10

# Using DDL Statements to Create and Manage Tables

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# Objectives

After completing this lesson, you should be able to do the following:

- Categorize the main database objects
- Review the table structure
- List the data types that are available for columns
- Create a simple table
- Explain how constraints are created at the time of table creation
- Describe how schema objects work

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**Objectives**

In this lesson, you are introduced to the data definition language (DDL) statements. You are taught the basics of how to create simple tables, alter them, and remove them. The data types available in DDL are shown and schema concepts are introduced. Constraints are discussed in this lesson. Exception messages that are generated from violating constraints during DML operations are shown and explained.

# Lesson Agenda

- Database objects
  - Naming rules
- `CREATE TABLE` statement:
  - Access another user's tables
  - `DEFAULT` option
- Data types
- Overview of constraints: `NOT NULL`, `PRIMARY KEY`, `FOREIGN KEY`, `CHECK` constraints
- Creating a table using a subquery
- `ALTER TABLE`
  - Read-only tables
- `DROP TABLE` statement

# Database Objects

| Object | Description |
|---|---|
| Table | Basic unit of storage; composed of rows |
| View | Logically represents subsets of data from one or more tables |
| Sequence | Generates numeric values |
| Index | Improves the performance of some queries |
| Synonym | Gives alternative name to an object |

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## Database Objects

The Oracle database can contain multiple data structures. Each structure should be outlined in the database design so that it can be created during the build stage of database development.

- **Table:** Stores data
- **View:** Subset of data from one or more tables
- **Sequence:** Generates numeric values
- **Index:** Improves the performance of some queries
- **Synonym:** Gives alternative name to an object

**Oracle Table Structures**

- Tables can be created at any time, even when users are using the database.
- You do not need to specify the size of a table. The size is ultimately defined by the amount of space allocated to the database as a whole. It is important, however, to estimate how much space a table will use over time.
- Table structure can be modified online.

**Note:** More database objects are available, but are not covered in this course.

## Naming Rules

Table names and column names:

- Must begin with a letter
- Must be 1–30 characters long
- Must contain only A–Z, a–z, 0–9, _, $, and #
- Must not duplicate the name of another object owned by the same user
- Must not be an Oracle server–reserved word

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### Naming Rules

You name database tables and columns according to the standard rules for naming any Oracle database object:

- Table names and column names must begin with a letter and be 1–30 characters long.
- Names must contain only the characters A–Z, a–z, 0–9, _ (underscore), $, and # (legal characters, but their use is discouraged).
- Names must not duplicate the name of another object owned by the same Oracle server user.
- Names must not be an Oracle server–reserved word.
  - You may also use quoted identifiers to represent the name of an object. A quoted identifier begins and ends with double quotation marks (“). If you name a schema object using a quoted identifier, then you must use the double quotation marks whenever you refer to that object. Quoted identifiers can be reserved words, although this is not recommended.

#### Naming Guidelines

Use descriptive names for tables and other database objects.

**Note:** Names are not case-sensitive. For example, `EMPLOYEES` is treated to be the same name as `eMPloyees` or `eMpLOYEES`. However, quoted identifiers are case-sensitive.

For more information, see the section on *Schema Object Names and Qualifiers* in the *Oracle Database SQL Language Reference 11g, Release 1 (11.1)*.

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## CREATE TABLE Statement

- You must have:
  - CREATE TABLE privilege
  - A storage area

```
CREATE TABLE [schema.]table
          (column datatype [DEFAULT expr][, ...]);
```

- You specify:
  - Table name
  - Column name, column data type, and column size

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### CREATE TABLE Statement

You create tables to store data by executing the SQL CREATE TABLE statement. This statement is one of the DDL statements that are a subset of the SQL statements used to create, modify, or remove Oracle database structures. These statements have an immediate effect on the database and they also record information in the data dictionary.

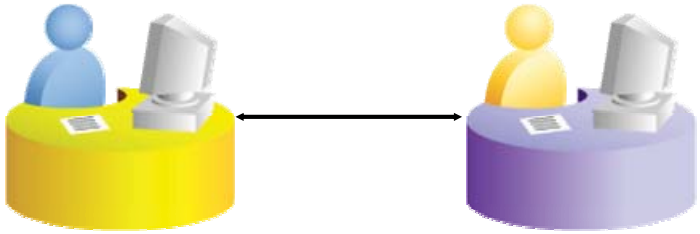
To create a table, a user must have the CREATE TABLE privilege and a storage area in which to create objects. The database administrator (DBA) uses data control language (DCL) statements to grant privileges to users.

In the syntax:

| | |
|---|---|
| *schema* | Is the same as the owner's name |
| *table* | Is the name of the table |
| DEFAULT *expr* | Specifies a default value if a value is omitted in the INSERT statement |
| *column* | Is the name of the column |
| *datatype* | Is the column's data type and length |

# Referencing Another User's Tables

- Tables belonging to other users are not in the user's schema.
- You should use the owner's name as a prefix to those tables.



**USERA**

```
SELECT *
FROM userB.employees;
```

**USERB**

```
SELECT *
FROM userA.employees;
```

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## Referencing Another User's Tables

A schema is a collection of logical structures of data or *schema objects*. A schema is owned by a database user and has the same name as that user. Each user owns a single schema.

Schema objects can be created and manipulated with SQL and include tables, views, synonyms, sequences, stored procedures, indexes, clusters, and database links.

If a table does not belong to the user, the owner's name must be prefixed to the table. For example, if there are schemas named `USERA` and `USERB`, and both have an `EMPLOYEES` table, then if `USERA` wants to access the `EMPLOYEES` table that belongs to `USERB`, `USERA` must prefix the table name with the schema name:

```
SELECT *
FROM   userb.employees;
```

If `USERB` wants to access the `EMPLOYEES` table that is owned by `USERA`, `USERB` must prefix the table name with the schema name:

```
SELECT *
FROM   usera.employees;
```

## DEFAULT Option

- Specify a default value for a column during an insert.

```
... hire_date DATE DEFAULT SYSDATE, ...
```

- Literal values, expressions, or SQL functions are legal values.
- Another column's name or a pseudocolumn are illegal values.
- The default data type must match the column data type.

```
CREATE TABLE hire_dates
        (id          NUMBER(8),
        hire_date DATE DEFAULT SYSDATE);
CREATE TABLE succeeded.
```

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### DEFAULT Option

When you define a table, you can specify that a column should be given a default value by using the DEFAULT option. This option prevents null values from entering the columns when a row is inserted without a value for the column. The default value can be a literal, an expression, or a SQL function (such as SYSDATE or USER), but the value cannot be the name of another column or a pseudocolumn (such as NEXTVAL or CURRVAL). The default expression must match the data type of the column.

Consider the following examples:

```
INSERT INTO hire_dates values(45, NULL);
```

The above statement will insert the null value rather than the default value.

```
INSERT INTO hire_dates(id) values(35);
```

The above statement will insert SYSDATE for the HIRE_DATE column.

**Note:** In SQL Developer, click the Run Script icon or press [F5] to run the DDL statements. The feedback messages will be shown on the Script Output tabbed page.

# Creating Tables

- Create the table:

```
CREATE TABLE dept
        (deptno      NUMBER(2),
         dname       VARCHAR2(14),
         loc         VARCHAR2(13),
         create_date DATE DEFAULT SYSDATE);
```

```
CREATE TABLE succeeded.
```

- Confirm table creation:

```
DESCRIBE dept
```

```
DESCRIBE dept
Name                          Null     Type
----------------------------- -------- ------------
DEPTNO                                 NUMBER(2)
DNAME                                  VARCHAR2(14)
LOC                                    VARCHAR2(13)
CREATE_DATE                            DATE
```

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## Creating Tables

The example in the slide creates the DEPT table with four columns: DEPTNO, DNAME, LOC, and CREATE_DATE. The CREATE_DATE column has a default value. If a value is not provided for an INSERT statement, the system date is automatically inserted.

To confirm that the table was created, run the DESCRIBE command.

Because creating a table is a DDL statement, an automatic commit takes place when this statement is executed.

# Lesson Agenda

- Database objects
  - Naming rules
- `CREATE TABLE` statement:
  - Access another user's tables
  - `DEFAULT` option
- Data types
- Overview of constraints: `NOT NULL`, `PRIMARY KEY`, `FOREIGN KEY`, `CHECK` constraints
- Creating a table using a subquery
- `ALTER TABLE`
  - Read-only tables
- `DROP TABLE` statement

# Data Types

| Data Type | Description |
|---|---|
| VARCHAR2(*size*) | Variable-length character data |
| CHAR(*size*) | Fixed-length character data |
| NUMBER(*p*,*s*) | Variable-length numeric data |
| DATE | Date and time values |
| LONG | Variable-length character data (up to 2 GB) |
| CLOB | Character data (up to 4 GB) |
| RAW and LONG RAW | Raw binary data |
| BLOB | Binary data (up to 4 GB) |
| BFILE | Binary data stored in an external file (up to 4 GB) |
| ROWID | A base-64 number system representing the unique address of a row in its table |

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## Data Types

When you identify a column for a table, you need to provide a data type for the column. There are several data types available:

| Data Type | Description |
|---|---|
| VARCHAR2(*size*) | Variable-length character data (A maximum *size* must be specified: minimum *size* is 1; maximum *size* is 4,000.) |
| CHAR [(*size*)] | Fixed-length character data of length *size* bytes (Default and minimum *size* is 1; maximum *size* is 2,000.) |
| NUMBER [(*p*,*s*)] | Number having precision *p* and scale *s* (Precision is the total number of decimal digits and scale is the number of digits to the right of the decimal point; precision can range from 1 to 38, and scale can range from –84 to 127.) |
| DATE | Date and time values to the nearest second between January 1, 4712 B.C., and December 31, 9999 A.D. |
| LONG | Variable-length character data (up to 2 GB) |
| CLOB | Character data (up to 4 GB) |

## Data Types (continued)

| Data Type | Description |
|---|---|
| RAW(*size*) | Raw binary data of length *size* (A maximum *size* must be specified: maximum *size* is 2,000.) |
| LONG RAW | Raw binary data of variable length (up to 2 GB) |
| BLOB | Binary data (up to 4 GB) |
| BFILE | Binary data stored in an external file (up to 4 GB) |
| ROWID | A base-64 number system representing the unique address of a row in its table |

**Guidelines**

- A LONG column is not copied when a table is created using a subquery.
- A LONG column cannot be included in a GROUP BY or an ORDER BY clause.
- Only one LONG column can be used per table.
- No constraints can be defined on a LONG column.
- You might want to use a CLOB column rather than a LONG column.

# Datetime Data Types

You can use several datetime data types:

| Data Type | Description |
|---|---|
| TIMESTAMP | Date with fractional seconds |
| INTERVAL YEAR TO MONTH | Stored as an interval of years and months |
| INTERVAL DAY TO SECOND | Stored as an interval of days, hours, minutes, and seconds |

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## Datetime Data Types

| Data Type | Description |
|---|---|
| TIMESTAMP | Enables storage of time as a date with fractional seconds. It stores the year, month, day, hour, minute, and the second value of the DATE data type as well as the fractional seconds value<br>There are several variations of this data type such as WITH TIMEZONE, WITH LOCALTIMEZONE. |
| INTERVAL YEAR TO MONTH | Enables storage of time as an interval of years and months. Used to represent the difference between two datetime values in which the only significant portions are the year and month |
| INTERVAL DAY TO SECOND | Enables storage of time as an interval of days, hours, minutes, and seconds. Used to represent the precise difference between two datetime values |

**Note:** These datetime data types are available with Oracle9*i* and later releases. The datetime data types are discussed in detail in the lesson titled "Managing Data in Different Time Zones" in the *Oracle Database 11g: SQL Fundamentals II* course.

Also, for more information about the datetime data types, see the topics *TIMESTAMP Datatype*, *INTERVAL YEAR TO MONTH Datatype*, and *INTERVAL DAY TO SECOND Datatype* in *Oracle Database SQL Language Reference 11g, Release 1 (11.1)*.

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## Including Constraints

- Constraints enforce rules at the table level.
- Constraints prevent the deletion of a table if there are dependencies.
- The following constraint types are valid:
  - NOT NULL
  - UNIQUE
  - PRIMARY KEY
  - FOREIGN KEY
  - CHECK

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### Constraints

The Oracle server uses constraints to prevent invalid data entry into tables.

You can use constraints to do the following:

- Enforce rules on the data in a table whenever a row is inserted, updated, or deleted from that table. The constraint must be satisfied for the operation to succeed.
- Prevent the deletion of a table if there are dependencies from other tables.
- Provide rules for Oracle tools, such as Oracle Developer.

**Data Integrity Constraints**

| Constraint | Description |
|---|---|
| NOT NULL | Specifies that the column cannot contain a null value |
| UNIQUE | Specifies a column or combination of columns whose values must be unique for all rows in the table |
| PRIMARY KEY | Uniquely identifies each row of the table |
| FOREIGN KEY | Establishes and enforces a referential integrity between the column and a column of the referenced table such that values in one table match values in another table. |
| CHECK | Specifies a condition that must be true |

## Constraint Guidelines

- You can name a constraint, or the Oracle server generates a name by using the `SYS_Cn` format.
- Create a constraint at either of the following times:
  - At the same time as the creation of the table
  - After the creation of the table
- Define a constraint at the column or table level.
- View a constraint in the data dictionary.

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### Constraint Guidelines

All constraints are stored in the data dictionary. Constraints are easy to reference if you give them a meaningful name. Constraint names must follow the standard object-naming rules, except that the name cannot be the same as another object owned by the same user. If you do not name your constraint, the Oracle server generates a name with the format `SYS_Cn`, where *n* is an integer so that the constraint name is unique.

Constraints can be defined at the time of table creation or after the creation of the table. You can define a constraint at the column or table level. Functionally, a table-level constraint is the same as a column-level constraint.

For more information, see the section on "Constraints" in *Oracle Database SQL Language Reference 11g, Release 1 (11.1)*.

# Defining Constraints

- Syntax:

```
CREATE TABLE [schema.]table
      (column datatype [DEFAULT expr]
      [column_constraint],
      ...
      [table_constraint][,...]);
```

- Column-level constraint syntax:

```
column [CONSTRAINT constraint_name] constraint_type,
```

- Table-level constraint syntax:

```
column,...
  [CONSTRAINT constraint_name] constraint_type
  (column, ...),
```

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## Defining Constraints

The slide gives the syntax for defining constraints when creating a table. You can create constraints at either the column level or table level. Constraints defined at the column level are included when the column is defined. Table-level constraints are defined at the end of the table definition and must refer to the column or columns on which the constraint pertains in a set of parentheses. It is mainly the syntax that differentiates the two; otherwise, functionally, a column-level constraint is the same as a table-level constraint.

`NOT NULL` constraints must be defined at the column level.

Constraints that apply to more than one column must be defined at the table level.

In the syntax:

| | |
|---|---|
| `schema` | Is the same as the owner's name |
| `table` | Is the name of the table |
| `DEFAULT expr` | Specifies a default value to be used if a value is omitted in the `INSERT` statement |
| `column` | Is the name of the column |
| `datatype` | Is the column's data type and length |
| `column_constraint` | Is an integrity constraint as part of the column definition |
| `table_constraint` | Is an integrity constraint as part of the table definition |

# Defining Constraints

- Example of a column-level constraint:

```
CREATE TABLE employees(
  employee_id  NUMBER(6)
    CONSTRAINT emp_emp_id_pk PRIMARY KEY,
  first_name   VARCHAR2(20),
  ...);
```

1

- Example of a table-level constraint:

```
CREATE TABLE employees(
  employee_id  NUMBER(6),
  first_name   VARCHAR2(20),
  ...
  job_id       VARCHAR2(10) NOT NULL,
  CONSTRAINT emp_emp_id_pk
    PRIMARY KEY (EMPLOYEE_ID));
```

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## Defining Constraints (continued)

Constraints are usually created at the same time as the table. Constraints can be added to a table after its creation and also be temporarily disabled.

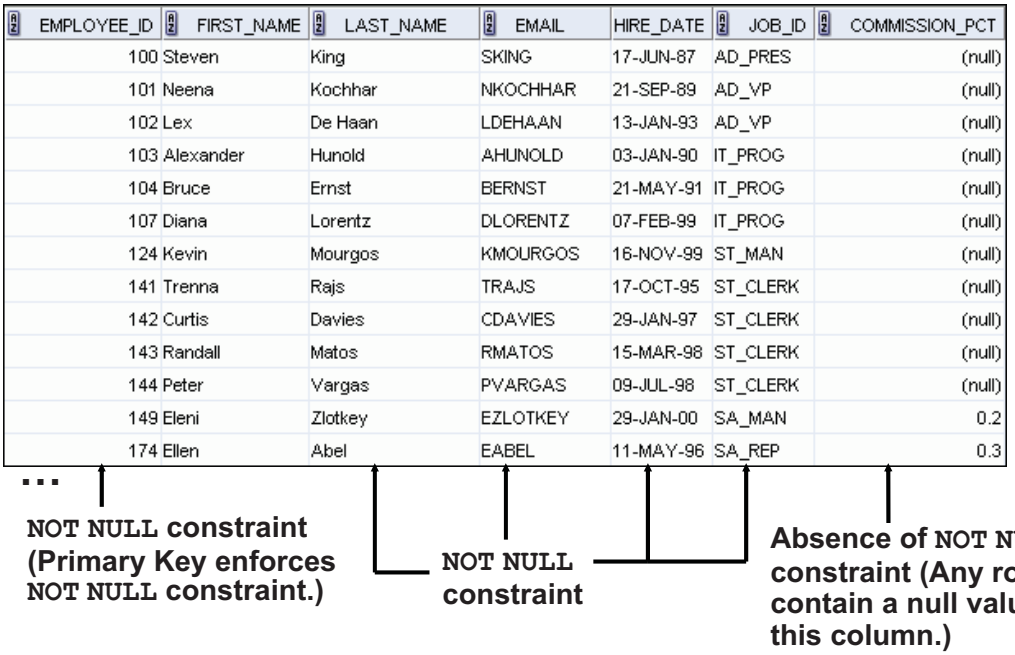
Both examples in the slide create a primary key constraint on the `EMPLOYEE_ID` column of the `EMPLOYEES` table.

1. The first example uses the column-level syntax to define the constraint.
2. The second example uses the table-level syntax to define the constraint.

More details about the primary key constraint are provided later in this lesson.

## NOT NULL Constraint

Ensures that null values are not permitted for the column:



| EMPLOYEE_ID | FIRST_NAME | LAST_NAME | EMAIL | HIRE_DATE | JOB_ID | COMMISSION_PCT |
|---|---|---|---|---|---|---|
| 100 | Steven | King | SKING | 17-JUN-87 | AD_PRES | (null) |
| 101 | Neena | Kochhar | NKOCHHAR | 21-SEP-89 | AD_VP | (null) |
| 102 | Lex | De Haan | LDEHAAN | 13-JAN-93 | AD_VP | (null) |
| 103 | Alexander | Hunold | AHUNOLD | 03-JAN-90 | IT_PROG | (null) |
| 104 | Bruce | Ernst | BERNST | 21-MAY-91 | IT_PROG | (null) |
| 107 | Diana | Lorentz | DLORENTZ | 07-FEB-99 | IT_PROG | (null) |
| 124 | Kevin | Mourgos | KMOURGOS | 16-NOV-99 | ST_MAN | (null) |
| 141 | Trenna | Rajs | TRAJS | 17-OCT-95 | ST_CLERK | (null) |
| 142 | Curtis | Davies | CDAVIES | 29-JAN-97 | ST_CLERK | (null) |
| 143 | Randall | Matos | RMATOS | 15-MAR-98 | ST_CLERK | (null) |
| 144 | Peter | Vargas | PVARGAS | 09-JUL-98 | ST_CLERK | (null) |
| 149 | Eleni | Zlotkey | EZLOTKEY | 29-JAN-00 | SA_MAN | 0.2 |
| 174 | Ellen | Abel | EABEL | 11-MAY-96 | SA_REP | 0.3 |

...

**NOT NULL constraint (Primary Key enforces NOT NULL constraint.)**

**NOT NULL constraint**

**Absence of NOT NULL constraint (Any row can contain a null value for this column.)**

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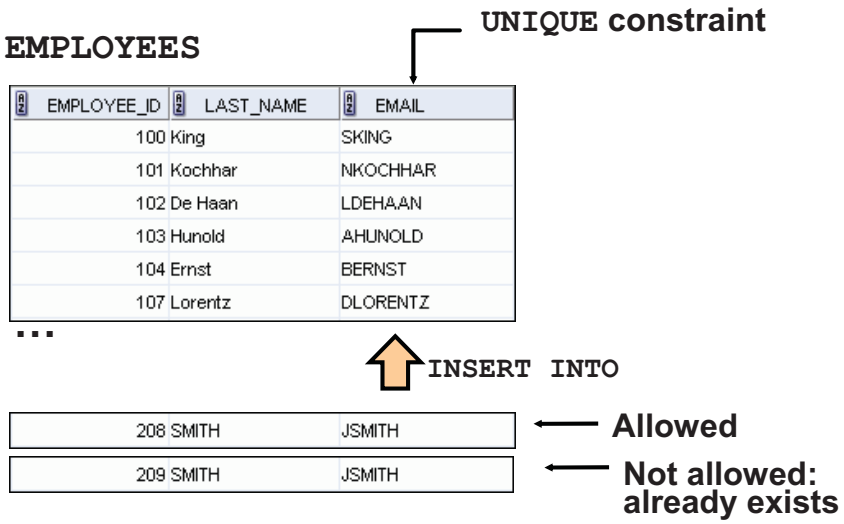
### NOT NULL Constraint

The NOT NULL constraint ensures that the column contains no null values. Columns without the NOT NULL constraint can contain null values by default. NOT NULL constraints must be defined at the column level. In the EMPLOYEES table, the EMPLOYEE_ID column inherits a NOT NULL constraint as it is defined as a primary key. Otherwise, the LAST_NAME, EMAIL, HIRE_DATE, and JOB_ID columns have the NOT NULL constraint enforced on them.

**Note:** Primary key constraint is discussed in detail later in this lesson.

# UNIQUE Constraint







## UNIQUE Constraint

A UNIQUE key integrity constraint requires that every value in a column or a set of columns (key) be unique—that is, no two rows of a table can have duplicate values in a specified column or a set of columns. The column (or set of columns) included in the definition of the UNIQUE key constraint is called the *unique key*. If the UNIQUE constraint comprises more than one column, that group of columns is called a *composite unique key*.

UNIQUE constraints enable the input of nulls unless you also define NOT NULL constraints for the same columns. In fact, any number of rows can include nulls for columns without the NOT NULL constraints because nulls are not considered equal to anything. A null in a column (or in all columns of a composite UNIQUE key) always satisfies a UNIQUE constraint.

**Note:** Because of the search mechanism for the UNIQUE constraints on more than one column, you cannot have identical values in the non-null columns of a partially null composite UNIQUE key constraint.

## UNIQUE Constraint

Defined at either the table level or the column level:

```
CREATE TABLE employees(
    employee_id      NUMBER(6),
    last_name        VARCHAR2(25) NOT NULL,
    email            VARCHAR2(25),
    salary           NUMBER(8,2),
    commission_pct   NUMBER(2,2),
    hire_date        DATE NOT NULL,
...
    CONSTRAINT emp_email_uk UNIQUE(email));
```

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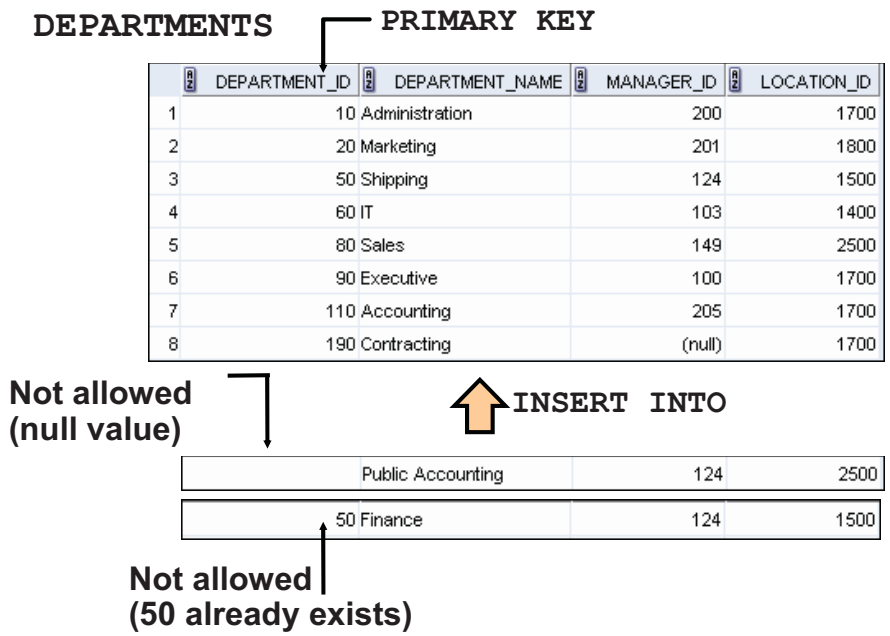
### UNIQUE Constraint (continued)

UNIQUE constraints can be defined at the column level or table level. You define the constraint at the table level when you want to create a composite unique key. A composite key is defined when there is not a single attribute that can uniquely identify a row. In that case, you can have a unique key that is composed of two or more columns, the combined value of which is always unique and can identify rows.

The example in the slide applies the UNIQUE constraint to the EMAIL column of the EMPLOYEES table. The name of the constraint is EMP_EMAIL_UK.

**Note:** The Oracle server enforces the UNIQUE constraint by implicitly creating a unique index on the unique key column or columns.

## PRIMARY KEY Constraint

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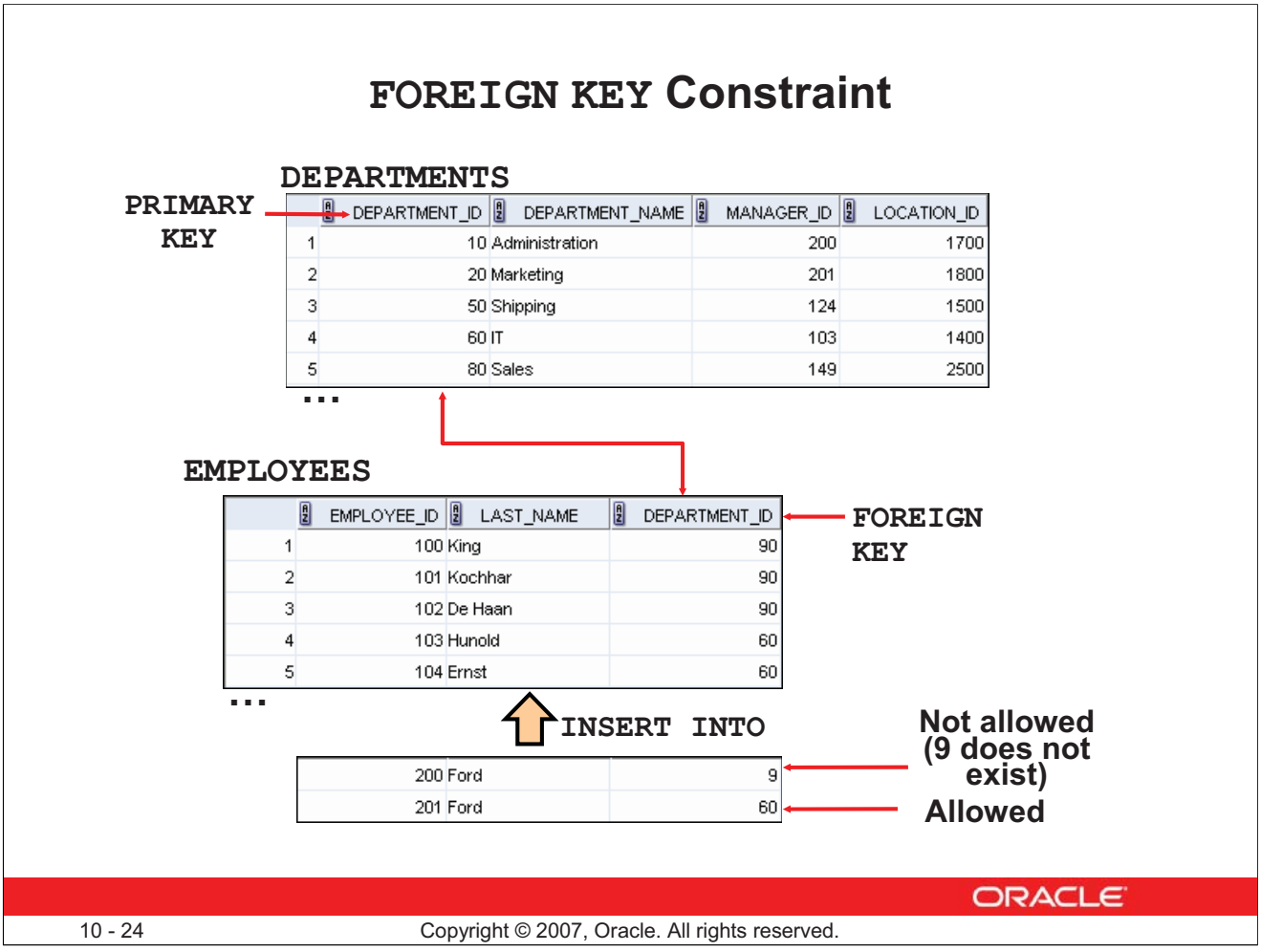
### PRIMARY KEY Constraint

A PRIMARY KEY constraint creates a primary key for the table. Only one primary key can be created for each table. The PRIMARY KEY constraint is a column or a set of columns that uniquely identifies each row in a table. This constraint enforces the uniqueness of the column or column combination and ensures that no column that is part of the primary key can contain a null value.

**Note:** Because uniqueness is part of the primary key constraint definition, the Oracle server enforces the uniqueness by implicitly creating a unique index on the primary key column or columns.




## FOREIGN KEY Constraint

The FOREIGN KEY (or referential integrity) constraint designates a column or a combination of columns as a foreign key and establishes a relationship with a primary key or a unique key in the same table or a different table.

In the example in the slide, DEPARTMENT_ID has been defined as the foreign key in the EMPLOYEES table (dependent or child table); it references the DEPARTMENT_ID column of the DEPARTMENTS table (the referenced or parent table).

**Guidelines**

- A foreign key value must match an existing value in the parent table or be NULL.
- Foreign keys are based on data values and are purely logical, rather than physical, pointers.

## FOREIGN KEY Constraint

Defined at either the table level or the column level:

```
CREATE TABLE employees(
    employee_id      NUMBER(6),
    last_name        VARCHAR2(25) NOT NULL,
    email            VARCHAR2(25),
    salary           NUMBER(8,2),
    commission_pct   NUMBER(2,2),
    hire_date        DATE NOT NULL,
...
    department_id    NUMBER(4),
    CONSTRAINT emp_dept_fk FOREIGN KEY (department_id)
      REFERENCES departments(department_id),
    CONSTRAINT emp_email_uk UNIQUE(email));
```

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### FOREIGN KEY Constraint (continued)

FOREIGN KEY constraints can be defined at the column or table constraint level. A composite foreign key must be created by using the table-level definition.

The example in the slide defines a FOREIGN KEY constraint on the DEPARTMENT_ID column of the EMPLOYEES table, using table-level syntax. The name of the constraint is EMP_DEPT_FK.

The foreign key can also be defined at the column level, provided that the constraint is based on a single column. The syntax differs in that the keywords FOREIGN KEY do not appear. For example:

```
CREATE TABLE employees
(...
department_id NUMBER(4) CONSTRAINT emp_deptid_fk
REFERENCES departments(department_id),
...
)
```

## FOREIGN KEY Constraint: Keywords

- FOREIGN KEY: Defines the column in the child table at the table-constraint level
- REFERENCES: Identifies the table and column in the parent table
- ON DELETE CASCADE: Deletes the dependent rows in the child table when a row in the parent table is deleted
- ON DELETE SET NULL: Converts dependent foreign key values to null

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### FOREIGN KEY Constraint: Keywords

The foreign key is defined in the child table and the table containing the referenced column is the parent table. The foreign key is defined using a combination of the following keywords:

- FOREIGN KEY is used to define the column in the child table at the table-constraint level.
- REFERENCES identifies the table and the column in the parent table.
- ON DELETE CASCADE indicates that when a row in the parent table is deleted, the dependent rows in the child table are also deleted.
- ON DELETE SET NULL indicates that when a row in the parent table is deleted, the foreign key values are set to null.

The default behavior is called the *restrict rule*, which disallows the update or deletion of referenced data.

Without the ON DELETE CASCADE or the ON DELETE SET NULL options, the row in the parent table cannot be deleted if it is referenced in the child table.

## CHECK Constraint

- Defines a condition that each row must satisfy
- The following expressions are not allowed:
  - References to CURRVAL, NEXTVAL, LEVEL, and ROWNUM pseudocolumns
  - Calls to SYSDATE, UID, USER, and USERENV functions
  - Queries that refer to other values in other rows

```
..., salary   NUMBER(2)
     CONSTRAINT emp_salary_min
            CHECK (salary > 0),...
```

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### CHECK Constraint

The CHECK constraint defines a condition that each row must satisfy. The condition can use the same constructs as the query conditions, with the following exceptions:

- References to the CURRVAL, NEXTVAL, LEVEL, and ROWNUM pseudocolumns
- Calls to SYSDATE, UID, USER, and USERENV functions
- Queries that refer to other values in other rows

A single column can have multiple CHECK constraints that refer to the column in its definition. There is no limit to the number of CHECK constraints that you can define on a column.

CHECK constraints can be defined at the column level or table level.

```
CREATE TABLE employees
   (...
    salary NUMBER(8,2) CONSTRAINT emp_salary_min
                       CHECK (salary > 0),
   ...
```

## CREATE TABLE: Example

```
CREATE TABLE employees
    ( employee_id    NUMBER(6)
        CONSTRAINT     emp_employee_id   PRIMARY KEY
    , first_name     VARCHAR2(20)
    , last_name      VARCHAR2(25)
        CONSTRAINT     emp_last_name_nn  NOT NULL
    , email          VARCHAR2(25)
        CONSTRAINT     emp_email_nn      NOT NULL
        CONSTRAINT     emp_email_uk      UNIQUE
    , phone_number   VARCHAR2(20)
    , hire_date      DATE
        CONSTRAINT     emp_hire_date_nn  NOT NULL
    , job_id         VARCHAR2(10)
        CONSTRAINT     emp_job_nn        NOT NULL
    , salary         NUMBER(8,2)
        CONSTRAINT     emp_salary_ck     CHECK (salary>0)
    , commission_pct NUMBER(2,2)
    , manager_id     NUMBER(6)
         CONSTRAINT emp_manager_fk REFERENCES
          employees (employee_id)
    , department_id  NUMBER(4)
        CONSTRAINT     emp_dept_fk       REFERENCES
           departments (department_id));
```

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### CREATE TABLE: Example

The example in the slide shows the statement that is used to create the EMPLOYEES table in the HR schema.

# Violating Constraints

```
UPDATE employees
SET    department_id = 55
WHERE  department_id = 110;
```

```
Error starting at line 1 in command:
UPDATE employees
SET    department_id = 55
WHERE  department_id = 110
Error report:
SQL Error: ORA-02291: integrity constraint (ORA16.EMP_DEPT_FK) violated - parent key not found
02291. 00000 - "integrity constraint (%s.%s) violated - parent key not found"
*Cause:    A foreign key value has no matching primary key value.
*Action:   Delete the foreign key or add a matching primary key.
```

Department 55 does not exist.

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## Violating Constraints

When you have constraints in place on columns, an error is returned if you try to violate the constraint rule. For example, if you try to update a record with a value that is tied to an integrity constraint, an error is returned.

In the example in the slide, department 55 does not exist in the parent table, `DEPARTMENTS`, and so you receive the "parent key not found" violation `ORA-02291`.

## Violating Constraints

You cannot delete a row that contains a primary key that is used as a foreign key in another table.

```
DELETE FROM departments
WHERE department_id = 60;
```

```
Error starting at line 1 in command:
DELETE FROM departments
WHERE       department_id = 60
Error report:
SQL Error: ORA-02292: integrity constraint (ORA16.EMP_DEPT_FK) violated - child record found
02292. 00000 - "integrity constraint (%s.%s) violated - child record found"
*Cause:    attempted to delete a parent key value that had a foreign
           dependency.
*Action:   delete dependencies first then parent or disable constraint.
```

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### Violating Constraints (continued)

If you attempt to delete a record with a value that is tied to an integrity constraint, an error is returned.

The example in the slide tries to delete department 60 from the `DEPARTMENTS` table, but it results in an error because that department number is used as a foreign key in the `EMPLOYEES` table. If the parent record that you attempt to delete has child records, then you receive the "child record found" violation `ORA-02292`.

The following statement works because there are no employees in department 70:

```
DELETE FROM  departments
WHERE department_id = 70;
```

```
1 rows deleted
```

# Lesson Agenda

- Database objects
  - Naming rules
- `CREATE TABLE` statement:
  - Access another user's tables
  - `DEFAULT` option
- Data types
- Overview of constraints: `NOT NULL`, `PRIMARY KEY`, `FOREIGN KEY`, `CHECK` constraints
- Creating a table using a subquery
- `ALTER TABLE`
  - Read-only tables
- `DROP TABLE` statement

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## Creating a Table Using a Subquery

- Create a table and insert rows by combining the CREATE TABLE statement and the AS *subquery* option.

```
CREATE TABLE table
            [(column, column...)]
AS subquery;
```

- Match the number of specified columns to the number of subquery columns.
- Define columns with column names and default values.

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### Creating a Table Using a Subquery

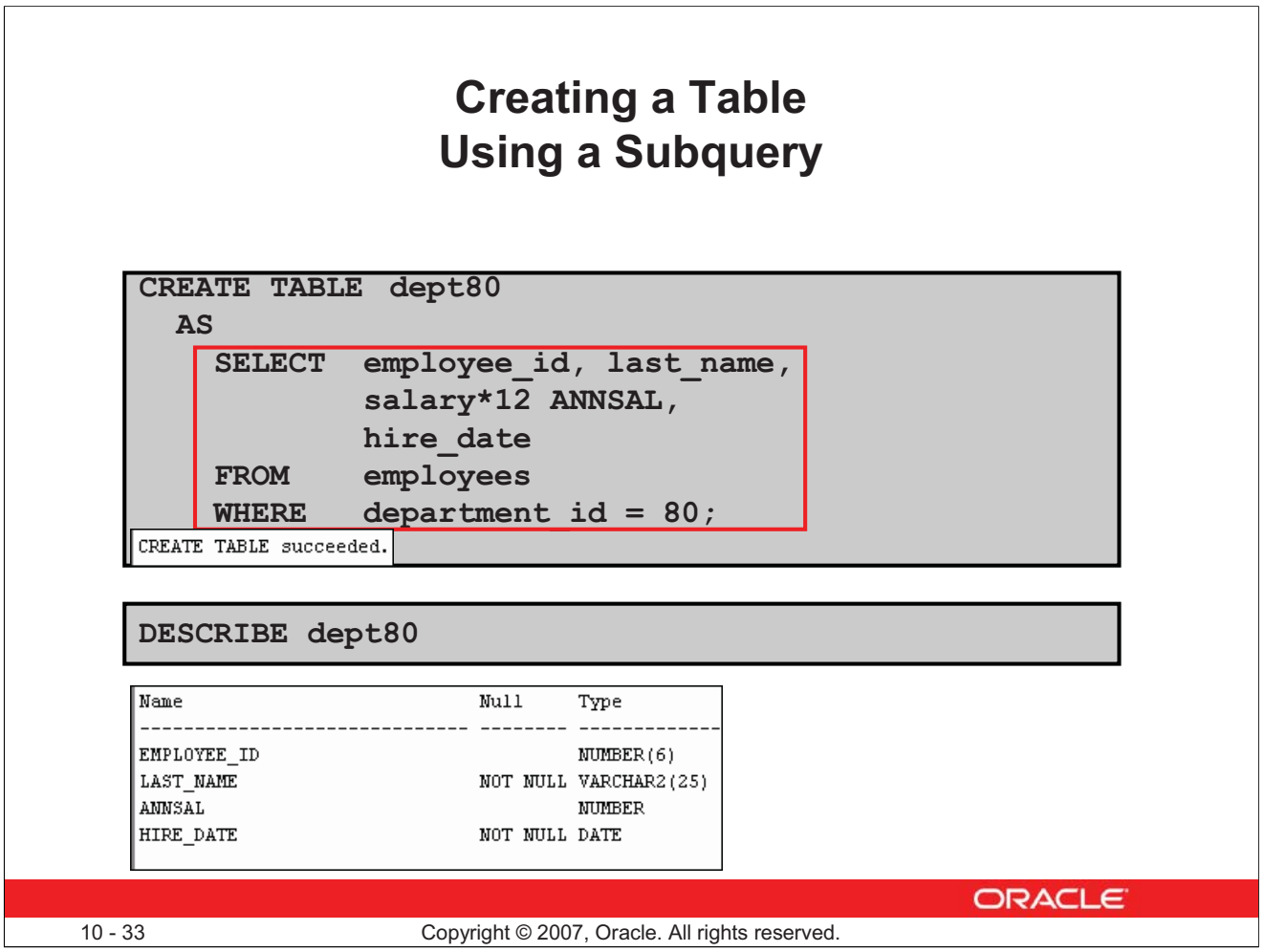
A second method for creating a table is to apply the AS *subquery* clause, which both creates the table and inserts rows returned from the subquery.

In the syntax:

| | |
|---|---|
| *table* | is the name of the table |
| *column* | is the name of the column, default value, and integrity constraint |
| *subquery* | is the SELECT statement that defines the set of rows to be inserted into the new table |

**Guidelines**

- The table is created with the specified column names, and the rows retrieved by the SELECT statement are inserted into the table.
- The column definition can contain only the column name and default value.
- If column specifications are given, the number of columns must equal the number of columns in the subquery SELECT list.
- If no column specifications are given, the column names of the table are the same as the column names in the subquery.
- The column data type definitions and the NOT NULL constraint are passed to the new table. Note that only the explicit NOT NULL constraint will be inherited. The PRIMARY KEY column will not pass the NOT NULL feature to the new column. Any other constraint rules are not passed to the new table. However, you can add constraints in the column definition.




## Creating a Table Using a Subquery (continued)

The example in the slide creates a table named `DEPT80`, which contains details of all the employees working in department 80. Notice that the data for the `DEPT80` table comes from the `EMPLOYEES` table.

You can verify the existence of a database table and check the column definitions by using the `DESCRIBE` command.

However, be sure to provide a column alias when selecting an expression. The expression `SALARY*12` is given the alias `ANNSAL`. Without the alias, the following error is generated:

```
Error starting at line 1 in command:
CREATE TABLE    dept80
AS SELECT  employee_id, last_name,
salary*12,
hire_date FROM employees WHERE   department_id = 80
Error at Command Line:3 Column:6
Error report:
SQL Error: ORA-00998: must name this expression with a column alias
00998. 00000 -  "must name this expression with a column alias"
*Cause:
*Action:
```

# Lesson Agenda

- Database objects
  - Naming rules
- CREATE TABLE statement:
  - Access another user's tables
  - DEFAULT option
- Data types
- Overview of constraints: NOT NULL, PRIMARY KEY, FOREIGN KEY, CHECK constraints
- Creating a table using a subquery
- ALTER TABLE
  - Read-only tables
- DROP TABLE statement

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## ALTER TABLE Statement

Use the ALTER TABLE statement to:

- Add a new column
- Modify an existing column definition
- Define a default value for the new column
- Drop a column
- Rename a column
- Change table to read-only status

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### ALTER TABLE Statement

After you create a table, you may need to change the table structure for any of the following reasons:

- You omitted a column.
- Your column definition or its name needs to be changed.
- You need to remove columns.
- You want to put the table into the read-only mode

You can do this by using the ALTER TABLE statement.

# Read-Only Tables

Use the ALTER TABLE syntax to put a table into the read-only mode:

- Prevents DDL or DML changes during table maintenance
- Change it back into read/write mode

```
ALTER TABLE employees READ ONLY;

-- perform table maintenance and then
-- return table back to read/write mode

ALTER TABLE employees READ WRITE;
```

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## Read-Only Tables

With Oracle Database 11*g*, you can specify READ ONLY to place a table in the read-only mode. When the table is in the READ-ONLY mode, you cannot issue any DML statements that affect the table or any SELECT ... FOR UPDATE statements. You can issue DDL statements as long as they do not modify any data in the table. Operations on indexes associated with the table are allowed when the table is in the READ ONLY mode.

Specify READ/WRITE to return a read-only table to the read/write mode.

**Note:** You can drop a table that is in the READ ONLY mode.

For information about the ALTER TABLE statement, see the course titled *Oracle Database 10g SQL Fundamentals II*.

# Lesson Agenda

- Database objects
  - Naming rules
- `CREATE TABLE` statement:
  - Access another user's tables
  - `DEFAULT` option
- Data types
- Overview of constraints: `NOT NULL`, `PRIMARY KEY`, `FOREIGN KEY`, `CHECK` constraints
- Creating a table using a subquery
- `ALTER TABLE`
  - Read-only tables
- `DROP TABLE` statement

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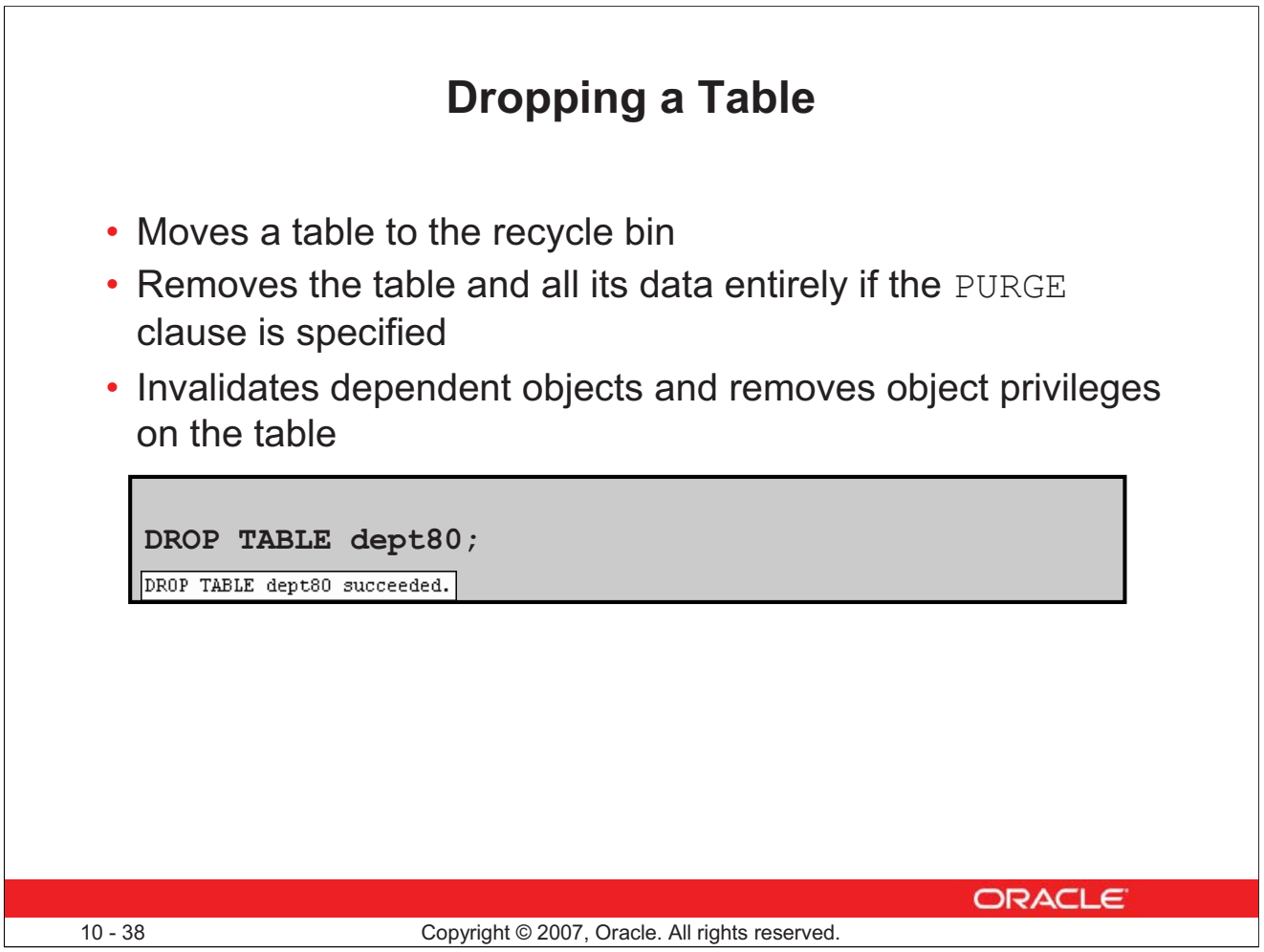


## Dropping a Table

The DROP TABLE statement moves a table to the recycle bin or removes the table and all its data from the database entirely. Unless you specify the PURGE clause, the DROP TABLE statement does not result in space being released back to the tablespace for use by other objects, and the space continues to count towards the user's space quota. Dropping a table invalidates the dependent objects and removes object privileges on the table.

When you drop a table, the database loses all the data in the table and all the indexes associated with it.

**Syntax**

```
DROP TABLE table [PURGE]
```

In the syntax, *table* is the name of the table.

**Guidelines**

- All the data is deleted from the table.
- Any views and synonyms remain, but are invalid.
- Any pending transactions are committed.
- Only the creator of the table or a user with the DROP ANY TABLE privilege can remove a table.

**Note:** Use the FLASHBACK TABLE statement to restore a dropped table from the recycle bin. This is discussed in detail in the course titled *Oracle Database 11g: SQL Fundamentals II*.

# Summary

In this lesson, you should have learned how to use the `CREATE TABLE` statement to create a table and include constraints:

- Categorize the main database objects
- Review the table structure
- List the data types that are available for columns
- Create a simple table
- Explain how constraints are created at the time of table creation
- Describe how schema objects work

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## Summary

In this lesson, you should have learned how to do the following:

**CREATE TABLE**

- Use the `CREATE TABLE` statement to create a table and include constraints.
- Create a table based on another table by using a subquery.

**DROP TABLE**

- Remove rows and a table structure.
- When executed, this statement cannot be rolled back.