

Chapter 6

Introduction to Structured Query Language (SQL)

Database Systems:
Design, Implementation, and Management,
Sixth Edition, Rob and Coronel

In this chapter, you will learn:

- The basic commands and functions of SQL
- How to use SQL for data administration (to create tables, indexes, and views)
- How to use SQL for data manipulation (to add, modify, delete, and retrieve data)
- How to use SQL to query a database to extract useful information

Introduction to SQL

- SQL functions fit into two broad categories:
- Data definition language
 - SQL includes commands to create
 - Database objects such as tables, indexes, and views
 - Commands to define access rights to those database objects
- Data manipulation language
 - Includes commands to insert, update, delete, and retrieve data within the database tables

Introduction to SQL (continued)

- SQL is relatively easy to learn
- Basic command set has a vocabulary of less than 100 words
- Nonprocedural language
- American National Standards Institute (ANSI) prescribes a standard SQL
- Several SQL dialects exist

SQL Data Definition Commands

TABLE 6.1 SQL DATA DEFINITION COMMANDS

COMMAND OR OPTION	DESCRIPTION
CREATE SCHEMA AUTHORIZATION	Creates a database schema
CREATE TABLE	Creates a new table in the user's database schema
NOT NULL	Constraint that ensures that a column will not have null values
UNIQUE	Constraint that ensures that a column will not have duplicate values
PRIMARY KEY	Defines a primary key for a table
FOREIGN KEY	Defines a foreign key for a table
DEFAULT	Defines a default value for a column (when no value is given)
CHECK	Constraint used to validate data in a column
CREATE INDEX	Creates an index for a table
CREATE VIEW	Creates a dynamic subset of rows/columns from one or more tables
ALTER TABLE	Modifies a table's definition (adds, modifies, or deletes attributes or constraints)
CREATE TABLE AS	Creates a new table based on a query in the user's database schema
DROP TABLE	Permanently deletes a table (and thus its data)
DROP INDEX	Permanently deletes an index
DROP VIEW	Permanently deletes a view

Data Manipulation Commands

TABLE 6.2 DATA MANIPULATION COMMANDS

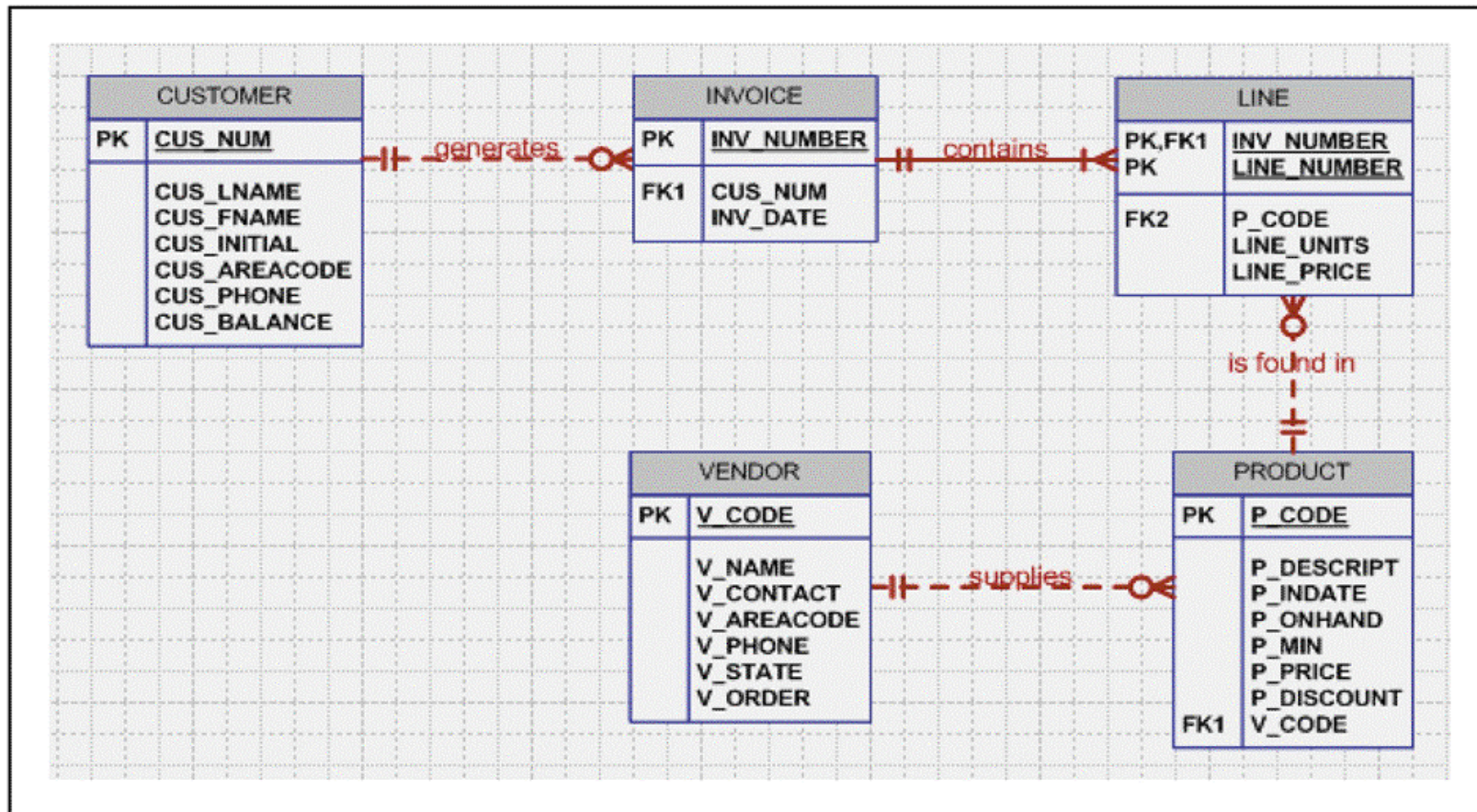
COMMAND OR OPTION	DESCRIPTION
INSERT	Inserts row(s) into a table
SELECT	Selects attributes from rows in one or more tables or views
WHERE	Restricts the selection of rows based on a conditional expression
GROUP BY	Groups the selected rows based on one or more attributes
HAVING	Restricts the selection of grouped rows based on a condition
ORDER BY	Orders the selected rows

Data Definition Commands

- Examine the simple database model and the database tables that will form the basis for the many SQL examples
- Understand the data environment

The Database Model

FIGURE 6.1 THE DATABASE MODEL



Creating the Database

- Two tasks must be completed
 - create the database structure
 - create the tables that will hold the end-user data
- First task
 - RDBMS creates the physical files that will hold the database
 - Tends to differ substantially from one RDBMS to another

The Database Schema

- Authentication
 - Process through which the DBMS verifies that only registered users are able to access the database
 - Log on to the RDBMS using a user ID and a password created by the database administrator
- Schema
 - Group of database objects—such as tables and indexes—that are related to each other

Data Types

- Data type selection is usually dictated by the nature of the data and by the intended use
- Pay close attention to the expected use of attributes for sorting and data retrieval purposes

Some Common SQL Data Types

TABLE 6.4 SOME COMMON SQL DATA TYPES

DATA TYPE	FORMAT	COMMENTS
Numeric	NUMBER(L,D)	Used to store numbers (fixed and floating point) in the range 10^{-130} to 10^{126} , with up to 38 decimal places. Allows you to specify numbers in terms of storage length and the number of decimal places. The declaration NUMBER(7,2) indicates numbers that will be stored with two decimal places and may be up to six digits long, including the sign and the decimal place. Examples: 12.32, -134.99. If you specify only a single parameter by writing NUMBER(7), only the number length is specified, allowing you to store numbers that are up to six digits long, without specifying the number of decimal places. Therefore, both 0.023 and -243562 are acceptable when you specify NUMBER(7). The designation NUMBER, without parameters, is also allowed. However, this “no parameter” designation uses the system default specifications for any numbers you may store.
	INTEGER	May be abbreviated as INT. Integers are (whole) counting numbers, so they cannot be used if you want to store numbers that require decimal places. Up to 11 digits. Examples: 12, 36576, 9989765.
	SMALLINT DECIMAL(L,D)	Like INTEGER, but limited to integer values up to six digits. If your integer values are relatively small, use SMALLINT instead of INT to produce better storage optimization. Like the NUMBER specification, but the storage length is a <i>minimum</i> specification. That is, greater lengths are acceptable, but smaller ones are not. DECIMAL(9,2), DECIMAL(9), and DECIMAL are all acceptable.
Character	CHAR(L)	Fixed length character data for up to 255 characters. If you store strings that are not as long as the CHAR parameter value, the remaining spaces are filled with blanks. Therefore, if you specify CHAR(25), strings like “Smith” and “Katzenjammer” are stored as Smithbbbbbbbbbbbbbbbbbbbbbb and Katzenjammerbbbbbbbbbbbbbb. (The letter “b” indicates a blank, not the letter “b”.) In short, if you must store variable-length strings, do not use CHAR, because this designation wastes storage space. However, a U. S. phone area code is always three digits long, so CHAR(3) would be appropriate if you want to store such codes.
	VARCHAR(L)	Variable-length character data. The designation VARCHAR(25) will let you store characters that are up to 25 characters long. Unlike the CHAR designation, VARCHAR will not store trailing blanks. Therefore, if you specify VARCHAR(25), strings like “Smith” and “Katzenjammer” are stored without trailing blanks. VARCHAR is more efficient than CHAR if variable-length character data are to be stored. Oracle users may use VARCHAR2, as well as VARCHAR.
Date	DATE	Stores dates in the Julian date format. The year value is four digits long, 0001 through 9999, the month values require two digits 01 through 12, and the day values require two digits, 01 through 31.

Creating Table Structures

- Use one line per column (attribute) definition
- Use spaces to line up the attribute characteristics and constraints
- Table and attribute names are capitalized
- NOT NULL specification
- UNIQUE specification
- Primary key attributes contain both a NOT NULL and a UNIQUE specification
- RDBMS will automatically enforce referential integrity for foreign keys
- Command sequence ends with a semicolon

Other SQL Constraints

- NOT NULL constraint
 - Ensures that a column does not accept nulls
- UNIQUE constraint
 - Ensures that all values in a column are unique
- DEFAULT constraint
 - Assigns a value to an attribute when a new row is added to a table
- CHECK constraint
 - Validates data when an attribute value is entered

SQL Indexes

- When a primary key is declared, DBMS automatically creates a unique index
- Often need additional indexes
- Using the CREATE INDEX command, SQL indexes can be created on the basis of any selected attribute
- Composite index
 - Index based on two or more attributes
 - Often used to prevent data duplication

A Duplicated TEST Record

TABLE 6.5 A DUPLICATED TEST RECORD

EMP_NUM	TEST_NUM	TEST_CODE	TEST_DATE	TEST_SCORE
110	1	WEA	15-May-2003	93
110	2	WEA	12-May-2004	87
111	1	HAZ	14-Dec-2002	91
111	2	WEA	18-Feb-2004	95
111	3	WEA	18-Feb-2004	95
112	1	CHEM	17-Aug-2003	91

Data Manipulation Commands

- Adding table rows
- Saving table changes
- Listing table rows
- Updating table rows
- Restoring table contents
- Deleting table rows
- Inserting table rows with a select subquery

Common SQL Data Manipulation Commands

TABLE 6.6 COMMON SQL DATA MANIPULATION COMMANDS

COMMAND	DESCRIPTION
INSERT	Lets you insert data into a table, one row at a time. Used to make the initial data entries into a new table structure or to add data to a table that already contains data.
SELECT	Lists the table contents.
COMMIT	Lets you permanently save your work to disk.
UPDATE	Enables you to make changes to column values in one or more data rows.
ROLLBACK	Restores the database table contents to their original condition (since the last COMMIT).
DELETE	Enables you to delete one or more data rows.

A Data View and Entry Form

FIGURE 6.3 A DATA VIEW AND ENTRY FORM

The screenshot displays a window titled "PRODUCT Table Data View and Data Entry". The window is divided into two main sections. On the left, there is a data entry form with the following fields:

Product code:	TIGER/31
Description:	Power painter, 15 psi., 3-nozzle
Stock date:	03-Dec-03
Units on hand:	8
Minimum units:	5
Price:	\$109.99
Discount rate:	0.00
Vendor code:	25595

On the right side of the window, there is an illustration of a duck in a blue suit holding a hammer, standing next to a computer terminal on a red stand. Below the illustration, the text "Duck Data Entry System" is displayed in red. At the bottom center of the window, there is a red button labeled "Close the product form". At the bottom left, there is a record navigation bar showing "Record: 1 of 16" and "Product code: Primary key".

Saving Table Changes

- Changes made to table contents are not physically saved on disk until
 - Database is closed
 - Program is closed
 - COMMIT command is used
- Syntax
 - COMMIT [WORK]
- Will permanently save any changes made to any table in the database

Listing Table Rows

- SELECT
 - Used to list contents of table
- Syntax
 - SELECT *columnlist*
FROM *tablename*
- Columnlist represents one or more attributes, separated by commas
- Asterisk can be used as wildcard character to list all attributes

Updating Table Rows

- UPDATE
 - Modify data in a table
- Syntax
 - UPDATE *tablename*
SET *columnname* = *expression* [, *columnname*
= *expression*]
[WHERE *conditionlist*];
- If more than one attribute is to be updated in the row, separate corrections with commas

Restoring Table Contents

- ROLLBACK
 - Used restore the database to its previous condition
 - Only applicable if COMMIT command has not been used to permanently store the changes in the database
- Syntax
 - ROLLBACK;
- COMMIT and ROLLBACK only work with data manipulation commands that are used to add, modify, or delete table rows

Deleting Table Rows

- DELETE
 - Deletes a table row
- Syntax
 - DELETE FROM *tablename*
[WHERE *conditionlist*];
- WHERE condition is optional
- If WHERE condition is not specified, all rows from the specified table will be deleted

Inserting Table Rows with a Select Subquery

- INSERT
 - Inserts multiple rows from another table (source)
 - Uses SELECT subquery
 - Query that is embedded (or nested) inside another query
 - Executed first
- Syntax
 - INSERT INTO *tablename* SELECT *columnlist* FROM *tablename*

Selecting Rows with Conditional Restrictions

- Select partial table contents by placing restrictions on rows to be included in output
 - Add conditional restrictions to the SELECT statement, using WHERE clause
- Syntax
 - SELECT *columnlist*
FROM *tablelist*
[WHERE *conditionlist*] ;

Selected PRODUCT Table Attributes for VENDOR Code 21344

FIGURE 6.5 SELECTED PRODUCT TABLE ATTRIBUTES FOR VENDOR CODE 21344

	P_DESCRIPT	P_INDATE	P_PRICE	V_CODE
▶	7.25-in. pwr. saw blade	13-Dec-03	\$14.99	21344
	9.00-in. pwr. saw blade	13-Nov-03	\$17.49	21344
	Rat-tail file, 1/8-in. fine	15-Dec-03	\$4.99	21344

The Microsoft Access QBE and its SQL

FIGURE 6.6 THE MICROSOFT ACCESS QBE AND ITS SQL

The figure illustrates the Microsoft Access Query By Example (QBE) interface and its corresponding SQL. The main window shows the QBE grid for a query named 'Select Query' based on the 'PRODUCT' table. The grid contains the following data:

Field:	P_DESCRPT	P_INDATE	P_PRICE	V_CODE		
Table:	PRODUCT	PRODUCT	PRODUCT	PRODUCT		
Sort:						
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Criteria:				21344		
or:						

Below the QBE grid, the 'Microsoft Access-generated SQL' view shows the following query:

```
SELECT PRODUCT.P_DESCRPT, PRODUCT.P_INDATE, PRODUCT.P_PRICE, PRODUCT.V_CODE
FROM PRODUCT
WHERE (((PRODUCT.V_CODE)=21344));
```

The 'User-entered SQL' view shows the same query with a simplified WHERE clause:

```
SELECT P_DESCRPT, P_INDATE, P_PRICE, V_CODE
FROM PRODUCT
WHERE V_CODE=21344;
```

On the right side, the 'View' menu is open, showing options: Design View, SQL View (selected), Datasheet View, PivotTable View, PivotChart View, Totals, Table Names, Properties (F4), Join Properties, and Toolbars.

Comparison Operators

TABLE 6.7 COMPARISON OPERATORS

SYMBOL	MEANING
=	Equal to
<	Less than
<=	Less than or equal to
>	Greater than
>=	Greater than or equal to
<> or !=	Not equal to

Selected PRODUCT Table Attributes for VENDOR Codes Other than 21344

FIGURE 6.7 SELECTED PRODUCT TABLE ATTRIBUTES FOR VENDOR CODES OTHER THAN 21344

	P_DESCRIPTION	P_INDATE	P_PRICE	V_CODE
▶	Power painter, 15 psi., 3-nozzle	03-Nov-03	\$109.99	25595
	Hrd. cloth, 1/4-in., 2x50	15-Jan-04	\$39.95	23119
	Hrd. cloth, 1/2-in., 3x50	15-Jan-04	\$43.99	23119
	B&D jigsaw, 12-in. blade	30-Dec-03	\$109.92	24288
	B&D jigsaw, 8-in. blade	24-Dec-03	\$99.87	24288
	B&D cordless drill, 1/2-in.	20-Jan-04	\$38.95	25595
	Claw hammer	20-Jan-04	\$9.95	21225
	Hicut chain saw, 16 in.	07-Feb-04	\$256.99	24288
	1.25-in. metal screw, 25	01-Mar-04	\$6.99	21225
	2.5-in. wd. screw, 50	24-Feb-04	\$8.45	21231
	Steel matting, 4'x8'x1/8", .5" mesh	17-Jan-04	\$119.95	25595

Selected PRODUCT Table Attributes with a P_PRICE Restriction

FIGURE 6.8 SELECTED PRODUCT TABLE ATTRIBUTES WITH A P_PRICE RESTRICTION

	P_DESCRIPTION	P_ONHAND	P_MIN	P_PRICE
▶	Claw hammer	23	10	\$9.95
	Rat-tail file, 1/8-in. fine	43	20	\$4.99
	PVC pipe, 3.5-in., 8-ft	188	75	\$5.87
	1.25-in. metal screw, 25	172	75	\$6.99
	2.5-in. wd. screw, 50	237	100	\$8.45

Selected PRODUCT Table Attributes: The ASCII Code Effect

FIGURE 6.9 SELECTED PRODUCT TABLE ATTRIBUTES: THE ASCII CODE EFFECT

	P_CODE	P_DESCRIPT	P_ONHAND	P_MIN	P_PRICE
▶	11QER/31	Power painter, 15 psi., 3-nozzle	8	5	\$109.99
	13-Q2/P2	7.25-in. pwr. saw blade	32	15	\$14.99
	14-Q1/L3	9.00-in. pwr. saw blade	18	12	\$17.49
	1546-QQ2	Hrd. cloth, 1/4-in., 2x50	15	8	\$39.95

Selected PRODUCT Table Attributes: Date Restriction

FIGURE 6.10 SELECTED PRODUCT TABLE ATTRIBUTES: DATE RESTRICTION

	P_DESCRIPTION	P_ONHAND	P_MIN	P_PRICE	P_INDATE
▶	B&D cordless drill, 1/2-in.	12	5	\$38.95	20-Jan-04
	Claw hammer	23	10	\$9.95	20-Jan-04
	Hicut chain saw, 16 in.	11	5	\$256.99	07-Feb-04
	PVC pipe, 3.5-in., 8-ft	188	75	\$5.87	20-Feb-04
	1.25-in. metal screw, 25	172	75	\$6.99	01-Mar-04
	2.5-in. wd. screw, 50	237	100	\$8.45	24-Feb-04

SELECT Statement with a Computed Column

FIGURE 6.11 SELECT STATEMENT WITH A COMPUTED COLUMN

	P_DESCRIPTION	P_ONHAND	P_PRICE	Expr1
▶	Power painter, 15 psi., 3-nozzle	8	\$109.99	\$879.92
	7.25-in. pwr. saw blade	32	\$14.99	\$479.68
	9.00-in. pwr. saw blade	18	\$17.49	\$314.82
	Hrd. cloth, 1/4-in., 2x50	15	\$39.95	\$599.25
	Hrd. cloth, 1/2-in., 3x50	23	\$43.99	\$1,011.77
	B&D jigsaw, 12-in. blade	8	\$109.92	\$879.36
	B&D jigsaw, 8-in. blade	6	\$99.87	\$599.22
	B&D cordless drill, 1/2-in.	12	\$38.95	\$467.40
	Claw hammer	23	\$9.95	\$228.85
	Sledge hammer, 12 lb.	8	\$14.40	\$115.20
	Rat-tail file, 1/8-in. fine	43	\$4.99	\$214.57
	Hicut chain saw, 16 in.	11	\$256.99	\$2,826.89
	PVC pipe, 3.5-in., 8-ft	188	\$5.87	\$1,103.56
	1.25-in. metal screw, 25	172	\$6.99	\$1,202.28
	2.5-in. wd. screw, 50	237	\$8.45	\$2,002.65
	Steel matting, 4'x8'x1/6", .5" mesh	18	\$119.95	\$2,159.10

SELECT Statement with a Computed Column and an Alias

FIGURE 6.12 SELECT STATEMENT WITH A COMPUTED COLUMN AND AN ALIAS

	P_DESCRIPT	P_ONHAND	P_PRICE	TOTVALUE
▶	Power painter, 15 psi., 3-nozzle	8	\$109.99	\$879.92
	7.25-in. pwr. saw blade	32	\$14.99	\$479.68
	9.00-in. pwr. saw blade	18	\$17.49	\$314.82
	Hrd. cloth, 1/4-in., 2x50	15	\$39.95	\$599.25
	Hrd. cloth, 1/2-in., 3x50	23	\$43.99	\$1,011.77
	B&D jigsaw, 12-in. blade	8	\$109.92	\$879.36
	B&D jigsaw, 8-in. blade	6	\$99.87	\$599.22
	B&D cordless drill, 1/2-in.	12	\$38.95	\$467.40
	Claw hammer	23	\$9.95	\$228.85
	Sledge hammer, 12 lb.	8	\$14.40	\$115.20
	Rat-tail file, 1/8-in. fine	43	\$4.99	\$214.57
	Hicut chain saw, 16 in.	11	\$256.99	\$2,826.89
	PVC pipe, 3.5-in., 8-ft	188	\$5.87	\$1,103.56
	1.25-in. metal screw, 25	172	\$6.99	\$1,202.28
	2.5-in. wd. screw, 50	237	\$8.45	\$2,002.65
	Steel matting, 4'x8'x1/8", .5" mesh	18	\$119.95	\$2,159.10

Arithmetic Operators: The Rule of Precedence

- Perform operations within parentheses
- Perform power operations
- Perform multiplications and divisions
- Perform additions and subtractions

Selected PRODUCT Table Attributes: The Logical OR

FIGURE 6.13 SELECTED PRODUCT TABLE ATTRIBUTES: THE LOGICAL OR

	P_DESCRIPT	P_INDATE	P_PRICE	V_CODE
▶	7.25-in. pwr. saw blade	13-Dec-03	\$14.99	21344
	9.00-in. pwr. saw blade	13-Nov-03	\$17.49	21344
	B&D jigsaw, 12-in. blade	30-Dec-03	\$109.92	24288
	B&D jigsaw, 8-in. blade	24-Dec-03	\$99.87	24288
	Rat-tail file, 1/8-in. fine	15-Dec-03	\$4.99	21344
	Hicut chain saw, 16 in.	07-Feb-04	\$256.99	24288

Selected PRODUCT Table Attributes: The Logical AND

FIGURE 6.14 SELECTED PRODUCT TABLE ATTRIBUTES: THE LOGICAL AND

	P_DESCRIPTION	P_INDATE	P_PRICE	V_CODE
▶	B&D cordless drill, 1/2-in.	20-Jan-04	\$38.95	25595
	Claw hammer	20-Jan-04	\$9.95	21225
	PVC pipe, 3.5-in., 8-ft	20-Feb-04	\$5.87	
	1.25-in. metal screw, 25	01-Mar-04	\$6.99	21225
	2.5-in. wd. screw, 50	24-Feb-04	\$8.45	21231

Selected PRODUCT Table Attributes: The Logical AND and OR

FIGURE 6.15 SELECTED PRODUCT TABLE ATTRIBUTES: THE LOGICAL AND AND OR

	P_DESCRIPT	P_INDATE	P_PRICE	V_CODE
▶	B&D jigsaw, 12-in. blade	30-Dec-03	\$109.92	24288
	B&D jigsaw, 8-in. blade	24-Dec-03	\$99.87	24288
	B&D cordless drill, 1/2-in.	20-Jan-04	\$38.95	25595
	Claw hammer	20-Jan-04	\$9.95	21225
	Hicut chain saw, 16 in.	07-Feb-04	\$256.99	24288
	PVC pipe, 3.5-in., 8-ft	20-Feb-04	\$5.87	
	1.25-in. metal screw, 25	01-Mar-04	\$6.99	21225
	2.5-in. wd. screw, 50	24-Feb-04	\$8.45	21231

Special Operators

- **BETWEEN**
 - Used to check whether attribute value is within a range
- **IS NULL**
 - Used to check whether attribute value is null
- **LIKE**
 - Used to check whether attribute value matches a given string pattern
- **IN**
 - Used to check whether attribute value matches any value within a value list
- **EXISTS**
 - Used to check if a subquery returns any rows

Advanced Data Definition Commands

- All changes in the table structure are made by using the ALTER command
 - Followed by a keyword that produces specific change
 - Three options are available
 - ADD
 - MODIFY
 - DROP

Changing a Column's Data Type

- ALTER can be used to change data type
- Some RDBMSs (such as Oracle) do not permit changes to data types unless the column to be changed is empty

Changing a Column's Data Characteristics

- Use `ALTER` to change data characteristics
- If the column to be changed already contains data, changes in the column's characteristics are permitted if those changes do not alter the data type

Adding or Dropping a Column

- Use ALTER to add a column
 - Do not include the NOT NULL clause for new column
- Use ALTER to drop a column
 - Some RDBMSs impose restrictions on the deletion of an attribute

The Effect of Data Entry into the New P_SALECODE Column

FIGURE 6.16 THE EFFECT OF DATA ENTRY INTO THE NEW P_SALECODE COLUMN

	P_CODE	P_DESCRIPT	P_INDATE	P_ONHAND	P_MIN	P_PRICE	P_DISCOUNT	V_CODE	P_SALECODE
▶	1546-QQ2	Hrd. cloth, 1/4-in., 2x50	15-Jan-04	15	8	\$39.95	0.00	23119	2

Update of the P_SALECODE Column in Multiple Data Rows

FIGURE 6.17 UPDATE OF THE P_SALECODE COLUMN IN MULTIPLE DATA ROWS

	P_CODE	P_DESCRIPTION	P_INDATE	P_PRICE	P_SALECODE
▶	11QER/31	Power painter, 15 psi., 3-	03-Nov-03	\$109.99	
	13-Q2/P2	7.25-in. pwr. saw blade	13-Dec-03	\$14.99	
	14-Q1/L3	9.00-in. pwr. saw blade	13-Nov-03	\$17.49	
	1546-QQ2	Hrd. cloth, 1/4-in., 2x50	15-Jan-04	\$39.95	2
	1558-QW1	Hrd. cloth, 1/2-in., 3x50	15-Jan-04	\$43.99	
	2232/QTY	B&D jigsaw, 12-in. blade	30-Dec-03	\$109.92	1
	2232/QWE	B&D jigsaw, 8-in. blade	24-Dec-03	\$99.87	1
	2238/QPD	B&D cordless drill, 1/2-in.	20-Jan-04	\$38.95	
	23109-HB	Claw hammer	20-Jan-04	\$9.95	
	23114-AA	Sledge hammer, 12 lb.	02-Jan-04	\$14.40	
	54778-2T	Rat-tail file, 1/8-in. fine	15-Dec-03	\$4.99	
	89-WRE-Q	Hicut chain saw, 16 in.	07-Feb-04	\$256.99	
	PVC23DRT	PVC pipe, 3.5-in., 8-ft	20-Feb-04	\$5.87	
	SM-18277	1.25-in. metal screw, 25	01-Mar-04	\$6.99	
	SW-23116	2.5-in. wd. screw, 50	24-Feb-04	\$8.45	
	WR3/TT3	Steel matting, 4'x8'x1/8",	17-Jan-04	\$119.95	

The Effect of Multiple Data Updates in the PRODUCT Table (MS Access)

FIGURE 6.18 THE EFFECT OF MULTIPLE DATA UPDATES IN THE PRODUCT TABLE (MS ACCESS)

	P_CODE	P_DESCRIPT	P_INDATE	P_PRICE	P_SALECODE
▶	11QER/31	Power painter, 15 psi., 3-nozzle	03-Nov-2003	\$109.99	2
	13-Q2/P2	7.25-in. pwr. saw blade	13-Dec-2003	\$14.99	2
	14-Q1/L3	9.00-in. pwr. saw blade	13-Nov-2003	\$17.49	2
	1546-QQ2	Hrd. cloth, 1/4-in., 2x50	15-Jan-2004	\$39.95	
	1558-QW1	Hrd. cloth, 1/2-in., 3x50	15-Jan-2004	\$43.99	
	2232/QTY	B&D jigsaw, 12-in. blade	30-Dec-2003	\$109.92	
	2232/QWE	B&D jigsaw, 8-in. blade	24-Dec-2003	\$99.87	2
	2238/QPD	B&D cordless drill, 1/2-in.	20-Jan-2004	\$38.95	1
	23109-HB	Claw hammer	20-Jan-2004	\$9.95	1
	23114-AA	Sledge hammer, 12 lb.	02-Jan-2004	\$14.40	
	54778-2T	Rat-tail file, 1/8-in. fine	15-Dec-2003	\$4.99	2
	89-WRE-Q	Hicut chain saw, 16 in.	07-Feb-2004	\$256.99	1
	PVC23DRT	PVC pipe, 3.5-in., 8-ft	20-Feb-2004	\$5.87	
	SM-18277	1.25-in. metal screw, 25	01-Mar-2004	\$6.99	
	SW-23116	2.5-in. wd. screw, 50	24-Feb-2004	\$8.45	
	WR3/TT3	Steel matting, 4'x8'x1/8", .5" mesh	17-Jan-2004	\$119.95	1

Copying Parts of Tables

- SQL permits copying contents of selected table columns so that the data need not be reentered manually into newly created table(s)
- First create the PART table structure
- Next add rows to new PART table using PRODUCT table rows

PART Attributes Copied from the PRODUCT Table

FIGURE 6.19 PART ATTRIBUTES COPIED FROM THE PRODUCT TABLE

	PART_CODE	PART_DESCRIPTOR	PART_PRICE
▶	11QER/31	Power painter, 15 psi., 3-nozzle	\$109.99
	13-Q2/P2	7.25-in. pwr. saw blade	\$14.99
	14-Q1/L3	9.00-in. pwr. saw blade	\$17.49
	1546-QQ2	Hrd. cloth, 1/4-in., 2x50	\$39.95
	1558-QW1	Hrd. cloth, 1/2-in., 3x50	\$43.99
	2232/QTY	B&D jigsaw, 12-in. blade	\$109.92
	2232/QWE	B&D jigsaw, 8-in. blade	\$99.87
	2238/QPD	B&D cordless drill, 1/2-in.	\$38.95
	23109-HB	Claw hammer	\$9.95
	23114-AA	Sledge hammer, 12 lb.	\$14.40
	54778-2T	Rat-tail file, 1/8-in. fine	\$4.99
	89-WRE-Q	Hicut chain saw, 16 in.	\$256.99
	PVC23DRT	PVC pipe, 3.5-in., 8-ft	\$5.87
	SM-18277	1.25-in. metal screw, 25	\$6.99
	SW-23116	2.5-in. wd. screw, 50	\$8.45
	WR3/TT3	Steel matting, 4'x8'x1/8", .5" mesh	\$119.95

Advanced Select Queries

- SQL provides useful functions
 - Count
 - Find minimum and maximum values
 - Calculate averages
- SQL allows the user to limit queries to only those entries having no duplicates or entries whose duplicates may be grouped

Selected PRODUCT Table Attributes: Ordered by (Ascending) P_PRICE

FIGURE 6.20 SELECTED PRODUCT TABLE ATTRIBUTES: ORDERED BY (ASCENDING) P_PRICE

	P_CODE	P_DESCRIPT	P_INDATE	P_PRICE
▶	54778-2T	Rat-tail file, 1/8-in. fine	15-Dec-03	\$4.99
	PVC23DRT	PVC pipe, 3.5-in., 8-ft	20-Feb-04	\$5.87
	SM-18277	1.25-in. metal screw, 25	01-Mar-04	\$6.99
	SW-23116	2.5-in. wd. screw, 50	24-Feb-04	\$8.45
	23109-HB	Claw hammer	20-Jan-04	\$9.95
	23114-AA	Sledge hammer, 12 lb.	02-Jan-04	\$14.40
	13-Q2/P2	7.25-in. pwr. saw blade	13-Dec-03	\$14.99
	14-Q1/L3	9.00-in. pwr. saw blade	13-Nov-03	\$17.49
	2238/QPD	B&D cordless drill, 1/2-in.	20-Jan-04	\$38.95
	1546-QQ2	Hrd. cloth, 1/4-in., 2x50	15-Jan-04	\$39.95
	1558-QW1	Hrd. cloth, 1/2-in., 3x50	15-Jan-04	\$43.99
	2232/QWE	B&D jigsaw, 8-in. blade	24-Dec-03	\$99.87
	2232/QTY	B&D jigsaw, 12-in. blade	30-Dec-03	\$109.92
	11QER/31	Power painter, 15 psi., 3-nozzle	03-Nov-03	\$109.99
	WR3/TT3	Steel matting, 4'x8'x1/8", .5" mesh	17-Jan-04	\$119.95
	89-WRE-Q	Hicut chain saw, 16 in.	07-Feb-04	\$256.99

Partial Listing of EMPLOYEE Table Contents

FIGURE 6.21 PARTIAL LISTING OF EMPLOYEE TABLE CONTENTS

	EMP_NUM	EMP_TITLE	EMP_LNAME	EMP_FNAME	EMP_INITIAL	EMP_AREACODE	EMP_PHONE
▶	100	Mr.	Kolmycz	George	D	615	324-5456
	101	Ms.	Lewis	Rhonda	G	615	324-4472
	102	Mr.	Vandam	Rhett		901	675-8993
	103	Ms.	Jones	Anne	M	615	898-3456
	104	Mr.	Lange	John	P	901	504-4430
	105	Mr.	Williams	Robert	D	615	890-3220
	106	Mrs.	Smith	Jeanine	K	615	324-7883
	107	Mr.	Diante	Jorge	D	615	890-4567
	108	Mr.	Wiesenbach	Paul	R	615	897-4358
	109	Mr.	Smith	George	K	901	504-3339
	110	Mrs.	Genkazi	Leighla	W	901	569-0093
	111	Mr.	Washington	Rupert	E	615	890-4925
	112	Mr.	Johnson	Edward	E	615	898-4387
	113	Ms.	Smythe	Melanie	P	615	324-9006
	114	Ms.	Brandon	Marie	G	901	882-0845
	115	Mrs.	Saranda	Hermine	R	615	324-5505
	116	Mr.	Smith	George	A	615	890-2984

Telephone List Query Results

FIGURE 6.22 TELEPHONE LIST QUERY RESULTS

	EMP_LNAME	EMP_FNAME	EMP_INITIAL	EMP_AREACODE	EMP_PHONE
▶	Brandon	Marie	G	901	882-0845
	Diante	Jorge	D	615	890-4567
	Genkazi	Leighla	W	901	569-0093
	Johnson	Edward	E	615	898-4387
	Jones	Anne	M	615	898-3456
	Kolmycz	George	D	615	324-5456
	Lange	John	P	901	504-4430
	Lewis	Rhonda	G	615	324-4472
	Saranda	Hermine	R	615	324-5505
	Smith	George	A	615	890-2984
	Smith	George	K	901	504-3339
	Smith	Jeanine	K	615	324-7883
	Smythe	Melanie	P	615	324-9006
	Vandam	Rhett		901	675-8993
	Washington	Rupert	E	615	890-4925
	Wiesenbach	Paul	R	615	897-4358
	Williams	Robert	D	615	890-3220

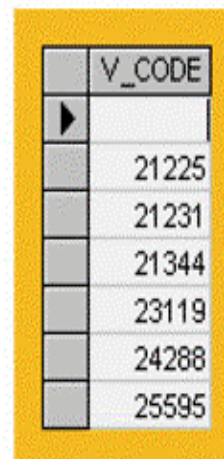
A Query Based on Multiple Restrictions

FIGURE 6.23 A QUERY BASED ON MULTIPLE RESTRICTIONS

	P_DESCRIPTION	V_CODE	P_INDATE	P_PRICE
▶	Sledge hammer, 12 lb.		02-Jan-04	\$14.40
	Claw hammer	21225	20-Jan-04	\$9.95
	9.00-in. pwr. saw blade	21344	13-Nov-03	\$17.49
	7.25-in. pwr. saw blade	21344	13-Dec-03	\$14.99
	Rat-tail file, 1/8-in. fine	21344	15-Dec-03	\$4.99
	Hrd. cloth, 1/2-in., 3x50	23119	15-Jan-04	\$43.99
	Hrd. cloth, 1/4-in., 2x50	23119	15-Jan-04	\$39.95
	B&D cordless drill, 1/2-in.	25595	20-Jan-04	\$38.95

A Listing of Distinct (Different) V_CODE Values in the PRODUCT Table

FIGURE 6.24 A LISTING OF DISTINCT (DIFFERENT) V_CODE VALUES IN THE PRODUCT TABLE



	V_CODE
▶	
	21225
	21231
	21344
	23119
	24288
	25595

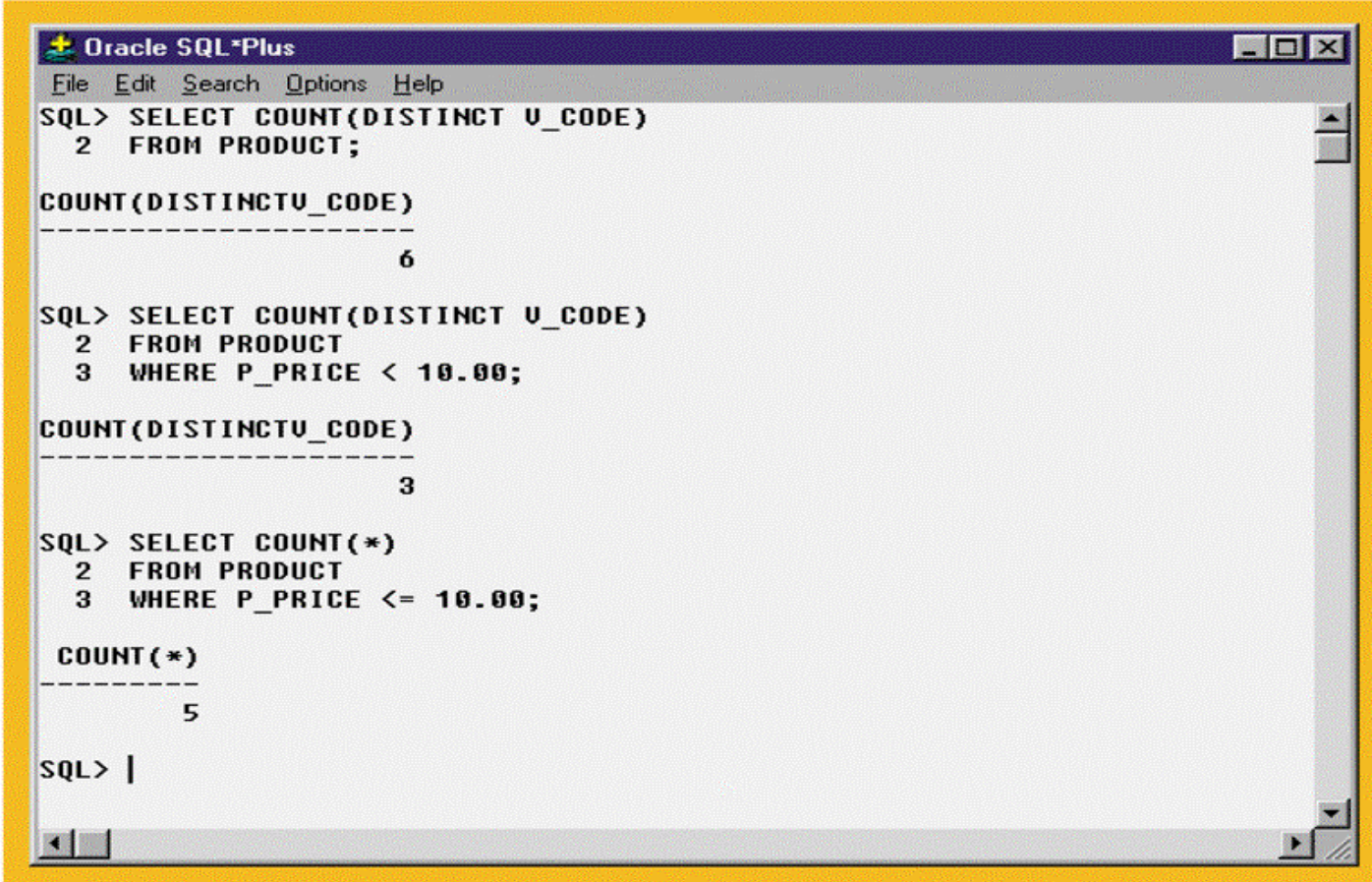
Some Basic SQL Aggregate Functions

TABLE 6.10 SOME BASIC SQL AGGREGATE FUNCTIONS

FUNCTION	OUTPUT
COUNT	The number of rows containing “non null” values
MIN	The minimum attribute value encountered in a given column
MAX	The maximum attribute value encountered in a given column
SUM	The sum of all values for a given column
AVG	The arithmetic mean (average) for the specified column

COUNT Function Output Examples

FIGURE 6.25 COUNT FUNCTION OUTPUT EXAMPLES



```
Oracle SQL*Plus
File Edit Search Options Help
SQL> SELECT COUNT(DISTINCT U_CODE)
  2 FROM PRODUCT;

COUNT(DISTINCT U_CODE)
-----
                        6

SQL> SELECT COUNT(DISTINCT U_CODE)
  2 FROM PRODUCT
  3 WHERE P_PRICE < 10.00;

COUNT(DISTINCT U_CODE)
-----
                        3

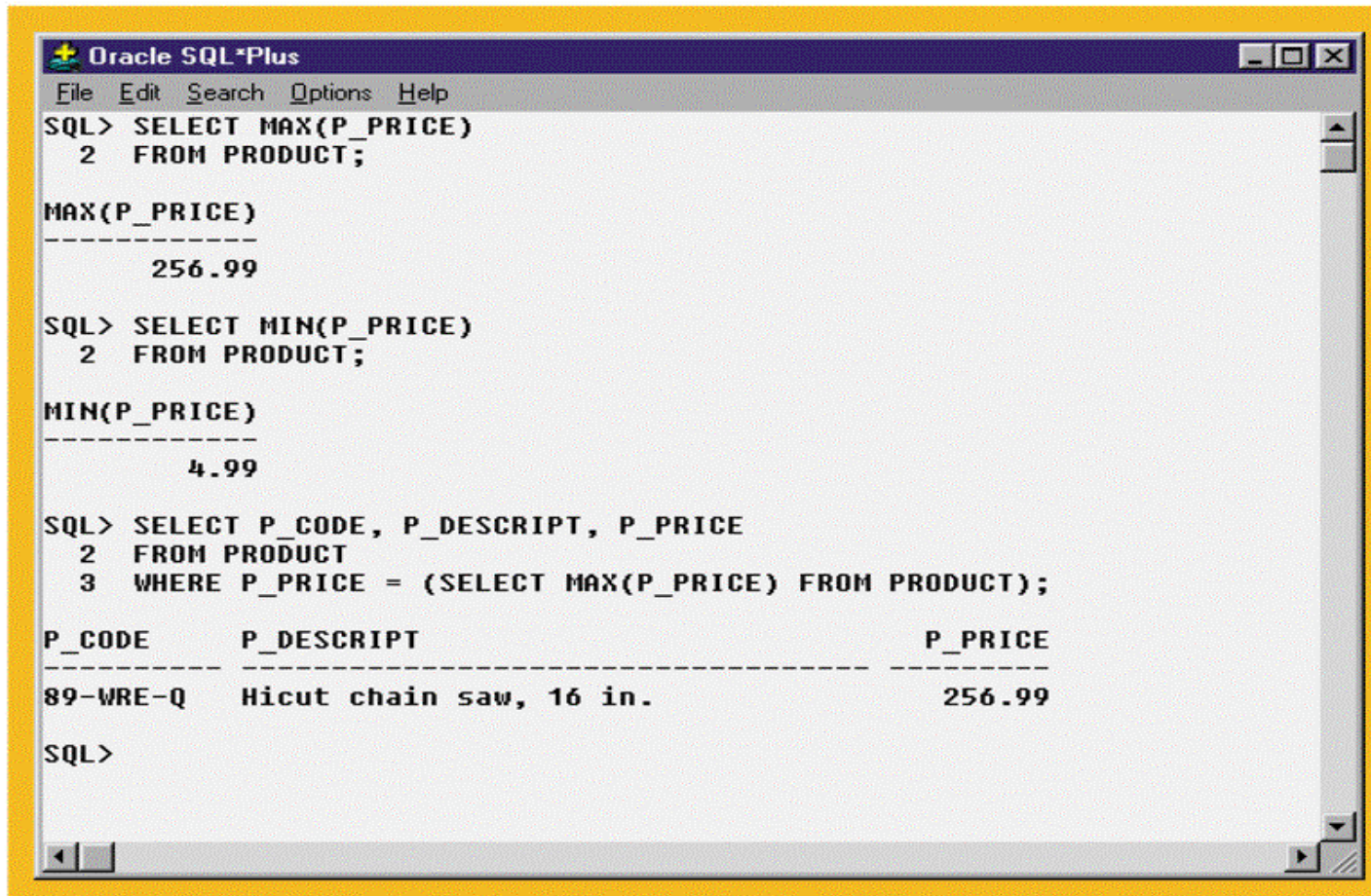
SQL> SELECT COUNT(*)
  2 FROM PRODUCT
  3 WHERE P_PRICE <= 10.00;

COUNT(*)
-----
        5

SQL> |
```


MAX and MIN Function Output Examples

FIGURE 6.26 MAX AND MIN FUNCTION OUTPUT EXAMPLES



```
Oracle SQL*Plus
File Edit Search Options Help
SQL> SELECT MAX(P_PRICE)
2 FROM PRODUCT;

MAX(P_PRICE)
-----
      256.99

SQL> SELECT MIN(P_PRICE)
2 FROM PRODUCT;

MIN(P_PRICE)
-----
       4.99

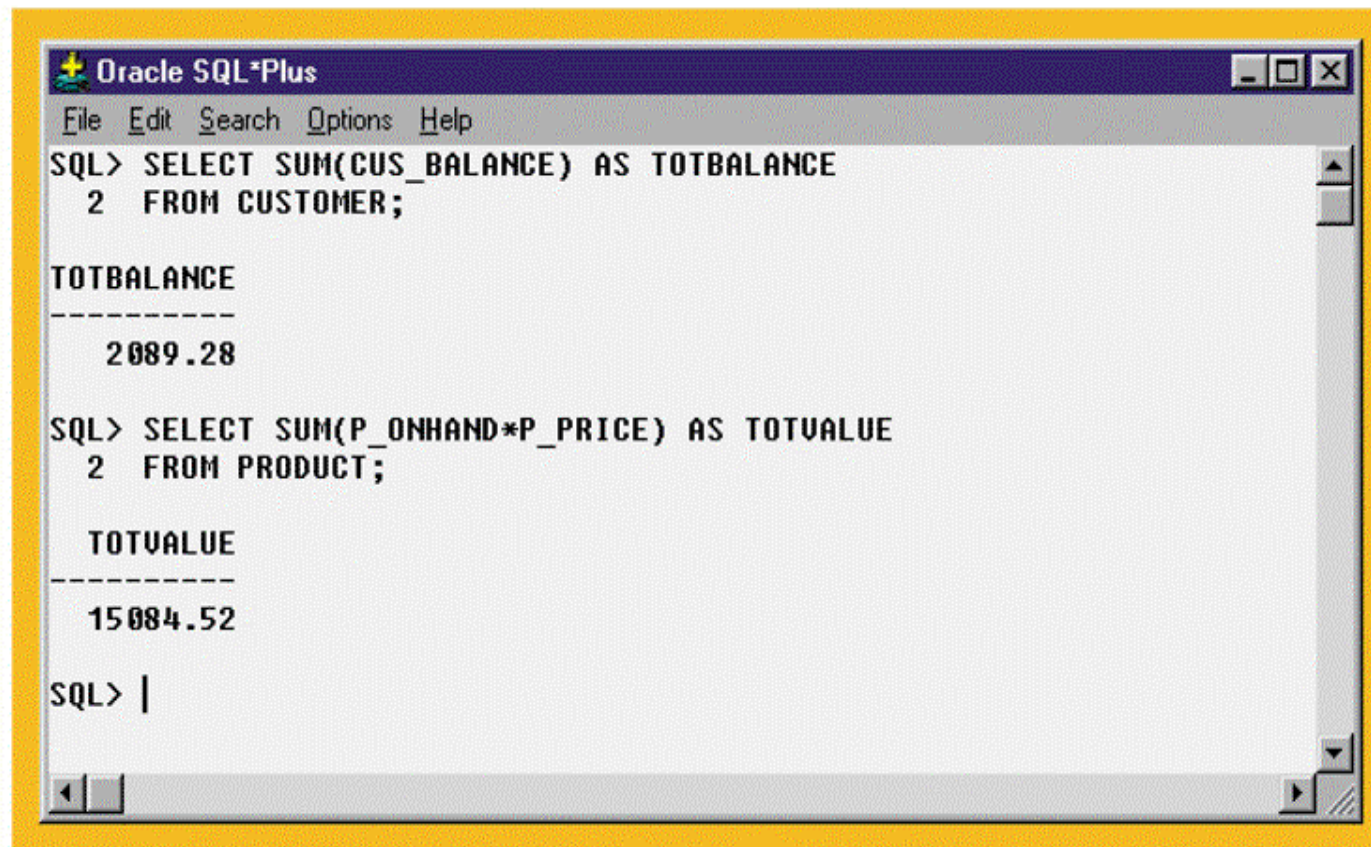
SQL> SELECT P_CODE, P_DESCRIPT, P_PRICE
2 FROM PRODUCT
3 WHERE P_PRICE = (SELECT MAX(P_PRICE) FROM PRODUCT);

P_CODE      P_DESCRIPT                                P_PRICE
-----
89-WRE-Q    Hicut chain saw, 16 in.                    256.99

SQL>
```


The Total Value of All Items in the PRODUCT Table

FIGURE 6.27 THE TOTAL VALUE OF ALL ITEMS IN THE PRODUCT TABLE



```
Oracle SQL*Plus
File Edit Search Options Help
SQL> SELECT SUM(CUS_BALANCE) AS TOTBALANCE
2 FROM CUSTOMER;

TOTBALANCE
-----
  2089.28

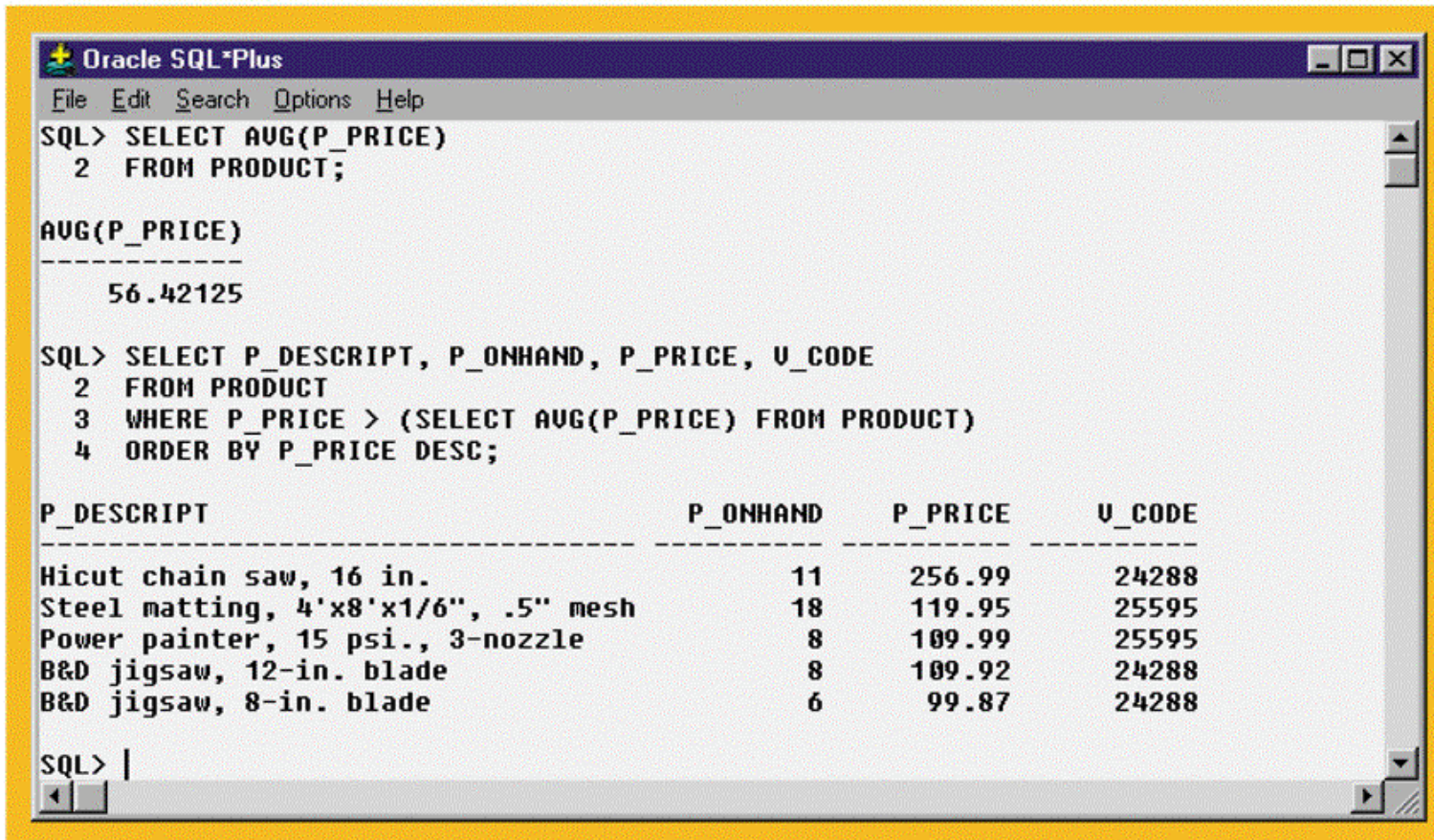
SQL> SELECT SUM(P_ONHAND*P_PRICE) AS TOTVALUE
2 FROM PRODUCT;

TOTVALUE
-----
 15084.52

SQL> |
```

AVG Function Output Examples

FIGURE 6.28 AVG FUNCTION OUTPUT EXAMPLES



```
Oracle SQL*Plus
File Edit Search Options Help
SQL> SELECT AVG(P_PRICE)
2 FROM PRODUCT;

AVG(P_PRICE)
-----
56.42125

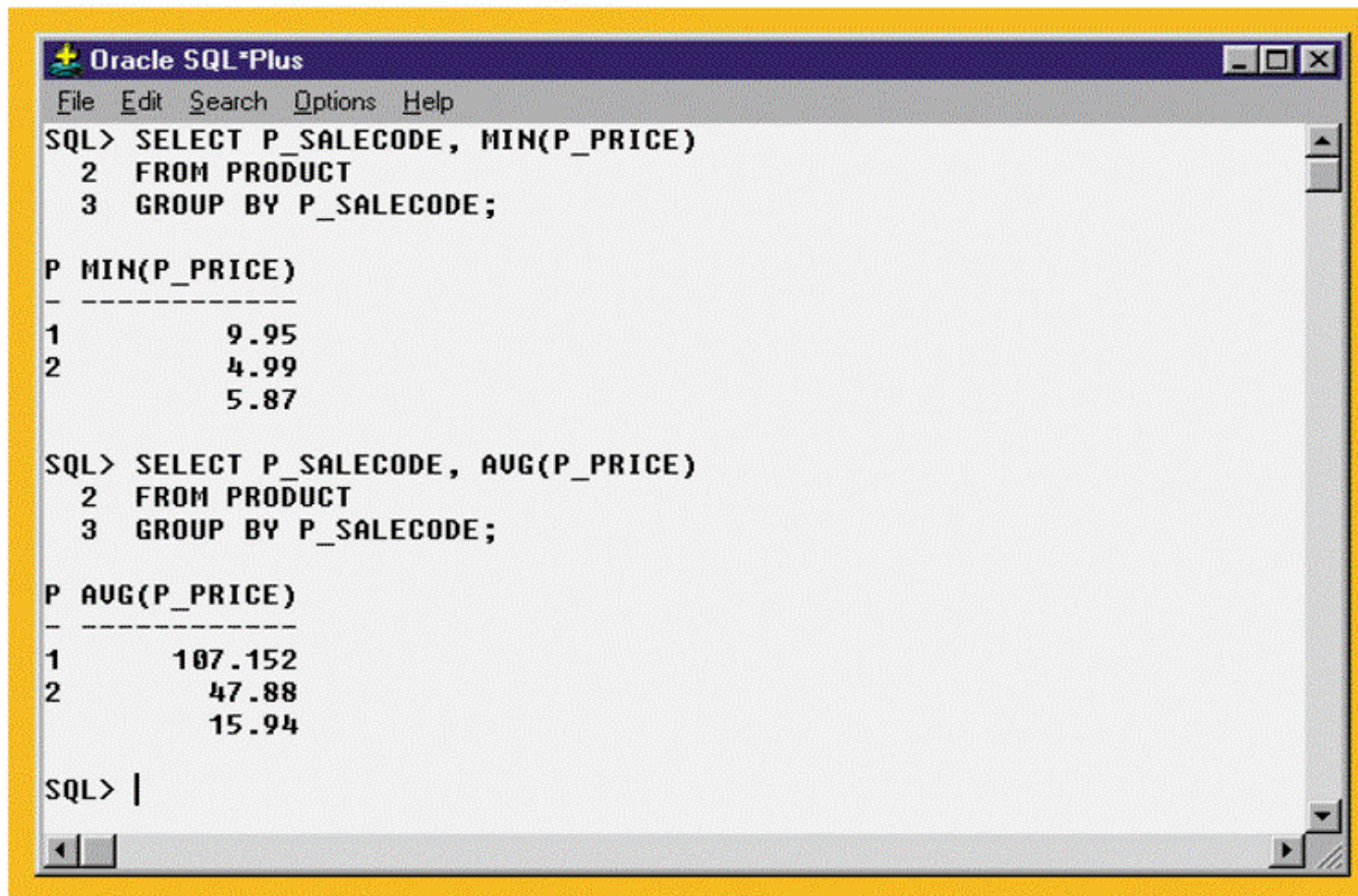
SQL> SELECT P_DESCRIPT, P_ONHAND, P_PRICE, U_CODE
2 FROM PRODUCT
3 WHERE P_PRICE > (SELECT AVG(P_PRICE) FROM PRODUCT)
4 ORDER BY P_PRICE DESC;

P_DESCRIPT                                P_ONHAND    P_PRICE    U_CODE
-----
Hicut chain saw, 16 in.                    11         256.99     24288
Steel matting, 4'x8'x1/6", .5" mesh        18         119.95     25595
Power painter, 15 psi., 3-nozzle           8          109.99     25595
B&D jigsaw, 12-in. blade                   8          109.92     24288
B&D jigsaw, 8-in. blade                    6           99.87     24288

SQL> |
```


GROUP BY Clause Output Examples

FIGURE 6.29 GROUP BY CLAUSE OUTPUT EXAMPLES



```
Oracle SQL*Plus
File Edit Search Options Help
SQL> SELECT P_SALECODE, MIN(P_PRICE)
2 FROM PRODUCT
3 GROUP BY P_SALECODE;

P MIN(P_PRICE)
-----
1          9.95
2          4.99
           5.87

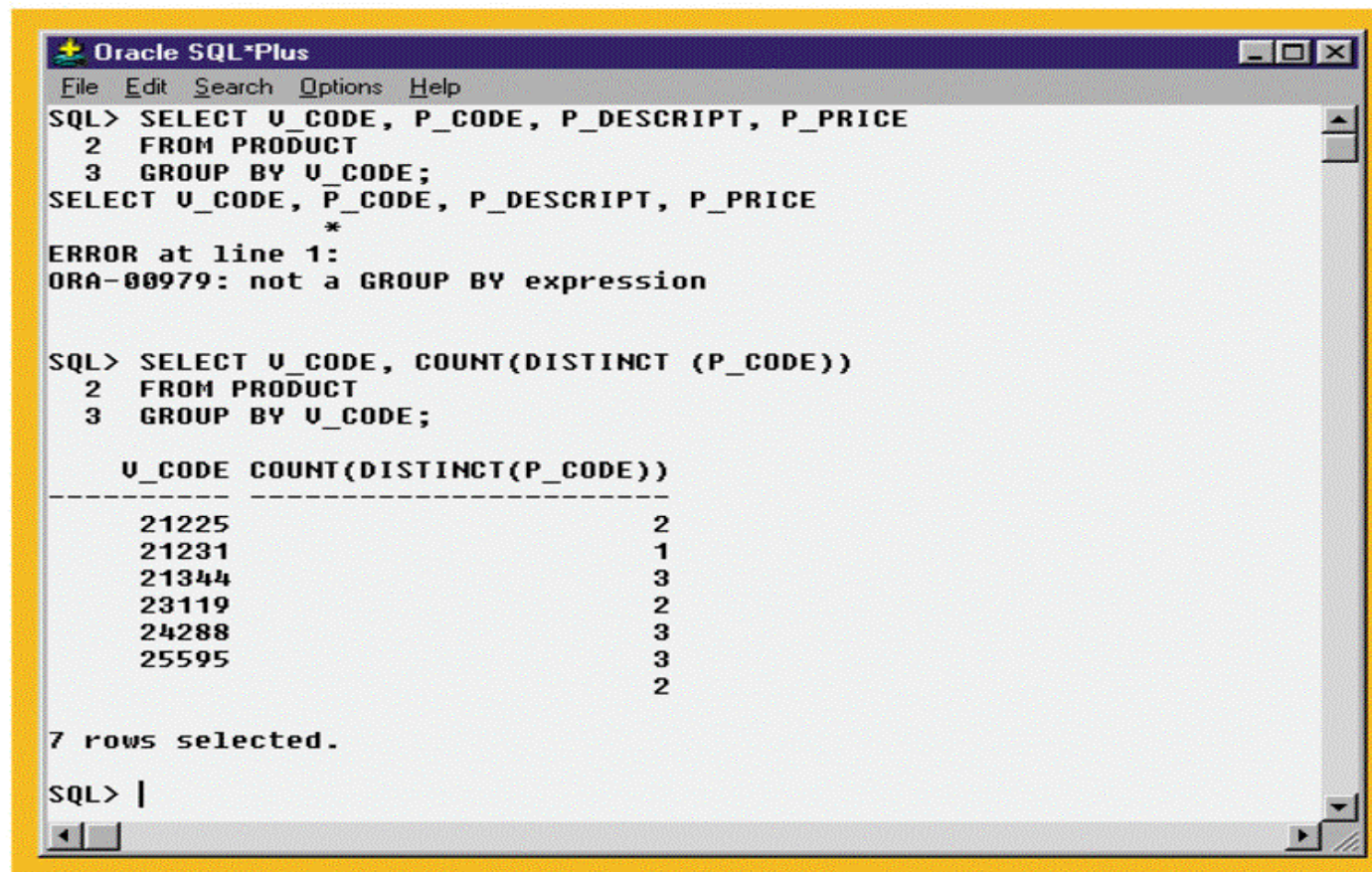
SQL> SELECT P_SALECODE, AVG(P_PRICE)
2 FROM PRODUCT
3 GROUP BY P_SALECODE;

P AVG(P_PRICE)
-----
1         107.152
2          47.88
           15.94

SQL> |
```

Incorrect and Correct Use of the GROUP BY Clause

FIGURE 6.30 INCORRECT AND CORRECT USE OF THE GROUP BY CLAUSE



```
Oracle SQL*Plus
File Edit Search Options Help
SQL> SELECT U_CODE, P_CODE, P_DESCRIPT, P_PRICE
 2 FROM PRODUCT
 3 GROUP BY U_CODE;
SELECT U_CODE, P_CODE, P_DESCRIPT, P_PRICE
      *
ERROR at line 1:
ORA-00979: not a GROUP BY expression

SQL> SELECT U_CODE, COUNT(DISTINCT (P_CODE))
 2 FROM PRODUCT
 3 GROUP BY U_CODE;

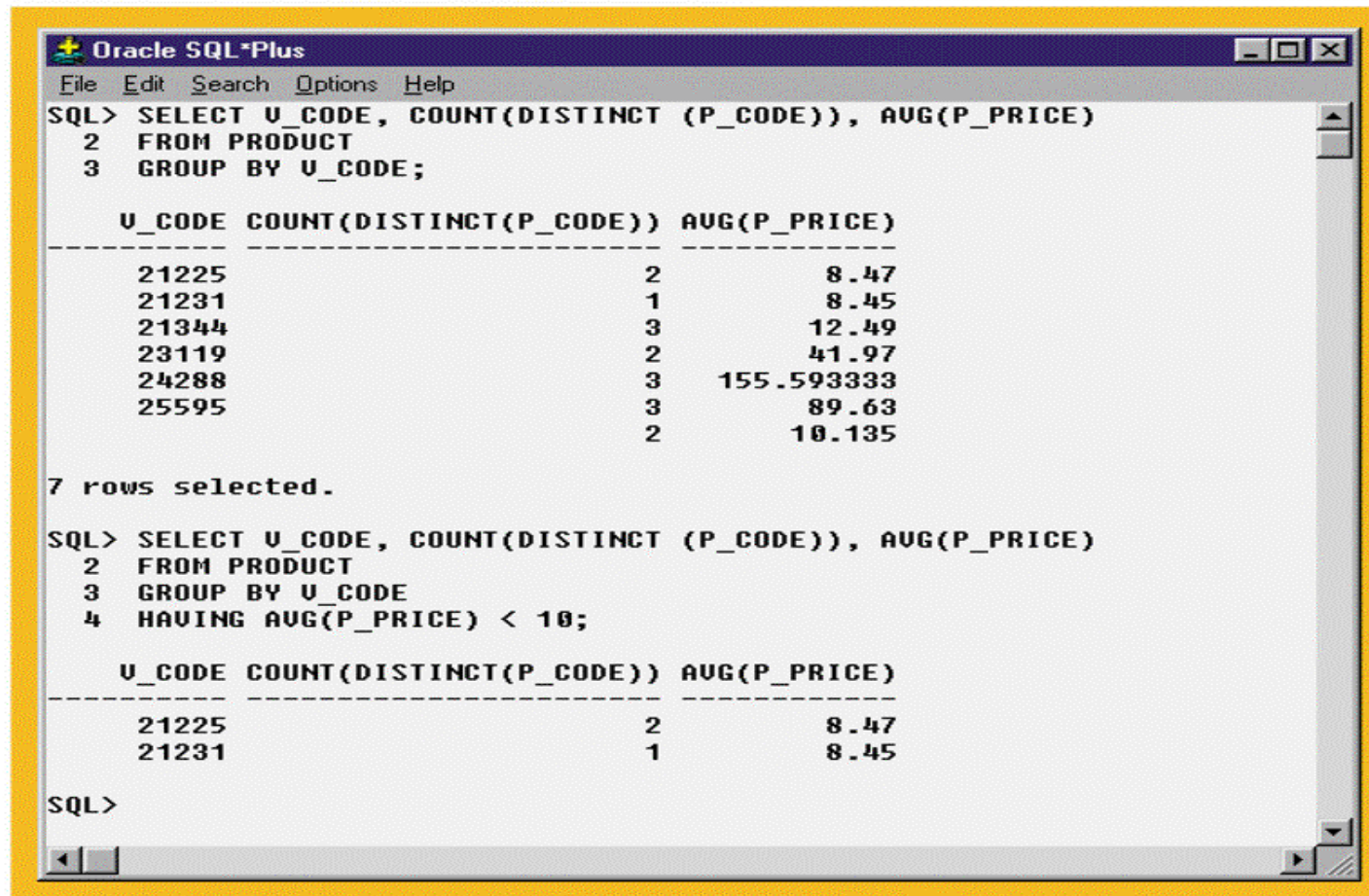
  U_CODE  COUNT(DISTINCT(P_CODE))
-----
21225                2
21231                1
21344                3
23119                2
24288                3
25595                3
                2

7 rows selected.

SQL> |
```

An Application of the HAVING Clause

FIGURE 6.31 AN APPLICATION OF THE HAVING CLAUSE



```
Oracle SQL*Plus
File Edit Search Options Help
SQL> SELECT U_CODE, COUNT(DISTINCT (P_CODE)), AVG(P_PRICE)
2 FROM PRODUCT
3 GROUP BY U_CODE;

  U_CODE COUNT(DISTINCT(P_CODE))  AVG(P_PRICE)
-----
  21225                2             8.47
  21231                1             8.45
  21344                3            12.49
  23119                2            41.97
  24288                3       155.593333
  25595                3             89.63
                2            10.135

7 rows selected.

SQL> SELECT U_CODE, COUNT(DISTINCT (P_CODE)), AVG(P_PRICE)
2 FROM PRODUCT
3 GROUP BY U_CODE
4 HAVING AVG(P_PRICE) < 10;

  U_CODE COUNT(DISTINCT(P_CODE))  AVG(P_PRICE)
-----
  21225                2             8.47
  21231                1             8.45

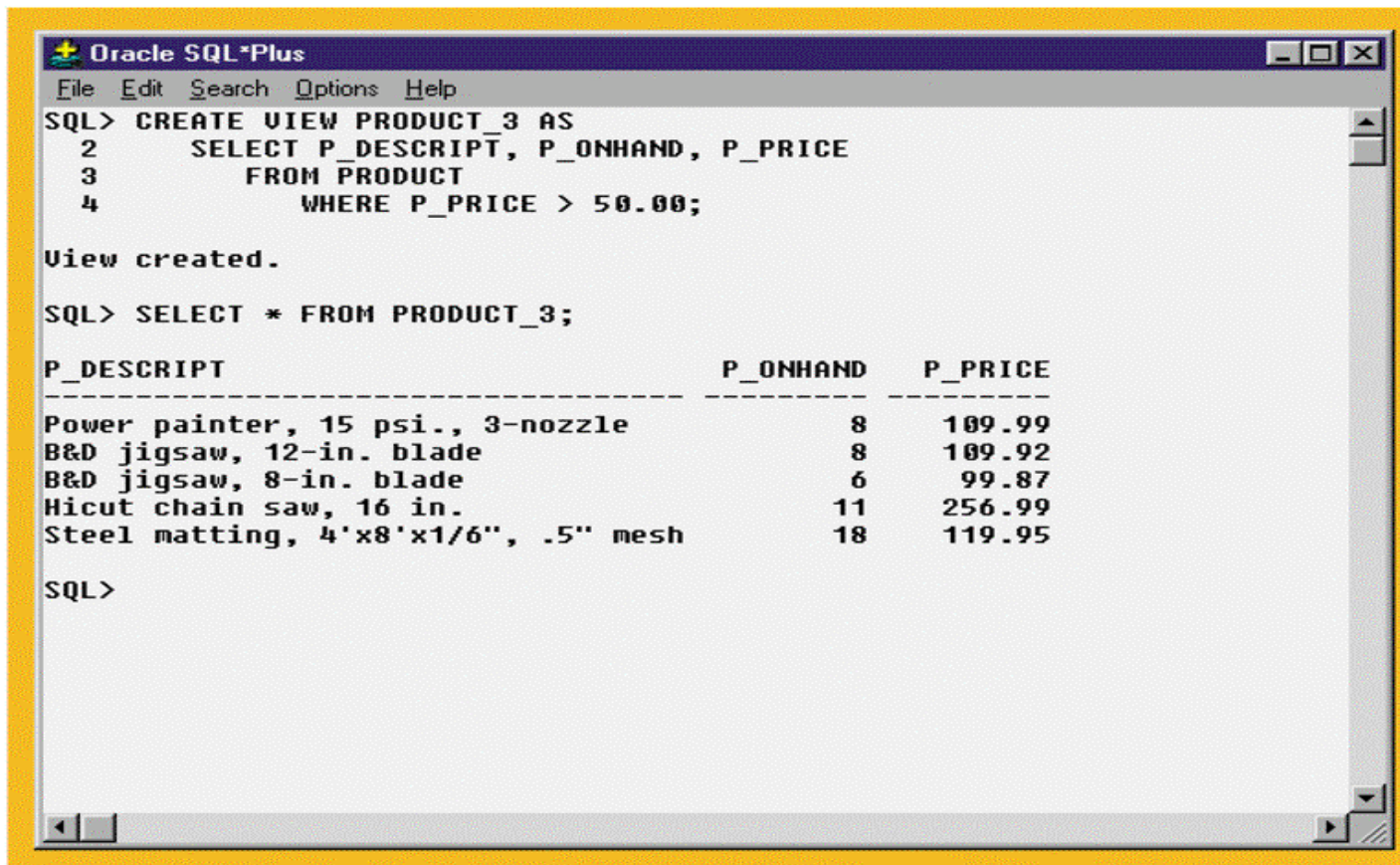
SQL>
```


Virtual Tables: Creating a View

- View is a virtual table based on a SELECT query
 - Can contain columns, computed columns, aliases, and aggregate functions from one or more tables
- Base tables are tables on which the view is based
- Create a view by using the CREATE VIEW command

Creating a Virtual Table with the CREATE VIEW Command

FIGURE 6.32 CREATING A VIRTUAL TABLE WITH THE CREATE VIEW COMMAND



```
Oracle SQL*Plus
File Edit Search Options Help
SQL> CREATE VIEW PRODUCT_3 AS
2     SELECT P_DESCRIPT, P_ONHAND, P_PRICE
3     FROM PRODUCT
4     WHERE P_PRICE > 50.00;

View created.

SQL> SELECT * FROM PRODUCT_3;

P_DESCRIPT                                P_ONHAND    P_PRICE
-----
Power painter, 15 psi., 3-nozzle           8          109.99
B&D jigsaw, 12-in. blade                   8          109.92
B&D jigsaw, 8-in. blade                    6           99.87
Hicut chain saw, 16 in.                   11         256.99
Steel matting, 4'x8'x1/6", .5" mesh       18         119.95

SQL>
```

Joining Database Tables

- Ability to combine (join) tables on common attributes is most important distinction between a relational database and other databases
- Join is performed when data are retrieved from more than one table at a time
- Join is generally composed of an equality comparison between the foreign key and the primary key of related tables

Creating Links Through Foreign Keys

TABLE 6.11 CREATING LINKS THROUGH FOREIGN KEYS

TABLE	ATTRIBUTES TO BE SHOWN	LINKING ATTRIBUTE
PRODUCT	P_DESCRPT, P_PRICE	V_CODE
VENDOR	V_COMPANY, V_PHONE	V_CODE

The Results of a Join

FIGURE 6.33 THE RESULTS OF A JOIN

	P_DESCRIPTION	P_PRICE	V_NAME	V_CONTACT	V_AREACODE	V_PHONE
▶	Claw hammer	\$9.95	Bryson, Inc.	Smithson	615	223-3234
	1.25-in. metal screw, 25	\$6.99	Bryson, Inc.	Smithson	615	223-3234
	2.5-in. wd. screw, 50	\$8.45	D&E Supply	Singh	615	228-3245
	7.25-in. pwr. saw blade	\$14.99	Gomez Bros.	Ortega	615	889-2546
	9.00-in. pwr. saw blade	\$17.49	Gomez Bros.	Ortega	615	889-2546
	Rat-tail file, 1/8-in. fine	\$4.99	Gomez Bros.	Ortega	615	889-2546
	Hrd. cloth, 1/4-in., 2x50	\$39.95	Randsets Ltd.	Anderson	901	678-3998
	Hrd. cloth, 1/2-in., 3x50	\$43.99	Randsets Ltd.	Anderson	901	678-3998
	B&D jigsaw, 12-in. blade	\$109.92	ORDVA, Inc.	Hakford	615	898-1234
	B&D jigsaw, 8-in. blade	\$99.87	ORDVA, Inc.	Hakford	615	898-1234
	Hicut chain saw, 16 in.	\$256.99	ORDVA, Inc.	Hakford	615	898-1234
	Power painter, 15 psi., 3-nozzle	\$109.99	Rubicon System	Orton	904	456-0092
	B&D cordless drill, 1/2-in.	\$38.95	Rubicon System	Orton	904	456-0092
	Steel matting, 4'x8'x1/6", .5" mesh	\$119.95	Rubicon System	Orton	904	456-0092

An Ordered and Limited Listing After a JOIN

FIGURE 6.34 AN ORDERED AND LIMITED LISTING AFTER A JOIN

	P_DESCRIPT	P_PRICE	V_NAME	V_CONTACT	V_AREACODE	V_PHONE
▶	1.25-in. metal screw, 25	\$6.99	Bryson, Inc.	Smithson	615	223-3234
	2.5-in. wd. screw, 50	\$8.45	D&E Supply	Singh	615	228-3245
	Claw hammer	\$9.95	Bryson, Inc.	Smithson	615	223-3234
	B&D cordless drill, 1/2-in.	\$38.95	Rubicon Systems	Orton	904	456-0092
	Steel matting, 4'x8'x1/6", .5" mesh	\$119.95	Rubicon Systems	Orton	904	456-0092
	Hicut chain saw, 16 in.	\$256.99	ORDVA, Inc.	Hakford	615	898-1234

The Contents of the EMP Table

FIGURE 6.35 THE CONTENTS OF THE EMP TABLE

	EMP_NUM	EMP_TITLE	EMP_LNAME	EMP_FNAME	EMP_INITIAL	EMP_DOB	EMP_HIRE_DATE	EMP_AREACODE	EMP_PHONE	EMP_MGR
▶	100	Mr.	Kolmycz	George	D	15-Jun-42	15-Mar-85	615	324-5456	
	101	Ms.	Lewis	Rhonda	G	19-Mar-65	25-Apr-86	615	324-4472	100
	102	Mr.	Vandam	Rhett		14-Nov-58	20-Dec-90	901	675-8993	100
	103	Ms.	Jones	Anne	M	16-Oct-74	28-Aug-94	615	898-3456	100
	104	Mr.	Lange	John	P	08-Nov-71	20-Oct-94	901	504-4430	105
	105	Mr.	Williams	Robert	D	14-Mar-75	08-Nov-98	615	890-3220	
	106	Mrs.	Smith	Jeanine	K	12-Feb-68	05-Jan-89	615	324-7883	105
	107	Mr.	Diante	Jorge	D	21-Aug-74	02-Jul-94	615	890-4567	105
	108	Mr.	Wiesenbach	Paul	R	14-Feb-66	18-Nov-92	615	897-4358	
	109	Mr.	Smith	George	K	18-Jun-61	14-Apr-89	901	504-3339	108
	110	Mrs.	Genkazi	Leighla	W	19-May-70	01-Dec-90	901	569-0093	108
	111	Mr.	Washington	Rupert	E	03-Jan-66	21-Jun-93	615	890-4925	105
	112	Mr.	Johnson	Edward	E	14-May-61	01-Dec-83	615	898-4387	100
	113	Ms.	Smythe	Melanie	P	15-Sep-70	11-May-99	615	324-9006	105
	114	Ms.	Brandon	Marie	G	02-Nov-56	15-Nov-79	901	882-0845	108
	115	Mrs.	Saranda	Hermine	R	25-Jul-72	23-Apr-93	615	324-5505	105
	116	Mr.	Smith	George	A	08-Nov-65	10-Dec-88	615	890-2984	108

Using an Alias to Join a Table to Itself

FIGURE 6.36 USING AN ALIAS TO JOIN A TABLE TO ITSELF

	EMP_NUM	A.EMP_LNAME	EMP_MGR	B.EMP_LNAME
▶	112	Johnson	100	Kolmycz
	103	Jones	100	Kolmycz
	102	Vandam	100	Kolmycz
	101	Lewis	100	Kolmycz
	115	Saranda	105	Williams
	113	Smythe	105	Williams
	111	Washington	105	Williams
	107	Diante	105	Williams
	106	Smith	105	Williams
	104	Lange	105	Williams
	116	Smith	108	Wiesenbach
	114	Brandon	108	Wiesenbach
	110	Genkazi	108	Wiesenbach
	109	Smith	108	Wiesenbach

The Left Outer Join Results

FIGURE 6.37 THE LEFT OUTER JOIN RESULTS

	P_CODE	V_CODE	V_NAME
▶	23109-HB	21225	Bryson, Inc.
	SM-18277	21225	Bryson, Inc.
		21226	SuperLoo, Inc.
	SW-23116	21231	D&E Supply
	13-Q2/P2	21344	Gomez Bros.
	14-Q1/L3	21344	Gomez Bros.
	54778-2T	21344	Gomez Bros.
		22567	Dome Supply
	1546-QQ2	23119	Randsets Ltd.
	1558-QW1	23119	Randsets Ltd.
		24004	Brackman Bros.
	2232/QTY	24288	ORDVA, Inc.
	2232/QWE	24288	ORDVA, Inc.
	89-WRE-Q	24288	ORDVA, Inc.
		25443	B&K, Inc.
		25501	Damal Supplies
	11QER/31	25595	Rubicon Systems
	2238/QPD	25595	Rubicon Systems
	WR3/TT3	25595	Rubicon Systems

The Right Outer Join Results

FIGURE 6.38 THE RIGHT OUTER JOIN RESULTS

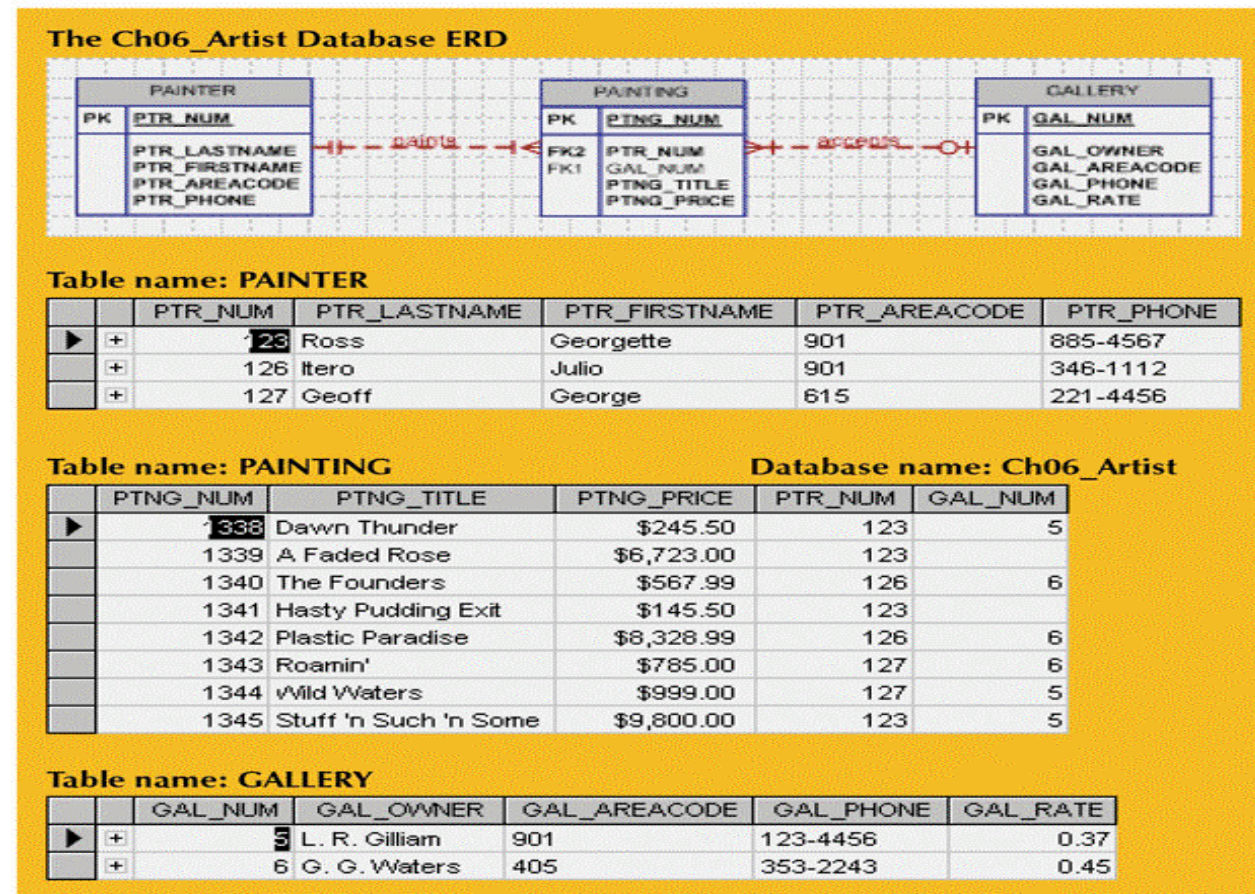
	P_CODE	V_CODE	V_NAME
▶	23114-AA		
	PVC23DRT		
	23109-HB	21225	Bryson, Inc.
	SM-18277	21225	Bryson, Inc.
	SW-23116	21231	D&E Supply
	13-Q2/P2	21344	Gomez Bros.
	14-Q1/L3	21344	Gomez Bros.
	54778-2T	21344	Gomez Bros.
	1546-QQ2	23119	Randssets Ltd.
	1558-QW1	23119	Randssets Ltd.
	2232/QTY	24288	ORDVA, Inc.
	2232/QWE	24288	ORDVA, Inc.
	89-WRE-Q	24288	ORDVA, Inc.
	11QER/31	25595	Rubicon Systems
	2238/QPD	25595	Rubicon Systems
	WR3/TT3	25595	Rubicon Systems

Converting an ER Model into a Database Structure

- Requires following specific rules that govern such a conversion
- Decisions made by the designer to govern data integrity are reflected in the foreign key rules
- Implementation decisions vary according to the problem being addressed

The Ch06_Artist Database ERD and Tables

FIGURE 6.39 THE CH06_ARTIST DATABASE ERD AND TABLES



A Data Dictionary for the Ch06_Artist Database

TABLE 6.12 A DATA DICTIONARY FOR THE CH06_ARTIST DATABASE

TABLE NAME	ATTRIBUTE NAME	CONTENTS	TYPE	FORMAT	RANGE	REQUIRED	PK OR FK	FK REFERENCED TABLE
PAINTER	PTR_NUM	Painter number	CHAR(4)	9999	1000-9999	Y	PK	
	PTR_LASTNAME	Painter last name	VARCHAR(15)	XXXXXXXXXXXX		Y		
	PTR_FIRSTNAME	Painter first name	VARCHAR(15)	XXXXXXXXXXXX		Y		
	PTR_AREACODE	Painter area code	CHAR(3)	999				
	PTR_PHONE	Painter phone	CHAR(8)	999-9999				
GALLERY	GAL_NUM	Gallery number	CHAR(4)	9999	1000-9999	Y	PK	
	GAL_OWNER	Gallery owner	VARCHAR(35)	XXXXXXXXXXXX				
	GAL_AREACODE	Gallery area code	CHAR(3)	999		Y		
	GAL_PHONE	Gallery phone	CHAR(8)	999-9999		Y		
	GAL_RATE	Gallery commission rate (pct.)	NUMBER(4,2)	99.99	0.00-60.00	Y		
PAINTING	PTNG_NUM	Painting number	CHAR(4)	9999	1000-9999	Y	PK	
	PTNG_TITLE	Painting title	VARCHAR(35)	XXXXXXXXXXXX				
	PTNG_PRICE	Painting Price	NUMBER(9,2)	99,999.99	10.00-99,999.99	Y		
	PTR_NUM	Painter number	CHAR(4)	9999	1000-9999	Y	FK	PAINTER
	GAL_NUM	Gallery number	CHAR(4)	9999	1000-9999		FK	GALLERY

FK = Foreign Key

PK = Primary key

CHAR = Fixed character length data, 1 to 255 characters.

VARCHAR = Variable character length data, 1 to 2,000 characters. May also be labeled VARCHAR2.

NUMBER = Numeric data. NUMBER(9,2) is used to specify numbers with two decimal places and up to nine digits long, including the decimal places. Some RDBMSes permit the use of a MONEY or a CURRENCY data type.

A Summary of Foreign Key Rules

TABLE 6.13 A SUMMARY OF FOREIGN KEY RULES

RELATIONSHIP	FOREIGN KEY LOCATION	THE ENTITIES PARTICIPATING IN THE RELATIONSHIPS ARE ...	KEY ATTRIBUTE CONSTRAINT	FOREIGN KEY ACTIONS	
				DELETE	UPDATE
M:N	New entity: composite key	Both mandatory	NN	R	C
		Both optional	NN	C	C
		One mandatory, one optional	NN	R	C
		Operations on mandatory side Operations on optional side	NN	C	C
1:M	Many side	Both mandatory	NN	R	C
		Both optional	NA	SN or R	C
		One mandatory, one optional	NA	SN or R	C
		Operations on mandatory side Operations on optional side	NN	R	C
1:1	Foreign key placement is a matter of informed choice. Put the FK in the ERD's optional side, the strong entity, the most frequent accessed side, or the side dictated by the case semantics. <i>Do not put the FK in both sides.</i>	Both mandatory	NN	R	C
		Both optional	NA	SN	C
		One mandatory, one optional	NA	SN	C
		Operations on mandatory side Operations on optional side	NN	R	C
Weak	Weak entity		NN*	C	C
Multi-valued Attributes	Create a set of new tables in 1:M relationships. Conform to the weak entity rules.		NN	C	C

NN = Not Null NA = Null Allowed R = Restrict
 SN = Set to Null C = Cascade * = Inherited from parent entity

Summary

- SQL commands can be divided into two overall categories:
 - Data definition language commands
 - Data manipulation language commands
- Basic data definition commands allow you to create tables, indexes, and views
- Many SQL constraints can be used with columns
- Aggregate functions
 - Special functions that perform arithmetic computations over a set of rows

Summary (continued)

- ORDER BY clause
 - Used to sort output of a SELECT statement
 - Can sort by one or more columns and use either an ascending or descending order
- Join output of multiple tables with SELECT statement
- Natural join uses join condition to match only rows with equal values in specified columns
- Right outer join and left outer join used to select rows that have no matching values in other related table