Chapter 7: SQL

Modern Database Management

6th Edition

Jeffrey A. Hoffer, Mary B. Prescott, Fred R. McFadden

SQL Is:

Structured Query Language

The standard for relational database management systems (RDBMS)

SQL-92 Standard -- Purpose:

- Specify syntax/semantics for data definition and manipulation
- Define data structures
- Enable portability
- Specify minimal (level 1) and complete (level 2) standards
- Allow for later growth/enhancement to standard

Benefits of a Standardized Relational Language

- Reduced training costs
- Productivity
- Application portability
- Application longevity
- Reduced dependence on a single vendor
- Cross-system communication

SQL Environment

Catalog

- a set of schemas that constitute the description of a database

Schema

- The structure that contains descriptions of objects created by a user (base tables, views, constraints)

Data Definition Language (DDL):

- Commands that define a database, including creating, altering, and dropping tables and establishing constraints

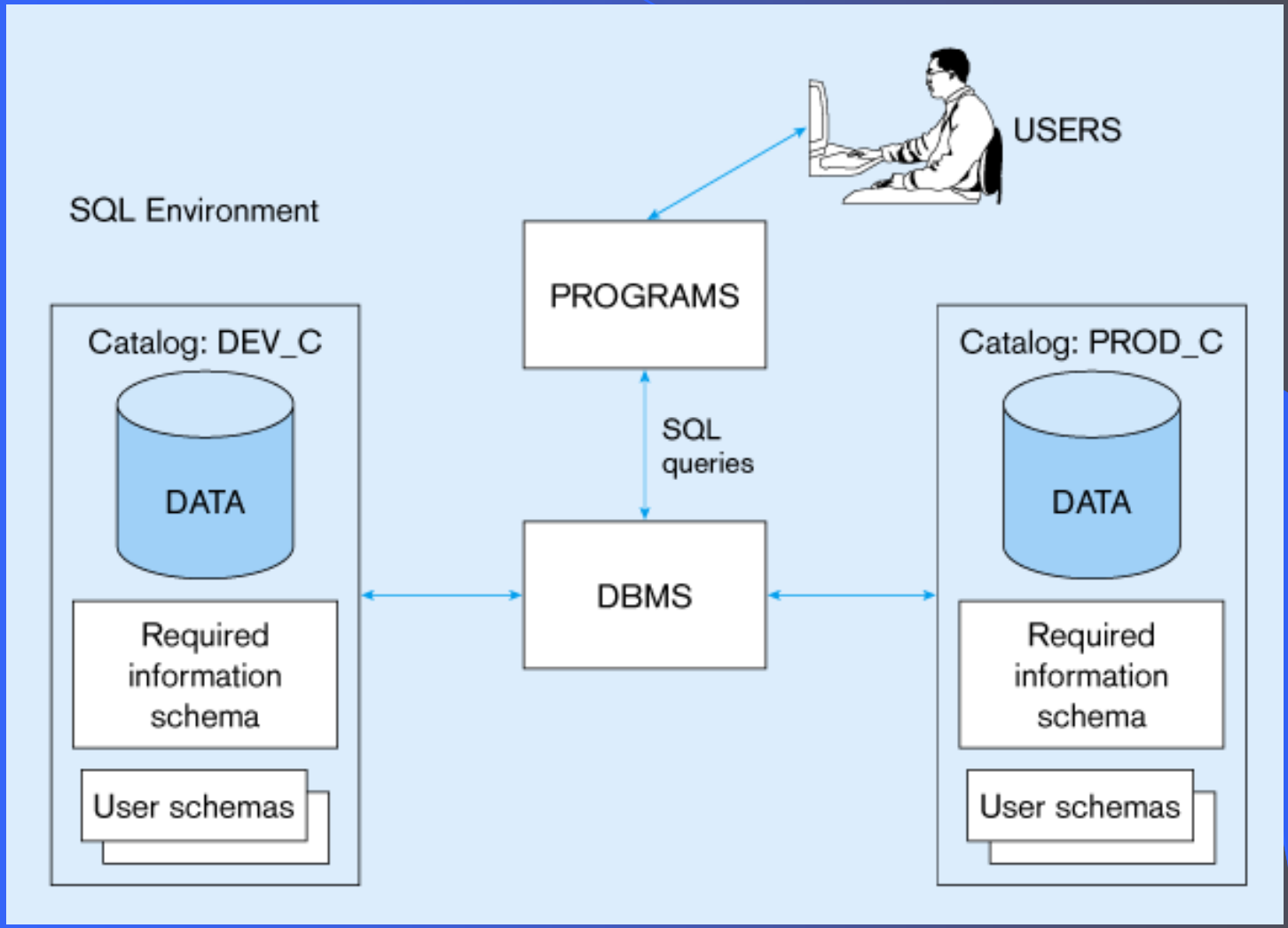
Data Manipulation Language (DML)

- Commands that maintain and query a database

Data Control Language (DCL)

- Commands that control a database, including administering privileges and committing data

Figure 7-1:
A simplified schematic of a typical SQL environment, as described by the SQL-92 standard



SQL Data types (from Oracle8)

String types

- CHAR(n) – fixed-length character data, n characters long Maximum length = 2000 bytes
- VARCHAR2(n) – variable length character data, maximum 4000 bytes
- LONG – variable-length character data, up to 4GB. Maximum 1 per table

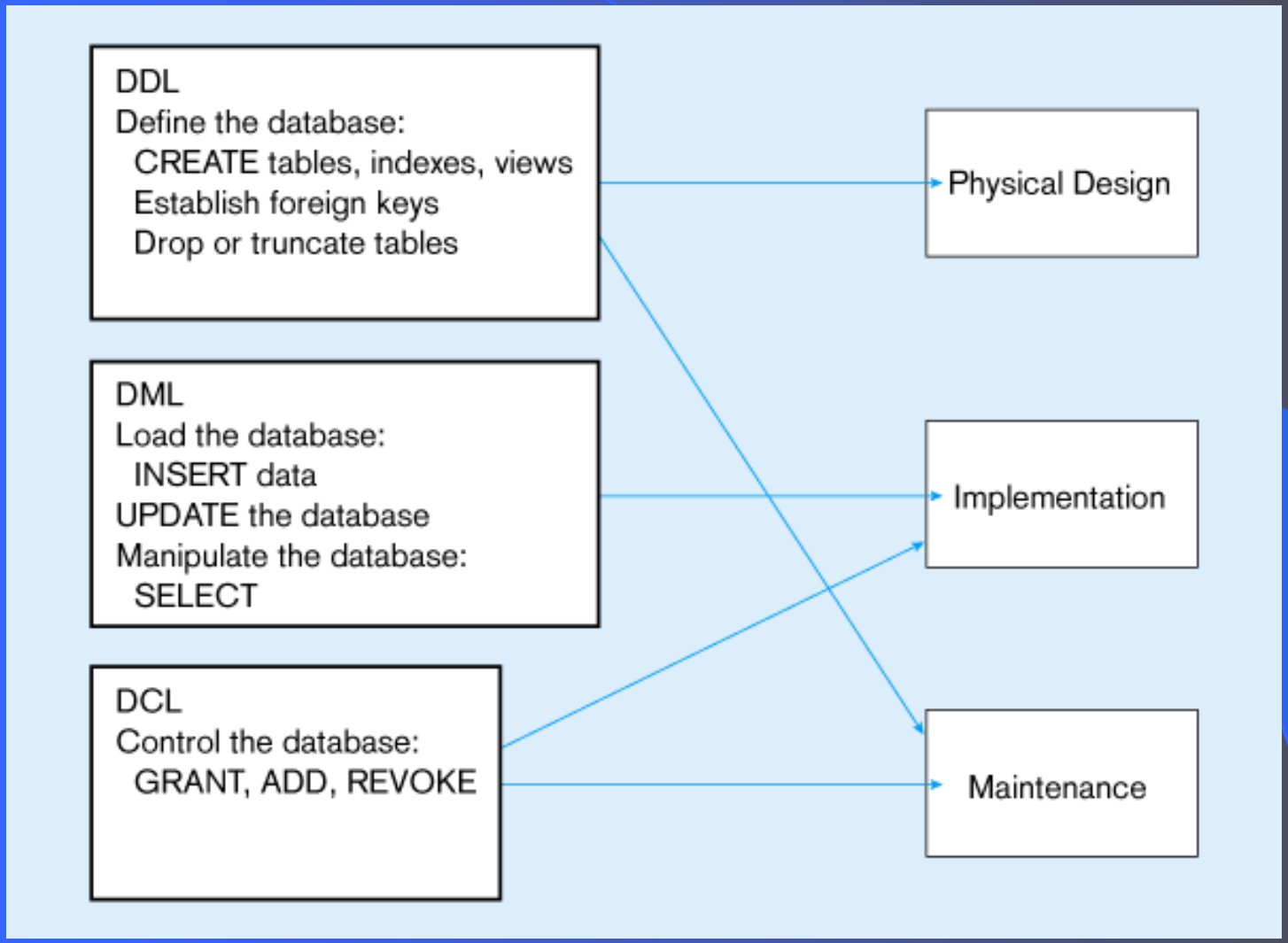
Numeric types

- NUMBER(p,q) – general purpose numeric data type
- INTEGER(p) – signed integer, p digits wide
- FLOAT(p) – floating point in scientific notation with p binary digits precision

Date/time type

- DATE – fixed-length date/time in dd-mm-yy form

Figure 7-4:
DDL, DML, DCL, and the database development process



SQL Database Definition

Data Definition Language (DDL)

Major CREATE statements:

- CREATE SCHEMA – defines a portion of the database owned by a particular user
- CREATE TABLE – defines a table and its columns
- CREATE VIEW – defines a logical table from one or more views

Other CREATE statements: CHARACTER SET, COLLATION, TRANSLATION, ASSERTION, DOMAIN

Table Creation

Figure 7-5: General syntax for CREATE TABLE

```
CREATE TABLE tablename
( {column definition   [table constraint] } . , . .
[ON COMMIT {DELETE | PRESERVE} ROWS] );

where column definition ::=
column_name
        {domain name | datatype [(size)] }
        [column_constraint_clause . . .]
        [default value]
        [collate clause]

and table constraint ::=
        [CONSTRAINT constraint_name]
        Constraint_type [constraint_attributes]
```

Steps in table creation:

1. Identify data types for attributes
2. Identify columns that can and cannot be null
3. Identify columns that must be unique (candidate keys)
4. Identify primary key-foreign key mates
5. Determine default values
6. Identify constraints on columns (domain specifications)
7. Create the table and associated indexes

Figure 7-3: Sample Pine Valley Furniture data

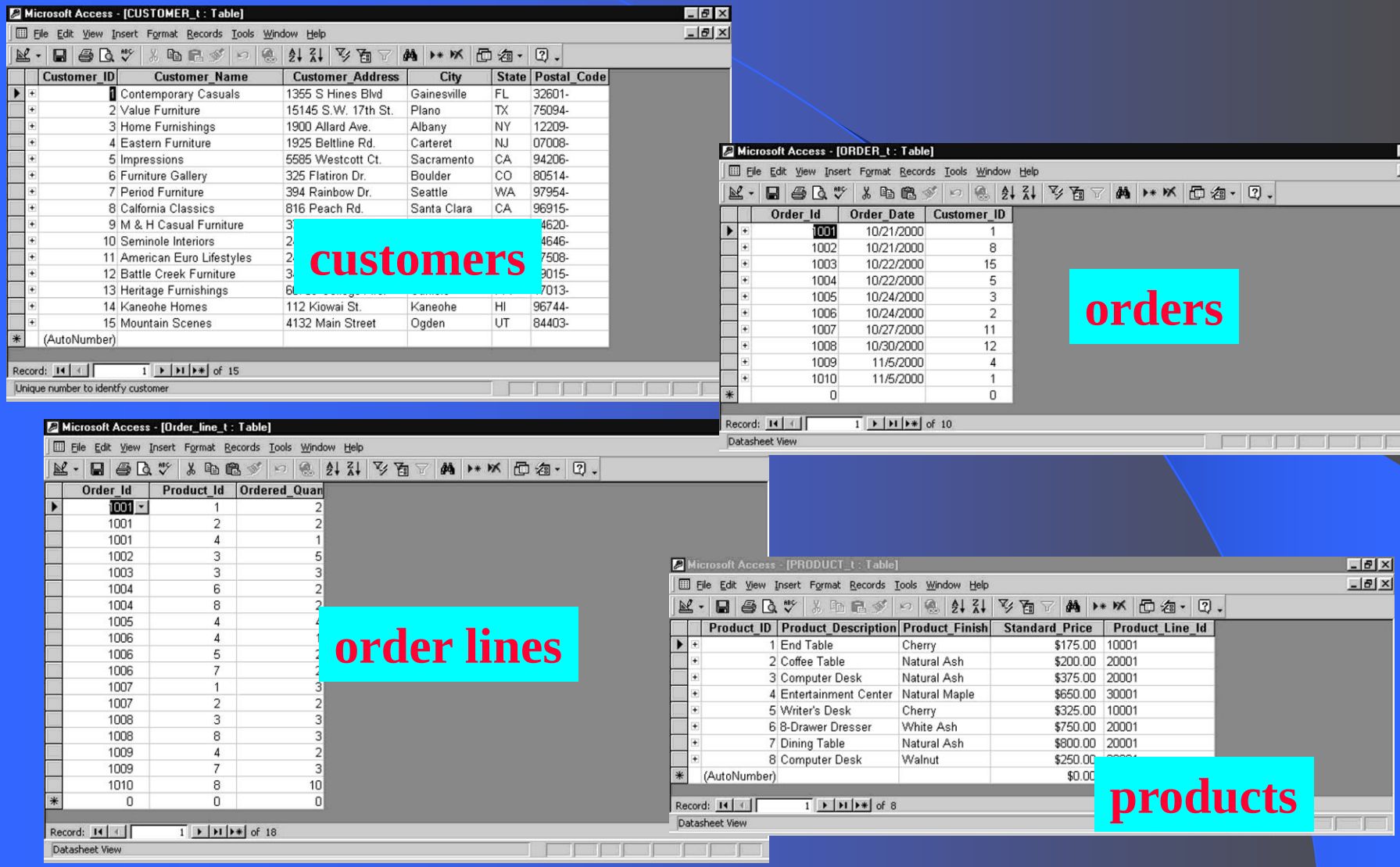


Figure 7-6: SQL database definition commands for Pine Valley Furniture

```
CREATE TABLE CUSTOMER_T
                (CUSTOMER_ID                NUMBER(11, 0) NOT NULL,
                 CUSTOMER_NAME              VARCHAR2(25) NOT NULL,
                 CUSTOMER_ADDRESS           VARCHAR2(30),
                 CITY                       VARCHAR2(20),
                 STATE                      VARCHAR2(2),
                 POSTAL_CODE                VARCHAR2(9),
CONSTRAINT CUSTOMER_PK PRIMARY KEY (CUSTOMER_ID));

CREATE TABLE ORDER_T
                (ORDER_ID                   NUMBER(11, 0) NOT NULL,
                 ORDER_DATE                 DATE          DEFAULT SYSDATE,
                 CUSTOMER_ID                NUMBER(11, 0),
CONSTRAINT ORDER_PK PRIMARY KEY (ORDER_ID),
CONSTRAINT ORDER_FK FOREIGN KEY (CUSTOMER_ID) REFERENCES CUSTOMER_T(CUSTOMER_ID));

CREATE TABLE PRODUCT_T
                (PRODUCT_ID                 INTEGER       NOT NULL,
                 PRODUCT_DESCRIPTION        VARCHAR2(50),
                 PRODUCT_FINISH             VARCHAR2(20)
                                CHECK (PRODUCT_FINISH IN ('Cherry', 'Natural Ash', 'White Ash',
                                  'Red Oak', 'Natural Oak', 'Walnut')),
                 STANDARD_PRICE             DECIMAL(6,2),
                 PRODUCT_LINE_ID            INTEGER,
CONSTRAINT PRODUCT_PK PRIMARY KEY (PRODUCT_ID));

CREATE TABLE ORDER_LINE_T
                (ORDER_ID                   NUMBER(11,0)  NOT NULL,
                 PRODUCT_ID                 NUMBER(11,0)  NOT NULL,
                 ORDERED_QUANTITY           NUMBER(11,0),
CONSTRAINT ORDER_LINE_PK PRIMARY KEY (ORDER_ID, PRODUCT_ID),
CONSTRAINT ORDER_LINE_FK1 FOREIGN KEY(ORDER_ID) REFERENCES ORDER_T(ORDER_ID),
CONSTRAINT ORDER_LINE_FK2 FOREIGN KEY (PRODUCT_ID) REFERENCES PRODUCT_T(PRODUCT_ID));
```

Figure 7-6: SQL database definition commands for Pine Valley Furniture

```
CREATE TABLE CUSTOMER_T
       (CUSTOMER_ID                NUMBER(11, 0) NOT NULL,
        CUSTOMER_NAME              VARCHAR2(25) NOT NULL,
        CUSTOMER_ADDRESS           VARCHAR2(30),
        CITY                       VARCHAR2(20),
        STATE                      VARCHAR2(2),
        POSTAL_CODE                VARCHAR2(9),
CONSTRAINT CUSTOMER_PK PRIMARY KEY (CUSTOMER_ID));

CREATE TABLE ORDER_T
       (ORDER_ID                   NUMBER(11, 0) NOT NULL,
        ORDER_DATE                 DATE          DEFAULT SYSDATE,
        CUSTOMER_ID                NUMBER(11, 0),
CONSTRAINT ORDER_PK PRIMARY KEY (ORDER_ID),
CONSTRAINT ORDER_FK FOREIGN KEY (CUSTOMER_ID) REFERENCES CUSTOMER_T(CUSTOMER_ID));

CREATE TABLE PRODUCT_T
       (PRODUCT_ID                 INTEGER       NOT NULL,
        PRODUCT_DESCRIPTION        VARCHAR2(50),
        PRODUCT_FINISH             VARCHAR2(20)
                  CHECK (PRODUCT_FINISH IN ('Cherry', 'Natural Ash', 'White Ash',
                                            'Red Oak', 'Natural Oak', 'Walnut')),
        STANDARD_PRICE             DECIMAL(6,2),
        PRODUCT_LINE_ID            INTEGER,
CONSTRAINT PRODUCT_PK PRIMARY KEY (PRODUCT_ID));

CREATE TABLE ORDER_LINE_T
       (ORDER_ID                   NUMBER(11,0) NOT NULL,
        PRODUCT_ID                 NUMBER(11,0) NOT NULL,
        ORDERED_QUANTITY           NUMBER(11,0),
CONSTRAINT ORDER_LINE_PK PRIMARY KEY (ORDER_ID, PRODUCT_ID),
CONSTRAINT ORDER_LINE_FK1 FOREIGN KEY(ORDER_ID) REFERENCES ORDER_T(ORDER_ID),
CONSTRAINT ORDER_LINE_FK2 FOREIGN KEY (PRODUCT_ID) REFERENCES PRODUCT_T(PRODUCT_ID));
```

Defining attributes and their data types

Figure 7-6: SQL database definition commands for Pine Valley Furniture

```
CREATE TABLE CUSTOMER_T
          (CUSTOMER_ID              NUMBER(11, 0) NOT NULL,
           CUSTOMER_NAME            VARCHAR2(25) NOT NULL,
           CUSTOMER_ADDRESS         VARCHAR2(30),
           CITY                     VARCHAR2(20),
           STATE                    VARCHAR2(2),
           POSTAL_CODE              VARCHAR2(9),
CONSTRAINT CUSTOMER_PK PRIMARY KEY (CUSTOMER_ID));

CREATE TABLE ORDER_T
          (ORDER_ID                 NUMBER(11, 0) NOT NULL,
           ORDER_DATE               DATE          DEFAULT SYSDATE,
           CUSTOMER_ID              NUMBER(11, 0),
CONSTRAINT ORDER_PK PRIMARY KEY (ORDER_ID),
CONSTRAINT ORDER_FK FOREIGN KEY (CUSTOMER_ID) REFERENCES CUSTOMER_T(CUSTOMER_ID));

CREATE TABLE PRODUCT_T
          (PRODUCT_ID               INTEGER       NOT NULL,
           PRODUCT_DESCRIPTION      VARCHAR2(50),
           PRODUCT_FINISH           VARCHAR2(20)
                    CHECK (PRODUCT_FINISH IN ('Cherry', 'Natural Ash', 'White Ash',
                      'Red Oak', 'Natural Oak', 'Walnut')),
           STANDARD_PRICE           DECIMAL(6,2),
           PRODUCT_LINE_ID          INTEGER,
CONSTRAINT PRODUCT_PK PRIMARY KEY (PRODUCT_ID));

CREATE TABLE ORDER_LINE_T
          (ORDER_ID                 NUMBER(11,0) NOT NULL,
           PRODUCT_ID               NUMBER(11,0) NOT NULL,
           ORDERED_QUANTITY         NUMBER(11,0),
CONSTRAINT ORDER_LINE_PK PRIMARY KEY (ORDER_ID, PRODUCT_ID),
CONSTRAINT ORDER_LINE_FK1 FOREIGN KEY(ORDER_ID) REFERENCES ORDER_T(ORDER_ID),
CONSTRAINT ORDER_LINE_FK2 FOREIGN KEY (PRODUCT_ID) REFERENCES PRODUCT_T(PRODUCT_ID));
```

Non-nullable specifications

Note: primary keys should not be null

Figure 7-6: SQL database definition commands for Pine Valley Furniture

```
CREATE TABLE CUSTOMER_T
        (CUSTOMER_ID            NUMBER(11, 0) NOT NULL,
         CUSTOMER_NAME          VARCHAR2(25) NOT NULL,
         CUSTOMER_ADDRESS       VARCHAR2(30),
         CITY                   VARCHAR2(20),
         STATE                  VARCHAR2(2),
         POSTAL_CODE            VARCHAR2(9),
CONSTRAINT CUSTOMER_PK PRIMARY KEY (CUSTOMER_ID));

CREATE TABLE ORDER_T
        (ORDER_ID               NUMBER(11, 0) NOT NULL,
         ORDER_DATE             DATE          DEFAULT SYSDATE,
         CUSTOMER_ID            NUMBER(11, 0),
CONSTRAINT ORDER_PK PRIMARY KEY (ORDER_ID),
CONSTRAINT ORDER_FK FOREIGN KEY (CUSTOMER_ID) REFERENCES CUSTOMER_T(CUSTOMER_ID));

CREATE TABLE PRODUCT_T
        (PRODUCT_ID             INTEGER       NOT NULL,
         PRODUCT_DESCRIPTION    VARCHAR2(50),
         PRODUCT_FINISH         VARCHAR2(20)
                CHECK (PRODUCT_FINISH IN ('Cherry', 'Natural Ash', 'White Ash',
                  'Red Oak', 'Natural Oak', 'Walnut')),
         STANDARD_PRICE         DECIMAL(6,2),
         PRODUCT_LINE_ID        INTEGER,
CONSTRAINT PRODUCT_PK PRIMARY KEY (PRODUCT_ID));

CREATE TABLE ORDER_LINE_T
        (ORDER_ID               NUMBER(11,0)  NOT NULL,
         PRODUCT_ID             NUMBER(11,0)  NOT NULL,
         ORDERED_QUANTITY       NUMBER(11,0),
CONSTRAINT ORDER_LINE_PK PRIMARY KEY (ORDER_ID, PRODUCT_ID),
CONSTRAINT ORDER_LINE_FK1 FOREIGN KEY(ORDER_ID) REFERENCES ORDER_T(ORDER_ID),
CONSTRAINT ORDER_LINE_FK2 FOREIGN KEY (PRODUCT_ID) REFERENCES PRODUCT_T(PRODUCT_ID));
```

Identifying primary keys

This is a composite primary key

Figure 7-6: SQL database definition commands for Pine Valley Furniture

```
CREATE TABLE CUSTOMER_T
          (CUSTOMER_ID              NUMBER(11, 0) NOT NULL,
           CUSTOMER_NAME            VARCHAR2(25) NOT NULL,
           CUSTOMER_ADDRESS         VARCHAR2(30),
           CITY                     VARCHAR2(20),
           STATE                    VARCHAR2(2),
           POSTAL_CODE              VARCHAR2(9),
CONSTRAINT CUSTOMER_PK PRIMARY KEY (CUSTOMER_ID));

CREATE TABLE ORDER_T
          (ORDER_ID                 NUMBER(11, 0) NOT NULL,
           ORDER_DATE               DATE          DEFAULT SYSDATE,
           CUSTOMER_ID              NUMBER(11, 0),
CONSTRAINT ORDER_PK PRIMARY KEY (ORDER_ID),
CONSTRAINT ORDER_FK FOREIGN KEY (CUSTOMER_ID) REFERENCES CUSTOMER_T(CUSTOMER_ID));

CREATE TABLE PRODUCT_T
          (PRODUCT_ID               INTEGER       NOT NULL,
           PRODUCT_DESCRIPTION      VARCHAR2(50),
           PRODUCT_FINISH           VARCHAR2(20)
                    CHECK (PRODUCT_FINISH IN ('Cherry', 'Natural Ash', 'White Ash',
                      'Red Oak', 'Natural Oak', 'Walnut')),
           STANDARD_PRICE           DECIMAL(6,2),
           PRODUCT_LINE_ID          INTEGER,
CONSTRAINT PRODUCT_PK PRIMARY KEY (PRODUCT_ID));

CREATE TABLE ORDER_LINE_T
          (ORDER_ID                 NUMBER(11,0)  NOT NULL,
           PRODUCT_ID               NUMBER(11,0)  NOT NULL,
           ORDERED_QUANTITY         NUMBER(11,0),
CONSTRAINT ORDER_LINE_PK PRIMARY KEY (ORDER_ID, PRODUCT_ID),
CONSTRAINT ORDER_LINE_FK1 FOREIGN KEY(ORDER_ID) REFERENCES ORDER_T(ORDER_ID),
CONSTRAINT ORDER_LINE_FK2 FOREIGN KEY (PRODUCT_ID) REFERENCES PRODUCT_T(PRODUCT_ID));
```

Identifying foreign keys and establishing relationships

Figure 7-6: SQL database definition commands for Pine Valley Furniture

```
CREATE TABLE CUSTOMER_T
        (CUSTOMER_ID            NUMBER(11, 0) NOT NULL,
         CUSTOMER_NAME          VARCHAR2(25) NOT NULL,
         CUSTOMER_ADDRESS       VARCHAR2(30),
         CITY                   VARCHAR2(20),
         STATE                  VARCHAR2(2),
         POSTAL_CODE            VARCHAR2(9),
CONSTRAINT CUSTOMER_PK PRIMARY KEY (CUSTOMER_ID));

CREATE TABLE ORDER_T
        (ORDER_ID               NUMBER(11, 0) NOT NULL,
         ORDER_DATE             DATE          DEFAULT SYSDATE,
         CUSTOMER_ID            NUMBER(11, 0),
CONSTRAINT ORDER_PK PRIMARY KEY (ORDER_ID),
CONSTRAINT ORDER_FK FOREIGN KEY (CUSTOMER_ID) REFERENCES CUSTOMER_T(CUSTOMER_ID));

CREATE TABLE PRODUCT_T
        (PRODUCT_ID             INTEGER       NOT NULL,
         PRODUCT_DESCRIPTION    VARCHAR2(50),
         PRODUCT_FINISH         VARCHAR2(20)
                CHECK (PRODUCT_FINISH IN ('Cherry', 'Natural Ash', 'White Ash',
                        'Red Oak', 'Natural Oak', 'Walnut')),
         STANDARD_PRICE         DECIMAL(6,2),
         PRODUCT_LINE_ID        INTEGER,
CONSTRAINT PRODUCT_PK PRIMARY KEY (PRODUCT_ID));

CREATE TABLE ORDER_LINE_T
        (ORDER_ID               NUMBER(11,0)  NOT NULL,
         PRODUCT_ID             NUMBER(11,0)  NOT NULL,
         ORDERED_QUANTITY       NUMBER(11,0),
CONSTRAINT ORDER_LINE_PK PRIMARY KEY (ORDER_ID, PRODUCT_ID),
CONSTRAINT ORDER_LINE_FK1 FOREIGN KEY(ORDER_ID) REFERENCES ORDER_T(ORDER_ID),
CONSTRAINT ORDER_LINE_FK2 FOREIGN KEY (PRODUCT_ID) REFERENCES PRODUCT_T(PRODUCT_ID));
```

Default values and domain constraints

Figure 7-6: SQL database definition commands for Pine Valley Furniture

```
CREATE TABLE CUSTOMER_T
              (CUSTOMER_ID                NUMBER(11, 0) NOT NULL,
               CUSTOMER_NAME              VARCHAR2(25) NOT NULL,
               CUSTOMER_ADDRESS           VARCHAR2(30),
               CITY                       VARCHAR2(20),
               STATE                      VARCHAR2(2),
               POSTAL_CODE                VARCHAR2(9),
CONSTRAINT CUSTOMER_PK PRIMARY KEY (CUSTOMER_ID));
```

Overall table definitions

```
CREATE TABLE ORDER_T
              (ORDER_ID                   NUMBER(11, 0) NOT NULL,
               ORDER_DATE                 DATE          DEFAULT SYSDATE,
               CUSTOMER_ID                NUMBER(11, 0),
CONSTRAINT ORDER_PK PRIMARY KEY (ORDER_ID),
CONSTRAINT ORDER_FK FOREIGN KEY (CUSTOMER_ID) REFERENCES CUSTOMER_T(CUSTOMER_ID));
```

```
CREATE TABLE PRODUCT_T
              (PRODUCT_ID                 INTEGER       NOT NULL,
               PRODUCT_DESCRIPTION        VARCHAR2(50),
               PRODUCT_FINISH             VARCHAR2(20)
                          CHECK (PRODUCT_FINISH IN ('Cherry', 'Natural Ash', 'White Ash',
                                 'Red Oak', 'Natural Oak', 'Walnut')),
               STANDARD_PRICE             DECIMAL(6,2),
               PRODUCT_LINE_ID            INTEGER,
CONSTRAINT PRODUCT_PK PRIMARY KEY (PRODUCT_ID));
```

```
CREATE TABLE ORDER_LINE_T
              (ORDER_ID                   NUMBER(11,0)  NOT NULL,
               PRODUCT_ID                 NUMBER(11,0)  NOT NULL,
               ORDERED_QUANTITY           NUMBER(11,0),
CONSTRAINT ORDER_LINE_PK PRIMARY KEY (ORDER_ID, PRODUCT_ID),
CONSTRAINT ORDER_LINE_FK1 FOREIGN KEY(ORDER_ID) REFERENCES ORDER_T(ORDER_ID),
CONSTRAINT ORDER_LINE_FK2 FOREIGN KEY (PRODUCT_ID) REFERENCES PRODUCT_T(PRODUCT_ID));
```

Using and Defining Views

Views provide users controlled access to tables

Advantages of views:

- Simplify query commands
- Provide data security
- Enhance programming productivity

CREATE VIEW command

View Terminology

Base Table

- A table containing the raw data

Dynamic View

- A "virtual table" created dynamically upon request by a user.
- No data actually stored; instead data from base table made available to user
- Based on SQL SELECT statement on base tables or other views

Materialized View

- Copy or replication of data
- Data actually stored
- Must be refreshed periodically to match the corresponding base tables

Sample CREATE VIEW

```
CREATE VIEW EXPENSIVE_STUFF_V AS
SELECT PRODUCT_ID, PRODUCT_NAME, UNIT_PRICE
FROM PRODUCT_T
WHERE UNIT_PRICE >300
WITH CHECK_OPTION;
```

- View has a name
- View is based on a SELECT statement
- CHECK_OPTION works only for updateable views and prevents updates that would create rows not included in the view

Table 7-2: Pros and Cons of Using Dynamic Views

Table 7-2 Pros and Cons of Using Dynamic Views

Positive Aspects	*Negative Aspects*
Simplify query commands	Use processing time re-creating view each time it is referenced
Help provide data security and confidentiality	
Improve programmer productivity	May or may not be directly updateable
Contain most current base table data	
Use little storage space	
Provide a customized view for a user	
Establish physical data independence	

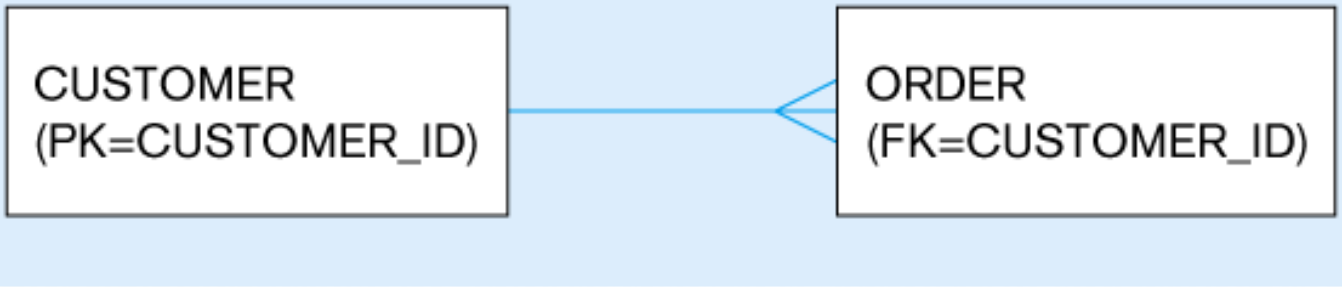
Data Integrity Controls

Referential integrity – constraint that ensures that foreign key values of a table must match primary key values of a related table in 1:M relationships

Restricting:

- Deletes of primary records
- Updates of primary records
- Inserts of dependent records

Figure 7-7: Ensuring data integrity through updates




```
CREATE TABLE CUSTOMER_T
                (CUSTOMER_ID          INTEGER DEFAULT 'C999'   NOT NULL,
                 CUSTOMER_NAME        VARCHAR(40)              NOT NULL,
                 . . .
CONSTRAINT CUSTOMER_PK PRIMARY KEY (CUSTOMER_ID),
ON UPDATE RESTRICT);
```

Cascaded Update: Changing a customer ID in the CUSTOMER table will result in that value changing in the ORDER table to match.

. . . ON UPDATE CASCADE);

Set Null Update: When a customer ID is changed, any customer ID in the ORDER table that matches the old customer ID is set to NULL.

. . . ON UPDATE SET NULL);

Set Default Update: When a customer ID is changed, any customer ID in the ORDER tables that matches the old customer ID is set to a predefined default value.

. . . ON UPDATE SET DEFAULT);

Changing and Removing Tables

ALTER TABLE statement allows you to change column specifications:

- ALTER TABLE CUSTOMER_T ADD (TYPE VARCHAR(2))

DROP TABLE statement allows you to remove tables from your schema:

- DROP TABLE CUSTOMER_T

Schema Definition

Control processing/storage efficiency:

- Choice of indexes
- File organizations for base tables
- File organizations for indexes
- Data clustering
- Statistics maintenance

Creating indexes

- Speed up random/sequential access to base table data
- Example
  - CREATE INDEX NAME_IDX ON CUSTOMER_T(CUSTOMER_NAME)
  - This makes an index for the CUSTOMER_NAME field of the CUSTOMER_T table

Insert Statement

Adds data to a table

Inserting into a table

- INSERT INTO CUSTOMER_T VALUES (001, 'CONTEMPORARY Casuals', 1355 S. Himes Blvd.', 'Gainesville', 'FL', 32601);

Inserting a record that has some null attributes requires identifying the fields that actually get data

- INSERT INTO PRODUCT_T (PRODUCT_ID, PRODUCT_DESCRIPTION,PRODUCT_FINISH, STANDARD_PRICE, PRODUCT_ON_HAND) VALUES (1, 'End Table', 'Cherry', 175, 8);

Inserting from another table

- INSERT INTO CA_CUSTOMER_T SELECT * FROM CUSTOMER_T WHERE STATE = 'CA';

Delete Statement

Removes rows from a table

Delete certain rows

- DELETE FROM CUSTOMER_T WHERE STATE = ‘HI’;

Delete all rows

- DELETE FROM CUSTOMER_T;

Update Statement

Modifies data in existing rows

```
UPDATE PRODUCT_T SET UNIT_PRICE = 775
WHERE PRODUCT_ID = 7;
```

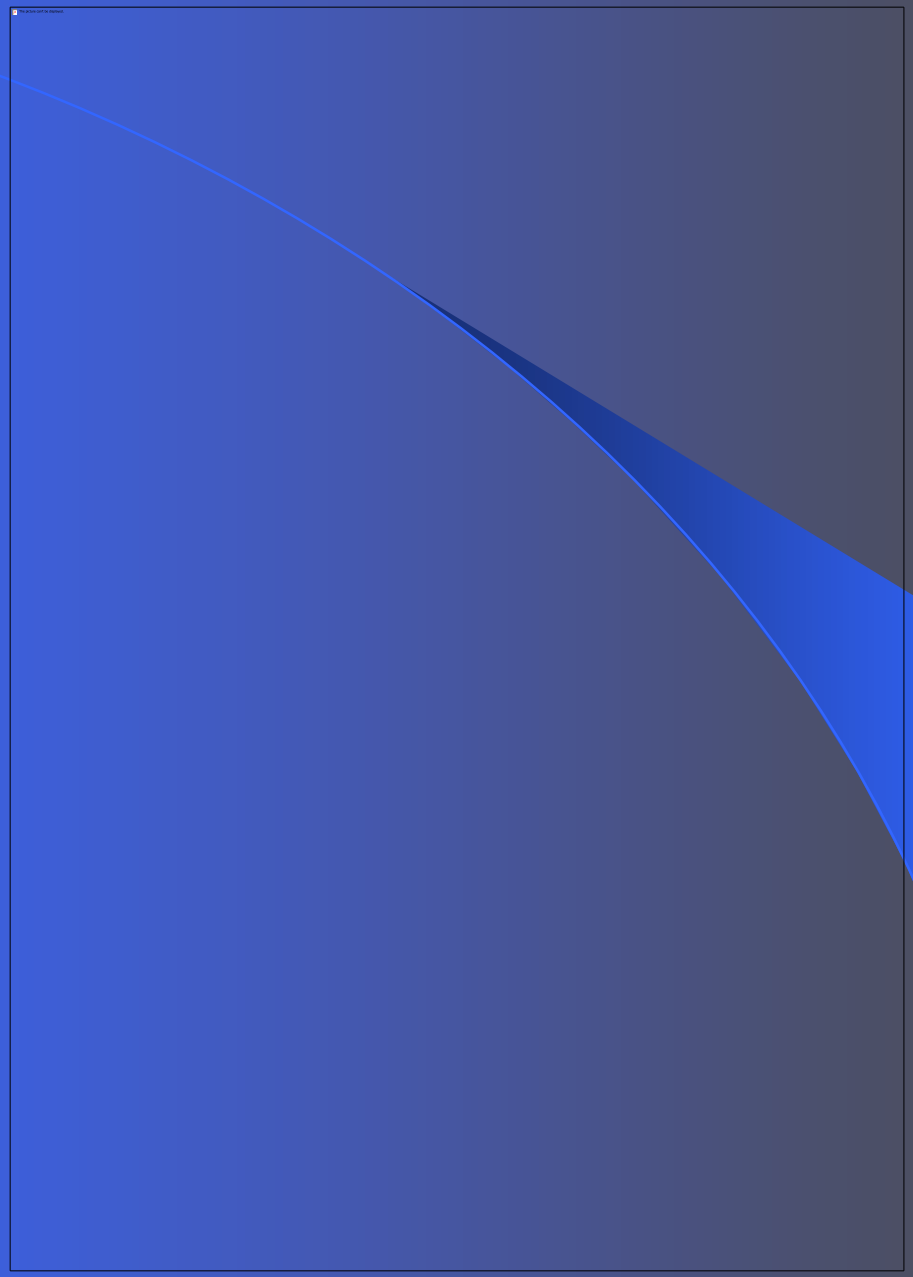
The SELECT Statement

Used for queries on single or multiple tables

Clauses of the SELECT statement:

- SELECT
  - List the columns (and expressions) that should be returned from the query
- FROM
  - Indicate the table(s) or view(s) from which data will be obtained
- WHERE
  - Indicate the conditions under which a row will be included in the result
- GROUP BY
  - Indicate categorization of results
- HAVING
  - Indicate the conditions under which a category (group) will be included
- ORDER BY
  - Sorts the result according to specified criteria

Figure 7-8: SQL statement processing order (adapted from van der Lans, p.100)



SELECT Example

Find products with standard price less than $275

```
SELECT PRODUCT_NAME, STANDARD_PRICE
FROM PRODUCT_V
WHERE STANDARD_PRICE < 275
```

Table 7-3: Comparison Operators in SQL

Table 7-3 Comparison Operators in SQL

Operator	*Meaning*
=	Equal to
>	Greater than
> =	Greater than or equal to
<	Less than
< =	Less than or equal to
<>	Not equal to
! =	Not equal to

SELECT Example with ALIAS

Alias is an alternative column or table name

```
SELECT CUST.CUSTOMER AS NAME,
  CUST.CUSTOMER_ADDRESS
FROM CUSTOMER_V CUST
WHERE NAME = 'Home Furnishings';
```

SELECT Example Using a Function

Using the COUNT ***aggregate function*** to find totals

```
SELECT COUNT(*) FROM ORDER_LINE_V
WHERE ORDER_ID = 1004;
```

Note: with aggregate functions you can't have single-valued columns included in the SELECT clause

SELECT Example – Boolean Operators

AND, OR, and NOT Operators for customizing conditions in WHERE clause

```
SELECT PRODUCT_DESCRIPTION,
PRODUCT_FINISH, STANDARD_PRICE
FROM PRODUCT_V
WHERE (PRODUCT_DESCRIPTION LIKE '%Desk'
OR PRODUCT_DESCRIPTION LIKE '%Table')
AND UNIT_PRICE > 300;
```

Note: the LIKE operator allows you to compare strings using wildcards. For example, the % wildcard in '%Desk' indicates that all strings that have any number of characters preceding the word "Desk" will be allowed

SELECT Example – Sorting Results with the ORDER BY Clause

Sort the results first by STATE, and within a state by CUSTOMER_NAME

```
SELECT CUSTOMER_NAME, CITY, STATE
FROM CUSTOMER_V
WHERE STATE IN ('FL', 'TX', 'CA', 'HI')
ORDER BY STATE, CUSTOMER_NAME;
```

Note: the IN operator in this example allows you to include rows whose STATE value is either FL, TX, CA, or HI. It is more efficient than separate OR conditions

SELECT Example –
Categorizing Results Using the GROUP BY Clause

For use with aggregate functions

- ***Scalar aggregate***: single value returned from SQL query with aggregate function
- ***Vector aggregate***: multiple values returned from SQL query with aggregate function (via GROUP BY)

```
SELECT STATE, COUNT(STATE)
FROM CUSTOMER_V
GROUP BY STATE;
```

Note: you can use single-value fields with aggregate functions if they are included in the GROUP BY clause

SELECT Example – Qualifying Results by Categories Using the HAVING Clause

For use with GROUP BY

```
SELECT STATE, COUNT(STATE)
FROM CUSTOMER_V
GROUP BY STATE
HAVING COUNT(STATE) > 1;
```

Like a WHERE clause, but it operates on groups (categories), not on individual rows. Here, only those groups with total numbers greater than 1 will be included in final result