO CURRENCY-BONUS.

     EXIT PROGRAM.
     STOP RUN.
```

Sample of Procedure Invocation

The first four examples are all equivalent. The last example returns an error indication.

```
call demoempl.get_bonus(1234);
EMP_ID         BONUS  CURRENCY_BONUS
  1234             6530  $

1 row processed


call demoempl.get_bonus(emp_id = 1234);
EMP_ID         BONUS  CURRENCY_BONUS
  1234             6530  $

1 row processed


select * from demoempl.get_bonus where emp_id = 1234;
EMP_ID         BONUS  CURRENCY_BONUS
  1234             6530  $

1 row processed

select * from demoempl.get_bonus(emp_id = 1234);
EMP_ID         BONUS  CURRENCY_BONUS
  1234             6530  $

1 row processed


call demoempl.get_bonus(0);
EMP_ID         BONUS  CURRENCY_BONUS
     0                  0   ERR

1 row processed
```

Appendix J: CA IDMS Scalar Functions

Overview

This appendix contains an alphabetical listing of the SQL scalar functions that come with CA IDMS. These scalar functions are either built-in or defined in the SYSCA schema as a user-defined function. It is worth knowing if an SQL scalar function is built-in or user-defined because there is a limit on the number of user-defined functions that can be invoked in a single SQL statement.

Note: For more information, see Syntactic Limits.

The table notations are coded as follows:

- B = The function is implemented as a true built-in function.
- U = The function is implemented as a user-defined function in the SYSCA schema.

Functions

Notation	Function	Meaning
U	ABS(*number*)	Absolute value of number
U	ACOS(*float*)	Arccosine, in radians, of *float*
U	ASIN(*float*)	Arcsine, in radians, of *float*
U	ATAN(*float*)	Arctangent, in radians, of *float*
U	ATAN2(*float1, float2*)	Arctangent, in radians, of *float2/float1*
B	CAST(*number or null*, AS *datatype*)	Converts **value-expression** to a specified data type.
B	CEIL(*number*)	Smallest integer greater than or equal to number data type. (Same as CEILING.)
B	CEILING(*number*)	Smallest integer greater than or equal to number. (Same as CEIL.)
B	CHAR(*code*)	Character with ASCII code value *code*, where *code* is between 0 and 255 other data types.

Notation	Function	Meaning
B	CHAR_LENGTH(*number*)	Length of the value in value expression. (Same as CHARACTER_LENGTH.)
B	CHARACTER_LENGTH (*number*)	Length of the value in value expression. (Same as CHAR_LENGTH.)
B	COALESCE(*datatype*)	Substitutes a value for a null value. (Same as VALUE.)
B	CONCAT(*string1, string2*)	Character string formed by appending *string2* to *string1*; if a string is null, the result is DBMS-dependent
B	CONVERT(*value, SQLtype*)	*Value* converted to *SQLtype*, where *SQLtype* can be any valid SQL data type.
U	COS(*float*)	Cosine of *float* radians
U	COSH(*float*)	Hyperbolic cosine of *float* radians
U	COT(*float*)	Cotangent of *float* radians
B	CURDATE()	The current date as a date value
B	CURTIME()	The current local time as a time value
B	DATABASE()	Current database
B	DATE(*date*)	Obtains the date from the value in value expression
B	DAY(*date*)	An integer from 1 to 41 representing the day of the month in *date*(Same as DAYOFMONTH.)
U	DAYNAME(*date*)	A character string representing the day component of *date*; the name for the day is specific to the data source
B	DAYOFMONTH(*date*)	An integer from 1 to 41 representing the day of the month in *date* (Same as DAY.)
U	DAYOFWEEK(*date*)	An integer from 1 to 7 representing the day of the week in *date*; 1 represents Sunday
U	DAYOFYEAR(*date*)	An integer from 1 to 366 representing the day of the year in *date*
B	DAYS(*date*)	An integer representation of the date in value expression

Notation	Function	Meaning
B	DECIMAL(*number, precision, scale*)	Decimal representation of the value in value expression.
U	DEGREES(*number*)	Degrees in *number* radians
B	DIGITS(*number*)	Character string representation of the value in value expression.
U	EXP(*float*)	Exponential function of *float*
B	FLOAT(*float*)	Floating point representation of the value in value expression.
U	FLOOR(*number*)	Largest integer less than or equal to *number*
B	HEX(*string*)	Hexadecimal representation of the value in value expression.
B	HOUR(*time*)	An integer from 0 to 23 representing the hour component of *time*
B	IFNULL(*expression, value*)	*Value* if *expression* is null; *expression* if not null
U	INSERT(*string1, start, length, string2*)	A character string formed by deleting *length* characters from *string1* beginning at *start*, and inserting *string2* into *string1* at *start*.
B	INTEGER(*number*)	Integer representation of the value in value expression
B	LCASE(*string*)	Converts all uppercase characters in *string* to lowercase. (Same as LOWER.)
B	LEFT(*string, count*)	The *count* leftmost characters from *string*
B	LENGTH(*string*)	Number of characters in *string*, excluding trailing blanks
B	LOCATE(*string1, string2[,start]*)	Position in *string2* of the first occurrence of *string1*, searching from the beginning of *string2*; if *start* is specified, the search begins from position *start* 0 is returned if *string2* does not contain *string1* Position 1 is the first character in *string2*.
U	LOG(*float*)	Base e logarithm of *float*
U	LOG10(*float*)	Base 10 logarithm of *float*

Notation	Function	Meaning
B	LOWER(*string*)	Converts all uppercase characters in *string* to lowercase. (Same as LCASE.)
B	LTRIM(*string*)	Characters of *string* with leading blank spaces removed
B	MICROSECOND (*timestamp*)	Obtains the microsecond part of the value in value-expression.
B	MINUTE(*time*)	An integer from 0 to 59 representing the minute component of *time*
U	MOD(*integer1, integer2*)	Remainder for *integer1/integer2*
B	MONTH(*date*)	An integer from 1 to 12 representing the month component of *date*
U	MONTHNAME(*date*)	A character string representing the month component of *date*; the name for the month is specific to the data source
B	NOW()	A timestamp value representing the current date and time
B	OCTET_LENGTH(*number*)	Obtains the length in bytes of the value in value-expression.
U	PI()	The constant pi
B	POSITION(*string1, string2[,start]*)	Position in *string2* of the first occurrence of *string1*, searching from the beginning of *string2*; if *start* is specified, the search begins from position *start* 0 is returned if *string2* does not contain *string1* Position 1 is the first character in *string2*.
U	POWER(*number, power*)	*Number* raised to (integer) *power*
B	PROFILE(*string*)	Obtains the value associated with an attribute of the current user session.
U	QUARTER(*date*)	An integer from 1 to 4 representing the quarter in *date*; 1 represents January 1 through March 31
U	RADIANS(*number*)	Radians in *number* degrees
U	RAND(*integer*)	Random floating point for seed *integer*
U	REPEAT(*string, count*)	A character string formed by repeating *string count* times

Notation	Function	Meaning
U	REPLACE(*string1, string2, string3*)	Replaces all occurrences of *string2* in *string1* with *string3*
U	RIGHT(*string, count*)	The *count* rightmost characters in *string*
U	ROUND(*number, places*)	*Number* rounded to *places* places
B	RTRIM(*string*)	The characters of *string* with no trailing blanks
B	SECOND(*time*)	An integer from 0 to 59 representing the second component of *time*
U	SIGN(*number*)	-1 to indicate *number* is less than 0 0 to indicate *number* is equal to 0 1 to indicate *number* is greater than 0
U	SIN(*float*)	Sine of *float* radians
U	SINH(*float*)	Hyperbolic sine of *float* radians
U	SPACE(*count*)	A character string consisting of *count* spaces
U	SQRT(*float*)	Square root of *float*
B	SUBSTR(*string, start, length*)	A character string formed by extracting *length* characters from *string* beginning at *start*
B	SUBSTRING(*string, FROM start, FOR length*)	A character string formed by extracting *length* characters from *string* beginning at *start*
U	TAN(*float*)	Tangent of *float* radians
U	TANH(*float*)	Hyperbolic tangent of *float* radians
B	TIME(*time*)	Obtains time from the value in value expression
B	TIMESTAMP(*string1, string2*)	Obtains timestamp from a value or pair of values
B	TRIM(*orientation, string*)	Removes leading and/or trailing pad characters from CHARACTER or VARCHAR value expressions
U	TRUNCATE(*number, places*)	*Number* truncated to *places* places
B	UCASE(*string*)	Converts all lowercase characters in *string* to uppercase. (Same as UPPER.)

Notation	Function	Meaning
B	UPPER(*string*)	Converts all lowercase characters in *string* to uppercase. (Same as UCASE.)
B	USER()	Current user
B	VALUE(*datatype*)	Substitutes a value for a null value. (Same as COALESCE.)
B	VARGRAPHIC(*string*)	Obtains graphic string representation of a character string
U	WEEK(*date*)	An integer from 1 to 53 representing the week of the year in *date*
B	YEAR(*date*)	An integer representing the year component of *date*

Appendix K: Sample COBOL Function

Sample Function Definition

The following example illustrates an SQL-invoked function definition:

```
CREATE FUNCTION FIN.UDF_FUNBONUS
  ( F_EMP_ID                           DECIMAL(4)
  )
    RETURNS DECIMAL(10)
    EXTERNAL NAME FUNBONUS PROTOCOL IDMS
    DEFAULT DATABASE CURRENT
    USER MODE
    LOCAL WORK AREA 0
    ;
```

Sample Function Program

The following example shows a sample SQL function program written in COBOL. This program requires the SQL employee demo database.

```
*COBOL PGM SOURCE FOR FUNBONUS
*RETRIEVAL
*DMLIST
 IDENTIFICATION DIVISION.
 PROGRAM-ID.                      FUNBONUS.
 AUTHOR.                          DEFJE01.
 INSTALLATION.                    SYSTEM71.
 DATE-WRITTEN.                    mm/dd/yyyy.

*----------------------------------------------------------------*
*                                                                *
* CA IDMS SQL                     nn.n                           *
*                                                                *
* FUNBONUS implements the SQL function FUNBONUS                  *
*                                                                *
*----------------------------------------------------------------*
 ENVIRONMENT DIVISION.
*
 CONFIGURATION SECTION.
*SOURCE-COMPUTER.                 IBM WITH DEBUGGING MODE.
*
 DATA DIVISION.
*
 WORKING-STORAGE SECTION.
*----------------------------------------------------------------*
*                                                                *
*----------------------------------------------------------------*
LINKAGE SECTION.
 EXEC SQL BEGIN DECLARE SECTION END-EXEC.

 EXEC SQL
   INCLUDE TABLE FIN.UDF_FUNBONUS NO STRUCTURE
 END-EXEC.

 EXEC SQL END DECLARE SECTION END-EXEC.
 77 RESULT-IND                            PIC S9(04) COMP SYNC.
 01 FUN-SQLSTATE.
    02 FUN-SQLSTATE-CLASS                 PIC X(02).
    02 FUN-SQLSTATE-SUBCLASS              PIC X(03).
*-----------------------------------------------------------------*
PROCEDURE DIVISION USING F-EMP-ID
                   , USER-FUNC
                   , F-EMP-ID-I
                   , USER-FUNC-I
                   , RESULT-IND
                   , FUN-SQLSTATE.
0000-MAINLINE.

IF F-EMP-ID-I NOT < 0
  THEN
    EXEC SQL
      SELECT SUM(BONUS_AMOUNT) INTO :USER-FUNC
        FROM DEMOEMPL.BENEFITS
       WHERE EMP_ID = :F-EMP-ID
    END-EXEC

    IF SQLSTATE NOT = '00000'
       MOVE -1 TO USER-FUNC-I
       MOVE '38901' TO FUN-SQLSTATE
    ELSE
       MOVE 0 TO USER-FUNC-I
 ELSE
   MOVE -1 TO USER-FUNC-I
   MOVE '38902' TO FUN-SQLSTATE.
EXIT PROGRAM.
STOP RUN.
```

Function Invocation

The following example illustrates invoking the SQL function defined earlier:

```
SELECT EMP_ID, FIN.UDF_FUNBONUS (EMP_ID   )
  FROM DEMOEMPL.EMPLOYEE
 WHERE EMP_ID = 3411
*+
*+ EMP_ID     USER_FUNC
*+ ------     ---------
*+  3411          5100
*+
*+ 1 row processed
```

Appendix L: Sample CA ADS Procedure

SQL Procedure Example

The following SQL-invoked procedure, GET_PROC_AREA, writes any supplied message in a global area. The contents of the global area are shown when no input is supplied. The procedure definition is given next:

```
CREATE PROCEDURE DEFJE01.GET_PROC_AREA
  ( IN_AREA           CHARACTER (25),
    GLOBAL_AREA       CHARACTER (25)
  )
    EXTERNAL NAME GETPAREA
    PROTOCOL ADS
    SYSTEM MODE
    LOCAL WORK AREA 0
    GLOBAL WORK AREA 25 KEY GGLA
  ;
```

Work Records

To access the procedure parameters, the CA ADS dialog should include the <schema>.<procedure_name> as a work record. This record does not reside in the dictionary; it is automatically constructed by the CA ADS dialog compiler (ADSC or ADSOBCOM) when the dialog is compiled. The following DDDL syntax defines the global work area record:

```
ADD RECORD NAME GETPAREA-SQLPROC-GLOBAL-AREA.
 03 AREA-C                    PIC   X OCCURS 25.
```

The work records included in the mapless dialog GETPAREA are provided next:

- DEFJE01.GET_PROC_AREA
- GETPAREA-SQLPROC-GLOBAL-AREA

Premap Process

The premap process performs the actions of the SQL-invoked procedure. The premap process for the sample procedure is provided next:

```
ADD
PROCESS NAME IS GETPAREA_PROC VERSION IS 1
    PUBLIC ACCESS IS ALLOWED FOR ALL
    PROCESS SOURCE FOLLOWS
IF IN-AREA-I GE 0
  THEN
    DO.
      MOVE 0 TO GLOBAL-AREA-I.
      MOVE IN-AREA TO GLOBAL-AREA.
      MOVE IN-AREA TO GETPAREA-SQLPROC-GLOBAL-AREA.
      MOVE 'WRITING TO GLOBAL AREA' TO IN-AREA.
    END.
   ELSE
     DO.
      MOVE 0 TO IN-AREA-I.
      MOVE 'READING FROM GLOBAL-AREA' TO IN-AREA.
      MOVE 0 TO GLOBAL-AREA-I.
      MOVE GETPAREA-SQLPROC-GLOBAL-AREA TO GLOBAL-AREA.
     END.
LEAVE ADS.
  MSEND
```

Procedure Invocation

The GET_PROC_AREA invocation is given below. The first example illustrates writing to the global area:

```
CALL DEFJE01.GET_PROC_AREA ('HELLO FROM ADS DIALOG');
*+
*+ IN_AREA                     GLOBAL_AREA
*+ -------                     -----------
*+ WRITING TO GLOBAL AREA      HELLO FROM ADS DIALOG
*+
*+ 1 row processed
```

The second example illustrates reading from the global area:

```
CALL DEFJE01.GET_PROC_AREA ();
*+
*+ IN_AREA                     GLOBAL_AREA
*+ -------                     -----------
*+ READING FROM GLOBAL_AREA    HELLO FROM ADS DIALOG
*+
*+ 1 row processed
```

Appendix M: Sample CA ADS Function

SQL Function Example

The first example involves the SQL-invoked function ASIND, which returns the arcsine in degrees of the supplied value. The SQL function is implemented using a CA ADS dialog that invokes the CA ADS built-in function ARCSINE-DEGREES().

The SQL function is provided next:

```
CREATE FUNCTION DEFJE01.ASIND
  (  ARG               DOUBLE PRECISION)
     RETURNS   DOUBLE PRECISION
     EXTERNAL NAME ASIND
     PROTOCOL ADS
     SYSTEM MODE
     LOCAL WORK AREA 0
     GLOBAL WORK AREA 0
     ;
```

Work Records

To access the function parameters, the CA ADS dialog should include the <schema>.<function_name> as a work record. This record does not reside in the dictionary; it is automatically constructed by the CA ADS dialog compiler (ADSC or ADSOBCOM) when the dialog is compiled. ADSO-SQLPROC-COM-AREA is a system-supplied record. The work records included in the mapless dialog ASIND are shown in the following example:

- DEFJE01.ASIND
- ADSO-SQLPROC-COM-AREA

Premap Process

The premap process performs the actions of the SQL-invoked function. The following example shows the premap process for the sample function:

```
ADD MODULE NAME IS ASIND-PROC VERSION IS 1
LANGUAGE PROCESS
PROCESS SOURCE FOLLOWS
IF ARG LE 1.0
    THEN
     DO.
       MOVE 0 TO USER-FUNC-I
       MOVE ARCSINE-DEGREES(ARG) TO USER-FUNC
     END.
    ELSE
      D0.
        MOVE '38099' TO SQLPROC-SQLSTATE.
        MOVE 'Arg must be <= 1.0' to SQLPROC-MSG-TEXT.
      END.
     LEAVE ADS.
 MSEND
```

Function Invocation

The SELECT clause is used to invoke the function. The first example illustrates a correctly executing function:

```
SELECT DEFJE01.ASIND (1)
  FROM SYSTEM.TABLE WHERE NAME = 'ASIND'
*+
*+                   USER_FUNC
*+                   ---------
*+   9.0000000000000000E+01
*+
*+ 1 row processed
```

The second example illustrates a function invocation that results in an error message.

```
SELECT DEFJE01.ASIND (2)
 FROM SYSTEM.TABLE WHERE NAME = 'ASIND'
*+ Status = -4    SQLSTATE = 38000      Messages follow:
*+ DB001075 C-4M321: Table Procedure ASIND exception 38099 ARG MUST BE <= 1.0
```

Appendix N: SQL Cache Tables

Overview

This appendix describes the table procedures that are used for displaying and controlling the SQL cache. It also provides some examples of how the DBA can display and control the cache. The SQL cache is used in conjunction with the dynamic SQL statement caching feature. Dynamic SQL and dynamic SQL statement caching is explained in the *CA IDMS SQL Programming Guide*.

Tables for Viewing, Monitoring, and Controlling the Cache

SQL is the Application Programming Interface (API) used to view, monitor, and change the cache and the cache configuration. Therefore, cache administration, configuration, and dynamic SQL cache monitoring is available in any environment that supports CA IDMS SQL, such as IDMSBCF, OCF, CA IDMS Visual DBA, and the CA IDMS SQL programs, among others.

This section describes three table procedures and one view of the SYSCA tables defined for dynamic SQL cache management.

DSCCACHEOPT

The DSCCACHEOPT table manages the SQL cache options.

Column	Data Type	Description
CACHEMAXCNT	INTEGER	The maximum number of entries that the cache can contain.
DEFAULT	CHAR(4)	Default for caching: ON/OFF. This specifies if caching is enabled or disabled for any connect name that does not appear in the EXCEPTCON column.
EXCEPTCNT	INTEGER	Count of rows in the DSCCACHEOPT relation with non-NULL value for the EXCEPTON column, in other words, the number of connect names in the list of exceptions.
EXCEPTCON	CHAR(8)	Connect name that forms an exception to the default caching.

Note the following:

- After startup of an IDMS Central Version, DSCCACHEOPT reflects the parameters of the sysgen SQL CACHE statement. In absence of an SQL CACHE statement there will be no rows in DSCCACHEOPT and SQL caching will be disabled, but can be activated by inserting a DSCACHEOPT row. Updates to the DSCCACHEOPT table will have no impact on the sysgen of the CV.
- In local mode when no DSCCACHEOPT row exists, a DSCCACHEOPT row will be automatically inserted with values derived from the SYSIDMS parameter SQL_CACHE_ENTRIES.
- There can be 0 to *n* rows in this table. If there are 0 rows, this means that SQL statement caching is not active and not defined to the system. If there are rows, then the first row will have non-NULL values for CACHEMAXCNT, DEFAULT and EXCEPTCNT and a NULL value for EXCEPTCON. The first row contains the main SQL cache parameters. Other rows in the DSCCACHEOPT relation will have only non-NULL values for the EXCEPTCON column. These rows form the list of exception connect names.
- You can issue select, insert, update and delete commands against DSCCACHEOPT.
- Deleting the first row automatically deletes all other rows and removes all SQL cache structures from the system, effectively disabling caching until a new DSCCACHEOPT row is inserted. Deleting other rows removes exception connect names from the exception list.
- Inserting a row is always possible. When one or more rows already exists, an insert can only specify a value for EXCEPTCON, this is the way to add connect names to the list. When no rows exist, the first insert must specify values for CACHEMAXCNT and DEFAULT. Other values are not allowed. A successful insertion of the first row enables SQL caching.
- Updating of CACHEMAXCNT and DEFAULT columns automatically applies to the first row only, so that no WHERE clause is needed to filter the first row. When CACHEMAXCNT is decreased, the entries in the SQL cache with the highest AGE (see the section, "DSCCACHE") are removed. Increase CACHEMAXCNT to allow the size of the cache to be increased. You cannot update EXCEPTCON for the first row. You cannot update EXCEPTCNT as this is automatically calculated.
- The size of the cache is specified in terms of number of entries. Each entry represents a single cached statement. The cache is allocated from the storage pool within a central version and from operating system storage in local mode. You can determine the amount of storage being consumed by the cache by selecting from the DSCCACHECTRL table.

DSCCACHECTRL

The DSCCACHECTRL table controls SQL caching.

Column	Data Type	Description
REQUEST	CHAR	Future use
STATUS	CHAR	Future use
CACHEMAXCNT	INTEGER	Maximum count of entries
CACHECURCNT	INTEGER	Current count of entries used
CURRENT	INTEGER	Current entry
OLDEST	INTEGER	Oldest entry
STORAGEUSEKB	INTEGER	Total storage used by the cache

Note the following:

- There can be 0 rows or 1 row in this table. If no rows are present, no SQL statements have been cached.
- Only select and delete statements against this table are possible.
- Deleting the 1 row in DSCCACHECTRL clears the SQL cache structures. It does not disable caching, which is controlled through the DSCCACHEOPT table.

DSCCACHE

The DSCCACHE table represents the SQL cache. Each row is a cache entry.

Column	Data Type	Description
KEY	INTEGER	Non-unique key
LOCK	BINARY(4)	Lock word for access to entry
DBNAME	CHAR (8)	DBName of SQL session
DEFAULTSCHEMA	CHAR (18)	Default schema of session if statement contains at least one unqualified table reference
USECNT	INTEGER	Usage count
AGE	INTEGER	A value used to determine which entry to purge from a full cache when a new entry is inserted. The longer an entry remains in the cache without being used, the higher its age.

Column	Data Type	Description
COMPILECOST	INTEGER	Compilation cost
ACCPLANSCANCOST	FLOAT	Cost of scan in access plan
ACCPLANCPUCOST	FLOAT	Cost of CPU in access plan
ACCPLANROWCNT	FLOAT	Count of rows in access plan
EXECCOST	INTEGER	Cost of last execution of statement
COMPILECNT	INTEGER	Count of (re)compilations
COMPILESTAMP	TIMESTAMP	Timestamp of compilation
STMTSIZE	INTEGER	Size of statement
STATEMENT	VARCHAR (8192)	Statement
SQLDIBSIZE	INTEGER	Size of SQLDIB
SQLCMD	INTEGER	Type of SQL command
SQLITCL	INTEGER	Combined Itree/TELL table length
SQLARG	INTEGER	Bit flags for argument usage
SQLOPT	INTEGER	Session options flags
SQLTBL	INTEGER	Length of tuple buffer row
SQLPBL	INTEGER	Length of parameter buffer
SQLCID	INTEGER	Cursor identifier
SQLSID	INTEGER	Section identifier
SQLNM1	CHAR(32)	Literal value 1
SQLNM2	CHAR(32)	Literal value 2
SQLITL	INTEGER	Size of Itree
SQLITBADDR	BINARY(4)	Address of Itree
RTREESIZE	INTEGER	Size of Rtree
RTREEOFFSET	INTEGER	Offset of Rtree for relocation purposes
RTREEDOFAOFF	INTEGER	Offset of DOFA in Rtree
RTREEADDR	BINARY(4)	Address of Rtree
FIBSIZE	INTEGER	Size of FIB
FIBADDR	BINARY(4)	Address of FIB
FOPSIZE	INTEGER	Size of FOP

Column	Data Type	Description
GSTSIZE	INTEGER	Size of GST
FOPADDR	BINARY(4)	Address of FOP
LASTUSER	CHAR(8)	Reserved
GLOBALCURSORNAME	CHAR(18)	Reserved
FCRC	BINARY(4)	FCRC flags
SQLDAADDR	BINARY(4)	Address of cached input SQLDA
STORAGEUSED	INTEGER	Size in bytes of used storage

Note the following:

- One row of this table represents one cached statement.
- Rows cannot be inserted or updated.
- Because of the size of the STATEMENT column in DSCCACHE and also because many of these columns are for internal use only, it is advisable to use a view on this table procedure. The supplied DSCCACHEV view (shown next) is an example of such a view.

The following acronyms are used in the previous table.

- Itree: A data structure that contains the internal input representation of an SQL statement
- Rtree: A data structure that contains the internal runtime instruction of an SQL statement. The Rtree is used by the SQL runtime engine IDMSHLDB.
- FIB: A data structure that contains runtime metadata.
- FOB/FOP: FIB objects list data structure
- GST: Global Security Table
- FCRC: Fixed part of Compiled Relational Command data structure
- SQLDA: the SQL Descriptor Area (SQLDA) is a data structure used to describe variable data passed as part of a dynamic SQL statement.

DSCCACHEV

SYSCA.DSCCACHEV is created during installation. It defines a view on the SYSCA.DSCCACHE table procedure as follows:

```
create view SYSCA.DSCCACHEV as
 select KEY, DBNAME, DEFAULTSCHEMA, USECNT, AGE
      , COMPILECNT as "#C", compilestamp
      , ACCPLANSCANCOST, ACCPLANCPUCOST
      , ACCPLANROWCNT, FIBSIZE, FIBADDR
      , SUBSTR(STATEMENT, 1, 72) as STMT1
 from SYSCA.DSCCACHE;
```

You have the option to define your own views.

Allowable Operations on DSCCACHE Tables

	DSCCACHOPT	**DSCCACHECTRL**	**DSCCACHE**	**DSCCACHE V**
Type	Table Procedure	Table Procedure	Table Procedure	View
SELECT	X	X	X	X
INSERT	X			
UPDATE	X			
DELETE	X	X	X	X

Examples of Displaying and Controlling the Cache

CACHE Options

To display the cache options:

```
Select * from SYSCA.DSCCACHEOPT;
*+
*+  CACHEMAXCNT  DEFAULT    EXCEPTCNT  EXCEPTCON
*+  -----------  -------    ---------  ---------
*+         1000  OFF                2  <null>
*+       <null>  <null>        <null>  SYSTEM
*+       <null>  <null>        <null>  APPLDICT
```

To change the default for caching:

```
Update SYSCA.DSCCACHEOPT set DEFAULT = 'ON';
```

To add the connect name 'TSTDICT' to the exception list:

```
Insert into SYSCA.DSCCACHEOPT (EXCEPTCON) values ('TSTDICT');
```

To remove the connect name 'SYSTEM' from the exception list:

```
Delete from SYSCA.DSCCACHEOPT where EXCEPTCON = 'SYSTEM';
```

To remove all the connect names from the exception list:

```
Delete from SYSCA.DSCCACHEOPT where EXCEPTCON is not null;
```

To decrease the number of entries in the cache from 1000 to 5:

```
Update SYSCA.DSCCACHEOPT set CACHEMAXCNT = 5;
```

Only the last 5 used entries will be kept in the cache.

To increase the number of entries in the cache from 5 to 9999:

```
Update SYSCA.DSCCACHEOPT set CACHEMAXCNT = 9999;
```

The cache will be extended with 9994 new slots.

To clear the SQL cache and remove all the SQL cache structures from the system, effectively disallowing any SQL caching:

```
Delete from SYSCA.DSCCACHEOPT;
```

To rebuild the SQL cache environment or to build the SQL cache environment in a system that has no SQL CACHE statement in its SYSGEN:

```
Insert into SYSCA.DSCCACHEOPT (CACHEMAXCNT, DEFAULT) values (1000, 'ON');
Insert into SYSCA.DSCCACHEOPT (EXCEPTCON) values ('APPLDICT');
Insert into SYSCA.DSCCACHEOPT (EXCEPTCON) values ('SYSTEM');
```

CACHE Control Parameters

To display cache control parameters:

```
Select * from SYSCA.DSCCACHECTRL;
*+
*+REQUEST  STATUS  CACHEMAXCNT  CACHECURCNT  CURRENT OLDEST
*+-------  ------  -----------  -----------  ------- ------
*+  A             1000                   7        6      0
*+
*+ STORAGEUSEKB
*+ ------------
*+         138
```

To clear the cache, but allow caching to continue as defined by the option in DSCCACHEOPT:

```
Delete from SYSCA.DSCCACHECTRL;
```

CACHE Entries

To display key columns of all cache entries:

```
Select * from SYSCA.DSCCACHEV;
*+
*+  KEY  DBNAME    DEFAULTSCHEMA     USECNT          AGE
*+  ---  ------    -------------     ------          ---
*+   29  SYSDICT   <null>                 4            0
*+   32  SYSDICT   <null>                 1            1
*+   28  SYSDICT   <null>                 2            1
*+   32  SYSDICT   <null>                 7            7
*+   29  SYSDICT   <null>                 6            6
*+
*+     #C  COMPILESTAMP                  FIBSIZE  FIBADDR
*+     --  ------------                  -------  --------
*+     1  2002-09-04-10.05.20.740186        736  12AC6208
*+     1  2002-09-04-10.07.20.009275       2528  12ACD088
*+     1  2002-09-04-10.06.19.785231       2580  12ACB888
*+     1  2002-09-04-10.02.39.729463        552  12AC0A08
*+     1  2002-09-04-10.03.00.735305        736  12ABFD88
*+
*+ STMT1
*+ -----
*+ Select * from SYSCA.DSCCACHEV
*+ select * from empnsql.department
*+ select * from empnsql.office
*+ select * from SYSCA.DSCCACHECTRL
*+ select * from sysca.dsccachev
```

To display cache entries with AGE > 1:

```
Select * from SYSCA.DSCCACHEV where AGE > 1;
```

To display cache entries for DBNAME SYSDICT:

```
Select * from SYSCA.DSCCACHEV where DBNAME = 'SYSDICT';
```

To display cache entries for statements that use schema EMPNSQL:

```
Select * from SYSCA.DSCCACHEV where STMT1 like '%EMPNSQL.%';
```

To remove cache entries that use schema EMPNSQL:

```
Delete from SYSCA.DSCCACHE where STATEMENT like '%empnsql.%';
```

Secure the Display and Changes

To secure the display of and any changes to SQL caching, the DSCCACHE tables (table procedures and views) must be secured using the standard CA IDMS security mechanism.

Note: The SQL cache contains SQL source statements, which might include confidential information.

Appendix O: Enhancing the Presentation of Access Strategy Information

Overview

This appendix provides the definition and data of a table, an index, and a view to enable presenting the access strategy information in an easy-to-read and understandable format. The definitions and data are collected in one SQL script that is installed as member EXPLDDL in the CA IDMS source library.

Contents of EXPLDDL

```
------------------------------------------------------------------------
--                                                                     -
-- The following SQL definitions can be very helpful when using the    -
-- EXPLAIN command.                                                    -
--                                                                     -
-- These definitions add meaning to the result of the EXPLAIN command  -
-- by creating easy-to-understand values for the abbreviated codes that-
-- EXPLAIN produces.  When you run an EXPLAIN statement against an SQL -
-- command or Access Module, the result is placed in an SQL table      -
-- called ACCESS_PLAN or another name that you choose.  After you      -
-- create the ACCESS_CODE table and PLANVIEW view, you can easily query-
-- any EXPLAIN results and readily determine what kind of access       -
-- strategies will be used for your SQL statements.  This is especially-
-- useful for finding SQL queries that will cause area sweeps or other -
-- access strategies that might suggest adding new indices or other    -
-- tuning options to the database.                                     -
--                                                                     -
-- Before running the script it is assumed that a "current" schema     -
-- has been set as follows                                             -
--   SET SESSION CURRENT SCHEMA <schema-name>;                         -
-- Also this current schema must have been assigned with an            -
-- appropriate DEFAULT AREA to accommodate for the ACCESS_CODE and     -
-- ACCESS_PLAN tables.                                                 -
--                                                                     -
------------------------------------------------------------------------

------------------------------------------------------------------------
--  Set up access plan code table:
create table ACCESS_CODE
       (COLUMN      smallint not null,       -- column index
        CODE_NUM    smallint,                -- numeric code
        CODE_CHAR   char,                    -- character code
        TEXT        char(16) not null)       -- display text
       no default index
       ;

create index ACCESS_CODE_IX
  on ACCESS_CODE
  (COLUMN, CODE_NUM, CODE_CHAR)
  clustered
  ;
```

```
--------------------------------------------------------------------

-- These are the codes for the COMMAND column:
insert into ACCESS_CODE values (1,8,NULL,'DECLARE');
insert into ACCESS_CODE values (1,9,NULL,'DELETE');
insert into ACCESS_CODE values (1,17,NULL,'INSERT');
insert into ACCESS_CODE values (1,25,NULL,'SELECT');
insert into ACCESS_CODE values (1,29,NULL,'UPDATE');

-- These are the codes for the STYPE column:
insert into ACCESS_CODE values (2,0,NULL,' ');
insert into ACCESS_CODE values (2,1,NULL,'Table Access');
insert into ACCESS_CODE values (2,2,NULL,'NL Join');
insert into ACCESS_CODE values (2,3,NULL,'SM Join');
insert into ACCESS_CODE values (2,4,NULL,'Sort');
insert into ACCESS_CODE values (2,5,NULL,'Merge Group');
insert into ACCESS_CODE values (2,6,NULL,'OR List');
insert into ACCESS_CODE values (2,7,NULL,'Dbk (Sorted)');
insert into ACCESS_CODE values (2,8,NULL,'Dbk (Unsorted)');

-- These are the codes for the ACMODE column:
insert into ACCESS_CODE values (3,NULL,' ',' ');
insert into ACCESS_CODE values (3,NULL,'A','Area Sweep');
insert into ACCESS_CODE values (3,NULL,'C','Calc');
insert into ACCESS_CODE values (3,NULL,'I','Index');
insert into ACCESS_CODE values (3,NULL,'M','Set Member');
insert into ACCESS_CODE values (3,NULL,'N','Insert');
insert into ACCESS_CODE values (3,NULL,'O','Set Owner');
insert into ACCESS_CODE values (3,NULL,'P','Procedure');
insert into ACCESS_CODE values (3,NULL,'R','Rowid Indx');
insert into ACCESS_CODE values (3,NULL,'S','Index Seql');
insert into ACCESS_CODE values (3,NULL,'T','Temp Seql');

-- These are the codes for the SORTC and SORTN columns:
insert into ACCESS_CODE values (4,NULL,' ',' ');
insert into ACCESS_CODE values (4,NULL,'D','Distinct');
insert into ACCESS_CODE values (4,NULL,'G','Group');
insert into ACCESS_CODE values (4,NULL,'M','Merge Join');
insert into ACCESS_CODE values (4,NULL,'O','Order By');
```

```
------------------------------------------------------------------------
-- This statement forces the definition of the ACCESS_PLAN table,
-- so that the following view creation can reference it.
EXPLAIN STATEMENT 'SELECT * FROM SYSTEM.TABLE' STATEMENT NUMBER 9999;


------------------------------------------------------------------------
-- This is a sample view definition. The ST instance of ACCESS_CODE
-- decodes the STYPE column of ACCESS_PLAN. The AM instance decodes the
-- ACMODE column. The S1 and S2 instances decode the SORTC and SORTN
-- columns, respectively. The COMMAND column isn't included in the
-- view, but could be decoded by introducing another ACCESS_CODE
-- INSTANCE in the FROM clause along with the matching join factors.
-- A descending sort was chosen to force the high level joins to the
-- top of the output - in sort of a top down tree format.
create view PLANVIEW(SNO, QB, PB, ST, "STEP TYPE", PST, TSCHEMA,
                     TABLE, "ACCESS MODE", ACNAME, LFS, OSORT,
                     ISORT, SQC) AS
 select CAST(SECTION AS DEC(4)),
        CAST(QBLOCK  AS DEC(3)),
        CAST(PBLOCK  AS DEC(3)),
        CAST(STEP    AS DEC(3)),
        ST.TEXT,
        CAST(PSTEP   AS DEC(3)),
        SUBSTR(TSCHEMA, 1, 8),
        SUBSTR(TABLE,   1, 10),
        SUBSTR(AM.TEXT, 1, 10),
        ACNAME,
        LFS,
        SUBSTR(S1.TEXT, 1, 10),
        SUBSTR(S2.TEXT, 1, 10), SUBQC
   from ACCESS_PLAN, ACCESS_CODE ST, ACCESS_CODE AM, ACCESS_CODE S1,
        ACCESS_CODE S2
  where ST.COLUMN = 2 and ST.CODE_NUM = STYPE
    and AM.COLUMN = 3 and AM.CODE_CHAR = ACMODE
    and S1.COLUMN = 4 and S1.CODE_CHAR = SORTC
    and S2.COLUMN = 4 and S2.CODE_CHAR = SORTN
  order by 1, 2, 4 desc;



------------------------------------------------------------------------
-- Look at the access plans
select * from PLANVIEW;
```

Appendix P: SQL Reserved Words

ABS
ACOS
ADD
ALL
ALLOCATE
ALTER
AND
ANY
AREA
AS
ASIN
ATAN
ATAN2
BEGIN
BETWEEN
BIGINT
BIN
BINARY
BUFFER
BY
CALL
CASCADE
CASE
CAST
CATALOG
CEIL
CEILING
CHAR
CHARACTER
DAYOFWEEK
DAYOFYEAR
DAYS
DBNAME
DBTABLE
DEC
DECIMAL
DECLARE
DEFAULT
DEGREES
DELETE
DESCRIPTOR
DIGITS
DISTINCT
DMCL
DO
DOUBLE
DROP
DSNAME
DYNAMIC
ELSE
ELSEIF
ENCODING
END
ESCAPE
ESTIMATED
EXCEPTION
EXEC
EXECUTE
IN
INDEX
INDEXES
INDICATOR
INNER
INOUT
INSERT
INT
INTEGER
INTERNAL
INTO
IS
ITERATE
JOIN
JOURNAL
KEYS
LANGUAGE
LCASE
LEAVE
LEFT
LENGTH
LIKE
LOAD
LOCAL
LOCATE
LOG
LOG10
LOGINT
LOOP
OUTER
PARAMETERS
PATH
PI
POSITION
POWER
PRECISION
PREPARE
PRESERVE
PRIVILEGES
PROCEDURE
PROFILE
PROGRAM
PROTOCOL
QUARTER
QUEUE
RADIANS
RAND
READ
REFERENCES
RELEASE
RENAME
REPEAT
REPLACE
RESIGNAL
RESULT
RETURN
RETURNS
REVOKE
TANH
THEN
TIME
TIMESTAMP
TINYINT
TO
TRANSACTION
TRIM
TRUNCATE
UCASE
UNDO
UNION
UNIQUE
UNSIGNED
UNTIL
UPDATE
UPPER
USE
USER
USERID
USING
VALUE
VALUES
VARCHAR
VARGRAPHIC
VIEW
VOLUME
WEEK
WHEN

CHARACTERS	EXISTS	LOWER	RIGHT	WHERE
CHARACTER_LENGTH	EXIT	LTRIM	ROLLBACK	WHILE
CHAR_LENGTH	EXP	MAINTAIN	ROUND	WITH
CHECK	EXPLAIN	MAP	RTRIM	WITHIN
CLOSE	EXTERNAL	MICROSECOND	SCHEMA	WITHOUT
COALESCE	FETCH	MICROSECONDS	SECOND	XMLELEMENT
COLUMN	FILE	MINUTE	SECOND	XMLPOINTER
COMMIT	FLOAT	MINUTES	SECONDS	XMLSERIALIZE
CONCAT	FLOOR	MOD	SEGMENT	YEAR
CONDITION	FOR	MONTH	SELECT	YEARS
CONNECT	FROM	MONTHNAME	SET	
CONSTRAINT	FUNCTION	MONTHS	SIGN	
CONTENT	GET	NO	SIGNAL	
CONVERT	GLOBAL	NOT	SIN	
COS	GOTO	NOW	SINH	
COSH	GRANT	NULL	SMALLINT	
COT	GRAPHIC	NUM	SPACE	
CREATE	GROUP	NUMBER	SPECIFIC	
CURDATE	HANDLER	OCTET_LENGTH	SORT	
CURRENT	HAVING	OF	STANDARD	
CURSOR	HEX	OFFSET	STORAGE	
CURTIME	HOUR	ON	SUBSTR	
DATABASE	HOURS	OPEN	SUBSTRING	
DATE	IDMS	OPTIMIZE	SYSTEM	
DAY	IF	OR	TABLE	
DAYNAME	IFNULL	ORDER	TABLESPACE	
DAYOFMONTH	IMMEDIATE	OUT	TAN	

Appendix Q: CA ADS, COBOL, PL/I Data Types

CA ADS PICTURE and USAGE clause	CA IDMS data type
PIC X(*n*) USAGE DISPLAY	CHAR(*n*)
01 *name* 49 *name*-LEN PIC S9(4) COMP 49 *name*-TEXT PIC X(*n*)	VARCHAR(*n*)
PIC S9(*p-s*)V9(*s*) USAGE COMP-3	DECIMAL(*p,s*)
PIC 9(*p-s*)V9(*s*) USAGE COMP-3	UNSIGNED DECIMAL(*p,s*)[1]
USAGE COMP-2	DOUBLE PRECISION
USAGE COMP-1	REAL
USAGE COMP-1	FLOAT
PIC S9(*n*) USAGE COMP (where *n*<5)	SMALLINT
PIC S9(*n*) USAGE COMP (where *n*>4 and *n*<10)	INTEGER
PIC S9(*n*) USAGE COMP (where *n*>9)	LONGINT or BIGINT
PIC S9(*p-s*)V9(*s*) USAGE DISPLAY	NUMERIC(*p,s*)
PIC 9(*p-s*)V9(*s*) USAGE DISPLAY	UNSIGNED NUMERIC(*p,s*)[1]
PIC X(*n*) USAGE DISPLAY	BINARY(*n*)
PIC G(*n*) USAGE DISPLAY-1	GRAPHIC(*n*)[1]
01 *name* 49 *name*-LEN PIC S9(4) COMP 49 *name*-TEXT PIC G(*n*) DISPLAY-1	VARGRAPHIC(*n*)[1]
PIC X(10) USAGE DISPLAY	DATE
PIC X(8) USAGE DISPLAY	TIME
PIC X(26) USAGE DISPLAY	TIMESTAMP
PIC X(8) USAGE DISPLAY	TID[1]

Note: This data type is a CA IDMS extension of the SQL standard.

COBOL PICTURE and USAGE clause	**CA IDMS data type**
PIC X(*n*) USAGE DISPLAY	CHAR(*n*)
01 *name* 49 *name*-LEN PIC S9(4) COMP 49 *name*-TEXT PIC X(*n*)	VARCHAR(*n*)
PIC S9(*p-s*)V9(*s*) USAGE COMP-3	DECIMAL(*p,s*)
PIC 9(*p-s*)V9(*s*) USAGE COMP-3	UNSIGNED DECIMAL(*p,s*)[1]
USAGE COMP-2	DOUBLE PRECISION
USAGE COMP-1	REAL
USAGE COMP-1	FLOAT
PIC S9(*n*) USAGE COMP (where *n*<5)	SMALLINT
PIC S9(*n*) USAGE COMP (where *n*>4 and *n*<10)	INTEGER
PIC S9(*n*) USAGE COMP (where *n*>9)	LONGINT or BIGINT
PIC S9(*p-s*)V9(*s*) USAGE DISPLAY	NUMERIC(*p,s*)
PIC 9(*p-s*)V9(*s*) USAGE DISPLAY	UNSIGNED NUMERIC(*p,s*)[1]
PIC X(*n*) USAGE SQLBIN	BINARY(*n*)
PIC G(*n*) USAGE DISPLAY-1	GRAPHIC(*n*)[1]
01 *name* 49 *name*-LEN PIC S9(4) COMP 49 *name*-TEXT PIC G(*n*) DISPLAY-1	VARGRAPHIC(*n*)[1]
PIC X(10) USAGE DISPLAY	DATE
PIC X(8) USAGE DISPLAY	TIME
PIC X(26) USAGE DISPLAY	TIMESTAMP
PIC X(8) USAGE SQLBIN	TID[1]

Note: This data type is a CA IDMS extension of the SQL standard.

Equivalent PL/I data type	CA IDMS data type
CHAR (*n*)	CHAR(*n*)
CHAR (*n*) VAR	VARCHAR(*n*)
FIXED DECIMAL (*p*,*s*)	DECIMAL(*p*,*s*)
FLOAT BINARY (*n*) where *n* <= 24 where *n* > 24	 REAL DOUBLE PRECISION
FLOAT DECIMAL (*n*) where *n* <= 6 where *n* > 6	 REAL DOUBLE PRECISION
FIXED BINARY (15)	SMALLINT
FIXED BINARY (31)	INTEGER
CHAR (*n*)	BINARY(*n*)
GRAPHIC (*n*)	GRAPHIC(*n*)[1]
GRAPHIC (*n*) VAR	VARGRAPHIC(*n*)[1]
CHAR (10)	DATE
CHAR (8)	TIME
CHAR (26)	TIMESTAMP
SQLBIN (*n*)	BINARY(*n*)
CHAR(8)	TID[1]

Note: This data type is a CA IDMS extension of the SQL standard.

Appendix R: Third-Party Acknowledgment

Portions of this product include software developed by the Daniel Veillard. The libxml2 software is distributed in accordance with the following license agreement:

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