CA IDMS™ SQL

Self Training Guide

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technologies

CA Technologies Product References

This document references the following CA Technologies products:

- CA IDMS™
- CA IDMS™/DB
- CA IDMS™ SQL
- CA IDMS™/DC or CA IDMS™ DC/UCF
- CA IDMS™ UCF

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Contents

Chapter 5: Using Conditional Retrieval 65

Chapter 6: Using Aggregate Functions 97

Chapter 7: Accessing Multiple Tables 115

Chapter 8: Nesting SELECT Statements 131

Chapter 9: Updating a Table 143

Appendix A: Sample Data Description Language 157

Appendix B: Answers to Exercises 163

Appendix C: Table Descriptions 195

Chapter 1: Introduction

This self-training guide provides information on how to use interactive SQL data manipulation language (DML).

After reading this guide and doing the exercises, you should be able to:

- Describe a relational database and state its benefits.
- Create SQL statements to retrieve data, based on specific criteria.
- Create SQL statements to insert, modify, and delete data from a table.

Anyone who will use basic SQL DML or who will use SQL in programs can benefit from the exercises in this manual.

Online Exercises: You can do the exercises in this guide online in any one of several processing environments. The exercises are designed to be used in the interactive environment.

If you want to do the exercises in this guide online, you must:

- Have online access to the demonstration database that is provided with the product installation and is used by the examples and exercises in this guide
- Know how to access and submit statement syntax to the interactive SQL tool in your environment.
- Be familiar with the keyboard and terminal in your environment

Check with your system administrator for access to the appropriate system, database, and interactive SQL tool.

Accessing CA IDMS/DB: Before you begin doing the exercises in this guide in the CA IDMS/DB environment, be familiar with documentation of the tool you will use to submit SQL statements, such as the CA IDMS Common Facilities Guide manual. Also, check with your system administrator to learn:

- The CA IDMS/DC or CA IDMS UCF system to which you should sign on so that you can access the demonstration database online.

  Note: The exercises in this guide use mixed upper and lower case characters. Before you invoke the interactive SQL tool, issue the DCUF SET UPLOW command to CA IDMS.

- The dictionary to which your SQL session should be connected.

- The qualifiers of the demonstration database table names—a table name in an SQL statement must include the qualifier unless the qualifier matches the default schema for your SQL session.

  Note: You can **set** the default schema by submitting this statement: SET SESSION CURRENT SCHEMA schema-name.

- Whether you should roll back (eliminate) changes you make to the demonstration database with INSERT, UPDATE, and DELETE statements.

  If so, submit this statement to the CA IDMS Command Facility before you begin the exercises:

  ```
  set options autocommit off;
  ```

  Then, after you finish a session of doing online exercises that update the database but before you exit the CA IDMS Command Facility, issue this statement:

  ```
  rollback work;
  ```

How to Proceed: If you have had no experience with relational databases, begin with Chapter 1, "Relational Database Concepts." Read the chapters in order and do the exercises and review exercises in each chapter. Keep in mind that several people in your organization may use this guide, so you probably don't want to mark in it.

If you are familiar with relational database concepts, begin with Chapter 2, "What Is SQL?" and read the chapters in order.

Allow five to eight hours to complete the entire self-training guide including the online practice exercises. You can complete the self-training guide in one sitting or in several sessions as follows:

- Session 1—Chapters 1 through 4
- Session 2—Chapters 5 and 6
- Session 3—Chapters 7 and 8

Practice exercises begin in Chapter 3, "Retrieving Data." Each exercise after the first builds on the previous exercise. If you are doing the exercises online, you can check your work by looking at the results shown after the exercise.

In Chapters 3 through 8, you see examples written out in full with the label How it's done. When you enter these statements online, you'll see a result table with the same contents as the one shown in the book. The table in the book may be abbreviated.

After each example and its result, there are exercises where the SQL statements are not given. Instead, a description of the requested information is given, and you write the statements necessary to achieve the result. These exercises are identified by the labels Now you try it and Try another.

Practicing Without Access to a Database: You can go through these exercises without having access to a database. Simply write out your answers.Then check the correct answers in Appendix B, "Answers to Exercises (see page 163)."

In Appendix A, "Sample Data Description Language" you will see sample statements for database definition that you do not enter. They are for your information only.

At the end of each chapter, you will find review exercises covering the material you have just studied. These exercises allow you to evaluate how well you have learned the material presented. You are encouraged to do them.

In addition, Chapters 3 through 7 include scenarios at the end. Each scenario requires you to create SQL statements to retrieve or update data based on a specific business requirement.

Answers to Exercises: Answers to online exercises, reviews, and scenarios appear in Appendix B, "Answers to Exercises" on page 179 B.

The Demonstration Database: In the online practice exercises, you will access data from the personnel database developed for a company called Commonwealth Auto.

Commonwealth Auto requires data to be maintained on all employees, jobs, skills, departments, benefits, and projects. Other associated employee information is also maintained, but you will not access it in these exercises.

The Human Resources and Accounting departments use the database for many of their activities. In this guide, these departments make requests for reports or information that you satisfy through your knowledge and use of SQL. The requests concern salary and budget information, department lists, and vacation and project updates. They range from the simple to the complex.

The requests are based on actual information maintained by a small corporation.

The Commonwealth Auto database consists of two schemas:

- DEMOEMPL tables containing employee information
- DEMOPROJ tables containing project-related information

The information is maintained in several tables in the database. These are the tables in the portion of the database you will use:

Table	Schema	Contents
ASSIGNMENT	DEMOPROJ	The assignment of employees to projects
BENEFITS	DEMOEMPL	The benefits an employee has with the company

Table	Schema	Contents
CONSULTANT	DEMOPROJ	Each consultant associated with the company
COVERAGE	DEMOEMPL	Employee's insurance information
DEPARTMENT	DEMOEMPL	Each department within the company
DIVISION	DEMOEMPL	Each division within the company
EMPLOYEE	DEMOEMPL	Personal information on each employee working for the company
EXPERTISE	DEMOPROJ	The skills each employee possesses
INSURANCE_PLAN	DEMOEMPL	Details of each insurance plan
JOB	DEMOEMPL	The jobs within the company
POSITION[1]	DEMOEMPL	The jobs an employee has held and is currently holding within the company
PROJECT	DEMOPROJ	The projects within the company
SKILL	DEMOPROJ	The skills throughout the company

Note: [1]—POSITION is also an SQL keyword; when it is used to qualify a column name, the table name must be enclosed in double quotation marks. For example, "POSITION".column-name. For information about qualifying column names, see Qualifying a Column Name (see page 119).

Appendix C, "Table Descriptions" presents a description of each column in each table in the database.

Related Publications

The following documents provide additional information related to the information contained in this manual.

- *CA IDMS SQL Programming Guide*
- *CA IDMS SQL Reference Guide*
- *CA IDMS Visual DBA User Guide*
- *CA IDMS Common Facilities Guide*

Chapter 2: Relational Database Concepts

Goal

At the end of this chapter, you will be able to:

- Define basic relational database terms
- List the components of a relational database

Summary

A relational database is a collection of tables containing data. A table consists of columns (attributes that describe the table) and rows (actual occurrences of data). Data can be accessed easily and quickly in a relational database and is viewed in a tabular format.

This section contains the following topics:

Tables

Relational databases present information as a collection of tables. Unless empty, each table contains related data.

Sample Tables

This diagram shows the EMPLOYEE, SKILL, DEPARTMENT, and PROJECT tables from the database for Commonwealth Auto:

EMPLOYEE

EMP_ID	EMP_LNAME	EMP_FNAME	DEPT_ID
2096	CARLSON	THOMAS	4600
2437	THOMPSON	HENRY	4600
2598	JACOBS	MARY	5100

DEPARTMENT

DEPT_ID	DEPT_NAME
5200	CORPORATE MARKETING
4600	MAINTENANCE
5100	BILLING

SKILL

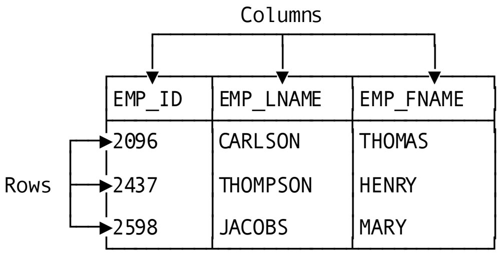
SKILL_ID	SKILL_NAME
4250	DATA ENTRY
4370	FILING
4490	GENERAL LEDGER

PROJECT

PROJ_ID	PROJ_DESC
C200	NEW BRAND RESEARCH
C240	SERVICE STUDY
D880	SYSTEM ANALYSIS

The EMPLOYEE table contains data about employees. The SKILL table contains information about skills that are used in Commonwealth Auto. The DEPARTMENT table contains information about the departments in the company. The PROJECT table contains information about projects.

A table is made up of columns and rows. A portion of the EMPLOYEE table in the Commonwealth Auto database looks like this:



EMP_ID	EMP_LNAME	EMP_FNAME
2096	CARLSON	THOMAS
2437	THOMPSON	HENRY
2598	JACOBS	MARY

Columns

A table has one or more columns. Each column:

- Has entries containing a single type of data
- Is displayed vertically
- Is identified by a name

For example, the employee ID (EMP_ID) column contains employee IDs, each of which is a number. The employee IDs are listed one below the other. At the top of the column is a heading based on the kind of data in the column.

Rows

A table has zero or more rows. Each row:

- Contains one value in each column
- Is displayed horizontally
- Is not named

The first part of one row from the EMPLOYEE table looks like this:

2096	CARLSON	THOMAS

Primary Keys

A business often needs to prevent duplicate rows of data from being stored in the same table. For example, each employee in the company needs an employee ID different from all other IDs. This is a way of distinguishing two employees who have the same name. You do not want to store two employees who have the same employee ID.

To ensure that duplicate rows are not stored, a column or combination of columns is identified as a **primary key** of the table when the table is defined. Each entry in the primary key column or columns must be unique; there can be no duplicates. As a result, the primary key uniquely identifies each row in the table.

A row of employee information in the EMPLOYEE table is uniquely identified by the employee ID. There is only one row with employee ID 2096 and only one row with employee ID 2437. However, there can be more than one employee with a first name of Mary. The column containing the first name is not a unique key:

EMP_ID	EMP_LNAME	EMP_FNAME
2096	CARLSON	THOMAS
2437	THOMPSON	HENRY
2598	JACOBS	MARY

Primary key

When you request data from a table and specify a value for the primary key, you see only one row returned.

Relationships Among Tables

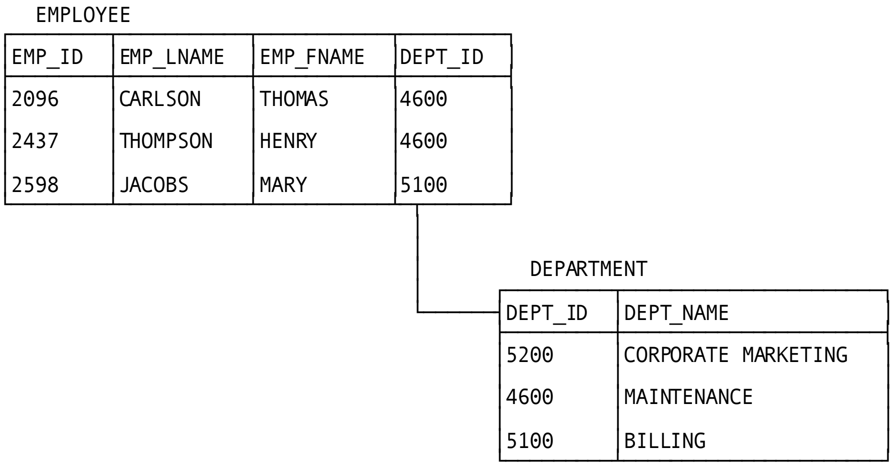
Normally, a database contains many tables holding related information. For example, in the Commonwealth Auto database, there is a table storing employee information and a table storing department information. Since each employee is associated with a department, there is a logical relationship between the two tables.

Foreign Keys

The database designer establishes relationships among tables by defining **foreign keys**. A foreign key is a value or combination of values in a table that exists as the primary key in another table. The names of the columns that make up the foreign key do not have to be the same as the primary key column names.

When you need to retrieve data in two tables at the same time, you use a foreign key and a primary key as common columns (columns that are common between the tables).

Here's an illustration of the relationship between the EMPLOYEE and DEPARTMENT tables:



EMPLOYEE

EMP_ID	EMP_LNAME	EMP_FNAME	DEPT_ID
2096	CARLSON	THOMAS	4600
2437	THOMPSON	HENRY	4600
2598	JACOBS	MARY	5100

DEPARTMENT

DEPT_ID	DEPT_NAME
5200	CORPORATE MARKETING
4600	MAINTENANCE
5100	BILLING

The department ID, DEPT_ID, is the primary key in the DEPARTMENT table and a foreign key in the EMPLOYEE table.

To find the name of the department that an employee is associated with, you would match the two tables based on this common column.

To find the name of the department that employee 2096 is associated with, you would look up the employee in the EMPLOYEE table based on the employee ID, 2096, and find department ID 4600. Then you would find the matching department ID 4600 in the DEPARTMENT table to find the department name, Maintenance.

Relational Operations

You can manipulate tables to form new tables with relational operations.

The three types of operations that you use most often against a relational database involve accessing specified rows, particular columns, and more than one table.

Specified Rows (SELECT)

You can request that specific rows of data be retrieved from a table or tables.

For example, you can retrieve all information on employees whose last names are Carlson or Jacobs. Information on other employees is not returned. This type of operation is called a **select** operation.

EMPLOYEE

EMP_ID	EMP_LNAME	EMP_FNAME	DEPT_ID
2096	CARLSON	THOMAS	4600
2437	THOMPSON	HENRY	4600
2598	JACOBS	MARY	5100

EMP_ID	EMP_LNAME	EMP_FNAM
2096	CARLSON	THOMAS
2598	JACOBS	MARY

Particular Columns (PROJECT)

You can identify particular columns of data to be retrieved.

For example, you can retrieve only the last name and first name of each employee in the company, in order to create a personnel list. This type of operation is called a **project** operation.

EMP_ID	EMP_LNAME	EMP_FNAME	DEPT_ID
2096	CARLSON	THOMAS	4600
2437	THOMPSON	HENRY	4600
2598	JACOBS	MARY	5100

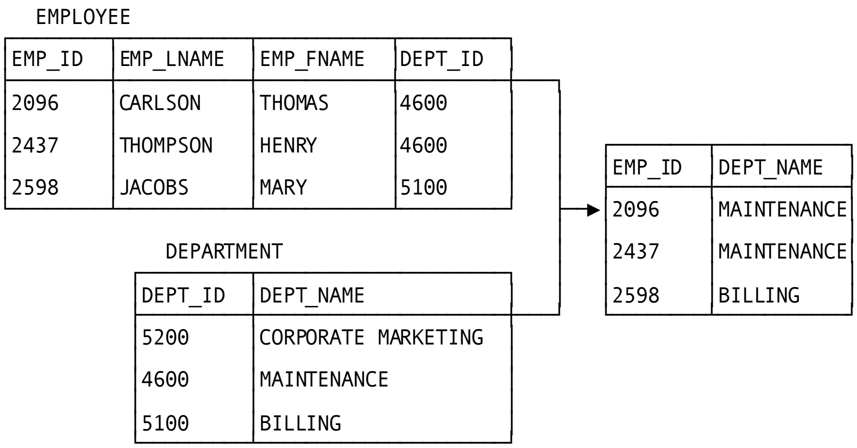
EMP_LNAME	EMP_FNAME
CARLSON	THOMAS
THOMPSON	HENRY
JACOBS	MARY

More than one table (JOIN)

You can retrieve data from more than one table at the same time.

For example, to create a list of department names and employees in each department, you need to retrieve information on each employee along with information on the department in which the employee works.

This data is in two tables: the employee information and department ID are in the EMPLOYEE table, and the department ID and department name are in the DEPARTMENT table. You can join the two tables to see both the employee and department information as a single table. This type of operation is called a **join** operation:



EMPLOYEE

EMP_ID	EMP_LNAME	EMP_FNAME	DEPT_ID
2096	CARLSON	THOMAS	4600
2437	THOMPSON	HENRY	4600
2598	JACOBS	MARY	5100

DEPARTMENT

DEPT_ID	DEPT_NAME
5200	CORPORATE MARKETING
4600	MAINTENANCE
5100	BILLING

EMP_ID	DEPT_NAME
2096	MAINTENANCE
2437	MAINTENANCE
2598	BILLING

You use one or more of these basic operations to retrieve data from the database. For example, you may want to access two tables to see employee and department information (join) but show only the employee last name and the department name (project).

Benefits of a Relational Database

- You can access data in tables easily and quickly.
- It's easy to understand the data you see because it is in a tabular format.
- Relational databases are becoming standard on various computers.
- When you are designing application programs to access the database, you don't have to be aware of all the details of underlying physical database structures.
- You can make changes to the database without affecting application programs.

Review

Match each description on the left with a term or terms on the right. Terms can match more than one description.

Description	Term
1. Components of a relational database that hold the data	a. Foreign key
2. Components of a table	b. Primary key
3. A column or combination of columns holding values that form the primary key of another table	c. Tables
4. The types of operations you can perform against a relational database	d. Rows and columns
5. A way to establish a relationship between two tables	e. Select, project, and join
6. A column or combination of columns that uniquely identifies a row in a table	

To check your answers, see Review Answers for Chapter 1 (see page 163).

Chapter 3: What Is SQL?

Goal

At the end of this chapter, you will be able to:

- Define the term 'SQL'
- Specify why SQL is used and what you can do with it
- Identify the components of an SQL statement
- Compare interactive and embedded SQL

Summary

Structured Query Language (SQL) is a standardized non-procedural language used to retrieve and update information in a relational database.

This section contains the following topics:

Why SQL

SQL serves as a standard language that:

- Can be used either for ad hoc queries and updates or in application programs.
- Eliminates the need for the user to know how the database is physically structured.
- Facilitates the exchange of information from computer to computer and from database to database.

Benefits of a Standard Language

- You need less training when you move from one computer or product to another.
- One database management system can communicate with another if they use a standard interface.

What Can SQL Do?

You can use SQL to:

- Define a database
- Manipulate data in the database
- Control access to data in the database in a multi-user environment

Data Definition

You use SQL data description language (DDL) statements to define a database and tables within the database.

Data Manipulation

You use SQL DML statements to manipulate the data in tables.

There are four basic SQL DML statements:

- SELECT
- INSERT
- UPDATE
- DELETE

The SELECT statement is used to retrieve data. The result of a query is a **result table**. INSERT, UPDATE, and DELETE (all called update operations) are used to make changes to the data.

Data Control

You use SQL DDL to control access to data in a multi-user environment. There are two basic SQL DDL commands:

- GRANT
- REVOKE

The GRANT command allows another user to access data and the REVOKE command removes that access.

If you cannot access a table, it probably means that you have not been granted access to it.

Components of an SQL Statement

An interactive SQL statement consists of a structured set of English-like elements:

- A **verb** that tells the action you want performed.
- Additional **options** that modify verbs and further define the operation.
- **Named entities** that identify the object of the action.
- **Clauses** (required or optional) to identify the table in which the data is located and to specify more about how you want the action performed.
- A **delimiter (;)** that signals the end of the statement.

Basic SQL statement:

select distinct city from employee where emp_id > 5555;

```
  │       │     │    └───────────┘      └─────────────────┘ │
  │       │     │    │           │      │                 │ │
Verb   Options  Named   Clause           Clause specifying  Delimiter
                entity  identifying      selection criteria
                        table
```

A delimiter is required for interactive SQL commands. If you enter SQL commands in an application program, you may need to use a different delimiter or none at all.

Statement Length

A statement can span several lines. It will not be executed until the delimiter is encountered.

Interactive and Embedded SQL

You can issue SQL statements either interactively or from within an application program.

Interactive SQL

When you use interactive SQL to enter a request or to change data, you get immediate results. This is the typical way of entering ad hoc statements.

For example, you might want to identify all employees who live in Boston. This SQL statement would return a table that includes the last name and first name of all employees residing in Boston:

```
select emp_lname, emp_fname
       from employee
       where city = 'Boston';
```

Embedded SQL

You can embed SQL statements in host application programs. With embedded SQL, the program receives the result of the request and acts on it, displays it, or prints it. For example, this embedded SQL statement returns to a COBOL program the last name and first name for employees living in the city requested by the program:

```
exec sql
select emp_lname, emp_fname
       into :emp_lname, :emp_fname
       from employee
            where city = :city_in
end-exec
```

Review

Fill in the blanks with the appropriate term or response:

1. SQL stands for _______ _______ _______.
2. You use SQL _______ statements to define tables.
3. You use SQL _______ statements to change data in a table.
4. The three SQL update operations are _______, _______, and _______.
5. An interactive SQL statement ends with a _______.
6. An SQL statement begins with a _______.
7. An interactive SQL statement _______ (*can/cannot*) span several lines.
8. Interactive SQL gives you _______ results.
9. Embedded SQL returns the results to the _______.

To check your answers, see Review Answers for Chapter 2 (see page 164).

Chapter 4: Retrieving Data

Goal

After completing this chapter, you will be able to respond to requests for information from Commonwealth Auto by creating SQL statements that:

- Retrieve data from all columns and rows in a table.
- Retrieve data from specified columns in a table.
- Give new names to column headings.
- Display the results of calculations.
- Eliminate duplicate rows from your results.
- Sort the information displayed.

Summary

To retrieve data from the database, you use the SELECT statement, probably the most frequently used SQL statement.

Online Exercises

The online exercises for this self-training guide begin in this chapter.

Important! Before you begin, be sure to read Online Exercises in the chapter "Introduction" in the preface of this guide.

When you see a complete statement ending with a delimiter (**;**) and the label **How it's done**, you can enter the statement online. The result you obtain should have the same content as the one in the book.

In most cases, after you have entered a statement, you will see another suggested retrieval with the label **Now you try it**. This time, you will use the knowledge you just gained to create your own statement *online*.

If your result does not match the one shown in the guide, or if you are unable to compose a statement, you can look up the correct syntax in Appendix B,"Answers to Exercises (see page 163)."

At the end of this chapter, there are additional scenarios and review exercises to give you extra practice with SQL.

The Database You'll Use

You will use the Commonwealth Auto database for these online exercises. The tables in this database contain data about employees, jobs, skills, projects, and departments.

Before you begin the online exercises in this chapter, look in Appendix C,"Table Descriptions" at the type of information kept in each table.

This section contains the following topics:

Retrieving all Columns from a Table

The basic statement for retrieving data from a table is SELECT. SELECT specifies which data you want to retrieve. The FROM clause in the SELECT statement specifies which table holds the data.

How It's Done

The DEPARTMENT table contains the following columns:

- DEPT_ID
- DEPT_HEAD_ID
- DIV_CODE
- DEPT_NAME

In order to list all information about each department, you need to access this table and select all columns. To do this, enter:

```
select *
       from department;
```

You can enter this statement all on one line or spanning several lines. You can use either lowercase or uppercase.

What does the asterisk (*) mean?

It means that you want to see all the columns in the table. You don't have to list the column names explicitly.

What does DEPARTMENT indicate?

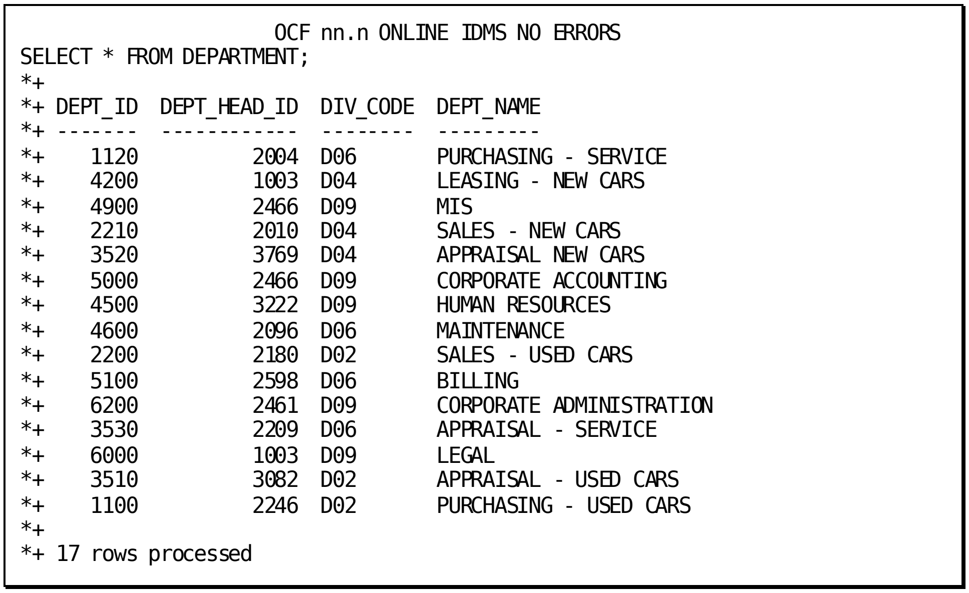
It's the name of the table from which you want to access data.

Why is there a semicolon at the end of the statement?

SQL will not process an interactive statement until it encounters a semicolon.

What You See

The result looks like this:



```
                            OCF nn.n ONLINE IDMS NO ERRORS
SELECT * FROM DEPARTMENT;
*+
*+ DEPT_ID  DEPT_HEAD_ID  DIV_CODE  DEPT_NAME
*+ -------  ------------  --------  ---------
*+    1120          2004  D06       PURCHASING - SERVICE
*+    4200          1003  D04       LEASING - NEW CARS
*+    4900          2466  D09       MIS
*+    2210          2010  D04       SALES - NEW CARS
*+    3520          3769  D04       APPRAISAL NEW CARS
*+    5000          2466  D09       CORPORATE ACCOUNTING
*+    4500          3222  D09       HUMAN RESOURCES
*+    4600          2096  D06       MAINTENANCE
*+    2200          2180  D02       SALES - USED CARS
*+    5100          2598  D06       BILLING
*+    6200          2461  D09       CORPORATE ADMINISTRATION
*+    3530          2209  D06       APPRAISAL - SERVICE
*+    6000          1003  D09       LEGAL
*+    3510          3082  D02       APPRAISAL - USED CARS
*+    1100          2246  D02       PURCHASING - USED CARS
*+
*+ 17 rows processed
```

Rows Are Not Ordered

There is no inherent order to the rows as they are stored in the database. The rows in your result, therefore, may be in a different order from those displayed here. The message specifying the number of rows returned may be worded differently and appear in a different position on your screen.

Exercise 3-1

Now You Try It

Commonwealth Auto maintains information on all the skills the company requires to do business. This information is maintained in the SKILL table.

Enter a statement to access all skill information. It isn't important whether you use uppercase or lowercase in your SQL statement.

What table do you need to access?

You need to access the SKILL table.

The result looks like this:

```
SKILL_ID  SKILL_NAME           SKILL_DESC
--------  ----------           ----------
    5420  Writing              General writing skills
    4444  Assembly             Auto body assembly experience
    5160  Calculus             Knowledge of advanced mathematics
    1000  Management           Experience managing people
    4420  Telephone            Basic customer support
    7000  Sales                Background in sales techniques
    4410  Typing               Minimum 60 wpm
    6666  Billing              Basic billing procedures
    3065  Electronics          Electronic diagnosis and repair
    5430  Mktng Writing        Background in promotional writing
    6470  Window Installation  Installation of automotive windows
    5130  Basic Math           Knowledge of basic math functions
    5500  Gen Mktng            Knowledge of basic marketing concepts
    5180  Statistics           Creating & evaluating statistics
    6670  Gas Engine Repair    Experience in gasoline engine repair
    6770  Purchasing           Basic buying & negotiation procedures
    4370  Filing               Ability to organize correspondence/invoices
    1030  Acct Mgt             Experience in managing acctng activities
    5309  Appraising           Used car evaluation
    4490  Gen Ledger           Experience with general ledger
    6650  Diesel Engine Repair Experience in diesel engine repair
    4430  Interviewing         Basic interviewing experience
    3333  Bodywork             Experience in repairing auto bodies
    3088  Brake work           Brake diagnosis and repair
    5200  Gen Acctng           Familiarity with basic AR and AP
    4250  Data Entry           Familiarity with computer keyboard
26 rows processed
```

If your results do not match what you see above, check “Exercise 3-1 Answer” in Review Answers for Chapter 3 (see page 165) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Retrieving Selected Columns from a Table

You just retrieved all columns and all rows from a table.

If you want to see only some of the columns, specify the names of the columns you want to see. Put a comma between column names.

How It's Done

If you want to see only the department ID and name for each department in the company, enter:

```
select dept_id, dept_name
       from department;
```

The result of this SELECT statement is a list of the values in the DEPT_ID and DEPT_NAME columns.

Where did you get the column names?

They come from the table descriptions. In this guide, the table descriptions appear in Error! Reference source not found..

The result looks like this:

```
DEPT_ID  DEPT_NAME
-------  ---------
   1120  PURCHASING - SERVICE
   4200  LEASING - NEW CARS
   4900  MIS
   2210  SALES - NEW CARS
   3520  APPRAISAL NEW CARS
   5000  CORPORATE ACCOUNTING
   4500  HUMAN RESOURCES
   4600  MAINTENANCE
   2200  SALES - USED CARS
   5100  BILLING
   6200  CORPORATE ADMINISTRATION
   3530  APPRAISAL - SERVICE
   6000  LEGAL
   3510  APPRAISAL - USED CARS
   1100  PURCHASING - USED CARS
   5200  CORPORATE MARKETING
   1110  PURCHASING - NEW CARS
  17 rows processed
```

How does this compare with the results displayed when you specified SELECT *?

You see only the columns you selected rather than all columns.

What determines the order of the columns?

It's based on the order in which you listed the columns in your SELECT statement.

Exercise 3-2

Now You Try It

The Human Resources department is responsible for keeping track of all skill information for the company. Right now, they need to see which skill IDs and names are currently on file. Create a SELECT statement to retrieve and display skill IDs and names from the SKILL table.

Look in Appendix C, “Table Descriptions” to identify the column names.

The result looks like this:

```
SKILL_ID  SKILL_NAME
--------  ----------
    5420  Writing
    4444  Assembly
    5160  Calculus
    1000  Management
    4420  Telephone
    7000  Sales
    4410  Typing
    6666  Billing
    3065  Electronics
    5430  Mktng Writing
    6470  Window Installation
    5130  Basic Math
    5500  Gen Mktng
    5180  Statistics
    6670  Gas Engine Repair
    6770  Purchasing
    4370  Filing
    1030  Acct Mgt
    5309  Appraising
    4490  Gen Ledger
    6650  Diesel Engine Repair
    4430  Interviewing
    3333  Bodywork
    3088  Brake work
    5200  Gen Acctng
    4250  Data Entry
```

If your results do not match what you see above, check Review Answers for Chapter 3 (see page 165) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

What message do you see?

You see a message stating the number of rows that have been retrieved.

Exercise 3-3

Try Another

The president of the company wants a Christmas card list of all employees. He wants to see the first and last names for each employee and the street and community in which they live.

Enter a SELECT statement to do this, using the EMPLOYEE table.

The result looks like this:

```
  EMP_FNAME   EMP_LNAME    STREET                   CITY
  ---------   ---------    ------                   ----
  Samuel      Spade        47 London St             Canton
  Catherine   Williams     566 Lincoln St           Boston
  Janice      Dexter       399 Pine St              Medford
  Cora        Parker       2 Spring St              Boston
  Mark        White        560 Camden St            Canton
  Marylou     Hamel        11 Main St               Medford
  James       Gallway      12 East Speen St         Stoneham
  Ronald      Wilder       30 Heron Ave             Natick
  Frank       Lowe         25 Rutland St            Natick
  Mary        Umidy        895A Braintree Circle    Medford
  Cynthia     Taylor       201 Washington St        Concord
  John        Brooks       129 Bedford St           Camden
  Carl        Smith        18 South St              Newton
  Martin      Loren        401 Cross St             Grover
  Bruce       MacGregor    254 Waterside Rd         Camden
  Michael     Smith        201 Summer St            Brookline
  William     Griffin      390 Sherman St           Taunton
  Jason       Thompson     3 Flintlock St           Natick
  Stephen     Wills        34 Avon Dr               Canton
  David       Alexander    18 Cross St              Grover

 55 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 3 (see page 165) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Renaming Column Headings

In your results, each column has a heading. The heading is the name of the column as it was specified in the table definition.

```
 EMP_FNAME   EMP_LNAME    STREET                 CITY
 ---------   ---------    ------                 ----
 Samuel      Spade        47 London St           Canton
 Catherine   Williams     566 Lincoln St         Boston
 Janice      Dexter       399 Pine St            Medford
 Cora        Parker       2 Spring St            Boston
 Mark        White        560 Camden St          Canton
                        .
                        .
                        .
55 rows processed
```

How It's Done

To make a column heading more meaningful, you can rename it. To do this, add AS and the name you want to use after each column name:

```
select emp_fname as "First Name",
       emp_lname as "Last Name",
       street as "Street",
       city as "City"
       from employee;
```

Enclose new heading names in double quotation marks.

Don't forget the commas between column names.

This is the same SELECT statement you used to retrieve selected columns. However, in this case, the headings will have a more meaningful appearance.

These new column headings assigned using AS are temporary names and appear only in the display.

The result looks like this:

```
  First Name          Last Name           Street                City
  ----------          ---------           ------                ----
  Samuel              Spade               47 London St          Canton
  Catherine           Williams            566 Lincoln St        Boston
  Janice              Dexter              399 Pine St           Medford
  Cora                Parker              2 Spring St           Boston
  Mark                White               560 Camden St         Canton
  Marylou             Hamel               11 Main St            Medford
  James               Gallway             12 East Speen St      Stoneham
  Ronald              Wilder              30 Heron Ave          Natick
  Frank               Lowe                25 Rutland St         Natick
  Mary                Umidy               895A Braintree Circle Medford
  Cynthia             Taylor              201 Washington St     Concord
  John                Brooks              129 Bedford St        Camden
  Carl                Smith               18 South St           Newton
  Martin              Loren               401 Cross St          Grover
  Bruce               MacGregor           254 Waterside Rd      Camden
  Michael             Smith               201 Summer St         Brookline
  William             Griffin             390 Sherman St        Taunton
  Jason               Thompson            3 Flintlock St        Natick
  Stephen             Wills               34 Avon Dr            Canton
  David               Alexander           18 Cross St           Grover
                         .
                         .
                         .
 55 rows processed
```

Exercise 3-4

Now You Try It

Earlier, you produced a report that displayed department ID and name from the DEPARTMENT table. Produce the same report and rename the headings "Department ID" and "Name."

The result looks like this:

```
 DEPARTMENT ID  NAME
 -------------  ----
          1120  PURCHASING - SERVICE
          4200  LEASING - NEW CARS
          4900  MIS
          2210  SALES - NEW CARS
          3520  APPRAISAL NEW CARS
          5000  CORPORATE ACCOUNTING
          4500  HUMAN RESOURCES
          4600  MAINTENANCE
          2200  SALES - USED CARS
          5100  BILLING
          6200  CORPORATE ADMINISTRATION
          3530  APPRAISAL - SERVICE
          6000  LEGAL
          3510  APPRAISAL - USED CARS
          1100  PURCHASING - USED CARS
          5200  CORPORATE MARKETING
          1110  PURCHASING - NEW CARS

17 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 3 (see page 165) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Displaying Calculations in Columns

You can use arithmetic expressions to calculate new values from a column.

Use the following symbols for arithmetic operations:

Symbol	Meaning
*	Multiplication
/	Division
+	Addition
-	Subtraction

Order of Evaluation

Multiplication and division are performed first, from left to right. Addition and subtraction are performed second, from left to right. You can control the order in which operations are performed by using parentheses to enclose the operations you want performed first.

Computing with Null Values

Unless the column definition specifies otherwise, a column can contain no value. No value is also called **null**, or a **null value**. The result table usually shows null values as '<null>'.

The result of any calculation involving a null value is always a null value.

How It's Done

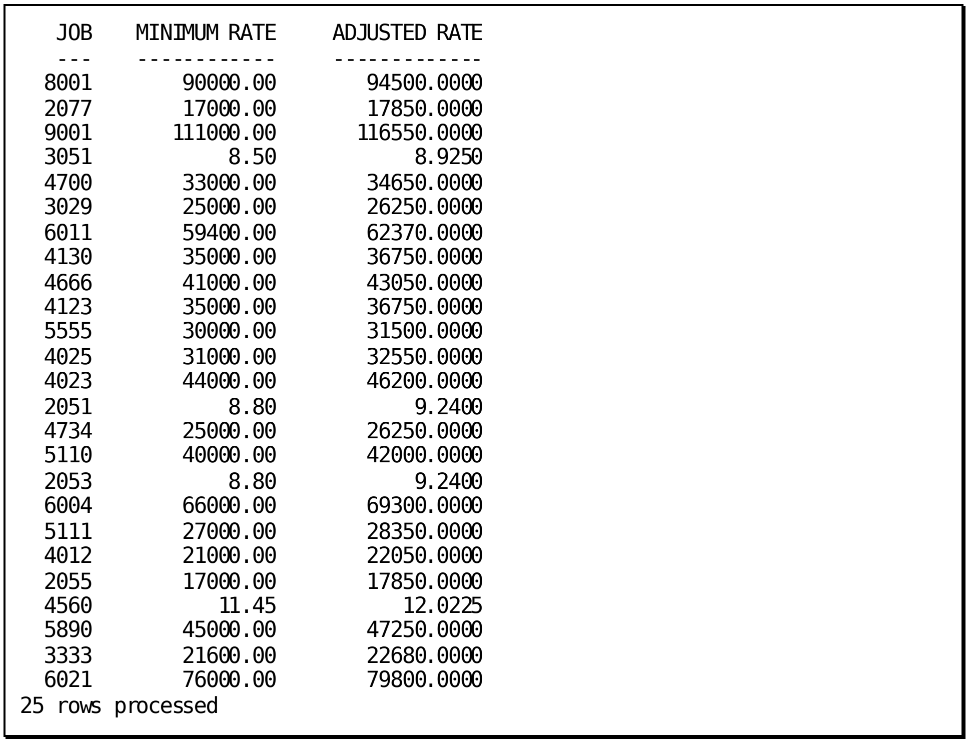
This year, the base rate for all jobs is rising 5 percent above last year's rates. The budget group needs a report showing job ID, last year's rate, and last year's rate plus 5 percent. This information is contained in the JOB table. To display the new rate, you will have to multiply the current rate by 1.05.

To create a table showing job ID, last year's rate, and this year's rate, enter:

```
select job_id as "Job", min_rate as "Minimum Rate",
       min_rate * 1.05 as "Adjusted Rate"
       from job;
```

You can omit the space on either side of the arithmetic symbol.

The result looks like this:



```
   JOB    MINIMUM RATE     ADJUSTED RATE
   ---    ------------     -------------
  8001        90000.00        94500.0000
  2077        17000.00        17850.0000
  9001       111000.00       116550.0000
  3051            8.50            8.9250
  4700        33000.00        34650.0000
  3029        25000.00        26250.0000
  6011        59400.00        62370.0000
  4130        35000.00        36750.0000
  4666        41000.00        43050.0000
  4123        35000.00        36750.0000
  5555        30000.00        31500.0000
  4025        31000.00        32550.0000
  4023        44000.00        46200.0000
  2051            8.80            9.2400
  4734        25000.00        26250.0000
  5110        40000.00        42000.0000
  2053            8.80            9.2400
  6004        66000.00        69300.0000
  5111        27000.00        28350.0000
  4012        21000.00        22050.0000
  2055        17000.00        17850.0000
  4560           11.45           12.0225
  5890        45000.00        47250.0000
  3333        21600.00        22680.0000
  6021        76000.00        79800.0000
25 rows processed
```

Why did you provide a heading for the calculated column?

You provided a heading to have a more meaningful name. If you hadn't, the heading would have been (**EXPR**) or **Expression**.

Exercise 3-5

Now You Try It

The Corporate Marketing department is considering revamping the bonus system. They want a report showing employee IDs, how much salary they earned and, if any, the bonus percentage and how much bonus each employee earned. This information is maintained in the POSITION table as SALARY_AMOUNT and BONUS_PERCENT.

Enter a SELECT statement to display this information. Rename the columns appropriately.

The result looks like this:

```
EMPLOYEE          SALARY  BONUS PERCENTAGE           BONUS PAID
--------          ------  ----------------           ----------
    3411        53665.00            <null>               <null>
    3411        44001.40            <null>               <null>
    4773        45240.00            <null>               <null>
    2010        76440.00             0.275          21021.00000
    3338        22048.84            <null>               <null>
    2246        59488.00            <null>               <null>
    2246        29536.00            <null>               <null>
    1034          <null>            <null>               <null>
    2424          <null>            <null>               <null>
    3767        50440.50             0.230          11601.31500
    3767         2200.00            <null>               <null>
    3449        74776.00            <null>               <null>
    3082        68016.00            <null>               <null>
    3341        48465.80            <null>               <null>
    4660        36400.00             0.250           9100.00000
    4660        24000.00            <null>               <null>
    2209        66144.00            <null>               <null>
    2894       111593.00            <null>               <null>
    4001        36921.00             0.230           8491.83000
    5090        48568.48             0.205           9956.53840
    1765        47009.34            <null>               <null>
    4456          <null>            <null>               <null>
    1765        18001.00            <null>               <null>
    3991        42016.00             0.235           9873.76000
    3991        27976.00            <null>               <null>
    3778          <null>            <null>               <null>
    4358        57824.50            <null>               <null>
    4962        30680.00            <null>               <null>
    2180        76961.00            <null>               <null>
    2180        19000.10            <null>               <null>
    2106        23920.00            <null>               <null>
    3222       110448.00            <null>               <null>
    4002        28601.80            <null>               <null>
    2437          <null>            <null>               <null>
    2096        85280.00            <null>               <null>
    2096          <null>            <null>               <null>
    2004        59280.00            <null>               <null>
    2004          <null>            <null>               <null>
    5103          <null>            <null>               <null>
    5008        47944.00            <null>               <null>
    4321        56977.80            <null>               <null>
    2598          <null>            <null>               <null>
    3764        54184.00             0.260          14087.84000
    3764        28912.00            <null>               <null>
    2448        70720.00             0.255          18033.60000
    2461        43784.00            <null>               <null>
    1234       117832.68            <null>               <null>
    1003       146432.00            <null>               <null>
    4027        28081.40            <null>               <null>
    2466        94953.52            <null>               <null>
    2174        49921.76            <null>               <null>
    2781        43888.00            <null>               <null>
    3704        22880.00            <null>               <null>
    4008        24441.00            <null>               <null>
```

```
     3433          <null>            <null>               <null>
     3288          <null>            <null>               <null>
     3841        33800.00            <null>               <null>
     4703        24857.00            <null>               <null>
     3294        53665.56            <null>               <null>
     3769        41600.00            <null>               <null>
     3118        45241.94            <null>               <null>

61 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 3 (see page 165) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Why the '<null>' entries?

Most positions are not sales positions and do not have bonuses attached.

Using Parentheses

Use parentheses to specify the order in which you want the arithmetic evaluation to take place.

How It's Done

You have been asked to produce a report that shows what weekly salaries would look like before and after a raise of $1,000 per year. Show yearly salary as well.

Try this without using parentheses first:

```
select salary_amount,
       salary_amount / 52 as "Current Wkly Sal",
       salary_amount + 1000 / 52 as "Adjusted Wkly Sal"
       from position;
```

The result looks like this:

```
SALARY_AMOUNT  CURRENT WKLY SAL  ADJUSTED WKLY SAL
-------------  ----------------  -----------------
     53665.00          1032.019           53684.00
     44001.40           846.180           44020.40
     45240.00           870.000           45259.00
     76440.00          1470.000           76459.00
     22048.84           424.016           22067.84
     59488.00          1144.000           59507.00
     29536.00           568.000           29555.00
       <null>            <null>             <null>
       <null>            <null>             <null>
     50440.50           970.009           50459.50
      2200.00            42.307            2219.00
     74776.00          1438.000           74795.00
     68016.00          1308.000           68035.00
     48465.80           932.034           48484.80
     36400.00           700.000           36419.00
     24000.00           461.538           24019.00
     66144.00          1272.000           66163.00
    111593.00          2146.019          111612.00
     36921.00           710.019           36940.00
     48568.48           934.009           48587.48
     47009.34           904.025           47028.34
       <null>            <null>             <null>
     18001.00           346.173           18020.00
     42016.00           808.000           42035.00
     27976.00           538.000           27995.00
       <null>            <null>             <null>
     57824.50          1112.009           57843.50
     30680.00           590.000           30699.00
     76961.00          1480.019           76980.00
     19000.10           365.386           19019.10
     23920.00           460.000           23939.00
    110448.00          2124.000          110467.00
     28601.80           550.034           28620.80
       <null>            <null>             <null>
     85280.00          1640.000           85299.00
       <null>            <null>             <null>
     59280.00          1140.000           59299.00
       <null>            <null>             <null>
       <null>            <null>             <null>
     47944.00           922.000           47963.00
     56977.80          1095.726           56996.80
       <null>            <null>             <null>
     54184.00          1042.000           54203.00
     28912.00           556.000           28931.00
     70720.00          1360.000           70739.00
     43784.00           842.000           43803.00
    117832.68          2266.013          117851.68
    146432.00          2816.000          146451.00
     28081.40           540.026           28100.40
     94953.52          1826.029           94972.52
     49921.76           960.033           49940.76
     43888.00           844.000           43907.00
     22880.00           440.000           22899.00
     24441.00           470.019           24460.00
       <null>            <null>             <null>
       <null>            <null>             <null>
       33800.00           650.000           33819.00
       24857.00           478.019           24876.00
       53665.56          1032.030           53684.56
       41600.00           800.000           41619.00
       45241.94           870.037           45260.94

 61 rows processed
```

Is the result correct?

Take one salary and do your own pencil and paper calculation to check your answers:

```
24,000.00 + 1,000 = 25,000.00 / 52 = 480.76923
```

The result is wrong: In the calculation involving the increase, the division occurred *before* the addition instead of after. Remember that the default order of evaluation is multiplication and division, performed left to right, and then addition and subtraction, performed left to right.

Use parentheses to specify that you want the addition to take place *before* the division. Enter:

```
select salary_amount,
       salary_amount / 52 as "Current Wkly Sal",
       (salary_amount + 1000) / 52 as "Adjusted Wkly Sal"
       from position;
```

The result looks like this:

```
  SALARY_AMOUNT  CURRENT WKLY SAL  ADJUSTED WKLY SAL
  -------------  ----------------  -----------------
       53665.00          1032.019           1051.250
       44001.40           846.180            865.411
       45240.00           870.000            889.230
       76440.00          1470.000           1489.230
       22048.84           424.016            443.246
       59488.00          1144.000           1163.230
       29536.00           568.000            587.230
         <null>            <null>             <null>
         <null>            <null>             <null>
       50440.50           970.009            989.240
        2200.00            42.307             61.538
       74776.00          1438.000           1457.230
       68016.00          1308.000           1327.230
       48465.80           932.034            951.265
       36400.00           700.000            719.230
       24000.00           461.538            480.769
       66144.00          1272.000           1291.230
      111593.00          2146.019           2165.250
       36921.00           710.019            729.250
       48568.48           934.009            953.240
       47009.34           904.025            923.256
         <null>            <null>             <null>
       18001.00          346.173           365.403
       42016.00          808.000           827.230
       27976.00          538.000           557.230
         <null>           <null>            <null>
       57824.50         1112.009          1131.240
       30680.00          590.000           609.230
       76961.00         1480.019          1499.250
       19000.10          365.386           384.617
       23920.00          460.000           479.230
      110448.00         2124.000          2143.230
       28601.80          550.034           569.265
         <null>           <null>            <null>
       85280.00         1640.000          1659.230
         <null>           <null>            <null>
       59280.00         1140.000          1159.230
         <null>           <null>            <null>
         <null>           <null>            <null>
       47944.00          922.000           941.230
       56977.80         1095.726          1114.957
         <null>           <null>            <null>
       54184.00         1042.000          1061.230
       28912.00          556.000           575.230
       70720.00         1360.000          1379.230
       43784.00          842.000           861.230
      117832.68         2266.013          2285.243
      146432.00         2816.000          2835.230
       28081.40          540.026           559.257
       94953.52         1826.029          1845.260
       49921.76          960.033           979.264
       43888.00          844.000           863.230
       22880.00          440.000           459.230
       24441.00          470.019           489.250
         <null>           <null>            <null>
         <null>           <null>            <null>
       33800.00          650.000           669.230
       24857.00          478.019           497.250
       53665.56         1032.030          1051.260
       41600.00          800.000           819.230
       45241.94          870.037           889.268

 61 rows processed
```

How does this result match your written calculation?

If you did your written calculation correctly, it should match this result.

Eliminating Duplicate Rows

Sometimes a row in a selected column contains information that is the same as information in another row.

Why Duplicates Occur

The EXPERTISE table contains skill IDs, the IDs of employees who have the skills, the level of ability an employee has in a skill, and the date the ability was acquired. Commonwealth Auto may have several employees who match a particular skill in the SKILL table and may have no employees who match another skill.

How It's Done

To obtain a list of skill IDs *associated with at least one employee*, enter:

```
select skill_id
       from expertise;
```

This gives a list of skill IDs that have been matched to employees who have that skill. Any skill that has no employees associated with it will not show up in the result.

The result looks like this:

```
SKILL_ID
--------
    1000
    6470
    1000
    6770
    6770
    7000
    3065
    3333
    6770
    4430
    7000
    5309
    1000
    6670
    6470
    3333
    4444
    7000
    4250
    4370
    5180
    1030
    4490
    5200
    6666
    5420
```

```
     5430
     1000
     5500
     5309
     5180
     1000
     4430
     3333
     6650
     6670
     6770
     6770
     5309
     5500
     6650
     5200
     7000
     7000
     7000
     5309
     5200
     6666
     4370
     4410
     7000
     7000
     4370
     4410
     4420
     7000
     1000
     4430
     5500
     3065
     6670
     7000
     4250
     5130
     5309
     5130
     6770
     7000
     5200

  69 rows processed
```

Why are some of the skill IDs repeated?

The result shows the skill ID for each employee. If more than one employee has that particular skill, the skill ID is repeated.

To see this more clearly, look at the skills and the associated employees by entering:

```
select skill_id, emp_id
       from expertise;
```

The result looks like this:

```
SKILL_ID EMP_ID
--------  ------
    1000    1003
    6470    1034
    1000    1234
    6770    1765
    6770    2004
    7000    2010
    3065    2096
    3333    2096
    6770    2106
    4430    2174
    7000    2180
    5309    2209
    1000    2246
    6670    2246
    6470    2424
    3333    2437
    4444    2437
    7000    2448
    4250    2461
    4370    2461
    5180    2461
    1030    2466
    4490    2466
    5200    2466
    6666    2598
    5420    2781
    5430    2781
    1000    2894
    5500    2894
    5309    3082
    5180    3118
    1000    3222
    4430    3222
    3333    3288
    6650    3288
    6670    3288
    6770    3294
    6770    3338
    5309    3341
    5500    3411
    6650    3433
    5200    3449
    7000    3704
    7000    3764
    7000    3767
    5309    3769
    5200    3778
    6666    3778
    4370    3841
    4410    3841
    7000    3991
    7000    4001
    4370    4002
    4410    4002
    4420    4008
```

```
   7000    4027
   1000    4321
   4430    4321
   5500    4358
   3065    4456
   6670    4456
   7000    4660
   4250    4703
   5130    4703
   5309    4773
   5130    4962
   6770    5008
   7000    5090
   5200    5103

69 rows processed
```

You want to eliminate the duplicate rows resulting from your first SELECT statement in order to see each skill ID only once.

To eliminate these rows, you can use the DISTINCT option immediately after the word SELECT.

How It's Done with DISTINCT

Using the first SELECT statement, add DISTINCT after SELECT:

```
select distinct skill_id
       from expertise;
```

The result looks like this:

```
SKILL_ID
--------
    1000
    1030
    3065
    3333
    4250
    4370
    4410
    4420
    4430
    4444
    4490
    5130
    5180
    5200
    5309
    5420
    5430
    5500
    6470
    6650
    6666
    6670
    6770
    7000

24 rows processed
```

Now the result shows a list of skill IDs with no duplicates.

Since using DISTINCT eliminates duplicate rows, fewer rows are returned.

Exercise 3-6

Now You Try It

The Accounting department needs a list of communities represented by employees in this company in order to identify applicable city taxes. One of the columns in the EMPLOYEE table contains the name of the community in which the employee resides. Enter a SELECT statement to list the communities in the table without showing any duplicates.

The result looks like this:

```
CITY
----
Boston
Brookline
Camden
Canton
Concord
Dedham
Grover
Medford
Natick
Newton
Stoneham
Taunton
Wilmington

13 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 3 (see page 165) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Organizing Data

When you retrieve data from the database, the rows are in an order selected by the database management system. If you want the data sorted in a particular order, use the ORDER BY clause. The ORDER BY clause must be the last clause in a SELECT statement.

How It's Done

You can order an employee list by entering:

```
select emp_id, emp_lname
       from employee
       order by emp_lname;
```

The result looks like this:

```
EMP_ID  EMP_LNAME
------  ---------
  2180  Albertini
  1765  Alexander
  2461  Anderson
  1003  Baldwin
  2466  Bennett
  4321  Bradley
  3082  Brooks
  2096  Carlson
  2145  Catlin
  4008  Clark
  4027  Courtney
  3433  Crane
  3841  Cromwell
  4773  Dexter
  3769  Donelson
  5103  Ferguson
  3778  Ferndale
  5008  Fordman
  1034  Gallway
  2894  Griffin
  4703  Halloran
  2246  Hamel
  2598  Jacobs
  2004  Johnson
  3294  Johnson
  3199  Loren
  3767  Lowe
  2448  Lynn
  4660  MacGregor
  1234  Mills
  3704  Moore
  3764  Park
  2010  Parker
  4358  Robinson
  4002  Roy
  3288  Sampson
  2209  Smith
  3341  Smith
  2299  Spade
  3449  Taylor
  4001  Thompson
  2437  Thompson
  4456  Thompson
  2781  Thurston
  2898  Umidy
  3222  Voltmer
  3338  White
  4962  White
  2106  Widman
  2424  Wilder
  3991  Wilkins
  3411  Williams
  5090  Wills
  3118  Wooding
  2174  Zander

55 rows processed
```

You can specify either ascending (ASC) or descending (DESC) order. The default order is ascending.

If you sort on a column that contains null values, the null values are grouped together.

Exercise 3-7

Now You Try It

Change the example above so that it is sorted in descending order. Specify DESC after the column name in the ORDER BY clause.

The result looks like this:

```
EMP_ID  EMP_LNAME
------  ---------
  2174  Zander
  3118  Wooding
  5090  Wills
  3411  Williams
  3991  Wilkins
  2424  Wilder
  2106  Widman
  3338  White
  4962  White
  3222  Voltmer
  2898  Umidy
  2781  Thurston
  2437  Thompson
  4456  Thompson
  4001  Thompson
  3449  Taylor
  2299  Spade
  2209  Smith
  3341  Smith
  3288  Sampson
  4002  Roy
  4358  Robinson
  2010  Parker
  3764  Park
  3704  Moore
  1234  Mills
  4660  MacGregor
  2448  Lynn
  3767  Lowe
  3199  Loren
  2004  Johnson
  3294  Johnson
  2598  Jacobs
  2246  Hamel
  4703  Halloran
  2894  Griffin
  1034  Gallway
  5008  Fordman
  3778  Ferndale
  5103  Ferguson
  3769  Donelson
  4773  Dexter
  3841  Cromwell
  3433  Crane
  4027  Courtney
  4008  Clark
  2145  Catlin
  2096  Carlson
  3082  Brooks
  4321  Bradley
  2466  Bennett
  1003  Baldwin
  2461  Anderson
  1765  Alexander
  2180  Albertini

55 rows processed
```

If your results do not match what you see above, check Exercise 3-7 Answer in Review Answers for Chapter 3 (see page 165) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Exercise 3-8

Try Another

Display the skills available in the company, as you did earlier, but list them in numeric order to make it easier to scan. Show both skill ID and skill name from the SKILL table.

The result looks like this:

```
SKILL_ID  SKILL_NAME
--------  ----------
    1000  Management
    1030  Acct Mgt
    3065  Electronics
    3088  Brake work
    3333  Bodywork
    4250  Data Entry
    4370  Filing
    4410  Typing
    4420  Telephone
    4430  Interviewing
    4444  Assembly
    4490  Gen Ledger
    5130  Basic Math
    5160  Calculus
    5180  Statistics
    5200  Gen Acctng
    5309  Appraising
    5420  Writing
    5430  Mktng Writing
    5500  Gen Mktng
    6470  Window Installation
    6650  Diesel Engine Repair
    6666  Billing
    6670  Gas Engine Repair
    6770  Purchasing
    7000  Sales

26 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 3 (see page 165) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Multiple Sort Columns

You've seen how to sort selected rows by specifying ORDER BY and a column name. If you specify more than one column name after ORDER BY, SQL sorts rows by the first column named, then by the second column named, and so on.

How It's Done

You often want to sort all employees by first name within last name for an employee list. To do this, enter:

```
select emp_lname, emp_fname
       from employee
       order by emp_lname, emp_fname;
```

The result looks like this:

```
EMP_LNAME            EMP_FNAME
---------            ---------
Albertini            Joan
Alexander            David
Anderson             Alice
Baldwin              James
Bennett              Patricia
Bradley              George
Brooks               John
Carlson              Thomas
Catlin               Martin
Clark                Robert
Courtney             Cecile
Crane                Herbert
Cromwell             Michelle
Dexter               Janice
Donelson             Julie
Ferguson             Adele
Ferndale             Jane
Fordman              Timothy
Gallway              James
Griffin              William
Halloran             Martin
Hamel                Marylou
Jacobs               Mary
Johnson              Carolyn
Johnson              Eleanor
Loren                Martin
Lowe                 Frank
Lynn                 David
MacGregor            Bruce
Mills                Thomas
Moore                Richard
Park                 Deborah
Parker               Cora
Robinson             Judith
Roy                  Linda
Sampson              Ralph
Smith                Carl
Smith                Michael
Spade                Samuel
Taylor               Cynthia
Thompson             Henry
Thompson             Jason
Thompson             Thomas
Thurston             Joseph
Umidy                Mary
Voltmer              Louise
White                Mark
White                Peter
Widman               Susan
Wilder               Ronald
Wilkins              Fred
Williams             Catherine
Wills                Stephen
Wooding              Alan
Zander               Jonathan

55 rows processed
```

Exercise 3-9

Now You Try It

Management needs a list of all employees assigned to each department. Enter a SELECT statement to show the department ID, last name, and employee ID from the EMPLOYEE table. Order the list by last name within each department. Use the table descriptions in Review Answers for Chapter 3 (see page 165) to find the correct column names.

The result looks like this:

```
DEPT_ID  EMP_LNAME            EMP_ID
-------  ---------            ------
   1100  Fordman                5008
   1100  Hamel                  2246
   1100  Halloran               4703
   1110  Widman                 2106
   1110  Alexander              1765
   1120  White                  3338
   1120  Johnson                3294
   1120  Johnson                2004
   1120  Umidy                  2898
   2200  Moore                  3704
   2200  Lowe                   3767
   2200  Albertini              2180
   2200  Lynn                   2448
   2200  MacGregor              4660
   2210  Wills                  5090
   2210  White                  4962
   2210  Park                   3764
   2210  Thompson               4001
   2210  Courtney               4027
   2210  Clark                  4008
   2210  Parker                 2010
   2210  Wilkins                3991
   3510  Dexter                 4773
   3510  Brooks                 3082
   3520  Donelson               3769
   3530  Smith                  3341
   3530  Smith                  2209
   4500  Zander                 2174
   4500  Voltmer                3222
   4500  Wooding                3118
   4600  Thompson               2437
   4600  Gallway                1034
   4600  Crane                  3433
   4600  Thompson               4456
   4600  Carlson                2096
   4600  Spade                  2299
   4600  Loren                  3199
   4600  Wilder                 2424
   4600  Sampson                3288
   5000  Ferguson               5103
   5000  Taylor                 3449
   5000  Bennett                2466
   5100  Ferndale               3778
   5100  Jacobs                 2598
   5200  Griffin                2894
   5200  Catlin                 2145
   5200  Thurston               2781
   5200  Williams               3411
   5200  Robinson               4358
   6200  Cromwell               3841
   6200  Mills                  1234
   6200  Anderson               2461
   6200  Bradley                4321
   6200  Roy                    4002
   6200  Baldwin                1003

55 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 3 (see page 165) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Identifying columns by number

Each column named after SELECT has an assumed number corresponding to the order in which it is named. You can use this number to identify columns in the ORDER BY clause:

```
select emp_id, emp_fname, emp_lname from employee
          ▲       ▲          ▲
          |       |          |
          |       |          |

          1       2          3

       order by 3;
```

How It's Done

Earlier you wrote a SELECT statement to display the skills available in the company in numeric order by skill ID. Modify the ORDER BY clause in that statement to identify the column by number rather than by name:

```
select skill_id, skill_name
       from skill
       order by 1;
```

The result looks like this:

```
SKILL_ID  SKILL_NAME
--------  ----------
    1000  Management
    1030  Acct Mgt
    3065  Electronics
    3088  Brake work
    3333  Bodywork
    4250  Data Entry
    4370  Filing
    4410  Typing
    4420  Telephone
    4430  Interviewing
    4444  Assembly
    4490  Gen Ledger
    5130  Basic Math
    5160  Calculus
    5180  Statistics
    5200  Gen Acctng
    5309  Appraising
    5420  Writing
    5430  Mktng Writing
    5500  Gen Mktng
    6470  Window Installation
    6650  Diesel Engine Repair
    6666  Billing
    6670  Gas Engine Repair
    6770  Purchasing
    7000  Sales

26 rows processed
```

You *must* refer to a column by number when the column is a calculated column like **salary_amount / 52**.

You can also use a column number when you select all columns from a table with SELECT *.

Exercise 3-10

Now You Try It

Enter a SELECT statement to list employee IDs, salary, bonus percentage, and bonus paid, taken from the POSITION table. Sort the result by the bonus paid. Use numbers to identify the columns in the ORDER BY clause and rename the columns appropriately.

The result looks like this:

```
 EMPLOYEE     BASE SALARY  BONUS PERCENTAGE          BONUS PAID
 --------     -----------  ----------------          ----------
     4001        36921.00             0.230          8491.83000
     4660        36400.00             0.250          9100.00000
     3991        42016.00             0.235          9873.76000
     5090        48568.48             0.205          9956.53840
     3767        50440.50             0.230         11601.31500
     3764        54184.00             0.260         14087.84000
     2448        70720.00             0.255         18033.60000
     2010        76440.00             0.275         21021.00000
     3082        68016.00            <null>              <null>
     2424          <null>            <null>              <null>
     2246        29536.00            <null>              <null>
     2246        59488.00            <null>              <null>
     1034          <null>            <null>              <null>
                        .
                        .
                        .
61 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 3 (see page 165) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Another Way to Name the Column

You've seen that you can use ORDER BY with column names and column numbers. You can also use ORDER BY with a column heading you named with AS.

How It's Done

The Human Resources department needs to see a list of all consultants ordered by the hourly compensation taken from the lowest rate to the highest. You now have three ways you can retrieve this information. Try all three:

```
select con_id as "Consultant",

       rate as "Hourly Rate"
       from consultant
       order by rate desc;
select con_id as "Consultant",
       rate as "Hourly Rate"
       from consultant
       order by 2 desc;


select con_id as "Consultant",
       rate as "Hourly Rate"
       from consultant
       order by "Hourly Rate" desc;
```

For each of these,

The result looks like this:

```
CONSULTANT  HOURLY RATE
----------  -----------
      9000       148.00
      9388        76.00
      9443        50.00
      9439        47.00

4 rows processed
```

You can use any of these methods or a combination of them in an ORDER BY clause.

Review

Choose the correct answers for the questions below. More than one answer can apply for each question.

1. How many columns would be retrieved by the following statement:

   ```
   select * from sample_table;
   ```

   ■ a. One

   ■ b. Five

   ■ c. All

2. How can you limit the number of columns returned by your SELECT statement?

   ■ a. Use a FROM clause

   ■ b. List the columns you want to see

   ■ c. Use * after SELECT

   ■ d. Leave out the * between SELECT and FROM

3. How can you give heading names to columns?

   ■ a. Put a comma after the column name and specify the heading

   ■ b. Use AS after the column name and specify the heading

   ■ c. Use the heading in place of the column name

4. Given a table called SUPPLY_PRICE and a column in that table called PART_NUMBER, which of the following statements will find the number of *unique* part numbers in the table?

   ■ a. **select part_number from supply_price;**

   ■ b. **select * from supply_price;**

   ■ c. **select distinct part_number from supply_price;**

   ■ d. **select part_number distinct from supply_price;**

5. How can you name the column you want to sort by?

   ■ a. Use the column name

   ■ b. Use the heading name

   ■ c. Use the table name

   ■ d. Use the column number

To check your answers, see Review Answers for Chapter 3 (see page 165).

Scenarios

Create the appropriate statements online to retrieve the needed data:

1. You need to list all jobs the company has for a government report. The report should show job ID, job title, and minimum and maximum rate for the job. Use the JOB table, checking Appendix C, "Table Descriptions" for table descriptions.

2. The report you just created (in Scenario 1) has all the necessary information but is difficult to read because it is not sorted. Modify the SELECT statement to create the same report sorted by job title.

3. Periodically, a company list is produced showing each department and all employees assigned to that department. This list should be sorted first by department ID and then by employee ID within each department. Display department ID, employee ID, and employee last name. Create the appropriate SQL SELECT statement to produce this list using the EMPLOYEE table.

4. The report you just created is very useful except that the headings are difficult to understand. Rewrite the statement so that the column headings are "Department", "Employee ID", and "Last Name".

5. The Human Resources department needs a report of all employees listing ID, amount of vacation accrued for each employee, and vacation accrued incremented by 32 hours, in order to see whether any employees will have over the maximum allowable vacation once the accruals have been applied. Create this report using the BENEFITS table. Name the column headings appropriately, and order the report by employee ID.

To check your answers, see Review Answers for Chapter 3 (see page 165).

Chapter 5: Using Conditional Retrieval

Goal

When you have completed this chapter, you will be able to create SQL statements to retrieve selected rows of data from a table and to use multiple predicates in a WHERE clause. You will also understand the order in which multiple conditions are evaluated.

Summary

Usually you want to retrieve only some rows from a table just as you want to retrieve only some columns in that table. You have already seen how to limit the number of **columns** displayed. Now you will see how to limit the number of **rows** displayed using a WHERE clause. A WHERE clause specifies criteria used in selecting rows to be retrieved.

This section contains the following topics:

The WHERE Clause

You can screen the data being retrieved by using the WHERE clause in a SELECT statement. In the WHERE clause, you specify selection criteria. The WHERE clause filters out rows that do not meet the selection criteria. The WHERE clause follows the FROM clause:

```
select ...
       from ...
       where ...
       order by ...;
```

Components of the WHERE Clause

The WHERE clause is made up of two components:

- The keyword WHERE
- A search condition

A search condition is made up of predicates. In general, predicates compare values to one another. If the values meet the comparison, the row is selected.

Comparison Operators and Keywords in Predicates

You use a predicate to compare one value to another. The values compared in the predicate must be of compatible data types. For example, a column defined as a character data type cannot be compared to a column defined as an integer data type even though the character string contains numbers.

Check the Data Type When Comparing

The table layout specifies whether the column you want to compare is defined as a character data type. A column may appear to contain numeric data when you look at the values stored in the database, although it is actually defined as character. For example, the SKILL_LEVEL column in the EXPERTISE table is defined as a character column but usually contains numeric data.

Entering Character Literals

Use single quotation marks if you use a character literal such as 'Smith' and enter the literal with uppercase and lowercase letters exactly as you expect it exists in the database.

Ways You Can Compare Values

You can use these operators to compare values:

Comparison operator	Meaning
=	Equal to
<>	Not equal to
>	Greater than
<	Less than
>=	Greater than or equal to
<=	Less than or equal to

You can use these keywords to compare values:

Keyword	Meaning
IS NULL	Checks whether a value is null
BETWEEN	Locates values within a range of values
IN	Locates values identified by specific values in a list

Keyword	Meaning
LIKE	Retrieves rows based on character combinations in a nonnumeric column

Using Comparison Operators in Predicates

The search value in the predicate can be:

- A numeric literal (for example, vac_accrued >= **40**).
- A character literal (for example, emp_lname = **'Smith'**).

You can also use two column names in a predicate (for example, **vac_taken** <= **vac_accrued**).

The column name you use in the WHERE clause need not appear in the SELECT column list.

How It's Done

The Human Resources department needs to see a list of all employees and the number of vacation hours they have accrued in 1999. The BENEFITS table contains this information. Enter:

```
select emp_id, vac_accrued
       from benefits
       where fiscal_year = 2000;
```

The result looks like this:

```
EMP_ID  VAC_ACCRUED
------  -----------
  3411        68.00
  4773        68.00
  2010        92.75
  3338        68.00
  2246        92.50
  1034        92.50
  2424        92.50
  3767        68.00
  3449        68.00
  3082        68.00
  3341        68.00
  4660        68.00
  2209        92.50
  2894        68.00
  4001        68.00
  5090        46.00
  1765        92.50
  4456        68.00
  3991        68.00
  3778        68.00
  4358        68.00
  4962        68.00
  2180        92.50
  2106        92.50
  3222        68.00
  4002        68.00
  2437        68.00
  2096        92.50
  2004        92.50
  5103        46.00
  5008        46.50
  4321        68.00
  2598        60.00
  3764        68.00
  2448        68.00
  2461        68.00
  1003        92.00
  1234        92.00
  4027        68.00
  2466        92.50
  2174        92.00
  2781        68.00
  3704        68.00
  4008        68.00
  3433        68.00
  3288        68.00
  3841        68.00
  4703        46.75
  3294        68.00
  3769        68.00
  3118        68.00

51 rows processed
```

Exercise 4-1

Now You Try It

The manager of the Marketing department is looking at a resource plan that assigns employee 5103 to a project coming up. However, the manager doesn't know who employee 5103 is.

Create a SELECT statement to retrieve all rows in the EMPLOYEE table that have an employee with an ID of 5103. Display employee ID and first and last name.

The result looks like this:

```
EMP_ID  EMP_FNAME            EMP_LNAME
------  ---------            ---------
  5103  Adele                Ferguson

1 row processed
```

If your results do not match what you see above, check Review Answers for Chapter 4 (see page 172) for the correct SQL syntax.

Why do you see only one row?

The employee ID is a unique key, so there is only one employee with this ID.

Exercise 4-2

Try Another

The new company fiscal year is approaching and the Accounting department's budget director is compiling some salary statistics.

The budget director needs a list of employee IDs, job IDs, and salaries where the salary is greater than $100,000. The POSITION table contains this information.

The result looks like this:

```
EMP_ID  JOB_ID   SALARY_AMOUNT
------  ------   -------------
  2894    6021       111593.00
  3222    6004       110448.00
  1234    8001       117832.68
  1003    9001       146432.00

4 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 4 (see page 172) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Exercise 4-3

And Another

Commonwealth Auto has employees who live in several different communities. The Accounting department needs to know which employees live in Boston because a city tax is being levied on those residents and the payroll must be adjusted.

Use the EMPLOYEE table to write a SELECT statement that selects all employees who live in Boston. Type in the value exactly as you expect to find it in the table, using uppercase and lowercase letters. Enclose the value in quotes because CITY is defined as a character column. Display employee ID, first and last name, and city and order the result by employee ID.

The result looks like this:

```
EMP_ID  EMP_FNAME            EMP_LNAME            CITY
------  ---------            ---------            ----
  1003  James                Baldwin              Boston
  2010  Cora                 Parker               Boston
  2437  Henry                Thompson             Boston
  3411  Catherine            Williams             Boston
  3841  Michelle             Cromwell             Boston
  4962  Peter                White                Boston

6 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 4 (see page 172) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

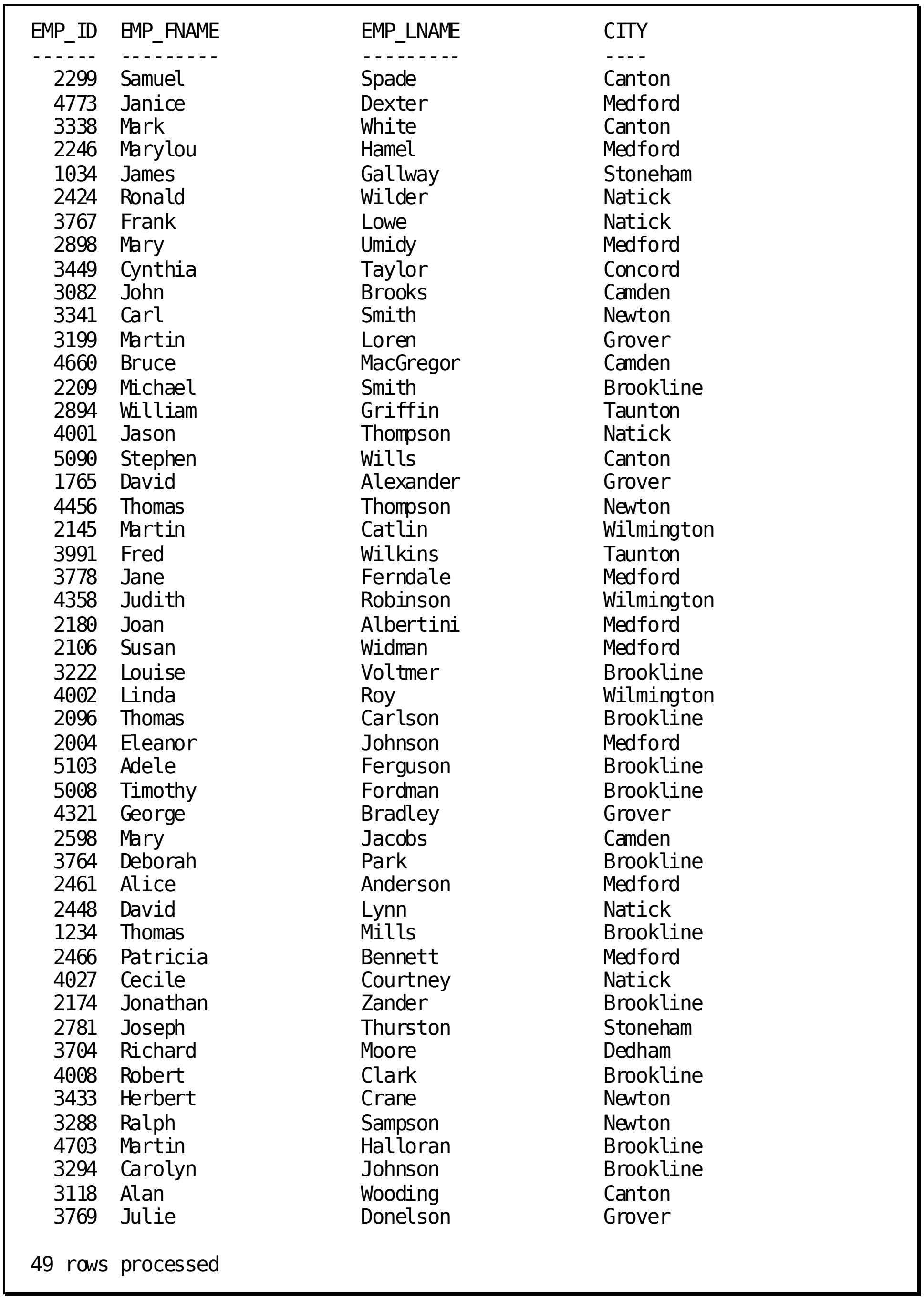
Exercise 4-4

Try It Using NOT

Use NOT following the word WHERE to select rows that do not meet the search condition.

Employees who do not live in Boston are not affected by the new tax. Create another SELECT statement to retrieve all employees who do not live in Boston. Use the keyword NOT after WHERE. Display employee ID, first and last name, and city.

The result looks like this:



```
EMP_ID  EMP_FNAME             EMP_LNAME             CITY
------  ---------             ---------             ----
  2299  Samuel                Spade                 Canton
  4773  Janice                Dexter                Medford
  3338  Mark                  White                 Canton
  2246  Marylou               Hamel                 Medford
  1034  James                 Gallway               Stoneham
  2424  Ronald                Wilder                Natick
  3767  Frank                 Lowe                  Natick
  2898  Mary                  Umidy                 Medford
  3449  Cynthia               Taylor                Concord
  3082  John                  Brooks                Camden
  3341  Carl                  Smith                 Newton
  3199  Martin                Loren                 Grover
  4660  Bruce                 MacGregor             Camden
  2209  Michael               Smith                 Brookline
  2894  William               Griffin               Taunton
  4001  Jason                 Thompson              Natick
  5090  Stephen               Wills                 Canton
  1765  David                 Alexander             Grover
  4456  Thomas                Thompson              Newton
  2145  Martin                Catlin                Wilmington
  3991  Fred                  Wilkins               Taunton
  3778  Jane                  Ferndale              Medford
  4358  Judith                Robinson              Wilmington
  2180  Joan                  Albertini             Medford
  2106  Susan                 Widman                Medford
  3222  Louise                Voltmer               Brookline
  4002  Linda                 Roy                   Wilmington
  2096  Thomas                Carlson               Brookline
  2004  Eleanor               Johnson               Medford
  5103  Adele                 Ferguson              Brookline
  5008  Timothy               Fordman               Brookline
  4321  George                Bradley               Grover
  2598  Mary                  Jacobs                Camden
  3764  Deborah               Park                  Brookline
  2461  Alice                 Anderson              Medford
  2448  David                 Lynn                  Natick
  1234  Thomas                Mills                 Brookline
  2466  Patricia              Bennett               Medford
  4027  Cecile                Courtney              Natick
  2174  Jonathan              Zander                Brookline
  2781  Joseph                Thurston              Stoneham
  3704  Richard               Moore                 Dedham
  4008  Robert                Clark                 Brookline
  3433  Herbert               Crane                 Newton
  3288  Ralph                 Sampson               Newton
  4703  Martin                Halloran              Brookline
  3294  Carolyn               Johnson               Brookline
  3118  Alan                  Wooding               Canton
  3769  Julie                 Donelson              Grover

49 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 4 (see page 172) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

What is another way of getting this information?

You could have used <> (not equal) instead of the keyword NOT.

Using Keywords in Predicates

You have been using comparison operators in predicates to compare one value to another. You can also use keywords in predicates.

Testing for Null Values

You use the keyword IS NULL to retrieve rows for which no value has been stored in the specified column.

How It's Done

The company needs to have a list of employees who do not have a home telephone so that the Human Resources department can get in touch with them by other means in case of emergency.

To retrieve all employees who do not have a telephone, enter:

```
select emp_id, phone
       from employee
       where phone is null;
```

The result looks like this:

```
EMP_ID    PHONE
------    -----
    2299  <null>
    3411  <null>
    2010  <null>
    3199  <null>
    2598  <null>
    4008  <null>

6 rows processed
```

Exercise 4-5

Now You Try It

Only sales employees at Commonwealth Auto receive bonuses as part of their earnings. Payroll wants a list of all employees who do not receive bonuses.

Enter a SELECT statement to retrieve all employees from the POSITION table for which the database does not have a bonus percentage. Display employee ID.

The result looks like this:

```
 EMP_ID
 ------
   3411
   3411
   4773
   3338
   2246
   2246
   1034
   2424
   3767
   3449
   3082
   3341
   4660
   2209
   2894
   1765
   4456
   1765
   3991
   3778
   4358
   4962
   2180
   2180
   2106
   3222
   4002
   2437
   2096
   2096
   2004
   2004
   5103
   5008
   4321
   2598
   3764
   2461
   1234
   1003
   4027
   2466
   2174
   2781
   3704
   4008
   3433
   3288
   3841
   4703
   3294
   3769
   3118

53 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 4 (see page 172) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

IS NOT NULL

Use IS NOT NULL to *eliminate* rows containing nulls in a specified column.

Exercise 4-6

Now You Try It

Commonwealth Auto needs to be able to reach employees in case of emergency. The Human Resources department knows that not all employees have telephones. They need to have a list of telephone numbers for those employees who *do* have telephones.

Enter the SELECT statement to list all employees from the EMPLOYEE table who have a telephone. Display employee ID, first and last name, and telephone.

The result looks like this:

```
EMP_ID  EMP_FNAME             EMP_LNAME            PHONE
------  ---------             ---------            -----
  4773  Janice                Dexter               5083847566
  3338  Mark                  White                6179238844
  2246  Marylou               Hamel                5083457789
  1034  James                 Gallway              6172251178
  2424  Ronald                Wilder               5083347700
  3767  Frank                 Lowe                 5082844094
  2898  Mary                  Umidy                6173458860
  3449  Cynthia               Taylor               5082684508
  3082  John                  Brooks               5089273644
  3341  Carl                  Smith                6179658099
  4660  Bruce                 MacGregor            5092344620
  2209  Michael               Smith                6175563331
  2894  William               Griffin              5088449008
  4001  Jason                 Thompson             5082649956
  1765  David                 Alexander            5087394772
  4456  Thomas                Thompson             6179660089
  2145  Martin                Catlin               5087486625
  3991  Fred                  Wilkins              5081840883
  3778  Jane                  Ferndale             6173450099
  4358  Judith                Robinson             5087488011
  4962  Peter                 White                6177732280
  2180  Joan                  Albertini            5083145366
  2106  Susan                 Widman               5083346364
  3222  Louise                Voltmer              6176635520
  4002  Linda                 Roy                  5088477701
  2437  Henry                 Thompson             6179264105
  2096  Thomas                Carlson              6175553643
  2004  Eleanor               Johnson              5089253998
  5103  Adele                 Ferguson             6176600684
  5008  Timothy               Fordman              6176642209
  4321  George                Bradley              5087463300
  3764  Deborah               Park                 6179458377
  2461  Alice                 Anderson             5083873664
  2448  David                 Lynn                 5082844736
  1003  James                 Baldwin              6173295757
  1234  Thomas                Mills                6176646602
  2466  Patricia              Bennett              5089487709
  4027  Cecile                Courtney             5089445386
  2174  Jonathan              Zander               6176633854
  2781  Joseph                Thurston             6173286008
  3704  Richard               Moore                6177739440
  3841  Michelle              Cromwell             6173298763
  3433  Herbert               Crane                6178653440
  3288  Ralph                 Sampson              6179654443
  4703  Martin                Halloran             6176648290
  3294  Carolyn               Johnson              6175567551
  3118  Alan                  Wooding              5083766984
  3769  Julie                 Donelson             5084850432
49 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 4 (see page 172) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

BETWEEN Predicate

Use the BETWEEN predicate to specify a range of values you are searching for. BETWEEN selects all rows that have values in a specified column in between or equal to the starting or ending values of the specified range.

How It's Done

Human Resources is interested in obtaining a list of employees who have between 1 and 3 dependents being covered by their insurance plan.

To retrieve this data, enter:

```
select emp_id, num_dependents
       from coverage
       where num_dependents between 1 and 3;
```

The result looks like this:

```
EMP_ID  NUM_DEPENDENTS
------  --------------
  2299               1
  3411               3
  3411               3
  3338               2
  2246               2
  2246               2
  3767               2
  3767               2
  3199               2
  3199               2
  2894               3
  2894               3
  5090               3
  4456               1
  1765               2
  1765               2
  4358               1
  4358               1
  3222               2
  2437               2
  2096               1
  2096               3
  2096               3
  5103               1
  5103               1
  5008               2
  5008               2
  2598               1
  2448               3
  1003               3
  1003               3
  2781               2
  4008               1
  3704               3
  3433               1
  3433               1
  3433               1
  3288               1
  3288               1
  4703               1
  4703               1
  3118               1

42 rows processed
```

Exercise 4-7

Now You Try It

Human Resources is doing a salary comparison and needs some information on jobs, employees, and salaries. They have asked you to show them all employees whose salary is between $20,000 and $35,000.

What table holds this information?

The information is stored in the POSITION table.

Enter the appropriate SELECT statement.

The result looks like this:

```
JOB_ID  EMP_ID   SALARY_AMOUNT
------  ------   -------------
  2077    3338        22048.84
  2077    2246        29536.00
  3333    4660        24000.00
  3333    3991        27976.00
  3333    4962        30680.00
  2077    2106        23920.00
  4012    4002        28601.80
  3333    3764        28912.00
  3333    4027        28081.40
  3333    3704        22880.00
  3333    4008        24441.00
  4012    3841        33800.00
  2077    4703        24857.00

13 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 4 (see page 172) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Use NOT BETWEEN to retrieve all rows that do *not* fall into the specified range.

IN Predicate

You can compare a value to a list of values using the IN predicate.

How It's Done

Human Resources needs to identify employees who reside in three communities for potential car pooling. To do this, enter:

```
select emp_id, city
       from employee
       where city in ('Camden', 'Brookline', 'Canton');
```

Enclose the list of values in parentheses and separate values with a comma.

The result looks like this:

```
EMP_ID  CITY
------  ----
  2299  Canton
  3338  Canton
  3082  Camden
  4660  Camden
  2209  Brookline
  5090  Canton
  3222  Brookline
  2096  Brookline
  5103  Brookline
  5008  Brookline
  2598  Camden
  3764  Brookline
  1234  Brookline
  2174  Brookline
  4008  Brookline
  4703  Brookline
  3294  Brookline
  3118  Canton

18 rows processed
```

Exercise 4-8

Now You Try It

The Payroll department needs to identify employees whose salaries are $41,600, $45,240, or $50,440 for tax rate purposes. Using the BENEFITS table, write a SELECT statement to display employee ID and salary.

The result looks like this:

```
EMP_ID   SALARY_AMOUNT
------   -------------
  4773        45240.00
  3769        41600.00

2 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 4 (see page 172) for the correct SQL syntax.

You can insert NOT before IN to identify values you do *not* want returned.

The LIKE Predicate and Masks

You can use the keyword LIKE and mask characters to find a character string when you know or are concerned about only some of the characters. Mask characters are symbols that serve as place holders for other characters. For example, **LIKE 'Th%'** means everything beginning with **Th**. The % is the mask specifying that any number of characters can follow.

This table shows the symbols you can use as mask characters:

Mask	Meaning
Percent (%)	Specifies any number of unknown characters (including none)
Underscore (_)	Specifies a single unknown character

How It's Done

The company nurse wants to identify all employees whose last names begin with **S** in order to notify them that their yearly physical examination is due. Enter:

```
select emp_lname
       from employee
       where emp_lname like 'S%';
```

Enter the character string to be matched exactly as you expect to find it in the database. Use uppercase and lowercase letters as necessary.

The result looks like this:

```
EMP_LNAME
---------
Sampson
Smith
Smith
Spade

4 rows processed
```

Where to Place Mask Characters

Mask characters can come anywhere in the search string.

If you want to find all employees whose names contain **mp**, enter:

```
select emp_lname
       from employee
       where emp_lname like '%mp%';
```

The result looks like this:

```
EMP_LNAME
---------
Sampson
Thompson
Thompson
Thompson

4 rows processed
```

Exercise 4-9

Now You Try It

How would you display all departments associated with **NEW CARS**?

The result looks like this:

```
DEPT_ID  DEPT_NAME
-------  ---------
   4200  LEASING - NEW CARS
   2210  SALES - NEW CARS
   3520  APPRAISAL NEW CARS
   1110  PURCHASING - NEW CARS

4 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 4 (see page 172) for the correct SQL syntax. Remember, result tables may be shortened in this guide.

Use NOT in front of LIKE to search for rows containing all values *except* those that match the mask.

Exercise 4-10

Try Another

Enter a SELECT statement to display all departments that are *not* associated with associated with **NEW CARS**.

The result looks like this:

```
DEPT_ID  DEPT_NAME
-------  ---------
   1120  PURCHASING - SERVICE
   4900  MIS
   5000  CORPORATE ACCOUNTING
   4500  HUMAN RESOURCES
   4600  MAINTENANCE
   2200  SALES - USED CARS
   5100  BILLING
   6200  CORPORATE ADMINISTRATION
   3530  APPRAISAL - SERVICE
   6000  LEGAL
   3510  APPRAISAL - USED CARS
   1100  PURCHASING - USED CARS
   5200  CORPORATE MARKETING

13 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 4 (see page 172) for the correct SQL syntax. Remember, result tables may be shortened in this guide.

Using Calculated Values in Predicates

You can use arithmetic expressions to calculate a value for a search condition. Use the following symbols for arithmetic operations:

Symbol	Meaning
*	Multiplication
/	Division
+	Addition
-	Subtraction

Remember that multiplication and division are performed first, from left to right, and addition and subtraction second, from left to right. You can control the order in which operations are performed by using parentheses to enclose the operations you want performed first.

How it's done

As part of the salary review process, Human Resources needs to identify all jobs where the difference between the maximum and minimum salaries is greater than $10,000. To do this, use the JOB table and enter:

```
select job_id, job_title, min_rate,
       max_rate, max_rate - min_rate
       from job
       where max_rate - min_rate > 10000;
```

The result looks like this:

```
JOB_ID  JOB_TITLE                    MIN_RATE        MAX_RATE         (EXPR)
------  ---------                    --------        --------         ------
  8001  Vice President               90000.00       136000.00       46000.00
  2077  Purch Clerk                  17000.00        30000.00       13000.00
  9001  President                   111000.00       190000.00       79000.00
  4700  Purch Agnt                   33000.00        60000.00       27000.00
  3029  Computer Operator            25000.00        44000.00       19000.00
  6011  Manager - Acctng             59400.00       121000.00       61600.00
  4130  Benefits Analyst             35000.00        56000.00       21000.00
  4666  Sr Mechanic                  41000.00        91000.00       50000.00
  4123  Recruiter                    35000.00        56000.00       21000.00
  5555  Salesperson                  30000.00        79000.00       49000.00
  4025  Writer - Mktng               31000.00        50000.00       19000.00
  4023  Accountant                   44000.00       120000.00       76000.00
  4734  Mktng Admin                  25000.00        62000.00       37000.00
  5110  CUST SER MGR                 40000.00       108000.00       68000.00
  6004  Manager - HR                 66000.00       138000.00         72000.00
  5111  CUST SER REP                 27000.00        54000.00         27000.00
  4012  Admin Asst                   21000.00        44000.00         23000.00
  2055  PAYROLL CLERK                17000.00        30000.00         13000.00
  5890  Appraisal Spec               45000.00        70000.00         25000.00
  3333  Sales Trainee                21600.00        39000.00         17400.00
  6021  Manager - Mktng              76000.00       150000.00         74000.00

21 rows processed
```

Exercise 4-11

Now You Try It

The corporate planning group wants to know what projects have been completed in less time than originally estimated.

Use the PROJECT table to identify the columns and display project ID as well as the number of hours saved.

The result looks like this:

```
PROJ_ID          (EXPR)
-------          ------
C203              58.50

1 row processed
```

If your results do not match what you see above, check Review Answers for Chapter 4 (see page 172) for the correct SQL syntax.

Combining Predicates

You can combine predicates with AND and OR:

- Use AND when all predicates must be true
- Use OR when only one predicate must be true

The default order of evaluation is AND before OR. You can use parentheses to override the default order.

How It's Done

The Human Resources department needs to identify employees who live in Camden, Brookline, or Canton and who have telephones in order to set up a calling network. You created both of these search conditions earlier in this chapter. Now you want to combine them.

To produce this list, enter:

```
select emp_id, city, phone
       from employee
       where city in ('Camden', 'Brookline', 'Canton')
        and phone is not null;
```

The result looks like this:

```
EMP_ID  CITY                 PHONE
------  ----                 -----
  3338  Canton               6179238844
  3082  Camden               5089273644
  4660  Camden               5092344620
  2209  Brookline            6175563331
  5090  Canton               5083389935
  3222  Brookline            6176635520
  2096  Brookline            6175553643
  5103  Brookline            6176600684
  5008  Brookline            6176642209
  3764  Brookline            6179458377
  1234  Brookline            6176646602
  2174  Brookline            6176633854
  4703  Brookline            6176648290
  3294  Brookline            6175567551
  3118  Canton               5083766984

15 rows processed
```

Exercise 4-12

Now You Try It

Change this SELECT statement from AND to OR.

Your result looks like this:

```
EMP_ID  CITY                PHONE
------  ----                -----
  2299  Canton              <null>
  4773  Medford             5083847566
  3338  Canton              6179238844
  2246  Medford             5083457789
  1034  Framingham          6172251178
  2424  Natick              5083347700
  3767  Natick              5082844094
  2898  Medford             6173458860
  3449  Concord             5082684508
  3082  Camden              5089273644
  3341  Newton              6179658099
  4660  Framingham          5092344620
  2209  Brookline           6175563331
  2894  Taunton             5088449008
  4001  Natick              5082649956
  5090  Canton              5083389935
  1765  Grover              5087394772
  4456  Newton              6179660089
  2145  Wilmington          5087486625
  3991  Taunton             5081840883
  3778  Medford             6173450099
  4358  Wilmington          5087488011
  4962  Boston              6177732280
  2180  Medford             5083145366
  2106  Medford             5083346364
  3222  Brookline           6176635520
  4002  Wilmington          5088477701
  2437  Boston              6179264105
  2096  Brookline           6175553643
  2004  Medford             5089253998
  5103  Brookline           6176600684
  5008  Brookline           6176642209
  4321  Grover              5087463300
  2598  Camden              <null>
  3764  Brookline           6179458377
  2461  Medford             5083873664
  2448  Natick              5082844736
  1003  Boston              6173295757
  1234  Brookline           6176646602
  2466  Medford             5089487709
  4027  Natick              5089445386
  2174  Brookline           6176633854
  2781  Stoneham            6173286008
  3704  Dedham              6177739440
  4008  Brookline           <null>
  3841  Boston              6173298763
  3433  Newton              6178653440
  3288  Newton              6179654443
```

```
 4703  Brookline           6176648290
 3294  Brookline           6175567551
 3118  Canton              5083766984
 3769  Grover              5084850432

52 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 4 (see page 172) for the correct SQL syntax. Remember, result tables may be shortened in this guide.

Compare the result of the first SELECT statement with the result of the second.

The first SELECT statement gives a more limited list because an employee must *both* live in one of the three communities *and* have a telephone in order to be included in the list.

The second SELECT statement results in a longer list because an employee must *either* live in one of the three communities *or* have a telephone (and live anywhere) in order to be included. Thus, the result table lists everyone who has a telephone and everyone who lives in the three communities.

Try One with Both AND and OR

You can have multiple predicates, connecting them with either AND or OR.

The Human Resources department needs a list of employees who have a telephone and live in Brookline and all employees who live in Boston regardless of whether they have a telephone.

To produce this list, enter:

```
select emp_id, city, phone
       from employee
       where phone is not null and city = 'Brookline'
            or city = 'Boston';
```

The result looks like this:

```
 EMP_ID  CITY                 PHONE
 ------  ----                 -----
   3411  Boston               <null>
   2010  Boston               <null>
   2209  Brookline            6175563331
   4962  Boston               6177732280
   3222  Brookline            6176635520
   2437  Boston               6179264105
   2096  Brookline            6175553643
   5103  Brookline            6176600684
   5008  Brookline            6176642209
   3764  Brookline            6179458377
   1003  Boston               6173295757
   1234  Brookline            6176646602
   2174  Brookline            6176633854
   3841  Boston               6173298763
   4703  Brookline            6176648290
   3294  Brookline            6175567551

16 rows processed
```

Using Parentheses

The default order of evaluation is AND before OR. You use parentheses to override the default order of evaluation. Multiple search conditions enclosed in parentheses are evaluated as a single search condition.

How It's Done

If the Human Resources department wants a list of employees living in Brookline or Boston who have a telephone, you would insert parentheses to group the Brookline and Boston predicates. The parentheses specify that you want the OR portion of the clause to be evaluated first:

```
select emp_id, city, phone
       from employee
       where phone is not null
         and (city = 'Brookline' or city = 'Boston');
```

The result looks like this:

```
EMP_ID  CITY                 PHONE
------  ----                 -----
  2209  Brookline            6175563331
  4962  Boston               6177732280
  3222  Brookline            6176635520
  2437  Boston               6179264105
  2096  Brookline            6175553643
  5103  Brookline            6176600684
  5008  Brookline            6176642209
  3764  Brookline            6179458377
  1003  Boston               6173295757
  1234  Brookline            6176646602
  2174  Brookline            6176633854
  3841  Boston               6173298763
  4703  Brookline            6176648290
  3294  Brookline            6175567551

14 rows processed
```

Compare this result with the result from the previous statement. The previous SELECT statement without parentheses listed employees who have a telephone and who also live in Brookline as well as employees who live in Boston whether or not they have a telephone.

The second SELECT statement with parentheses listed employees who live in either Brookline or Boston and who have a telephone, no matter which community they live in.

When you create a complex combination of predicates as in the last example, use parentheses to group predicates and establish the order of evaluation.

The placement of Parentheses

You've just seen that using parentheses can make a difference in the order in which the predicates are evaluated.

Look at these two SELECT statements. They are exactly the same except for the placement of the parentheses.

Enter both SELECT statements and compare the results:

```
1.   select emp_id, phone, city, dept_id
            from employee
            where phone is not null
               or (city = 'Boston' and dept_id = 5200);

2.   select emp_id, phone, city, dept_id
            from employee
            where (phone is not null or city = 'Boston')
              and dept_id = 5200;
```

Now take all parentheses out of the request.

How are the results different?

The first SELECT statement specifies that the employee must *either* live in Boston and work in department 5200 *or* have a telephone in order to be on the list.

The second SELECT statement specifies that the employee must either have a telephone or live in Boston. In either case, the employee must also work in department 5200 in order to be placed on the list.

If you take out all the parentheses, SQL evaluates the conditions in the same order as for the first SELECT statement.

Review

Choose the correct answers for the questions below. More than one answer can apply for each question.

1. The clause that allows the user to specify a search condition that filters the rows to be selected is:
    - a. The WHERE clause
    - b. The FROM clause
    - c. The SELECT clause
    - d. The AS clause
2. What are the components of the WHERE clause?
    - a. The keyword FROM
    - b. The keyword WHERE
    - c. A search condition
    - d. A table name
3. You can compare a character column to a:
    - a. FROM clause
    - b. Mask
    - c. WHERE clause
    - d. Table name
4. Masks are used with:
    - a. The IN predicate
    - b. The BETWEEN predicate
    - c. The LIKE predicate
    - d. The FROM clause
5. Which of the following are mask characters?
    - a. #
    - b. _
    - c. *
    - d. %
6. The IS NULL predicate causes:
    - a. Retrieval of rows where a column contains the value zero
    - b. Retrieval of rows where a column contains no value
    - c. No retrieval of rows

- d. No retrieval of rows where all columns contain zero

7. Parentheses are used to:

   - a. Set up the sequence of arithmetic evaluation
   - b. Set up the sequence of evaluation of AND and OR with multiple predicates
   - c. Set off table names
   - d. Set up alternate headings

To check your answers, see Review Answers for Chapter 4 (see page 172).

Scenarios

Create the appropriate statements online to retrieve the needed data:

1. Periodically, a list is published giving divisions and their departments. A new department was recently added to division D09, so a new list for that division is needed. Use the DEPARTMENT table and show division code, department ID, and department name. Order by department ID.

   Hint: DIV_CODE is a character column.

2. All Commonwealth Auto employees whose last names begin with L and Mare due to have flu shots. The medical office needs to have the complete names of these individuals and the department to which each is assigned. Sort the list by last name. (Use the EMPLOYEE table.)

3. The Marketing department has a large project coming up and needs employees who have at least a medium level of competence (greater than 02) in skill 3333. Display employee ID and level of competence for each employee using the EXPERTISE table.

   Hint: SKILL_LEVEL is a character column.

4. In order to identify employees involved in media projects, the Human Resources department needs a list of employees associated with a project ID that begins with P (indicating media-related). Order the list by employee ID. (Use the EMPLOYEE table to find this information.)

5. The budget group needs a list of employees who hold a position that pays less than $25,000. Show employee ID and salary.

   Hint: The POSITION table contains information about positions held in Commonwealth Auto.

Chapter 6: Using Aggregate Functions

Goal

When you have completed this chapter, you will be able to use aggregate functions to count rows of data and to calculate averages, sums, maximums, and minimums for groups of data.

Summary

You can use the aggregate functions AVG, COUNT, MAX, MIN, and SUM to perform calculations within your SELECT statement to summarize information about groups of rows in a table.

This section contains the following topics:

Aggregate Functions

There are five aggregate functions. Except for COUNT, these functions operate on a collection of values in one column of a table and produce a single result:

Function	Meaning
AVG	Returns the average of all values in the named column
COUNT	Counts the number of rows that satisfy a condition
MAX	Returns the highest value in the named column
MIN	Returns the lowest value in the named column
SUM	Returns the total of all values in the named column

How to Use Aggregate Functions

To use an aggregate function, you specify the name of the function followed by the name of the column in parentheses, as in SUM(SALARY_AMOUNT).

You can use the aggregate functions AVG, MAX, MIN, and SUM with a column name (SALARY_AMOUNT) or, if you are using &U$IDBGJ., you can use these functions with an arithmetic expression (SALARY_AMOUNT/52) as well.

Where to Use Aggregate Functions

- Instead of a column name with SELECT
- In a HAVING clause as a value in a predicate

AVG

The aggregate function AVG calculates the **average** value of all rows in a specified column.

How It's Done

The president of Commonwealth Auto wants to know the average salary for all employees in the company. To produce this information, use the POSITION table and enter:

```
select avg(salary_amount)
       from position;
```

The result looks like this:

```
                      (EXPR)
                      ------
                    51101.16

 1 row processed
```

Exercise 5-1

Now You Try It

Use the COVERAGE table to write a SELECT statement to display the average number of dependents for all employees in Commonwealth Auto. The Human Resources department needs this information for statistical purposes.

The result looks like this:

```
                          (EXPR)
                          ------
                               1

1 row processed
```

If your results do not match what you see above, check Review Answers for Chapter 5 (see page 177) for the correct SQL syntax.

Note: If the column being averaged has an integer data type, the result is an integer (that is, a whole number). Refer to the SQL reference manual for your environment to learn how to convert an integer data type to a decimal data type in the result of your query.

Exercise 5-2

Using WHERE

Use the BENEFITS table to write a SELECT statement to display the average vacation accrued in fiscal year 1999 for all employees in Commonwealth Auto. The Human Resources department needs this information for statistical purposes.

The result looks like this:

```
                          (EXPR)
                          ------
                          121.01

1 row processed
```

If your results do not match what you see above, check Review Answers for Chapter 5 (see page 177) for the correct SQL syntax.

COUNT

Use the aggregate function COUNT to **count** the number of rows in a table.

You use an asterisk in parentheses after COUNT when you want all rows to be counted. You use a column name in parentheses after COUNT when you want all rows with a value in that column to be counted.

How It's Done

Human Resources needs a total count of employees working at Commonwealth Auto. To find this number, enter:

```
select count(*)
       from employee;
```

The result looks like this:

```
      (EXPR)
      ------
          55

1 row processed
```

Every row in the EMPLOYEE table was counted.

Exercise 5-3

Now You Try It

The Human Resources department would like to know how many different types of skills there are in the company. Enter the appropriate statement to determine the total number of skills in the SKILL table.

The result looks like this:

```
      (EXPR)
      ------
          26

1 row processed
```

If your results do not match what you see above, check Review Answers for Chapter 5 (see page 177) for the correct SQL syntax.

Specifying a Column Name with COUNT

If you specify a column name with COUNT, only the rows containing a value in that column are counted.

How It's Done

Human Resources has made another request. They would like to know how many employees have telephones in their homes. You can comply with this request by creating a SELECT statement using COUNT and the column name PHONE from the EMPLOYEE table:

```
select count(phone)
       from employee;
```

The result looks like this:

```
      (EXPR)
      ------
          49

 1 row processed
```

There were fewer rows returned with this request than there were when you specified COUNT(*). This time, COUNT counted only the rows that had a telephone number. It did not count the rows that contain a null value for PHONE. When you used COUNT(*), *all* rows are counted.

Exercise 5-4

Using WHERE

How many employees in department 5200 have telephones? Add a WHERE clause to your previous statement to find out.

The result looks like this:

```
      (EXPR)
      ------
           4

 1 row processed
```

If your results do not match what you see above, check Review Answers for Chapter 5 (see page 177) for the correct SQL syntax.

MAX

Use the aggregate function MAX (**maximum**) to determine the highest value in a specified column.

How It's Done

The Human Resources department would like to know the highest salary in the company. Salaries are stored in the POSITION table. To show this information, enter:

```
select max(salary_amount)
       from position;
```

The result looks like this:

```
       (EXPR)
       ------
    146432.00

 1 row processed
```

Exercise 5-5

Now You Try It

Human Resources also needs to know the highest salary held for job 3333. Enter an appropriate SELECT statement using a WHERE clause.

The result looks like this:

```
       (EXPR)
       ------
     30680.00

 1 row processed
```

If your results do not match what you see above, check Review Answers for Chapter 5 (see page 177) for the correct SQL syntax.

MIN

Use the aggregate function MIN (**minimum**) to determine the lowest value in a specified column.

How It's Done

Human Resources needs to determine the lowest salary in the company. To obtain this, enter:

```
select min(salary_amount)
       from position;
```

The result looks like this:

```
      (EXPR)
      ------
     2200.00

1 row processed
```

Exercise 5-6

Now You Try It

The Human Resources department is concerned that the company have a healthy group of employees. They need to see the smallest amount of sick time taken. The BENEFITS table contains this information.

The result looks like this:

```
    (EXPR)
    ------
      0.00

1 row processed
```

If your results do not match what you see above, check Review Answers for Chapter 5 (see page 177) for the correct SQL syntax.

SUM

Use the aggregate function SUM to **total** numeric columns.

How It's Done

The budget group in the Accounting department needs to allocate funds for next year's budget based on this year's salaries.

To obtain a sum of all salaries, enter:

```
select sum(salary_amount)
       from position;
```

The result looks like this:

```
                           (EXPR)
                           ------
                       2555058.42

1 row processed
```

Exercise 5-7

Now You Try It

Also as part of the budget process, the budget group needs to identify all vacation hours taken. (This information is in the BENEFITS table.)

Enter a statement to display this sum.

The result looks like this:

```
                           (EXPR)
                           ------
                         17469.50

1 row processed
```

If your results do not match what you see above, check Review Answers for Chapter 5 (see page 177) for the correct SQL syntax.

Aggregate Functions and Null Values

There may be null values in columns included in a calculation. Aggregate functions ignore rows where a null value is found.

Eliminating Duplicate Rows

You can eliminate duplicate rows when using SUM, AVG, and COUNT by using DISTINCT. This causes the duplicate rows to be eliminated before the aggregate function is applied.

Using DISTINCT

If you use DISTINCT, you must name a column explicitly; you cannot use an arithmetic expression.

How It's Done

Put DISTINCT immediately before the column name.

Count the number of communities represented by the employees at Commonwealth Auto by entering:

```
select count(distinct city)
       from employee;
```

The result looks like this:

```
      (EXPR)
      ------
          13

1 row processed
```

Exercise 5-8

Now You Try It

Count the number of different projects on which at least one person is working.

What table do you need to use?

You'll find this information in the CONSULTANT table.

The result looks like this:

```
      (EXPR)
      ------
           1

1 row processed
```

If your results do not match what you see above, check Review Answers for Chapter 5 (see page 177) for the correct SQL syntax.

Grouping Information

You can use aggregate functions to display information for groups of rows rather than for a whole table. For example, the president wants to know the average salary for employees assigned to each job rather than the average salary for all employees in the whole company. The POSITION table, where the salary information is maintained, has more than one row for each job. In order to retrieve the information for the president, you need to group all rows with the same job ID and then find the average salary for that group.

Using GROUP BY

To summarize information for groups of rows, such as all employees who have the same job ID, use the GROUP BY clause. The GROUP BY clause indicates which columns contain values to be grouped together.

How It's Done

To find the average salary for employees by job, use the GROUP BY clause and enter:

```
select job_id, avg(salary_amount)
       from position
       group by job_id;
```

The result looks like this:

```
JOB_ID                              (EXPR)
------                              ------
  2051                              <null>
  2053                              <null>
  2077                            23672.56
  3333                            23130.05
  4012                            37546.80
  4023                            74776.00
  4025                            43888.00
  4123                            49921.76
  4130                            45241.94
  4560                              <null>
  4666                            85280.00
  4700                            53477.38
  4734                            55744.75
  5110                            56977.80
  5555                            54738.99
  5890                            53893.16
  6004                           110448.00
  6011                            94953.52
  6021                           111593.00
  8001                           117832.68
  9001                           146432.00

21 rows processed
```

The GROUP BY clause grouped the rows of data by job and then AVG took the average salary for each group. For example, nine salaries are averaged for JOB_ID 3333. Three jobs have null for an average salary because they have only hourly employees.

Exercise 5-9

Now You Try It

For statistical purposes, you need to know the number of employees in each department. Enter a SELECT statement to retrieve this information from the EMPLOYEE table.

The result looks like this:

```
DEPT_ID       (EXPR)
-------       ------
   1100            3
   1110            2
   1120            4
   2200            5
   2210            8
   3510            2
   3520            1
   3530            2
   4500            3
   4600            9
   5000            3
   5100            2
   5200            5
   6200            6

14 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 5 (see page 177) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Exercise 5-10

Try Another

The budget group needs to identify the total salaries for each job in order to determine salary budgets for next year.

Using the POSITION table, enter a SELECT statement to show the sum of salaries for employees by job. Display job ID and sum for each job.

The result looks like this:

```
JOB_ID                           (EXPR)
------                           ------
  2051                           <null>
  2053                           <null>
  2077                        118362.84
  3333                        208170.50
  4012                        150187.20
  4023                         74776.00
  4025                         43888.00
  4123                         49921.76
  4130                         45241.94
  4560                           <null>
  4666                         85280.00
  4700                        267386.90
  4734                        111489.50
  5110                         56977.80
  5555                        492650.98
  5890                        269465.80
  6004                        110448.00
  6011                         94953.52
  6021                        111593.00
  8001                        117832.68
  9001                        146432.00

21 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 5 (see page 177) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Things to remember when using GROUP BY

- You can use GROUP BY with any aggregate function
- You can specify more than one column in the GROUP BY clause
- Columns listed in the SELECT statement that are not part of the calculation by an aggregate function must be identified in the GROUP BY clause

Using ORDER BY with Aggregate Functions

When you want to sort a result table based on an aggregate function, you must specify the aggregate function by number (or heading name) rather than specifying the function itself.

How It's Done

Earlier you found the average salary for employees by job using GROUP BY. To sort this result by the average salary, enter:

```
select job_id, avg(salary_amount)
```

```
       from position
       group by job_id
       order by 2;
```

The result looks like this:

```
JOB_ID                              (EXPR)
------                              ------
  3333                            23130.05
  2077                            23672.56
  4012                            37546.80
  4025                            43888.00
  4130                            45241.94
  4123                            49921.76
  4700                            53477.38
  5890                            53893.16
  5555                            54738.99
  4734                            55744.75
  5110                            56977.80
  4023                            74776.00
  4666                            85280.00
  6011                            94953.52
  6004                           110448.00
  6021                           111593.00
  8001                           117832.68
  9001                           146432.00
  2053                              <null>
  4560                              <null>
  2051                              <null>

21 rows processed
```

Using HAVING

You can add a search condition to use with an aggregate function.

The HAVING clause allows you to search for a particular condition within each group. HAVING takes the same predicates as WHERE. The clause must specify an aggregate function because it applies to summary rows only. You use a HAVING clause to eliminate groups from the result, just as you use a WHERE clause to eliminate rows.

You can have both a WHERE clause and a HAVING clause in your SELECT statement.

How It's Done

The company is concerned that there are several departments with only a very few employees. To display those departments that have fewer than three employees, enter:

```
select dept_id, count(emp_id)
       from employee
       group by dept_id
       having count(emp_id) < 3;
```

The result looks like this:

```
DEPT_ID      (EXPR)
-------      ------
   1110           2
   3510           2
   3520           1
   3530           2
   5100           2

5 rows processed
```

Exercise 5-11

Now You Try It

Some Commonwealth Auto employees live in the same community. Since the company is encouraging car pooling, the car pooling group needs to know which communities have more than two people living there.

Enter a SELECT statement to list the name of the community and the number of employees living in that community. Show only those communities that have more than two employees. This information is contained in the EMPLOYEE table.

The result looks like this:

```
CITY                        (EXPR)
----                        ------
Boston                           6
Brookline                       11
Camden                           3
Canton                           4
Grover                           4
Medford                          9
Natick                           5
Newton                           4
Wilmington                       3

9 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 5 (see page 177) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Exercise 5-12

Try Another

The budget director has given you another request. She needs to see which jobs have an average salary greater than $25,000. Use the POSITION table to write the appropriate SELECT statement using HAVING and display the job ID and the average salary amount.

The result looks like this:

```
JOB_ID                          (EXPR)
------                          ------
  4012                        37546.80
  4023                        74776.00
  4025                        43888.00
  4123                        49921.76
  4130                        45241.94
  4666                        85280.00
  4700                        53477.38
  4734                        55744.75
  5110                        56977.80
  5555                        54738.99
  5890                        53893.16
  6004                       110448.00
  6011                        94953.52
  6021                       111593.00
  8001                       117832.68
  9001                       146432.00

16 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 5 (see page 177) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Renaming Column Headings

Remember that you can request new headings for the result table. This is particularly useful when you use aggregate functions because the default heading is not meaningful.

Exercise 5-13

Now You Try One

Use the statement above, and rename the column with the aggregate function. Use the AS keyword, and make the heading "Average Salary".

The result looks like this:

```
JOB_ID                    AVERAGE SALARY
------                    --------------
  4012                          37546.80
  4023                          74776.00
  4025                          43888.00
  4123                          49921.76
  4130                          45241.94
  4666                          85280.00
  4700                          53477.38
  4734                          55744.75
  5110                          56977.80
  5555                          54738.99
  5890                          53893.16
  6004                         110448.00
  6011                          94953.52
  6021                         111593.00
  8001                         117832.68
  9001                         146432.00

16 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 5 (see page 177) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Review

Fill in the blank with the correct term:

1. You use ______ to perform calculations within a SELECT statement.
2. An aggregate function can be used instead of a column name with ______ or in the _______ clause.
3. When the aggregate function AVG encounters a null value, it _______ the row.
4. The _______ clause acts as a search condition with an aggregate function.
5. You rename an aggregate function column heading by using ______ and the heading you want.

To check your answers, see Review Answers for Chapter 5 (see page 177).

Scenarios

Create the appropriate statements online to retrieve the needed data:

1. In order to plan for the Christmas party for Commonwealth Auto, the Human Resources department needs a count of employees by department. (The EMPLOYEE table contains this information.)

2. As part of its salary research, the Human Resources department needs to know the minimum and maximum salaries being earned for each job ID in the company. (Use the POSITION table.)

3. Upper management needs to know how many subordinate employees there are for each manager in order to evaluate the span of control within the company. The EMPLOYEE table contains this information.

4. A project is coming up that requires project members having the skill ID 3333 (body work). The project leader needs to find out how many employees have a skill level greater than 02 for this skill to see whether he needs to hire consultants to staff the project. Keep in mind that the SKILL_LEVEL column contains character data. (Use the EXPERTISE table.)

   Note: Use a WHERE clause with more than one predicate.

5. The Human Resources department is conducting research into salaries.They have asked you for a report showing:

   - Job ID
   - Average salary by job
   - Minimum salary by job
   - Maximum salary by job

   They need this report only for positions with a job ID less than 4000 (indicating training and clerical positions) where the average salary is less than $25,000. Use the POSITION table and rename the column headings so that the report makes sense.

6. The training group is concerned that there are few people in the company who have certain crucial skills. They have asked you to give them a report listing the number of employees who have either a medium level of competence (02 or above) for skill 3333 (body work) or a high level of competence (04) for skill 4444 (assembly). The report should list a skill only if there are more than two employees that fit that category.

   Note: Hint: The column SKILL_LEVEL is a character column.

To check your answers, see Review Answers for Chapter 5 (see page 177).

Chapter 7: Accessing Multiple Tables

Goal

When you have completed this chapter, you will be able to create SQL statements that retrieve data from more than one table.

Summary

Until now, you have been retrieving data from only one table at a time. Often, however, the data you want resides in more than one table. For example, you may want information on the department an employee works in as well as the employee information itself. The **join** operation allows you to do this.

This section contains the following topics:

What Is a Join Operation?

A join is a type of select in which you request data from more than one table.

Look at the table descriptions for EMPLOYEE and DEPARTMENT in Appendix C, “Table Descriptions.” The EMPLOYEE table carries employee information plus the employee's department ID. The *name* of the department is not carried in this table.

If you want to see more information about the department, you need to look at the DEPARTMENT table where you find the ID and name of the department. To display both employee and department information at the same time, you need to access both tables at once to **join** them.

Common Columns

A **join** can occur when tables have a column in common. Each table must have at least one column that corresponds to a column in at least one other table in the join.

Usually these common columns are planned as part of the data base design. In Error! Reference source not found. you read about **foreign keys**, which are columns or combination of columns in one table corresponding to the primary key of another table. These are planned common columns:

EMPLOYEE

EMP_ID	EMP_LNAME	EMP_FNAME	DEPT_ID
2096	CARLSON	THOMAS	4600
2437	THOMPSON	HENRY	4600
2598	JACOBS	MARY	5100

DEPARTMENT

DEPT_ID	DEPT_NAME
5200	CORPORATE MARKETING
4600	MAINTENANCE
5100	BILLING

Joining Tables on Common Columns

To join two tables, you must associate one or more columns in one table to one or more columns in a second table. The joining columns must:

- Exist in both tables
- Have data of equivalent type
- Appear in the WHERE clause

Normally, a row from one table is joined with a row from the other when the common columns contain equal values.

Statement Used

The statement used to join tables is composed of:

- The columns to be displayed listed after SELECT
- A FROM clause identifying the tables from which data is being retrieved
- A WHERE clause indicating the column to be matched and any additional search conditions

Note: If you are joining tables from different schemas, you must preface the table name with the schema name.

In the WHERE clause, you specify a column name from one table, a comparison operator (usually =), and a column name from the other table.

How It's Done

Periodically, the Human Resources department produces a list of the employees who head departments.

The ID of the employee who heads a particular department is found in the DEPARTMENT table. The employee's name is found in the EMPLOYEE table. You need to join these two tables to get all the information for the list.

To join the DEPARTMENT and EMPLOYEE tables based on the head of the department, you use the DEPT_HEAD_ID column in the DEPARTMENT table and the EMP_ID column in the EMPLOYEE table. The columns have different names, but both contain employee IDs.

To join the two tables, enter:

```
select emp_id, emp_lname, emp_fname, dept_name
       from employee, department
       where dept_head_id = emp_id;
```

In this statement, all the join columns have unique names. The SELECT statement specifies that you want to see employee ID, employee last name and first name, and name of department. This information is going to come from two different tables. The common columns are matched in the WHERE clause.

The result looks like this:

```
EMP_ID  EMP_LNAME              EMP_FNAME      DEPT_NAME
------  ---------              ---------      ---------
  2004  Johnson                Eleanor        PURCHASING - SERVICE
  1003  Baldwin                James          LEASING - NEW CARS
  2466  Bennett                Patricia       MIS
  2010  Parker                 Cora           SALES - NEW CARS
  3769  Donelson               Julie          APPRAISAL NEW CARS
  2466  Bennett                Patricia       CORPORATE ACCOUNTING
  3222  Voltmer                Louise         HUMAN RESOURCES
  2096  Carlson                Thomas         MAINTENANCE
  2180  Albertini              Joan           SALES - USED CARS
  2598  Jacobs                 Mary           BILLING
  2461  Anderson               Alice          CORPORATE ADMINISTRATION
  2209  Smith                  Michael        APPRAISAL - SERVICE
  1003  Baldwin                James          LEGAL
  3082  Brooks                 John           APPRAISAL - USED CARS
  2246  Hamel                  Marylou        PURCHASING - USED CARS
  2894  Griffin                William        CORPORATE MARKETING
  1765  Alexander              David          PURCHASING - NEW CARS
 17 rows processed
```

Exercise 6-1

Now You Try It

The Human Resources department needs information about divisions. They have asked you for a list of division descriptions and division heads by name.

Enter a SELECT statement to display each division description and employee last and first name.

What tables do you need to join?

You need to join the DIVISION and EMPLOYEE tables.

What are the common columns?

DIV_HEAD_ID in the DIVISION table and EMP_ID in the EMPLOYEE table are the common columns.

The result looks like this:

```
DIV_CODE  DIV_NAME    EMP_ID    EMP_LNAME            EMP_FNAME
--------  --------    ------    ---------            ---------
D06       SERVICE       4321    Bradley              George
D04       NEW CARS      2010    Parker               Cora
D09       CORPORATE     1003    Baldwin              James
D02       USED CARS     2180    Albertini            Joan

4 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 6 (see page 183) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Why Include the Join Condition

Without the join condition in the WHERE clause, the request would return a huge table containing every possible row combination from the tables being joined. This type of join is called a Cartesian product. It is very inefficient and contains a great deal of redundant information.

Qualifying a Column Name

In some cases, the join columns from two tables have the same name. Then you must add a qualification to the column names to distinguish one name from the other.

How It's Done

The EMPLOYEE table does not carry the department name, and the DEPARTMENT table does not carry the employee ID. If you want to see the names of the departments that the employees are associated with, you need to join the EMPLOYEE and DEPARTMENT tables. These two tables have a common column, DEPT_ID.

Because the column DEPT_ID has the same name in each table, you need to qualify each common column name with the name of its table. Enter:

```
select emp_id, department.dept_id, dept_name
       from department, employee
       where department.dept_id = employee.dept_id;
```

This statement specifies that the rows to be retrieved and joined from the EMPLOYEE and DEPARTMENT tables are those that have matching department IDs. If a department ID is present in the DEPARTMENT table but not in the EMPLOYEE table (as when a department has no employees), that row will not be returned.

The result looks like this:

```
EMP_ID  DEPT_ID  DEPT_NAME
------  -------  ---------
  2299     4600  MAINTENANCE
  3411     5200  CORPORATE MARKETING
  4773     3510  APPRAISAL - USED CARS
  2010     2210  SALES - NEW CARS
  3338     1120  PURCHASING - SERVICE
  2246     1100  PURCHASING - USED CARS
  1034     4600  MAINTENANCE
  2424     4600  MAINTENANCE
  3767     2200  SALES - USED CARS
  2898     1120  PURCHASING - SERVICE
  3449     5000  CORPORATE ACCOUNTING
  3082     3510  APPRAISAL - USED CARS
  3341     3530  APPRAISAL - SERVICE
  3199     4600  MAINTENANCE
  4660     2200  SALES - USED CARS
  2209     3530  APPRAISAL - SERVICE
  2894     5200  CORPORATE MARKETING
  4001     2210  SALES - NEW CARS
  5090     2210  SALES - NEW CARS
  1765     1110  PURCHASING - NEW CARS
  4456     4600  MAINTENANCE
  2145     5200  CORPORATE MARKETING
  3991     2210  SALES - NEW CARS
  3778     5100  BILLING
  4358     5200  CORPORATE MARKETING
  4962     2210  SALES - NEW CARS
  2180     2200  SALES - USED CARS
  2106     1110  PURCHASING - NEW CARS
  3222     4500  HUMAN RESOURCES
  4002     6200  CORPORATE ADMINISTRATION
  2437     4600  MAINTENANCE
  2096     4600  MAINTENANCE
  2004     1120  PURCHASING - SERVICE
  5103     5000  CORPORATE ACCOUNTING
  5008     1100  PURCHASING - USED CARS
  4321     6200  CORPORATE ADMINISTRATION
  2598     5100  BILLING
  3764     2210  SALES - NEW CARS
  2461     6200  CORPORATE ADMINISTRATION
  2448     2200  SALES - USED CARS
  1003     6200  CORPORATE ADMINISTRATION
  1234     6200  CORPORATE ADMINISTRATION
  2466     5000  CORPORATE ACCOUNTING
  4027     2210  SALES - NEW CARS
  2174     4500  HUMAN RESOURCES
  2781     5200  CORPORATE MARKETING
  3704     2200  SALES - USED CARS
  4008     2210  SALES - NEW CARS
  3841     6200  CORPORATE ADMINISTRATION
  3433     4600  MAINTENANCE
  3288     4600  MAINTENANCE
  4703     1100  PURCHASING - USED CARS
  3294     1120  PURCHASING - SERVICE
  3118     4500  HUMAN RESOURCES
  3769     3520  APPRAISAL NEW CARS

55 rows processed
```

Does it matter which of the two department ID columns you choose to display?

No. The values in each of the two matching columns is the same.

Qualifying a Table Name

In some cases, the tables are in different schemas. Then you must add a qualification to the table name to specify which schema the table is associated with.

How It's Done

The EMPLOYEE table doesn't contain project id and description information, and the PROJECT table doesn't carry the project leader's first and last name. If you want to see the projects and their respective project leaders, you must join the EMPLOYEE and PROJECT tables using the PROJ_LEADER_ID and EMP_ID columns. However, the EMPLOYEE table is assigned to the DEMOEMPL schema and the PROJECT table is assigned to the DEMOPROJ schema. To access data from both schemas, you must qualify the table names with the schema name. Enter:

```
select emp_id, emp_lname, emp_fname, proj_desc from
       demoempl.employee, demoproj.project
       where emp_id=proj_leader_id;
```

```
EMP_ID  EMP_LNAME             EMP_FNAME      PROJ_DESC
------  ---------             ---------      ---------
  3411  Williams              Catherine      TV ads - WTVK
  3411  Williams              Catherine      New brand research
  2894  Griffin               William        Consumer study
  4358  Robinson              Judith         Service study
  2466  Bennett               Patricia       Systems analysis

5 rows processed
```

Exercise 6-2

Now You Try It

You have to give the Human Resources department a list of employees and the skills each has. However, it is easier to read this report if the employees' names are listed as well.

Enter a SELECT statement to list employee ID, last name, first name, and skill ID using the EMPLOYEE and EXPERTISE tables. Qualify the column name that is the same in both tables. The EXPERTISE table is in DEMOPROJ and the EMPLOYEE table is in DEMOEMPL.

The result looks like this:

```
EMP_ID  EMP_LNAME            EMP_FNAME            SKILL_ID
------  ---------            ---------            --------
  1003  Baldwin              James                    1000
  1034  Gallway              James                    6470
  1234  Mills                Thomas                   1000
  1765  Alexander            David                    6770
  2004  Johnson              Eleanor                  6770
  2010  Parker               Cora                     7000
  2096  Carlson              Thomas                   3065
  2096  Carlson              Thomas                   3333
  2106  Widman               Susan                    6770
  2174  Zander               Jonathan                 4430
  2180  Albertini            Joan                     7000
  2209  Smith                Michael                  5309
  2246  Hamel                Marylou                  1000
  2246  Hamel                Marylou                  6670
                          .
                          .
                          .
69 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 6 (see page 183) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Using an Alias

You use an **alias** as a shorthand method for qualifying a column name.

You specify the alias in the FROM clause:

```
from expertise x, employee e
```

You then use the alias as a prefix on the column name.

How It's Done

To use an alias instead of the table name to qualify the column names from the previous example, enter:

```
select x.emp_id, emp_lname,
       emp_fname, skill_id
       from expertise x, employee e
       where x.emp_id = e.emp_id;
```

The result is the same as the previous statement.

Sorting the Result

You can sort the table resulting from a join operation with ORDER BY.

Exercise 6-3

Now You Try It

Sort your last request in descending order by employee last name and employee first name.

The result looks like this:

```
EMP_ID  EMP_LNAME             EMP_FNAME             SKILL_ID
------  ---------             ---------             --------
  2174  Zander                Jonathan                  4430
  3118  Wooding               Alan                      5180
  5090  Wills                 Stephen                   7000
  3411  Williams              Catherine                 5500
  3991  Wilkins               Fred                      7000
  2424  Wilder                Ronald                    6470
  2106  Widman                Susan                     6770
  4962  White                 Peter                     5130
  3338  White                 Mark                      6770
  3222  Voltmer               Louise                    1000
  3222  Voltmer               Louise                    4430
  2781  Thurston              Joseph                    5420
  2781  Thurston              Joseph                    5430
  4456  Thompson              Thomas                    3065
  4456  Thompson              Thomas                    6670
  4001  Thompson              Jason                     7000
  2437  Thompson              Henry                     3333
  2437  Thompson              Henry                     4444
  3449  Taylor                Cynthia                   5200
  2209  Smith                 Michael                   5309
  3341  Smith                 Carl                      5309
  3288  Sampson               Ralph                     6670
  3288  Sampson               Ralph                     6650
  3288  Sampson               Ralph                     3333
  4002  Roy                   Linda                     4410
  4002  Roy                   Linda                     4370
  4358  Robinson              Judith                    5500
  2010  Parker                Cora                      7000
  3764  Park                  Deborah                   7000
  3704  Moore                 Richard                   7000
  1234  Mills                 Thomas                    1000
  4660  MacGregor             Bruce                     7000
  2448  Lynn                  David                     7000
  3767  Lowe                  Frank                     7000
  2004  Johnson               Eleanor                   6770
  3294  Johnson               Carolyn                   6770
  2598  Jacobs                Mary                      6666
  2246  Hamel                 Marylou                   1000
  2246  Hamel                 Marylou                   6670
  4703  Halloran              Martin                    5130
  4703  Halloran              Martin                    4250
  2894  Griffin               William                   5500
  2894  Griffin               William                   1000
  1034  Gallway               James                     6470
  5008  Fordman               Timothy                   6770
  3778  Ferndale              Jane                      6666
  3778  Ferndale              Jane                      5200
  5103  Ferguson              Adele                     5200
  3769  Donelson              Julie                     5309
  4773  Dexter                Janice                    5309
  3841  Cromwell              Michelle                  4370
    .
    .
    .

69 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 6 (see page 183) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Additional Search Criteria in a Join

Remember that you specify the columns to be joined in the WHERE clause. You can have additional search criteria in the WHERE clause as well by using AND and OR.

Exercise 6-4

Now You Try It

Human Resources wants a list of managers in charge of projects. You need to create a list of those managers with their IDs, last and first names.

What tables will you join?

You'll join the EMPLOYEE and CONSULTANT tables.

What are the join columns?

EMP_ID in EMPLOYEE and MANAGER_ID in CONSULTANT are the join columns.

Do you need to qualify any column name?

Yes, both tables have MANAGER_ID columns.

What additional search criteria do you need?

You need to specify that you only want each manager listed once.

The result looks like this:

```
MANAGER_ID  EMP_LNAME            EMP_FNAME
----------  ---------            ---------
      1003  Baldwin              James
      2466  Bennett              Patricia

2 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 6 (see page 183) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Things to Remember about Joining Tables

When you join tables:

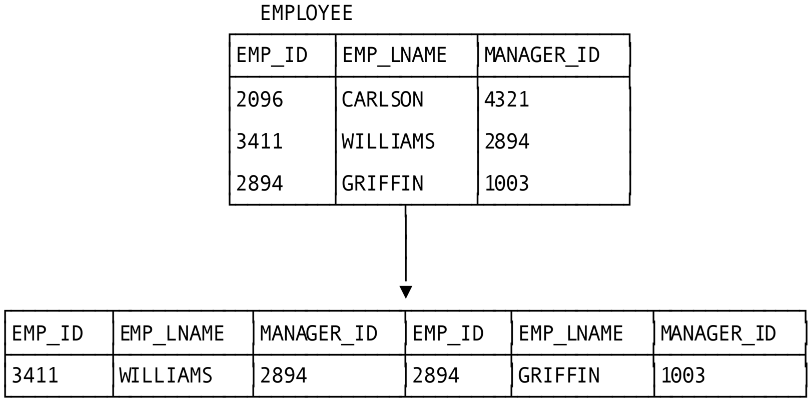
- You are combining rows of data from two or more tables to form one result table
- The join is based on common columns
- If a column name in the SELECT statement has the same name in two or more tables, it must be prefixed to specify the table
- The FROM clause contains the names of all the tables you are joining
- You should use a WHERE clause to limit the result table

Joining a Table to Itself

You join a table to itself when two rows in a table contain information that you want to combine together. This is called a **reflexive join**.

How It's Done

The Human Resources department needs to identify Catherine William's manager. The EMPLOYEE table contains the employee ID and the manager ID. To find the name of Catherine William's manager, first you find Catherine William's employee ID (3411) in the EMP_ID column. The row containing Catherine William's employee ID also contains her manager's employee ID (2894) in the MANAGER_ID column. Now you look in the EMPLOYEE table again to find the manager's ID (2894) in the employee ID column. You'll find the manager's name in this row:



EMPLOYEE

EMP_ID	EMP_LNAME	MANAGER_ID
2096	CARLSON	4321
3411	WILLIAMS	2894
2894	GRIFFIN	1003

EMP_ID	EMP_LNAME	MANAGER_ID	EMP_ID	EMP_LNAME	MANAGER_ID
3411	WILLIAMS	2894	2894	GRIFFIN	1003

To access this information, enter:

```
select mgr.emp_lname as "Manager",
       sub.emp_lname as "Subordinate"
       from employee mgr, employee sub
       where mgr.emp_id = sub.manager_id
         and sub.emp_id = 3411;
```

The result looks like this:

```
Manager                 Subordinate
-------                 -----------
Griffin                 Williams

1 row processed
```

Things to Remember about a Reflexive Join

- You assign aliases so that the manager's employee ID can be distinguished from the subordinate's employee ID
- You name the table twice in the FROM clause and give each reference an alias
- You compare the two columns that share the same type of information in the WHERE clause (MGR.EMP_ID = SUB.MANAGER_ID)

Using UNION

You can use UNION to append the rows returned by one set of selection criteria to the rows returned by another set.

Appending is different from joining. To join tables, you merge selected *columns* of one table with selected columns of another table. To append tables, you combine selected *rows* of one table to selected rows of another table.

How It's Done

To combine the CONSULTANT and EMPLOYEE tables to get a complete list of all people on the payroll, enter:

```
select con_id, con_lname, con_fname
       from consultant
       union
       select emp_id, emp_lname, emp_fname
              from employee;
```

This statement adds rows from the EMPLOYEE table to the rows in the CONSULTANT table.

The result looks like this:

```
EMP_ID  EMP_LNAME            EMP_FNAME
------  ---------            ---------
                   .
                   .
                   .
  4321  Bradley              George
  4358  Robinson             Judith
  4456  Thompson             Thomas
  4660  MacGregor            Bruce
  4703  Halloran             Martin
  4773  Dexter               Janice
  4962  White                Peter
  5008  Fordman              Timothy
  5090  Wills                Stephen
  5103  Ferguson             Adele
  9000  Legato               James
  9388  Candido              Linda
  9439  Miller               Charles
  9443  Jones                Diane
59 rows processed
```

Things to Remember about UNION

- UNION combines rows from separate SELECT statements and removes duplicate rows
- The columns you pair must have compatible data types.
- You must name the same number of columns in each of the SELECT statements
- Column names do not have to match
- If you want to sort the result table, use a single ORDER BY clause after the last SELECT statement
- The column names from the second table are used as column headings
- You can specify column headings using AS on the second table

Adding Rows Selectively

By adding WHERE clauses, you can use UNION to selectively add rows from one or more tables to another table.

How It's Done

To see information on both employees and consultants working in a particular department, enter:

```
select con_id, con_lname, con_fname
```

```
from consultant
where dept_id = 5200
union
select emp_id, emp_lname, emp_fname
       from employee
       where dept_id = 5200;
```

This statement adds selected rows from the EMPLOYEE table to selected rows in the CONSULTANT table.

The result looks like this:

```
EMP_ID  EMP_LNAME             EMP_FNAME
------  ---------             ---------
  2145  Catlin                Martin
  2781  Thurston              Joseph
  2894  Griffin               William
  3411  Williams              Catherine
  4358  Robinson              Judith
  9388  Candido               Linda
  9443  Jones                 Diane

7 rows processed
```

Review

Match each statement on the left with a term on the right. There will be one term left over.

Description	Term
1. Needed to join two or more tables	a. The WHERE clause
2. Resolves the problem of joining table columns that have the same name	b. Common columns
3. Where the joining is specified	c. The UNION clause
4. Where an alias is identified	d. The FROM clause
5. Used to append one table to another	e. The SELECT clause
	f. Aliases

To check your answers, see Review Answers for Chapter 6 (see page 183).

Scenarios

Create the appropriate statements online to retrieve the needed data:

1. Management would like to see which employees are involved in which projects. Write a SELECT statement to retrieve this information by joining the EMPLOYEE and PROJECT tables that contain the data. Display the information by project description.
2. The Human Resources department needs a list of employees and their remaining vacation time. This information is contained in the EMPLOYEE and BENEFITS tables. Display employee ID and last name as well as the vacation time remaining for fiscal year 2000. Order your report by employee ID.
3. More statistics are being gathered on vacation hours. You have been asked to produce a report of average vacation hours taken for each department. Display department ID and average vacation taken for fiscal year 1999. Order the report by department ID.
4. The budget committee needs a list of job titles, names of employees holding those jobs, and current salaries of those employees. They are interested only in jobs offering salaries of more than $55,000. Order your list by job title and include the job ID.

   Note: You need to join three tables to get this information.Specify the three tables in the FROM clause. Join two tables at a time in the WHERE clause. Use aliases to qualify column names.
5. Employee 2004 has just had a review and is due to get a pay increase. The increase is stored as REVIEW_PERCENT in the BENEFITS table. Employee 2004's manager has asked you to show her how much the increase is in dollar amount. To get this information, you need to multiply the current salary for fiscal year 2000 by the review percent. Show the employee ID, current salary, percent increase, and increase as a dollar amount.

   Note: You need to perform a calculation involving columns from two different tables.

To check your answers, see Review Answers for Chapter 6 (see page 183).

Chapter 8: Nesting SELECT Statements

Goal

When you have completed this chapter, you will be able to nest a SELECT statement within another SELECT statement to retrieve specified data.

Summary

An SQL request that is nested inside another SELECT statement is called a **subquery**. The subquery returns a set of values for use in the outer SELECT statement:

```
select
from
where column =

               (select
               from
               where column =

                              (select
                              from
                              where column = ));
```

You nest SELECT statements when you want to use data from one table as part of the criteria of another table. A subquery is often used in conjunction with predicates IN and EXISTS.

This section contains the following topics:

SELECT Statement in a WHERE Clause

You use a SELECT statement in a WHERE clause to create a result table that limits the rows that can be retrieved by the outer SELECT statement.

Generally, the SELECT statement nested within a WHERE clause can return only one column.

Using a Subquery with IN

Often, you want to retrieve rows from a table provided that values in a particular column are in another table. You can use IN as you did in Chapter 4. The nested SELECT statement provides the list that follows IN.

How It's Done

You might want the last names and telephones of employees who are department heads. To retrieve the information from the EMPLOYEE table, first determine the employees that are the heads of departments. You can do this through a subquery. You must enclose the subquery in parentheses. Enter:

```
select emp_lname, phone, dept_id
       from employee
       where emp_id in
             (select dept_head_id
                 from department);
```

The subquery first retrieves all the employee IDs of department heads from the DEPARTMENT table. The outer SELECT statement then uses this list to retrieve the last name, phone, and department ID of these employees from the EMPLOYEE table.

The result looks like this:

```
EMP_LNAME            PHONE       DEPT_ID
---------            -----       -------
Albertini            5083145366     2200
Alexander            5087394772     1110
Anderson             5083873664     6200
Baldwin              6173295757     6200
Bennett              5089487709     5000
Brooks               5089273644     3510
Carlson              6175553643     4600
Donelson             5084850432     3520
Griffin              5088449008     5200
Hamel                5083457789     1100
Jacobs               <null>         5100
Johnson              5089253998     1120
Parker               <null>         2210
Smith                6175563331     3530
Voltmer              6176635520     4500

15 rows processed
```

Exercise 7-1

Now You Try It

The Human Resources department needs to find out which departments have employees with more than 80 hours of vacation remaining for fiscal year 1999 so that the department head can be notified.

Enter a SELECT statement using a subquery to identify the IDs of those departments.

What tables are involved?

You need to access the BENEFITS table first to find out about remaining vacation hours. Then access the EMPLOYEE table to find the department ID.

You can use DISTINCT to eliminate duplicates.

The result looks like this:

```
DEPT_ID
-------
   4600
   6200

2 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 7 (see page 189) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Using an Aggregate Function in a Nested SELECT Statement

You can use an aggregate function in a nested SELECT statement when you want to compare a value in a table with another value derived through an aggregate function.

How It's Done

You want to see job IDs with current salaries that are higher than the average salary for all jobs. To do this, you use the POSITION table and enter:

```
select job_id, salary_amount
       from position
       where salary_amount >
             (select avg(salary_amount)
                     from position);
```

This statement first finds the average salary for all jobs in the POSITION table and then looks at all jobs to see which exceed that average.

The result looks like this:

```
JOB_ID   SALARY_AMOUNT
------   -------------
  4734        53665.00
  5555        76440.00
  4700        59488.00
  4023        74776.00
  5890        68016.00
  5890        66144.00
  6021       111593.00
  4734        57824.50
  5555        76961.00
  6004       110448.00
  4666        85280.00
  4700        59280.00
  5110        56977.80
  5555        54184.00
  5555        70720.00
  8001       117832.68
  9001       146432.00
  6011        94953.52
  4700        53665.56

19 rows processed
```

Enter the subquery SELECT statement alone to check these results by looking at the average salary itself.

Exercise 7-2

Now You Try It

As part of the Human Resources department's research on insurance claims, they need a list of employees who have more than the average number of dependents. To get this information, you need access to the COVERAGE table. Your report should display employee ID and number of dependents.

The result looks like this:

```
EMP_ID  NUM_DEPENDENTS
------  --------------
  3411               3
  3411               3
  3338               2
  2246               2
  2246               2
  3767               2
  3767               2
  3199               2
  3199               2
  2894               3
  2894               3
  5090               3
  1765               2
  1765               2
  3991               5
  3991               5
  3991               5
  4962               4
  3222               2
  2437               2
  2096               3
  2096               3
  5008               2
  5008               2
  2448               3
  1234               5
  1003               3
  1003               3
  2781               2
  3704               3

30 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 7 (see page 189) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Exercise 7-2B

Human Resources has requested you remove duplicate employees from the report.

```
EMP_ID  NUM_DEPENDENTS

------  --------------
  1003               3
  1234               5
  1765               2
  2096               3
  2246               2
  2437               2
  2448               3
  2781               2
  2894               3
  3199               2
  3222               2
  3338               2
  3411               3
  3704               3
  3767               2
  3991               5
  4962               4
  5008               2
  5090               3

19 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 7 (see page 189) for the correct SQL syntax. Remember result tables may be shortened in this guide.

Using EXISTS

When you want to retrieve rows from a table based on the existence of rows in another table, use the EXISTS predicate. The EXISTS predicate includes a subquery. If rows in a table meet the selection criteria in the subquery, the outer SELECT statement proceeds. With the EXISTS predicate, you usually use * rather than a column name with SELECT in the subquery for simplicity.

How It's Done

You want to retrieve the names of employees who have a certain level of a certain skill. You need to access both the EXPERTISE and EMPLOYEE tables to do this. Enter:

```
select emp_lname, emp_fname
       from employee
       where exists
             (select *
                     from expertise
                     where skill_id = 4444
                       and skill_level = '04'
                       and employee.emp_id = expertise.emp_id);
```

The outer SELECT statement looks at the first row in the EMPLOYEE table and passes the employee ID to the subquery. The subquery then evaluates this row by checking the employee ID against the criteria in the WHERE clause.

The outer SELECT statement and the subquery are connected by comparing common columns in the WHERE clause of the subquery.

The result looks like this:

```
EMP_LNAME           EMP_FNAME
---------        ---------
Thompson          Henry

1 row processed
```

Here's Another

If you want to list all the jobs in which an employee earns more than $65,000, enter:

```
select job_id, job_title
       from job
       where exists
             (select *
                     from position
                     where salary_amount > 65000
                       and "position".job_id = job.job_id);
```

Notes

POSITION is the table name **and** an SQL keyword; therefore, when the POSITION table name is used as an identifier, it must be enclosed in double quotation marks.

As an alternative, you can use an alias for the table name. For example:

```
select job_id, job_title
       from job
       where exists
             (select *
                     from position p
                     where salary_amount > 65000
                       and p.job_id = job.job_id);
```

The outer SELECT statement looks at the first row of the JOB table and passes the job ID to the subquery. If the row meets the selection criteria set up by the WHERE clause in the subquery, the row is displayed.

You need to qualify the column names in this example because the name, JOB_ID, is the same in both tables.

The result looks like this:

```
JOB_ID  JOB_TITLE
------  ---------
  8001  Vice President
  9001  President
  6011  Manager - Acctng
  4666  Sr Mechanic
  5555  Salesperson
  4023  Accountant
  6004  Manager - HR
  5890  Appraisal Spec
  6021  Manager - Mktng

9 rows processed
```

Exercise 7-3

Now You Try It

The budget group needs to know the department IDs of all departments where an employee earns more than $50,000. Enter a SELECT statement that will show this information using the POSITION and EMPLOYEE tables.

Note: Use DISTINCT to eliminate duplicates.

The result looks like this:

```
DEPT_ID
-------
   1100
   1120
   2200
   2210
   3510
   3530
   4500
   4600
   5000
   5200
   6200

11 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 7 (see page 189) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Using NOT EXISTS

You may also want to retrieve information from a table provided that *no* rows in another table meet the selection criteria.

For example, you might want to look for possible job openings by finding jobs that have no associated employee. To retrieve this information from the JOB table, first determine which jobs do not exist in the POSITION table. Enter:

```
select job_id, job_title
       from job
       where not exists
             (select * from position
                     where "position".job_id = job.job_id);
```

Notes

POSITION is the table name **and** an SQL keyword; therefore, when the POSITION table name is used as an identifier, it must be enclosed in double quotation marks.

As an alternative, you can use an alias for the table name. For example:

```
select job_id, job_title
       from job
       where not exists
             (select * from position p
                     where p.job_id = job.job_id);
```

The result looks like this:

```
JOB_ID  JOB_TITLE

------  ---------
  3051  Data Entry Clerk
  3029  Computer Operator
  5111  CUST SER REP
  2055  PAYROLL CLERK

4 rows processed
```

Things to Remember about Subqueries

- You usually use SELECT * in a subquery in an EXISTS predicate
- You must enclose the nested SELECT statement in parentheses
- You join the outer SELECT statement and the subquery when using the EXISTS predicate by comparing columns in the WHERE clause of the subquery
- You can use aliases to qualify column names

Review

Fill in the blanks with the appropriate words or phrases:

1. A nested SELECT statement is also known as a ______.
2. A subquery is located in a ______ clause.
3. A subquery must be enclosed in ____________________.
4. You use the ______ predicate to retrieve rows based on the existence of rows in another table.
5. When using an EXISTS predicate, the outer SELECT statement and the subquery are linked by matching ______ in the WHERE clause in the subquery.
6. You can use an asterisk (*) in the subquery if you are using the ______ keyword.

To check your answers, see Review Answers for Chapter 7 (see page 189).

Scenarios

Create the appropriate statements online to retrieve the needed data:

1. For tax purposes, the Accounting department needs to keep track of all jobs for which employees earn more than $65,000. A list of job titles is sufficient. (Use the JOB and POSITION tables.)
2. Upper management is concerned about the equality of salaries within Commonwealth Auto. They need to have a list by name of all jobs for which at least one employee earns less than $35,000. (Use the JOB and POSITION tables.)
3. Over the years, lots of department information has been added to the database. The Human Resources department is responsible for this portion of the database and knows that there are some departments still listed for which there are no longer any associated employees. They have asked you for a list showing these departments. Order the list by department ID. (Use the DEPARTMENT and EMPLOYEE tables.)

To check your answers, see Review Answers for Chapter 7 (see page 189)

Chapter 9: Updating a Table

Goal

When you have completed this chapter, you will be able to store rows of data in a table and change and delete existing data in a table.

Summary

Up to this time, you have been retrieving data that exists in a table in the database. Now you are going to add, modify, and delete rows of data in a table. The statements you will use are:

- **INSERT**, to add a row of data to a table
- **UPDATE**, to change the values in one or more columns in all rows of a table or in rows that satisfy a search condition
- **DELETE**, to remove one or more rows from a table

This section contains the following topics:

Inserting Data into a Table

To add complete new rows of data to an existing table, use the INSERT statement and specify the values you want to add.

How It's Done without Column Names

Suppose the company sets up a new department, the Audit department, and you need to add this information to the DEPARTMENT table. To do this, enter:

insert into department

values (4040, 1234,'D09', 'Audit');

The statement above adds the row into the table with the other department information.

Things to Remember when Using INSERT

- You can add only one row of values with one INSERT statement using the VALUE clause.
- Use INSERT INTO to identify the table to which you are going to add a new row
- Use the VALUES clause to identify the column values
- Enclose the column values in parentheses, separating them with commas
- Enclose values for character string data in single quotation marks
- The order of the column values must match the order of the columns defined for the table.
- Refer to the SQL reference manual for your environment to determine how to enter dates, money, and other types of data

Using the Keyword NULL

If you do not have data available for a particular column, you can insert the keyword NULL as a place holder if the column has been defined to allow null values.

Exercise 8-1

Now You Try It

Add another department to Commonwealth Auto. The only values you have right now are the department ID, 6060, the department name, Claims, and the division code, D09. The department name and division code columns contain character data. You do not know the ID of the head of the department.

Enter a SELECT statement to display all departments in order by department id and confirm your addition.

The result looks like this:

```
DEPT_ID  DEPT_HEAD_ID  DIV_CODE  DEPT_NAME
-------  ------------  --------  ---------
   1100          2246  D02       PURCHASING - USED CARS
   1110          1765  D04       PURCHASING - NEW CARS
   1120          2004  D06       PURCHASING - SERVICE
   2200          2180  D02       SALES - USED CARS
   2210          2010  D04       SALES - NEW CARS
   3510          3082  D02       APPRAISAL - USED CARS
   3520          3769  D04       APPRAISAL NEW CARS
   3530          2209  D06       APPRAISAL - SERVICE
   4040          1234  D09       Audit
   4200          1003  D04       LEASING - NEW CARS
   4500          3222  D09       HUMAN RESOURCES
   4600          2096  D06       MAINTENANCE
   4900          2466  D09       MIS
   5000          2466  D09       CORPORATE ACCOUNTING
   5100          2598  D06       BILLING
   5200          2894  D09       CORPORATE MARKETING
   6000          1003  D09       LEGAL
   6060        <null>  D09       Claims
   6200          2461  D09       CORPORATE ADMINISTRATION

19 rows processed
```

If your results do not match what you see above, check Review Answers for Chapter 8 (see page 192) for the correct SQL syntax. Remember that result tables may be shortened in this guide.

Using INSERT with Column Names

If you want to insert only one or a few columns in a row, specify the column names.

How It's Done

Suppose you want to add yet another department to the company, but you have only a department ID, department name, and division code. Enter:

```
insert into department (dept_id, dept_name, div_code)
     values (5050, 'Research', 'D09');
```

The column names are in parentheses and separated by commas.

The values must be given in the correct column order. You can use the word NULL when you don't have a value in a column as long as the column accepts null values.

If you do not specify a column and a value for that column, a null value will be inserted for you. If the column does not accept null values, the insert is rejected.

Enter a SELECT statement to display the DEPARTMENT table in Department id order to confirm the insertion.

The result looks like this:

```
DEPT_ID  DEPT_HEAD_ID  DIV_CODE  DEPT_NAME
-------  ------------  --------  ---------
   1100          2246  D02       PURCHASING - USED CARS
   1110          1765  D04       PURCHASING - NEW CARS
   1120          2004  D06       PURCHASING - SERVICE
   2200          2180  D02       SALES - USED CARS
   2210          2010  D04       SALES - NEW CARS
   3510          3082  D02       APPRAISAL - USED CARS
   3520          3769  D04       APPRAISAL NEW CARS
   3530          2209  D06       APPRAISAL - SERVICE
   4040          1234  D09       Audit
   4200          1003  D04       LEASING - NEW CARS
   4500          3222  D09       HUMAN RESOURCES
   4600          2096  D06       MAINTENANCE
   4900          2466  D09       MIS
   5000          2466  D09       CORPORATE ACCOUNTING
   5050        <null>  D09       RESEARCH
   5100          2598  D06       BILLING
   5200          2894  D09       CORPORATE MARKETING
   6000          1003  D09       LEGAL
   6060        <null>  D09       Claims
   6200          2461  D09       CORPORATE ADMINISTRATION

20 rows processed
```

Exercise 8-2

Try a Few More

Add two more departments that you choose. Leave the department head column null.

Enter a SELECT statement to display the table to confirm the insertions. To check your answers, see Review Answers for Chapter 8 (see page 192).

Exercise 8-3

Try Another

A project is about to get underway. You know that the project ID is P434 and that its name is Mass Media Campaign Blitz.

Insert a row into the PROJECT table giving this information. The PROJ_ID and PROJ_DESC columns contain character data.

Confirm the insertion. To check your answers, see Review Answers for Chapter 8 (see page 192).

The result looks like this:

```
PROJ_ID     PROJ_DESC
-------     ---------
C200        New brand research
C203        Consumer study
C240        Service study
P400        Christmas media
P434        Mass Media Campaign Blitz
P634        TV ads - WTVK
D880        Systems analysis

7 rows processed
```

Inserting rows with SELECT

You can copy selected rows from one table and put them into another table using the SELECT statement within the INSERT statement. A SELECT statement in an INSERT statement is referred to as a **query specification**.

Include a WHERE clause in the SELECT statement to insert only those rows meeting the search condition.

How It's Done

Your company has decided to hire one of the consultants, 9388, as a full-time employee. To add the employee information from the CONSULTANT table into the ASSIGNMENT table, enter:

```
insert into assignment (emp_id, proj_id, start_date)

   select con_id, proj_id, start_date
      from consultant
      where con_id = 9388;
```

The columns in the receiving table must have data compatible with the data of the corresponding columns in the sending table.

You can use SELECT * if you are using all columns in the same order as in the table to which you are adding the row.

Enter a SELECT statement to display the table and confirm the insertion.

The result looks like this:

```
EMP_ID  PROJ_ID     START_DATE  END_DATE
------  -------     ----------  --------
  2894  P634        2000-02-15  <null>
  3411  P634        2000-03-01  <null>
  4358  C240        1998-06-01  1998-08-15
  2466  D880        1999-11-01  <null>
  9388  D880        1997-12-21  <null>

5 rows processed
```

Modifying Data in a Table with SET

You use the UPDATE statement to modify columns or rows in a table.

Modifying Values in a Column

If you want to modify every value in a column throughout the table, you need to:

Identify the table you intend to modify by specifying UPDATE and the table name

Name the column in which the modification is to take place and give the new data with a **SET** clause

How It's Done

At certain times during the year, every employee's accrued vacation is increased by eight hours.

Exercise 8-4

Enter a SELECT statement to display the employees and vacation hours accrued. To check your SELECT statement, see Review Answers for Chapter 8 (see page 192). Jot down a couple of the employees and their vacation hours accrued so you can check them after you have made the changes.

To make the vacation hour changes, enter:

```
update benefits
    set vac_accrued = vac_accrued + 8
    where fiscal_year = 2000;
```

What message do you see?

You see a message specifying the number of rows that have been updated.

Display the Changes

Enter a SELECT statement sorted by employee id to display the updated table.

The result looks like this:

```
EMP_ID  VAC_ACCRUED
------  -----------
  1003       100.00
  1034       100.50
  1234       100.00
  1765       100.50
  2004       100.50
  2010       100.75
  2096       100.50
  2106       100.50
  2174       100.00
  2180       100.50
  2209       100.50
  2246       100.50
  2424       100.50
  2437        76.00
  2448        76.00
  2461        76.00
  2466       100.50
  2598        68.00
  2781        76.00
  2894        76.00
  3082        76.00
  3118        76.00
  3222        76.00
  3288        76.00
  3294        76.00
  3338        76.00
  3341        76.00
  3411        76.00
  3433        76.00
  3449        76.00
  3704        76.00
  3764        76.00
  3767        76.00
  3769        76.00
  3778        76.00
  3841        76.00
  3991        76.00
  4001        76.00
  4002        76.00
  4008        76.00
  4027        76.00
  4321        76.00
  4358        76.00
  4456        76.00
  4660        76.00
  4703        54.75
  4773        76.00
  4962        76.00
  5008        54.50
  5090        54.00
  5103        54.00


51 rows processed
```

Modifying Selected Rows

Often you want to change the value in a column only in rows that meet a certain search condition.

How It's Done

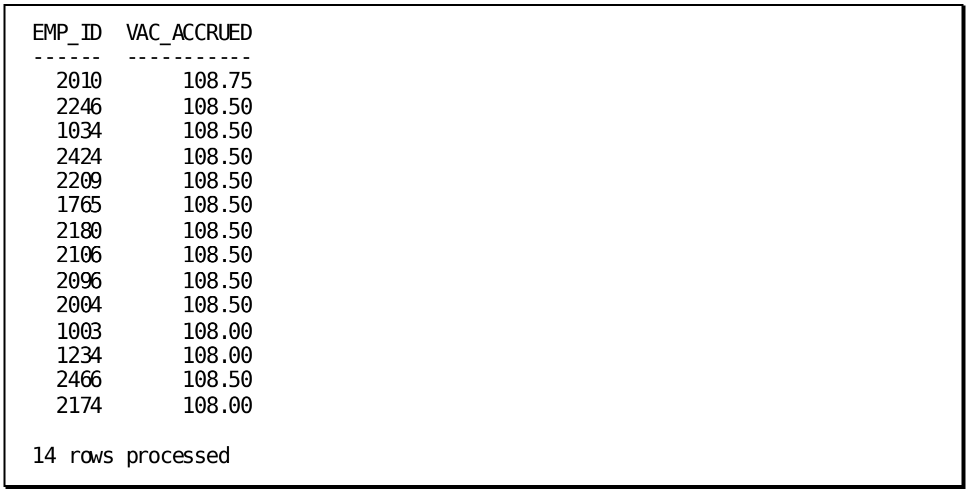
All employees who have accrued more than 80 hours of vacation time are supposed to have an additional eight hours added to their accrued vacation. To do this, add a WHERE clause to the previous statement:

```
update benefits
   set vac_accrued = vac_accrued + 8
   where vac_accrued > 80:ehp2
   and fiscal_year = 2000;
```

Display the Changes

Enter a SELECT statement to display the BENEFITS table to confirm the change.

The result looks like this:



```
EMP_ID  VAC_ACCRUED
------  -----------
  2010       108.75
  2246       108.50
  1034       108.50
  2424       108.50
  2209       108.50
  1765       108.50
  2180       108.50
  2106       108.50
  2096       108.50
  2004       108.50
  1003       108.00
  1234       108.00
  2466       108.50
  2174       108.00

14 rows processed
```

The only rows for which that column is updated are the rows that meet the condition.

Exercise 8-5

Now You Try It

It was recently discovered that the name of department 6060 is incorrect. Instead of Claims, it should be Lost Claims. Make the appropriate change to the DEPARTMENT table.

Confirm the modification by writing an appropriate SELECT statement. To check your answers, see Review Answers for Chapter 8 (see page 192)

Exercise 8-6

Try Another

Update the EMPLOYEE table so that employee 3433 is associated with department 6200.

Confirm the modification by issuing an appropriate SELECT statement. To check your answers, see Review Answers for Chapter 8 (see page 192)

Exercise 8-7

And Another

Three employees (1034, 3704, and 4660) have recently moved to Framingham. Update the EMPLOYEE table appropriately.

Confirm the modification by issuing an appropriate SELECT statement. To check your answers, see Review Answers for Chapter 8 (see page 192)

Removing Data from a Table

Use the DELETE statement to remove one or more rows from a database table.

How It's Done

One of the departments you entered previously, department 4040, shouldn't exist at all. Delete it by entering:

```
delete from department
     where dept_id = 4040;
```

This will delete only information on department 4040.

What message do you see?

You see a message stating that one row was deleted.

Display the Changes

Enter a SELECT statement to display the DEPARTMENT table to confirm the deletion.

The result looks like this:

```
DEPT_ID  DEPT_HEAD_ID  DIV_CODE  DEPT_NAME

-------  ------------  --------  ---------
   1100          2246  D02       PURCHASING - USED CARS
   1110          1765  D04       PURCHASING - NEW CARS
   1120          2004  D06       PURCHASING - SERVICE
   2200          2180  D02       SALES - USED CARS
   2210          2010  D04       SALES - NEW CARS
   3510          3082  D02       APPRAISAL - USED CARS
   3520          3769  D04       APPRAISAL NEW CARS
   3530          2209  D06       APPRAISAL - SERVICE
   4200          1003  D04       LEASING - NEW CARS
   4500          3222  D09       HUMAN RESOURCES
   4600          2096  D06       MAINTENANCE
   4900          2466  D09       MIS
   5000          2466  D09       CORPORATE ACCOUNTING
   5100          2598  D06       BILLING
   5200          2894  D09       CORPORATE MARKETING
   6000          1003  D09       LEGAL
   6060        <null>  D09       Claims
   6200          2461  D09       CORPORATE ADMINISTRATION

19 rows processed
```

Exercise 8-8

Now You Try It

Department 5050 also should not be in the database. Delete it from the DEPARTMENT table.

Enter a SELECT statement to confirm the deletion. To check your answers, see Review Answers for Chapter 8 (see page 192).

Omitting the WHERE Clause

If you do not use the WHERE clause in the DELETE statement, *all* rows of data are deleted from the table. The empty table remains in the database.

Exercise 8-9

Try Another

Create a DELETE statement to erase department 6060 and the other two departments you added from the DEPARTMENT table while practicing INSERT.

Confirm the deletion by issuing an appropriate SELECT statement. To check your answers, see Review Answers for Chapter 8 (see page 192).

Review

Choose the correct answers for the questions below. More than one answer can apply for each question.

1. You use a SELECT statement with INSERT to:
   a. Copy specific rows from one table to another
   b. Add a completely new row to a database
   c. Modify a row in a table
2. If you don't have a value for every column you are adding to a table, you can:
   a. Identify only the columns you are going to insert values into
   b. Use the keyword NULL for the columns where the value is unknown
   c. Use two quotes with a space between for the columns where the value is unknown
3. You can update all rows in a table by:
   a. Using a WHERE clause with an *
   b. Omitting the WHERE clause
   c. Using an * after the keyword UPDATE
4. You can update selected rows in a table by:
   a. Specifying columns after the keyword UPDATE
   b. Using a WHERE clause with an *
   c. Specifying a search condition in a WHERE clause
5. You are updating all columns in a table but do not know the specific value to put into one column. You can:
   a. Use the keyword UNKNOWN for the column where the value is unknown
   b. Use two quotes with a space between for the column where the value is unknown
   c. Use the keyword NULL for the column where the value is unknown
6. If you do not have a WHERE clause in a DELETE statement:
   a. All the rows are deleted and the table is deleted as well
   b. The table is deleted
   c. All the rows are deleted but the table remains

To check your answers, see Review Answers for Chapter 8 (see page 192).

Appendix A: Sample Data Description Language

This section contains the following topics:

About This Appendix

Up to now, you have been using SQL DML statements to retrieve or update data. You haven't been concerned with table design or layout, and you have had full access to all tables. This appendix shows how a system administrator might use DDL to define a database and users' access to it. If you use SQL against a multi-user database, your use can be affected by decisions made by the system administrator who:

- Creates databases and tables using SQL DDL
- Specifies which database the tables are associated with and identifies the physical files in which to store data
- Defines constraints on the data so that only valid data is stored in the database
- Restricts access to tables and creates views of them

Each of these functions can have an impact on the way you access data from tables.

No Online Exercises

There are no online exercises in this chapter. Please *do not* enter any of the statements online.

Table Creation

Before you can access a table, it must be defined to the database management system.

For example, to set up the EMPLOYEE table, you or the system administrator uses an appropriate tool to create the following DDL statement:

```
create table employee
(emp_id integer not null,
manager_id      integer
emp_fname       varchar(2_)     not null,
emp_lname       varchar(2_)     not null,
dept_id integer not null,
street  varchar(4_)     not null,
city    char(2_)not null,
state   char(_4)not null,
zip_codechar(_9)not null,
phone   char(1_),
status  char(_1),
ss_number       integer not null,
start_date      date    not null,
termination_datedate,
birth_date      date    not null);
```

The system administrator specifies the column names and the kind of data you can put into each column.

Common Columns

The system administrator identifies potential relationships between tables and plans for common columns that can become foreign keys. You use these common columns when you want to join tables.

Temporary Tables

In a multi-user database environment, there are times when you need to store data for only a short period of time, perhaps as long as a program is running. When tables are set up for this purpose, they are called **temporary tables**.

The data in temporary tables is not stored in the database and is not accessible to other users.

For example, you may need to access all the company's accounts receivable data for the past five years. This information is stored in an accounts receivable history table that covers the past 15 years. You want to retrieve data in different forms, so you'll use several SELECT statements.

Rather than access the very large history table every time you need to retrieve data, you can define a temporary table that has data from just the past five years and retrieve from this smaller table. This allows you quicker and more efficient access to the data.

Indexes

An index is a way to order a table logically to speed the retrieval of data.

For example, an index could be defined to order the EMPLOYEE table by employee last name. Another index could be established to order the same table by social security number.

An index is established on a column or combination of columns:

- To improve processing efficiency
- To prevent duplicate rows (when an index is specified as unique)

Identifying an Index

The system administrator examines all the columns and the programs that will run against the table to determine how the data is most likely to be accessed.

For example, assume several programs access the EMPLOYEE table to list employees alphabetically by last name. The system administrator would place an index on the employee last name to allow these programs to access the data efficiently.

There can be several indexes associated with one table.

When you issue a SELECT statement, SQL uses the indexes to access the data as efficiently as possible.

Creating an Index

To create an index on employee last name, the system administrator uses the following DDL statement:

```
create index lname_index
       on employee (emp_lname);
```

Indexes can be added or dropped as necessary.

Views

You don't always need to see an entire table. In fact, a table may contain data (like salary information) that shouldn't be seen by everyone.

You may also frequently want to see two or more tables together.

In these situations, the systems administrator creates a view.

What is a View

A view is defined using DDL and can be:

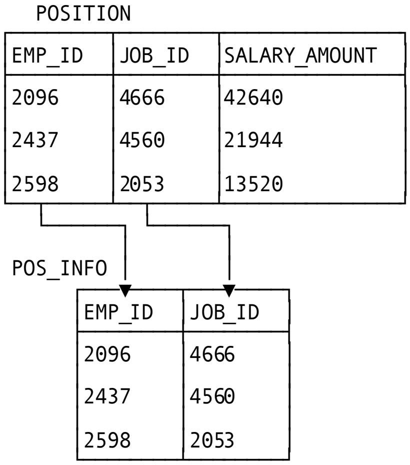
- A subset of columns and rows in one or more tables
- Two or more joined tables

A view is represented internally by a stored command, not stored data. A view can display data from one or more tables or from other views.

Each view has a name, just as a table has a name. You can use all SQL SELECT commands that you use against a table against a view as well.

When you display the view, you see only the *subset* of columns and rows specified in the view definition.

Here is a table and one view of it:



POSITION

EMP_ID	JOB_ID	SALARY_AMOUNT
2096	4666	42640
2437	4560	21944
2598	2053	13520

POS_INFO

EMP_ID	JOB_ID
2096	4666
2437	4560
2598	2053

Data Integrity

Data integrity means correctness of data throughout the database. When you add data to a table, you want that data to be correct and consistent with other data in the table.

If you add an employee to the EMPLOYEE table, you want to make sure that the employee has an ID. Every employee must have an ID to keep the employee entries consistent with one another. This is an example of data integrity.

In other cases, the value in a given column cannot be repeated. The employee ID is unique for each employee; two employees cannot have the same ID. This is another example of data integrity.

To ensure that the data is consistent across tables, integrity constraints are set up as part of the data definition. The data you enter is checked against these constraints.

Appendix B: Answers to Exercises

This section contains the following topics:

Review Answers for Chapter 1

These are the answers for Review (see page 22).

Description	Term
1. Components of a relational database that hold the data	c. Tables
2. Components of a table	d. Rows and columns
3. A column or combination of columns holding values that form the primary key of another table	a. Foreign key
4. The types of operations you can perform against a relational database	e. Select, project, and join
5. A way to establish a relationship between two tables	a. Foreign key
6. A column or combination of columns that uniquely identifies a row in a table	b. Primary key

Review Answers for Chapter 2

These are the answers for Review (see page 26).

1. SQL stands for **Structured Query Language**.
2. You use SQL **data description language (DDL)** statements to define tables.
3. You use SQL **data manipulation language (DML)** statements to change data in a table.
4. The three SQL update operations are **INSERT**, **UPDATE**, and **DELETE**.
5. An interactive SQL statement ends with a **delimiter/semicolon**.
6. An interactive SQL statement begins with a **verb**.
7. An interactive SQL statement **can** span several lines.
8. Interactive SQL gives you **immediate** results.
9. Embedded SQL returns the results to the **program**.

Review Answers for Chapter 3

Exercise 3-1 Answer

This is the answer for Exercise 3-1 (see page 30).

```
select *
       from skill;
```

Exercise 3-2 Answer

This is the answer for Exercise 3-2 (see page 32).

```
select skill_id, skill_name
       from skill;
```

Exercise 3-3 Answer

This is the answer for Exercise 3-3 (see page 33).

```
select emp_fname, emp_lname, street, city
       from employee;
```

Exercise 3-4 Answer

This is the answer for Exercise 3-4 (see page 37).

```
select dept_id as "Department ID", dept_name as "Name"
       from department;
```

Exercise 3-5 Answer

This is the answer for Exercise 3-5 (see page 39).

```
select emp_id as "Employee",
       salary_amount as "Salary",
       bonus_percent as "Bonus Percentage",
       bonus_percent * salary_amount as "Bonus Paid"
       from position;
```

Exercise 3-6 Answer

This is the answer for Exercise 3-6 (see page 49).

```
select distinct city
       from employee;
```

Exercise 3-7 Answer

This is the answer for Exercise 3-7 (see page 52).

```
select emp_id, emp_lname
       from employee
       order by emp_lname desc;
```

Exercise 3-8 Answer

This is the answer for Exercise 3-8 (see page 54).

```
select skill_id, skill_name
       from skill
       order by skill_id;
```

Exercise 3-9 Answer

This is the answer for Exercise 3-9 (see page 57).

```
select dept_id, emp_lname, emp_id
       from employee
       order by dept_id, emp_lname;
```

Exercise 3-10 Answer

This is the answer for Exercise 3-10 (see page 60).

```
select emp_id as "Employee",
       salary_amount as "Base Salary",
       bonus_percent as "Bonus Percentage",
       bonus_percent * salary_amount as "Bonus Paid"
       from position
       order by 4;
```

Review Answers

These are the answers for Review (see page 63).

1. How many columns would be retrieved by the following statement:

   `select * from sample_table;`

   - **c. All**

2. How can you limit the number of columns returned by your SELECT statement?

   - **b. List the columns you want to see**

3. How can you give heading names to columns?

   - **b. Use AS after the column name and specify the heading**

4. Given a table called SUPPLY_PRICE and a column in that table called PART_NUMBER, which of the following statements will find the number of *unique* part numbers in the table?

   - **c. select distinct part_number from supply_price;**

5. How can you name the column you want to sort by?

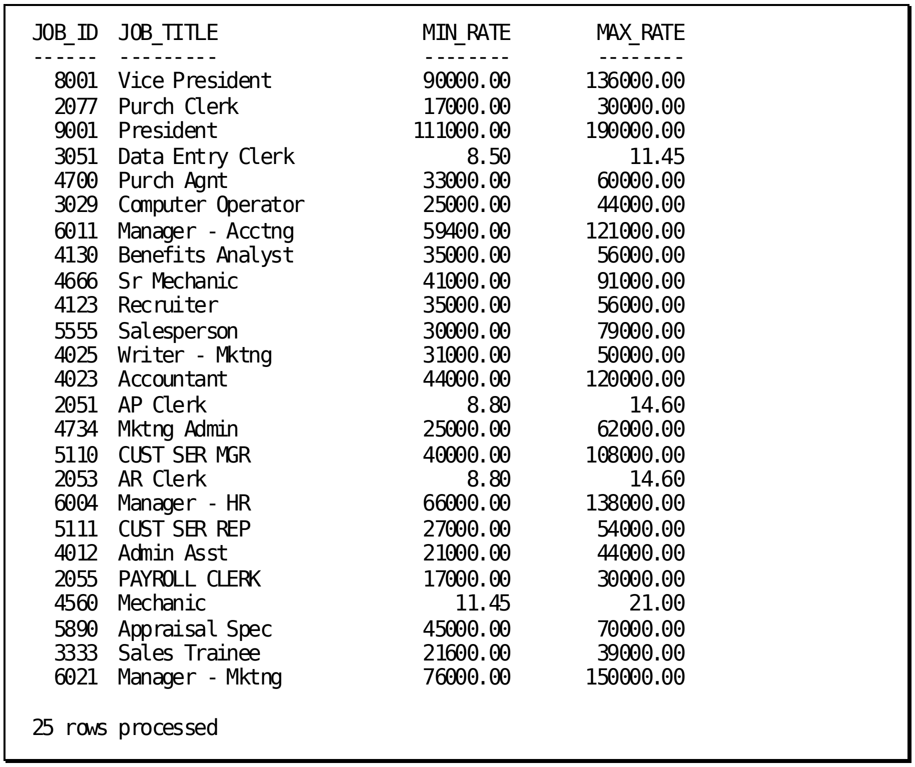
   - **a. Use the column name**
   - **b. Use the heading name**
   - **d. Use the column number**

Scenario Answers

These are the answers for Scenarios (see page 64).

1. You need to list all jobs the company has for a government screen. The screen should show job ID, job title, and minimum and maximum rate for the job. Use the JOB table, checking Appendix C for table descriptions.

```
select job_id, job_title, min_rate, max_rate
       from job;
```

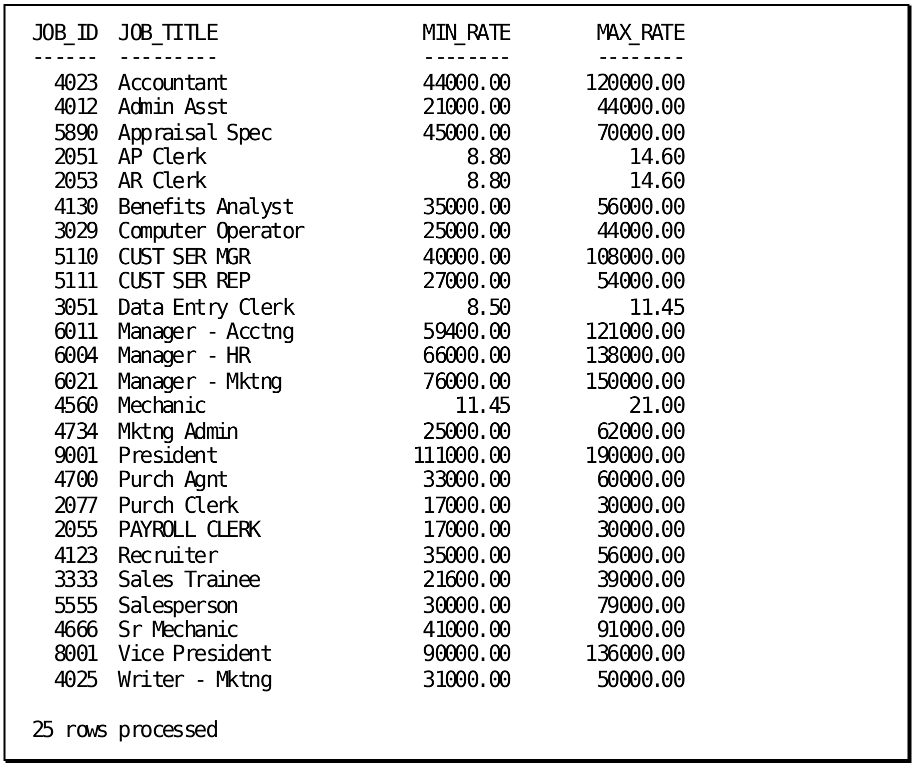


```
JOB_ID  JOB_TITLE                 MIN_RATE       MAX_RATE
------  ---------                 --------       --------
  8001  Vice President            90000.00      136000.00
  2077  Purch Clerk               17000.00       30000.00
  9001  President                111000.00      190000.00
  3051  Data Entry Clerk              8.50          11.45
  4700  Purch Agnt                33000.00       60000.00
  3029  Computer Operator         25000.00       44000.00
  6011  Manager - Acctng          59400.00      121000.00
  4130  Benefits Analyst          35000.00       56000.00
  4666  Sr Mechanic               41000.00       91000.00
  4123  Recruiter                 35000.00       56000.00
  5555  Salesperson               30000.00       79000.00
  4025  Writer - Mktng            31000.00       50000.00
  4023  Accountant                44000.00      120000.00
  2051  AP Clerk                      8.80          14.60
  4734  Mktng Admin               25000.00       62000.00
  5110  CUST SER MGR              40000.00      108000.00
  2053  AR Clerk                      8.80          14.60
  6004  Manager - HR              66000.00      138000.00
  5111  CUST SER REP              27000.00       54000.00
  4012  Admin Asst                21000.00       44000.00
  2055  PAYROLL CLERK             17000.00       30000.00
  4560  Mechanic                     11.45          21.00
  5890  Appraisal Spec            45000.00       70000.00
  3333  Sales Trainee             21600.00       39000.00
  6021  Manager - Mktng           76000.00      150000.00

25 rows processed
```

2. The screen you just created (in Scenario 1) has all the necessary information but is difficult to read because it is not sorted. Modify the SELECT statement to create the same screen sorted by job title.

```
select job_id, job_title, min_rate, max_rate
       from job
       order by job_title;
```

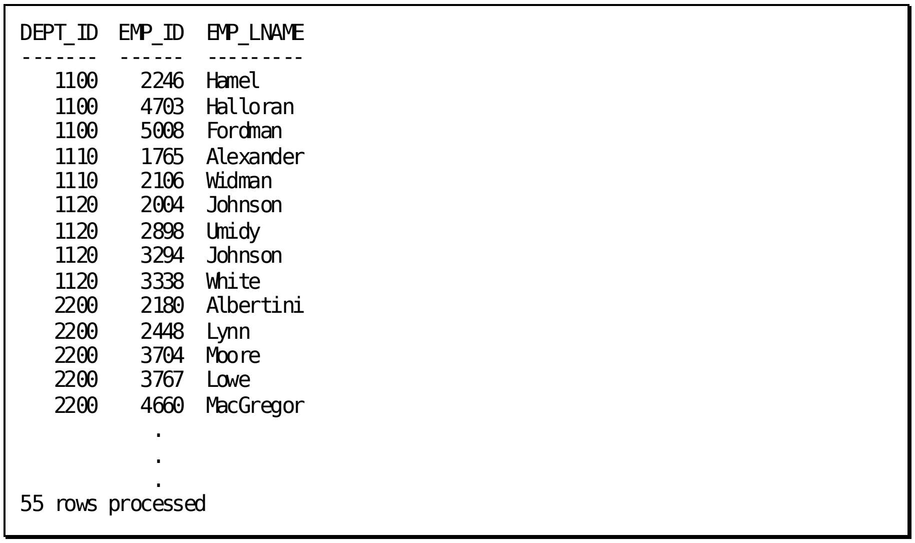


```
JOB_ID  JOB_TITLE                    MIN_RATE       MAX_RATE
------  ---------                    --------       --------
  4023  Accountant                   44000.00      120000.00
  4012  Admin Asst                   21000.00       44000.00
  5890  Appraisal Spec               45000.00       70000.00
  2051  AP Clerk                         8.80          14.60
  2053  AR Clerk                         8.80          14.60
  4130  Benefits Analyst             35000.00       56000.00
  3029  Computer Operator            25000.00       44000.00
  5110  CUST SER MGR                 40000.00      108000.00
  5111  CUST SER REP                 27000.00       54000.00
  3051  Data Entry Clerk                 8.50          11.45
  6011  Manager - Acctng             59400.00      121000.00
  6004  Manager - HR                 66000.00      138000.00
  6021  Manager - Mktng              76000.00      150000.00
  4560  Mechanic                        11.45          21.00
  4734  Mktng Admin                  25000.00       62000.00
  9001  President                   111000.00      190000.00
  4700  Purch Agnt                   33000.00       60000.00
  2077  Purch Clerk                  17000.00       30000.00
  2055  PAYROLL CLERK                17000.00       30000.00
  4123  Recruiter                    35000.00       56000.00
  3333  Sales Trainee                21600.00       39000.00
  5555  Salesperson                  30000.00       79000.00
  4666  Sr Mechanic                  41000.00       91000.00
  8001  Vice President               90000.00      136000.00
  4025  Writer - Mktng               31000.00       50000.00

25 rows processed
```

3. Periodically, a company list is produced showing each department and all employees assigned to that department. This list should be sorted first by department ID and then by employee ID within each department. Display department ID, employee ID, and employee last name. Create the appropriate SQL SELECT statement to produce this list using the EMPLOYEE table.

```
select dept_id, emp_id, emp_lname
       from employee
       order by dept_id, emp_id;
```



```
DEPT_ID  EMP_ID  EMP_LNAME
-------  ------  ---------
   1100    2246  Hamel
   1100    4703  Halloran
   1100    5008  Fordman
   1110    1765  Alexander
   1110    2106  Widman
   1120    2004  Johnson
   1120    2898  Umidy
   1120    3294  Johnson
   1120    3338  White
   2200    2180  Albertini
   2200    2448  Lynn
   2200    3704  Moore
   2200    3767  Lowe
   2200    4660  MacGregor
            .
            .
            .
55 rows processed
```

4. The screen you just created is very useful except that the headings are difficult to understand. Rewrite the statement so that the column names are "Department", "Employee ID", and "Last Name".

```
select dept_id as "Department", emp_id as "Employee ID",
       emp_lname as "Last Name"
       from employee
       order by 1, 2;
```

```
Department  Employee ID  Last Name
----------  -----------  ---------
      1100         2246  Hamel
      1100         4703  Halloran
      1100         5008  Fordman
      1110         1765  Alexander
      1110         2106  Widman
      1120         2004  Johnson
      1120         2898  Umidy
      1120         3294  Johnson
      1120         3338  White
      2200         2180  Albertini
      2200         2448  Lynn
      2200         3704  Moore
      2200         3767  Lowe
      2200         4660  MacGregor
             .
             .
             .
55 rows processed
```

Review Answers for Chapter 4

Exercise 4-1 Answer

This is the answer for Exercise 4-1 (see page 70).

```
select emp_id, emp_fname, emp_lname
       from employee
       where emp_id = 5103;
```

Exercise 4-2 Answer

This is the answer for Exercise 4-2 (see page 70).

```
select emp_id, job_id, salary_amount
       from position
       where salary_amount > 100000;
```

Exercise 4-3 Answer

This is the answer for Exercise 4-3 (see page 71).

```
select emp_id, emp_fname, emp_lname, city
       from employee
       where city = 'Boston'
       order by emp_id;
```

Exercise 4-4 Answer

This is the answer for Exercise 4-4 (see page 72).

```
select emp_id, emp_fname, emp_lname, city
       from employee
       where not city = 'Boston';
```

Exercise 4-5 Answer

This is the answer for Exercise 4-5 (see page 75).

```
select emp_id
       from position
       where bonus_percent is null;
```

Exercise 4-6 Answer

This is the answer for Exercise 4-6 (see page 77).

```
select emp_id, emp_fname, emp_lname, phone
       from employee
       where phone is not null;
```

Exercise 4-7 Answer

This is the answer for Exercise 4-7 (see page 81).

```
select job_id, emp_id, salary_amount
       from position
       where salary_amount between 20000 and 35000;
```

Exercise 4-8 Answer

This is the answer for Exercise 4-8 (see page 83).

```
select emp_id, salary_amount
       from position
       where salary_amount in (41600, 45240, 50440);
```

Exercise 4-9 Answer

This is the answer for Exercise 4-9 (see page 85).

```
select dept_id, dept_name from department
       where dept_name like '%NEW CARS%';
```

Exercise 4-10 Answer

This is the answer for Exercise 4-10 (see page 86).

```
select dept_id, dept_name from department
       where dept_name not like '%NEW CARS%';
```

Exercise 4-11 Answer

This is the answer for Exercise 4-11 (see page 88).

```
select proj_id, est_man_hours - act_man_hours
       from project
       where est_man_hours - act_man_hours > 0;
```

Exercise 4-12 Answer

This is the answer for Exercise 4-12 (see page 90).

```
select emp_id, city, phone
       from employee
       where city in ('Camden', 'Brookline', 'Canton')
          or phone is not null;
```

Review Answers

These are the answers for Review (see page 95).

1. The clause that allows the user to specify search conditions that filter the rows to be selected is:

   - **a. The WHERE clause**

2. What are the components of the WHERE clause?

   - **b. The keyword WHERE**
   - **c. A search condition**

3. You can compare a character column to a

   - **b. Mask**

4. Masks are used with

   - **c. The LIKE predicate**

5. Which of the following are mask characters?

   - **b. _**
   - **d. %**

6. The IS NULL predicate causes:

   - **b. The retrieval of rows where a column contains no value**

7. Parentheses are used to:

   - **a. Set up the sequence of arithmetic evaluation**
   - **b. Set up the sequence of evaluation of AND and OR in a compound WHERE clause**

Scenario Answers

These are the answers for Scenarios (see page 96).

1. Periodically, a list is published giving divisions and their departments. A new department was recently added to division D09, so a new list for that division is needed. Use the DEPARTMENT table and show division code, department ID, and department name. Order by department ID.

   ```
   select div_code, dept_id, dept_name
          from department
          where div_code = 'D09'
          order by dept_id;
   ```

```
DIV_CODE  DEPT_ID  DEPT_NAME
--------  -------  ---------
D09          4500  HUMAN RESOURCES
D09          4900  MIS
D09          5000  CORPORATE ACCOUNTING
D09          5200  CORPORATE MARKETING
D09          6000  LEGAL
D09          6200  CORPORATE ADMINISTRATION

6 rows processed
```

2. All Commonwealth Auto employees whose last names begin with L and M are due to have flu shots. The medical office needs to have the complete names of these individuals and the department to which each is assigned. Sort the list by last name. (Use the EMPLOYEE table.)

   ```
   select emp_lname, emp_fname, dept_id
          from employee
          where emp_lname like 'L%' or emp_lname like 'M%'
          order by emp_lname;
   ```

```
EMP_LNAME            EMP_FNAME            DEPT_ID
---------            ---------            -------
Loren                Martin                  4600
Lowe                 Frank                   2200
Lynn                 David                   2200
MacGregor            Bruce                   2200
Mills                Thomas                  6200
Moore                Richard                 2200

6 rows processed
```

3. The Marketing department has a large project coming up and needs employees who have at least a medium level of competence (greater than 02) in skill 3333. Display employee ID and level of competence for each employee using the EXPERTISE table.

   ```
   select emp_id, skill_level
          from expertise
          where skill_id = 3333
            and skill_level > '02';
   ```

```
EMP_ID  SKILL_LEVEL
------  -----------
  2437  04
  3288  04

2 rows processed
```

4. In order to identify employees involved in media projects, the Human Resources department needs a list of employees associated with a project ID that begins with P (indicating media-related). Order the list by employee ID. (Use the ASSIGNMENT table to find this information.)

```
select emp_id, proj_id
       from assignment
       where proj_id like 'P%'
       order by emp_id;
```

```
EMP_ID  PROJ_ID
------  -------
  2894  P634
  3411  P634

2 rows processed
```

5. The budget group needs a list of employees who hold a position that pays less than $25,000. Show employee ID and salary.

```
select emp_id, salary_amount
       from position
       where salary_amount < 25000;
```

```
EMP_ID   SALARY_AMOUNT
------   -------------
  3338        22048.84
  3767         2200.00
  4660        24000.00
  1765        18001.00
  2180        19000.10
  2106        23920.00
  3704        22880.00
  4008        24441.00
  4703        24857.00

9 rows processed
```

Review Answers for Chapter 5

Exercise 5-1 Answer

This is the answer for Exercise 5-1 (see page 98).

```
select avg(num_dependents)
       from coverage;
```

Exercise 5-2 Answer

This is the answer for Exercise 5-2 (see page 99).

```
select avg(vac_accrued)
       from benefits
       where fiscal_year = 1999;
```

Exercise 5-3 Answer

This is the answer for Exercise 5-3 (see page 100).

```
select count(*)
       from skill;
```

Exercise 5-4 Answer

This is the answer for Exercise 5-4 (see page 101).

```
select count(phone)
       from employee
       where dept_id = 5200;
```

Exercise 5-5 Answer

This is the answer for Exercise 5-5 (see page 102).

```
select max(salary_amount)
       from position
       where job_id = 3333;
```

Exercise 5-6 Answer

This is the answer for Exercise 5-6 (see page 103).

```
select min(sick_taken)
       from benefits;
```

Exercise 5-7 Answer

This is the answer for Exercise 5-7 (see page 104).

```
select sum(vac_taken)
       from benefits;
```

Exercise 5-8 Answer

This is the answer for Exercise 5-8 (see page 105).

```
select count(distinct proj_id)
       from consultant;
```

Exercise 5-9 Answer

This is the answer for Exercise 5-9 (see page 107).

```
select dept_id, count(emp_id)
       from employee
       group by dept_id;
```

Exercise 5-10 Answer

This is the answer for Exercise 5-10 (see page 108).

```
select job_id, sum(salary_amount)
       from position
       group by job_id;
```

Exercise 5-11 Answer

This is the answer for Exercise 5-11 (see page 111).

```
select city, count(emp_id)
       from employee
       group by city
       having count(emp_id) > 2;
```

Exercise 5-12 Answer

This is the answer for Exercise 5-12 (see page 112).

```
select job_id, avg(salary_amount)
       from position
       group by job_id
       having avg(salary_amount) > 25000;
```

Exercise 5-13 Answer

This is the answer for Exercise 5-13 (see page 112).

```
select job_id, avg(salary_amount) as "Average Salary"
```

```
from position
group by job_id
having avg(salary_amount) > 25000;
```

Review Answers

These are the answers for Review (see page 113).

1. You use **aggregate functions** to perform calculations within a SELECT statement.
2. An aggregate function can be used instead of a column name with **SELECT** or in the **HAVING** clause.
3. When the aggregate function AVG encounters a null value, it **ignores** the row.
4. The **HAVING** clause acts as a search condition with an aggregate function.
5. You rename an aggregate function column heading by using **AS** and the heading you want.

Scenario Answers

These are the answers for Scenario (see page 114).

1. In order to plan for the Christmas party for Commonwealth Auto, the Human Resources department needs a count of employees by department. (The EMPLOYEE table contains this information.)

   ```
   select dept_id, count(emp_id)
          from employee
          group by dept_id;
   ```

   ```
   DEPT_ID      (EXPR)
   -------      ------
      1100           3
      1110           2
      1120           4
      2200           5
      2210           8
      3510           2
      3520           1
      3530           2
      4500           3
      4600           9
      5000           3
      5100           2
      5200           5
      6200           6

   14 rows processed
   ```

2. As part of its salary research, the Human Resources department needs to know the minimum and maximum salaries being earned for each job ID in the company. (Use the POSITION table.)

   ```
   select job_id, min(salary_amount), max(salary_amount)
   ```

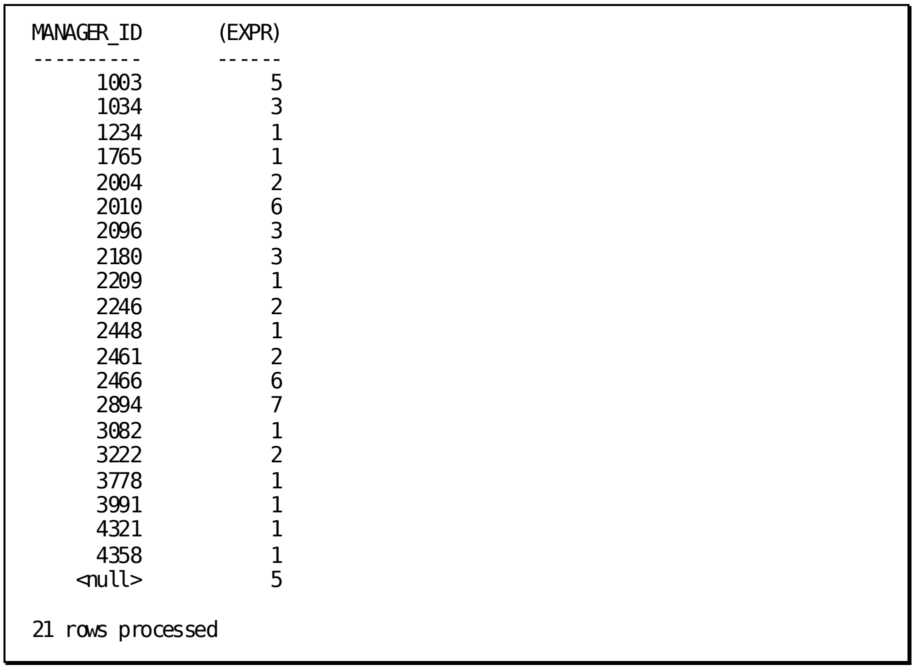
```
       from position
       group by job_id;
```

```
JOB_ID         (EXPR)         (EXPR)
------         ------         ------
  2051         <null>         <null>
  2053         <null>         <null>
  2077       18001.00       29536.00
  3333        2200.00       30680.00
  4012       28601.80       44001.40
  4023       74776.00       74776.00
  4025       43888.00       43888.00
  4123       49921.76       49921.76
  4130       45241.94       45241.94
  4560         <null>         <null>
  4666       85280.00       85280.00
  4700       47009.34       59488.00
  4734       53665.00       57824.50
  5110       56977.80       56977.80
  5555       36400.00       76961.00
  5890       41600.00       68016.00
  6004      110448.00      110448.00
  6011       94953.52       94953.52
  6021      111593.00      111593.00
  8001      117832.68      117832.68
  9001      146432.00      146432.00

21 rows processed
```

3. Upper management needs to know how many subordinate employees there are for each manager in order to evaluate the span of control within the company. The EMPLOYEE table contains this information.

```
select manager_id, count(emp_id)
       from employee
       group by manager_id;
```

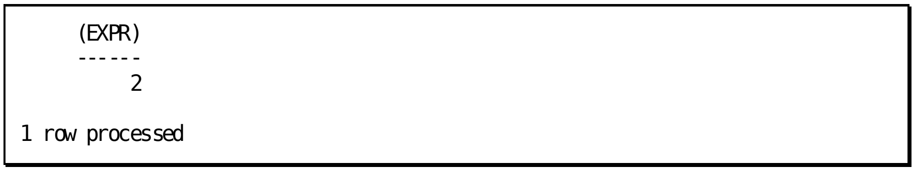


```
MANAGER_ID      (EXPR)
----------      ------
      1003           5
      1034           3
      1234           1
      1765           1
      2004           2
      2010           6
      2096           3
      2180           3
      2209           1
      2246           2
      2448           1
      2461           2
      2466           6
      2894           7
      3082           1
      3222           2
      3778           1
      3991           1
      4321           1
      4358           1
    <null>           5

21 rows processed
```

4. A project is coming up that requires project members having the skill ID 3333 (body work). The project leader needs to find out how many employees have a skill level greater than 02 for this skill to see whether he needs to hire consultants to staff the project. Keep in mind that the SKILL_LEVEL column contains character data. (Use the EXPERTISE table.)

```
select count(emp_id)
       from expertise
       where skill_id = 3333
         and skill_level > '02';
```



```
    (EXPR)
    ------
         2

1 row processed
```

5. The Human Resources department is conducting research into salaries. They have asked you for a screen showing:

- Job ID
- Average salary by job
- Minimum salary by job
- Maximum salary by job

They need this screen only for current positions with a job ID less than 4000 (indicating training and clerical positions) where the average salary is less than $25,000. Use the POSITION table and rename the column headings so that the screen makes sense.

```
select job_id as "Job",
       avg(salary_amount) as "Average Salary",
       min(salary_amount) as "Minimum Salary",
       max(salary_amount) as "Maximum Salary"
       from position
       where job_id < 4000
       group by job_id
       having avg(salary_amount) < 25000;
```

```
 Job                  Average Salary  Minimum Salary  Maximum Salary
 ---                  --------------  --------------  --------------
2077                        23672.56        18001.00        29536.00
3333                        23130.05         2200.00        30680.00
2 rows processed
```

6. The training group is concerned that there are few people in the company who have certain crucial skills. They have asked you to give them a screen listing the number of employees who have either a medium level of competence (02 or above) for skill 3333 (body work) or a high level of competence (04) for skill 4444 (assembly). The screen should list a skill only if there are more than two employees that fit that category.

```
select skill_id, count(emp_id)
       from expertise
       where (skill_id = 3333 and skill_level >= '02')
          or (skill_id = 4444 and skill_level = '04')
       group by skill_id
       having count(emp_id) > 2;
```

```
SKILL_ID      (EXPR)
--------      ------
    3333           3

1 row processed
```

Review Answers for Chapter 6

Exercise 6-1 Answer

This is the answer for Exercise 6-1 (see page 118).

```
select div_code, div_name, emp_id, emp_lname, emp_fname
       from employee, division
       where emp_id=div_head_id;
```

Exercise 6-2 Answer

This is the answer for Exercise 6-2 (see page 121).

```
select expertise.emp_id, emp_lname,
       emp_fname, skill_id
       from demoproj.expertise, demoempl.employee
       where expertise.emp_id = employee.emp_id;
```

Exercise 6-3 Answer

This is the answer for Exercise 6-3 (see page 123).

```
select expertise.emp_id, emp_lname, emp_fname, skill_id
       from demoproj.expertise, demoempl.employee
       where employee.emp_id = expertise.emp_id
       order by emp_lname desc, emp_fname desc;
```

Exercise 6-4 Answer

This is the answer for Exercise 6-4 (see page 125).

```
select distinct consultant.manager_id, emp_lname, emp_fname
       from demoproj.consultant, demoempl.employee
       where consultant.manager_id = employee.emp_id;
```

Review Answers

These are the answers for Review (see page 129).

Statement	Term
1. Needed to join two or more tables	b. Common columns
2. Resolves the problem of joining table columns that have the same name	f. Aliases
3. Where the joining is specified	a. The WHERE clause
4. Where an alias is identified	d. The FROM clause

Statement	Term
5. Used to append one table to another	c. The UNION clause

Scenario Answers

These are the answers for Scenarios (see page 114).

1. Management would like to see which employees are involved in which projects. Write a SELECT statement to retrieve this information by joining the ASSIGNMENT and PROJECT tables that contain the data. Display the information by project description.

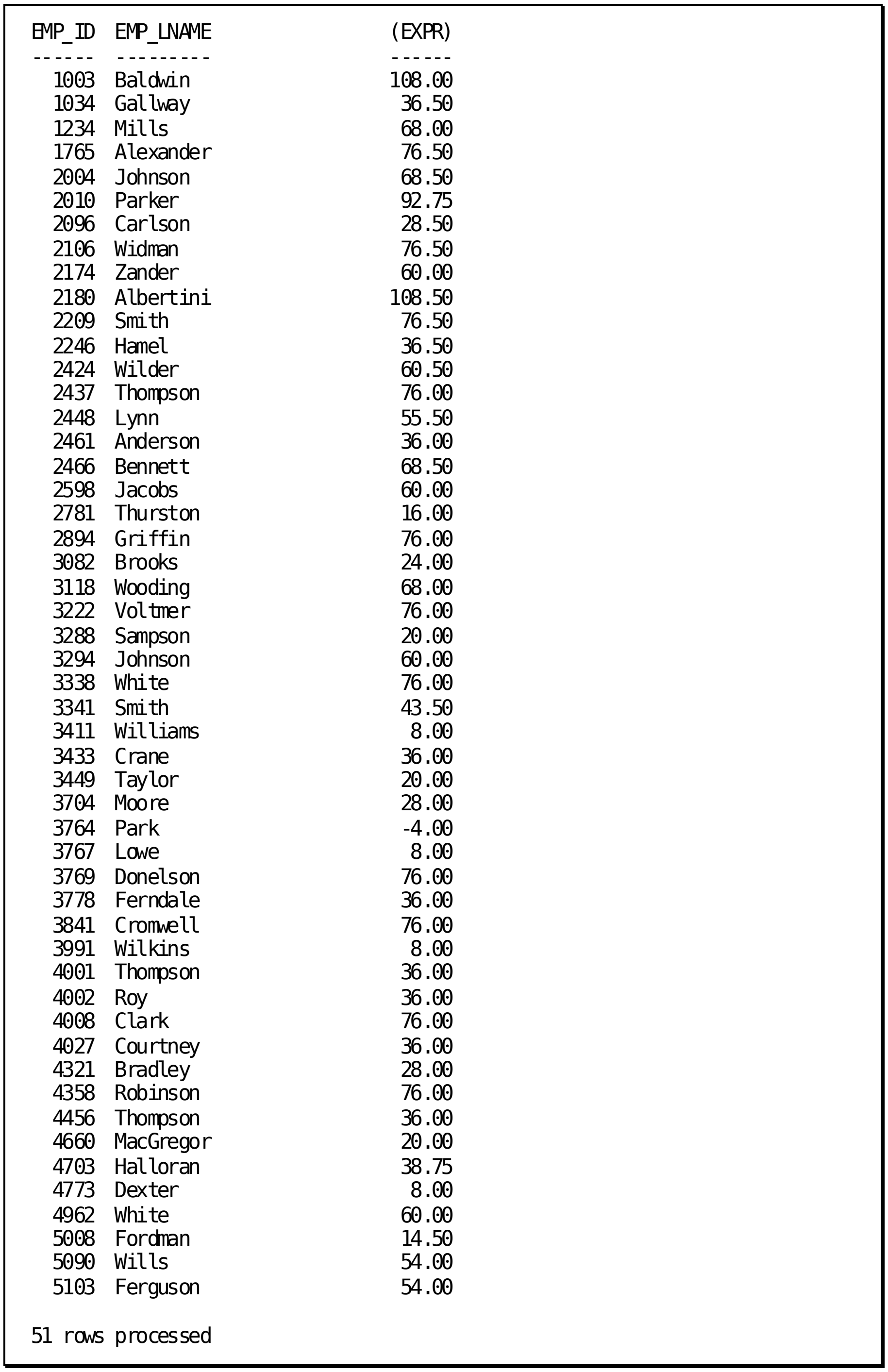
```
select assignment.proj_id, proj_desc, emp_id
       from assignment, project
       where project.proj_id = assignment.proj_id
       order by proj_desc;
```

```
PROJ_ID    PROJ_DESC                                                   EMP_ID
-------    ---------                                                   ------
C203       Consumer study                                                2894
C240       Service study                                                 4358
D880       Systems analysis                                              2466
D880       Systems analysis                                              9388
P634       TV ads - WTVK                                                 3411

5 rows processed
```

2. The Human Resources department needs a list of employees and their remaining vacation time. This information is contained in the EMPLOYEE and BENEFITS tables. Display employee ID and last name as well as the vacation time remaining in fiscal year 2000. Order your screen by employee ID.

```
select benefits.emp_id, emp_lname,
      (vac_accrued - vac_taken)
      from benefits, employee
      where benefits.emp_id = employee.emp_id
           and fiscal_year = 2000
      order by benefits.emp_id;
```



```
EMP_ID  EMP_LNAME                 (EXPR)
------  ---------                 ------
  1003  Baldwin                   108.00
  1034  Gallway                    36.50
  1234  Mills                      68.00
  1765  Alexander                  76.50
  2004  Johnson                    68.50
  2010  Parker                     92.75
  2096  Carlson                    28.50
  2106  Widman                     76.50
  2174  Zander                     60.00
  2180  Albertini                 108.50
  2209  Smith                      76.50
  2246  Hamel                      36.50
  2424  Wilder                     60.50
  2437  Thompson                   76.00
  2448  Lynn                       55.50
  2461  Anderson                   36.00
  2466  Bennett                    68.50
  2598  Jacobs                     60.00
  2781  Thurston                   16.00
  2894  Griffin                    76.00
  3082  Brooks                     24.00
  3118  Wooding                    68.00
  3222  Voltmer                    76.00
  3288  Sampson                    20.00
  3294  Johnson                    60.00
  3338  White                      76.00
  3341  Smith                      43.50
  3411  Williams                    8.00
  3433  Crane                      36.00
  3449  Taylor                     20.00
  3704  Moore                      28.00
  3764  Park                       -4.00
  3767  Lowe                        8.00
  3769  Donelson                   76.00
  3778  Ferndale                   36.00
  3841  Cromwell                   76.00
  3991  Wilkins                     8.00
  4001  Thompson                   36.00
  4002  Roy                        36.00
  4008  Clark                      76.00
  4027  Courtney                   36.00
  4321  Bradley                    28.00
  4358  Robinson                   76.00
  4456  Thompson                   36.00
  4660  MacGregor                  20.00
  4703  Halloran                   38.75
  4773  Dexter                      8.00
  4962  White                      60.00
  5008  Fordman                    14.50
  5090  Wills                      54.00
  5103  Ferguson                   54.00

51 rows processed
```

3. More statistics are being gathered on vacation hours. You have been asked to produce a screen of average vacation hours taken for each department. Display department ID and average vacation taken for fiscal 1999. Order the screen by department ID.

```
select dept_id, avg(vac_taken)
       from benefits, employee
       where benefits.emp_id = employee.emp_id
            and fiscal_year = 1999
       group by dept_id
       order by dept_id;
```

```
DEPT_ID                          (EXPR)
-------                          ------
   1100                          106.66
   1110                          160.00
   1120                          133.33
   2200                          120.00
   2210                          115.00
   3510                          100.00
   3520                          120.00
   3530                          120.00
   4500                          133.33
   4600                           99.42
   5000                           84.00
   5100                          120.00
   5200                          100.00
   6200                           86.66

14 rows processed
```

4. The budget committee needs a list of job titles, names of employees holding those jobs, and current salaries of those employees. They are interested only in jobs offering salaries of more than $55,000. Order your list by job title and include the job ID.

```
select j.job_id, job_title, emp_lname,
       emp_fname, salary_amount
       from job j, position p, employee e
       where j.job_id = p.job_id
         and p.emp_id = e.emp_id
         and salary_amount > 55000
       order by job_title;
```

```
JOB_ID  JOB_TITLE            EMP_LNAME       EMP_FNAME       SALARY_AMOUNT
------  ---------            ---------       ---------       -------------
  4023  Accountant           Taylor          Cynthia              74776.00
  5890  Appraisal Spec       Smith           Michael              66144.00
  5890  Appraisal Spec       Brooks          John                 68016.00
  5110  CUST SER MGR         Bradley         George               56977.80
  6011  Manager - Acctng     Bennett         Patricia             94953.52
  6004  Manager - HR         Voltmer         Louise              110448.00
  6021  Manager - Mktng      Griffin         William             111593.00
  4734  Mktng Admin          Robinson        Judith               57824.50
  9001  President            Baldwin         James               146432.00
  4700  Purch Agnt           Hamel           Marylou              59488.00
  4700  Purch Agnt           Johnson         Eleanor              59280.00
  5555  Salesperson          Albertini       Joan                 76961.00
  5555  Salesperson          Parker          Cora                 76440.00
  5555  Salesperson          Lynn            David                70720.00
  4666  Sr Mechanic          Carlson         Thomas               85280.00
  8001  Vice President       Mills           Thomas              117832.68

16 rows processed
```

5. Employee 2004 has just had a review and is due to get a pay increase. The increase is stored as REVIEW_PERCENT in the BENEFITS table. Employee 2004's manager has asked you to show her how much the increase is in dollar amount. To get this information, you need to multiply the current salary by the review percent. Show employee ID, current salary, percent increase, and increase as a dollar amount.

```
select position.emp_id, salary_amount,
       review_percent, (review_percent * salary_amount)
       from benefits, position
       where "position".emp_id = benefits.emp_id
         and "position".emp_id = 2004
         and fiscal_year = 2000
         and finish_date is null;
```

Notes

POSITION is the table name **and** an SQL keyword; therefore, when the POSITION table name is used as an identifier, it must be enclosed in double quotation marks.

As an alternative, you can use an alias for the table name. For example:

```
select position.emp_id, salary_amount,
       review_percent, (review_percent * salary_amount)
       from benefits b,  position p
       where p.emp_id = b.emp_id
         and p.emp_id = 2004
         and fiscal_year = 2000
         and finish_date is null;
```

```
EMP_ID   SALARY_AMOUNT  REVIEW_PERCENT              (EXPR)
------   -------------  --------------              ------
  2004        59280.00           0.030          1778.40000

1 row processed
```

Review Answers for Chapter 7

Exercise 7-1 Answer

This is the answer for Exercise 7-1 (see page 133).

Exercises

```
select distinct dept_id
       from employee
       where emp_id in
             (select emp_id
                     from benefits
                     where (vac_accrued - vac_taken) > 80)
                            and fiscal_year = 1999;
```

Exercise 7-2 Answer

This is the answer for Exercise 7-2 (see page 135).

```
select emp_id, num_dependents
       from coverage
       where num_dependents >
             (select avg(num_dependents)
                     from coverage);
```

Exercise 7-2b Answer

This is the answer for Exercise 7-2b (see page 136).

```
select distinct emp_id, num_dependents
       from coverage
       where num_dependents >
             (select avg(num_dependents)
                     from coverage);
```

Exercise 7-3 Answer

This is the answer for Exercise 7-3 (see page 139).

```
select distinct dept_id
       from employee
       where exists
             (select *
                     from position
                     where salary_amount > 50000
                       and employee.emp_id = "position".emp_id);
```

Or,

```
select distinct dept_id
       from employee
       where exists
             (select *
                     from position p
                     where salary_amount > 50000
                       and employee.emp_id = p.emp_id);
```

Review Answers

These are the answers for Review.

1. A nested SELECT statement is also known as a **subquery**.

2. A subquery is located in a **WHERE** clause.

3. A subquery must be enclosed in **parentheses**.

4. You use the **EXISTS** predicate to retrieve rows based on the existence of rows in another table.

5. When using an EXISTS predicate, the outer SELECT statement and the subquery are linked by matching **columns** in the WHERE clause in the subquery.

6. You can use an asterisk (*) in the subquery if you are using the **EXISTS** keyword.

Scenario Answers

These are the answers for Scenarios (see page 96).

1. For tax purposes, the Accounting department needs to keep track of all jobs for which employees earn more than $65,000. A list of job titles is sufficient. (Use the JOB and POSITION tables.)

```
select job_title
       from job
       where job_id in
             (select job_id from position
                     where salary_amount > 65000);
```

```
JOB_TITLE
---------
Accountant
Appraisal Spec
Manager - Acctng
Manager - HR
Manager - Mktng
President
Salesperson
Sr Mechanic
Vice President

9 rows processed
```

2. Upper management is concerned about the equality of salaries within Commonwealth Auto. They need to have a list by name of all jobs for which at least one employee earns less than $35,000. (Use the JOB and POSITION tables.)

```
select job_title
       from job
       where job_id in
             (select job_id from position
                     where salary_amount < 35000);
```

```
JOB_TITLE
---------
Admin Asst
Purch Clerk
Sales Trainee

3 rows processed
```

3. Over the years, lots of department information has been added to the database. The Human Resources department is responsible for this portion of the database and knows that there are some departments still listed for which there are no longer any associated employees. They have asked you for a list showing these departments. Order the list by department ID. (Use the DEPARTMENT and EMPLOYEE tables.)

```
select dept_id
       from department
       where not exists
             (select *
                     from employee
                     where employee.dept_id = department.dept_id)
       order by dept_id;
```

```
DEPT_ID
-------
   4200
   4900
   6000

3 rows processed
```

Review Answers for Chapter 8

Exercise 8-1 Answer

This is the answer for Exercise 8-1 (see page 133).

```
insert into department

       values (6060, null, 'D09', 'Claims');
select *

    from department
    order by dept_id;
```

Exercise 8-2 Answer

This is the answer for Exercise 8-2 (see page 147).

```
insert into department

    values (dept_id, null, 'div_code', 'dept_name');

insert into department
    values (dept_id, null, 'div_code', 'dept_name');

select *
    from department
    order by dept_id;
```

Exercise 8-3 Answer

This is the answer for Exercise 8-3 (see page 147).

```
insert into project (proj_id, proj_desc)

       values ('P434', 'Mass Media Campaign Blitz');
select proj_id, proj_desc

    from project
    order by proj_id;
```

Exercise 8-4 Answer

This is the answer for Exercise 8-4 (see page 150).

```
select emp_id, vac_accrued

    from benefits
    where fiscal_year = 2000
    order by emp_id;
```

Exercise 8-5 Answer

This is the answer for Exercise 8-5 (see page 153).

```
update department

       set dept_name = 'Lost Claims'
       where dept_id = 6060;
select dept_id, dept_name

    from department
    where dept_id = 6060;
```

Exercise 8-6 Answer

This is the answer for Exercise 8-6 (see page 153).

```
update employee

       set dept_id = 6200
       where emp_id = 3433;
select emp_id, dept_id

    from employee
    where emp_id = 3433;
```

Exercise 8-7 Answer

This is the answer for Exercise 8-7 (see page 153).

```
update employee

       set city = 'Framingham'
       where emp_id in (1034, 3704, 4660);
select emp_id, city

    from employee
    where emp_id in (3433,8377, 1034);
```

Exercise 8-8 Answer

This is the answer for Exercise 8-8 (see page 155).

```
delete from department

       where dept_id = 5050;
select *

    from department
    order by dept_id;
```

Exercise 8-9 Answer

This is the answer for Exercise 8-9 (see page 155).

```
delete from department

       where dept_id = 6060;
select *

    from department
    order by dept_id;
```

Review Answers

These are the answers for Review.

1. You use a SELECT statement with INSERT to:
    - **a. Copy specific rows from one table to another**
2. If you don't have a value for every column you are adding to a table, you can:
    - **a. Identify only the columns you are going to insert values into**
    - **b. Use the keyword NULL for the columns where the value is unknown**
3. You can update all rows in a table by:
    - **b. Omitting the WHERE clause**
4. You can update selected rows in a table by:
    - **c. Specifying a search condition in a WHERE clause**
5. You are updating all columns in a table but do not know the specific value to put into one column. You can:
    - **c. Use the keyword NULL for the column where the value is unknown**
6. If you do not have a WHERE clause in a DELETE statement:
    - **c. All the rows are deleted but the table remains**

Appendix C: Table Descriptions

This section contains the following topics:

Table Names and Descriptions

ASSIGNMENT

Table	Description
EMP_ID	Unique employee ID
PROJ_ID	ID of project to which consultant is assigned
START_DATE	Date employee was assigned to the project
END_DATE	Date employee completed work on the project

BENEFITS

Table	Description
FISCAL_YEAR	Fiscal year for which this data applies
EMP_ID	Unique employee ID
VAC_ACCRUED	Vacation hours accrued to date
VAC_TAKEN	Vacation hours taken to date
SICK_ACCRUED	Sick days accrued to date
SICK_TAKEN	Sick days taken to date
STOCK_PERCENT	Percentage of earnings allocated to stock purchase
STOCK_AMOUNT	Year-to-date amount deducted for stock purchase
LAST_REVIEW_DATE	Date of last employee review
REVIEW_PERCENT	Percent increase at last review
PROMO_DATE	Date of last promotion

Table	Description
RETIRE_PLAN	Retirement fund identifier: STOCK, BONDS, 401K
RETIRE_PERCENT	Percentage of earnings deducted for retirement
BONUS_AMOUNT	Amount of last bonus
COMP_ACCRUED	Hours of compensation time accrued
COMP_TAKEN	Hours of compensation time taken
EDUC_LEVEL	Level of education: GED, HSDIP, JRCOLL, COLL, MAS, PHD
UNION_ID	Union identification number
UNION_DUES	Amount of dues deducted per pay period

CONSULTANT

Table	Description
CON_ID	Unique consultant ID
CON_FNAME	Consultant's first name
CON_LNAME	Consultant's last name
MANAGER_ID	Employee ID of consultant's manager
DEPT_ID	ID of department to which consultant is assigned
PROJ_ID	ID of project to which consultant is assigned
STREET	Consultant's street address
CITY	Consultant's city
STATE	Consultant's state
ZIP_CODE	Consultant's zip code
PHONE	Consultant's phone
BIRTH_DATE	Birth date
START_DATE	Consultant's date of hire
SS_NUMBER	Social security number
RATE	Hourly rate of pay

COVERAGE

Table	Description
PLAN_CODE	Code of insurance plan providing the coverage
EMP_ID	Unique employee ID
SELECTION_DATE	Date employee selected this insurance plan
TERMINATION_DATE	Date employee terminated this insurance plan; if null, plan is still in force
NUM_DEPENDENTS	Number of dependents covered under **this insur**ance plan

DEPARTMENT

Table	Description
DEPT_ID	Unique department ID
DEPT_HEAD_ID	Employee ID of department head
DIV_CODE	Code of the division to which this department belongs
DEPT_NAME	Department name

DIVISION

Table	Description
DIV_CODE	Unique division ID
DIV_HEAD_ID	Employee ID of division head
DIV_NAME	Division name

EMPLOYEE

Table	Description
EMP_ID	Unique employee ID
MANAGER_ID	Employee ID of employee's manager
EMP_FNAME	Employee's first name

Table	Description
EMP_LNAME	Employee's last name
DEPT_ID	ID of department to which employee is assigned
STREET	Employee's street address
CITY	Employee's city
STATE	Employee's state
ZIP_CODE	Employee's zip code
PHONE	Employee's phone
STATUS	Status of employee: (A) Active; (S) Short-term disability; (L) Long term disability
SS_NUMBER	Social security number
START_DATE	Employee's date of hire
TERMINATION_DATE	Date of termination
BIRTH_DATE	Birth date

EXPERTISE

Table	Description
EMP_ID	Employee ID
SKILL_ID	Skill ID
SKILL_LEVEL	Level of ability in this skill: 01 (low) to 04 (high)
EXP_DATE	Date this level of ability was achieved

INSURANCE_PLAN

Table	Description
PLAN_CODE	Unique plan code for company offering the insurance
COMP_NAME	Name of insurance company
STREET	Street address of insurance company
CITY	City address of insurance company
STATE	State address of insurance company

Table	Description
ZIP_CODE	Zip code of insurance company
PHONE	Telephone number of insurance company
GROUP_NUMBER	Commonwealth's group number for this insurance company
DEDUCT	Dollar amount deductible **per year** for this insurance plan
MAX_LIFE_BENEFIT	Maximum dollar amount to be paid to insured employee
FAMILY_COST	Amount deducted **per paycheck** for family coverage
DEP_COST	Additional amount deducted per paycheck per dependent
EFF_DATE	Date this coverage plan becomes effective

JOB

Table	Description
JOB_ID	Unique job ID
JOB_TITLE	Job title
MIN_RATE	Minimum salary/hourly rate for this job
MAX_RATE	Maximum salary/hourly rate for this job
SALARY_IND	Indicator for type of salary: (S) salaried; (H) hourly
NUM_OF_POSITIONS	Total number of positions for this job
NUM_OPEN	Number of positions currently open
EFF_DATE	Date this job became effective
JOB_DESLINE_1	First line of job description
JOB_DESLINE_2	Second line of job description

POSITION

Table	Description
EMP_ID	Employee ID
JOB_ID	Job ID associated with this employee
START_DATE	Date employee began this job

Table	Description
FINISH_DATE	Date employee ended this job (null if current)
HOURLY_RATE	Hourly rate earned while in this job (if hourly position)
SALARY_AMOUNT	Yearly salary earned while in this job (if salaried position)
BONUS_PERCENT	Bonus percent amount for this position (if sales position)
COMM_PERCENT	Commission percent for this position (if sales position)
OVERTIME_RATE	Overtime rate for this position (if hourly position)

PROJECT

Table	Description
PROJ_ID	Unique project ID
PROJ_LEADER_ID	Employee ID of project leader
EST_START_DATE	Estimated date project is to begin
EST_END_DATE	Estimated date project is to end
ACT_START_DATE	Actual date project began
ACT_END_DATE	Actual date project ended
EST_MAN_HOURS	Total number of hours estimated for project
ACT_MAN_HOURS	Actual number of hours required for project
PROJ_DESC	Project description

SKILL

Table	Description
SKILL_ID	Unique skill ID
SKILL_NAME	Skill name
SKILL_DESC	Skill description