DATABASE SYSTEMS LAB

Course Code	: 30102422
Credit Hours	: 1
Prerequisite	: 30102421

Instructor Information

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Class Times	Building	Day	Start Time	End Time	Room No.
	-	Sun ,Tues	11:30	14:30	
	-	Mon ,Wed	11:30	14:30	

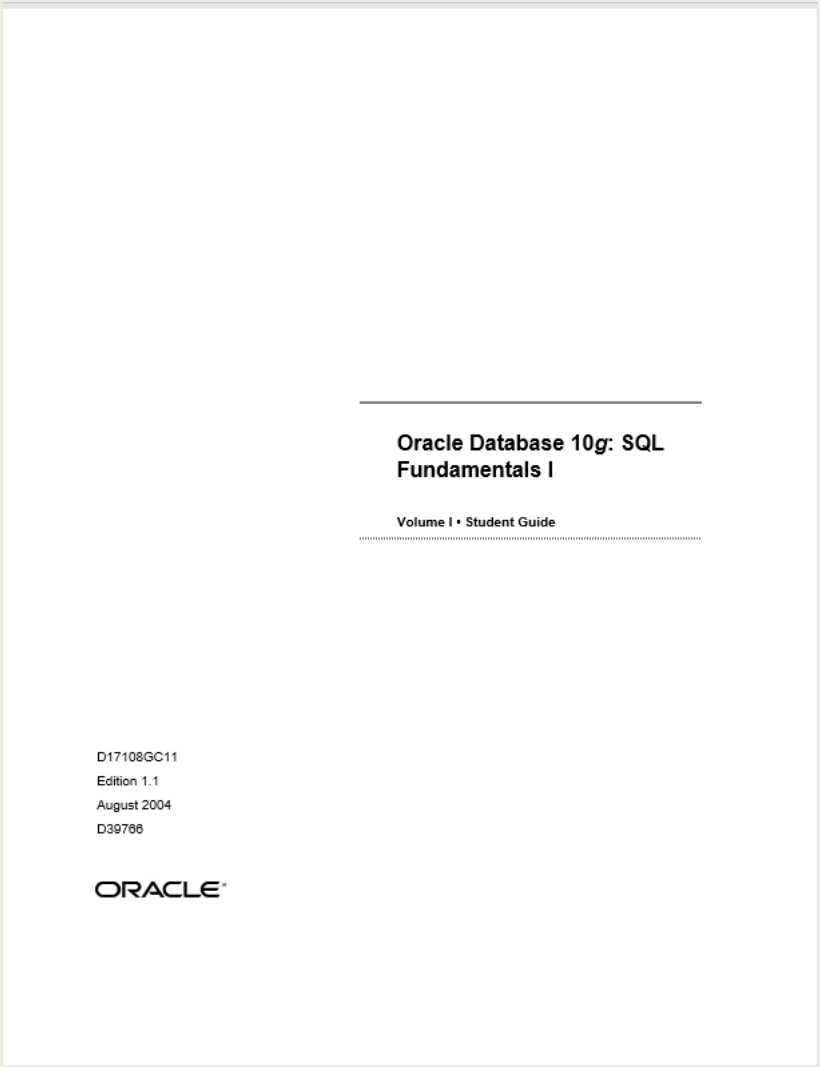
Course Description:

This Lab. practices the concepts introduced in the Database systems course using Oracle Database. The students are expected to implement a database project for some problem.

Course Title: Database Systems Lab **Credit Hour(1)**

[Pre-req. Course Code(30102421)]

Textbook: *Oracle Database 10g: SQL Fundamentals I, Volume I • Student Guide*



Oracle Database 10*g*: SQL Fundamentals I

Volume I • Student Guide

D17108GC11
Edition 1.1
August 2004
D39766

ORACLE

COURSE OBJECTIVES:

Upon completion of this course, students will have gained knowledge of the DBMS (Oracle) concepts and the ability to:

- Understand the concepts of relational databases and the Oracle Database 10g database technology.
- Use the powerful SQL programming language and its features.
- Identify features of Relational Database Management System (RDBMS).
- Categorize the main database objects
- Understand how constraints are created at the time of table creation
- Describe each data manipulation language (DML) statement
- List the capabilities of SQL SELECT statements
- Write SELECT statements to access data from more than one table using equijoins and non-equijoins
- Employ SQL functions to generate and retrieve customized data
- Identify when a subquery can help solve a question
- Write subqueries when a query is based on unknown values
- Use a set operator to combine multiple queries into a single query

COURSE SYLLABUS

Week	Course Topic	Notes
Week 1	Creating and Managing Tables: - Database Objects - Naming Conventions - The Create Table Statement - Creating a Table by Using a Subquery - Querying the Data Dictionary - The Alter Table Statement - Truncating a Table - Adding Comments to a Table	

Week 2	Including Constraints
	- Defining Constraints
	  o The Not Null Constraint
	  o The Unique Constraint
	  o The Primary Key Constraint
	  o The Foreign Key Constraint
	  o The Check Constraint
	- Adding a Constraint
	- Dropping a Constraint
	- Enabling and Disabling Constraints
	- Viewing Constraints	

Week 3	Manipulating Data - Data Manipulating Language. - The Insert Statement - Copying Rows from another Table - The Update Statement - The Delete Statement - Database Transactions - Commit and Rollback Statements	
Week 4	Writing Basic SQL Statements - Selecting Specific Columns - Arithmetic Expressions - Concatenation Operator - Using Column Aliases - Eliminating Duplicate Rows	

COURSE SYLLABUS

Week	Course Topic	Notes
Week 5	Restricting and Sorting Data - Where Clause - Comparison Operators - Special Operators - Logical Operator (And, Or, Not) - Order By Clause	
Week 6	Displaying Data from Multiple Tables - Cartesian Product. - Types of Joins - Table Aliases.	
Week 7	Single-Row Functions - Character Functions. - Number Functions - Date Functions ▪	
Week 8	Midterm Exam	Midterm Exam
Week 9	Project Proposal	
Week 10	Single-Row Functions - Conversion Functions - General Functions	

COURSE SYLLABUS

Week	Course Topic	Notes
Week 11	Aggregating Data using Group Functions - Types of Group Functions (AVG, SUM, MAX, MIN, COUNT). - Creating Groups of data: Group By Clause. - Excluding Group Results: Having Clause. - Nested Group Functions	
Week 12	Subqueries - Types of Subqueries ▪ Single-Row Subqueries ▪ Multiple-Row Subqueries	
Week 13	Multiple-Column Subqueries - Column Comparisons - Null Values in a subquery - Using a subquery in the From Clause	
Week 14	Using the Set Operators - Union / Union All - Intersect - Minus	
Week 15	Project Discussion	
Week 16	Final Exam	Final Exam

Week 1

Chapter 1:

Creating and Managing Tables

USING DDL STATEMENTS TO CREATE AND MANAGE TABLES

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*

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 names to objects

Naming Rules

Table names and column names:

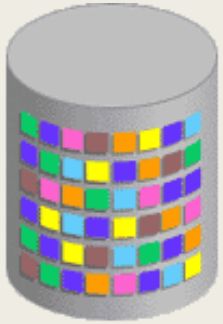
- *Must begin with a letter*
- *Must be 1–30 characters long*
- *Must contain only A–Z, a–z, 0–9, _, $, and #*
- *Must not duplicate the name of another object owned by the same user*
- *Must not be an Oracle server–reserved word*

CREATE TABLE Statement

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

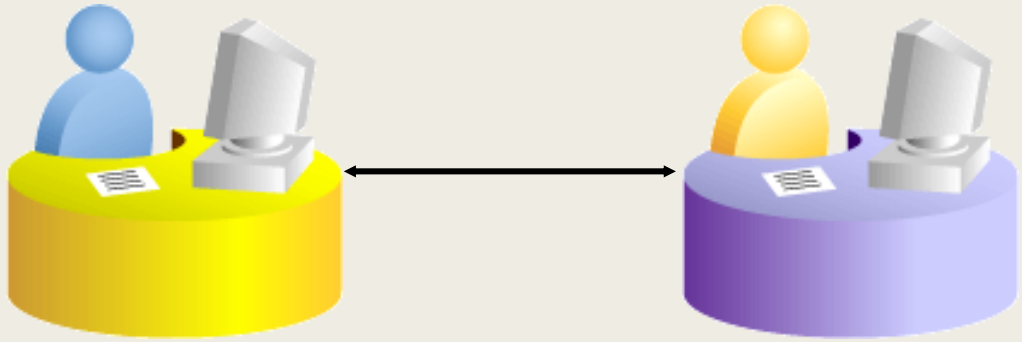
```
CREATE TABLE [schema.]table
        (column datatype [DEFAULT expr][, ...]);
```

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



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;
```

DEFAULT Option

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

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

  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);
Table created.
```

Creating Tables

- *Create the table.*

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

- *Confirm table creation.*

```
DESCRIBE dept
```

Name	Null?	Type
DEPTNO		NUMBER(2)
DNAME		VARCHAR2(14)
LOC		VARCHAR2(13)
CREATE_DATE		DATE

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

USING DDL STATEMENTS TO CREATE AND MANAGE TABLES

Objectives

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- *Explain how constraints are created at the time of table creation*
- *Describe how schema objects work*

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`

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 table is created
  - After the table has been created
- *Define a constraint at the column or table level.*
- *View a constraint in the data dictionary.*

Defining Constraints

- *Syntax:*

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

- *Column-level constraint:*

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

- *Table-level constraint:*

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

Defining Constraints

- *Column-level constraint:*

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

1

- *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));
```

2

NOT NULL Constraint

Ensures that null values are not permitted for the column:

EMPLOYEE_ID	LAST_NAME	EMAIL	PHONE_NUMBER	HIRE_DATE	JOB_ID	SALARY	DEPARTMENT_ID
100	King	SKING	515.123.4567	17-JUN-87	AD_PRES	24000	90
101	Kochhar	NKOCHHAR	515.123.4568	21-SEP-89	AD_VP	17000	90
102	De Haan	LDEHAAN	515.123.4569	13-JAN-93	AD_VP	17000	90
103	Hunold	AHUNOLD	590.423.4567	03-JAN-90	IT_PROG	9000	60
104	Ernst	BERNST	590.423.4568	21-MAY-91	IT_PROG	6000	60
178	Grant	KGRANT	011.44.1644.429263	24-MAY-99	SA_REP	7000	
200	Whalen	JWHALEN	515.123.4444	17-SEP-87	AD_ASST	4400	10

...

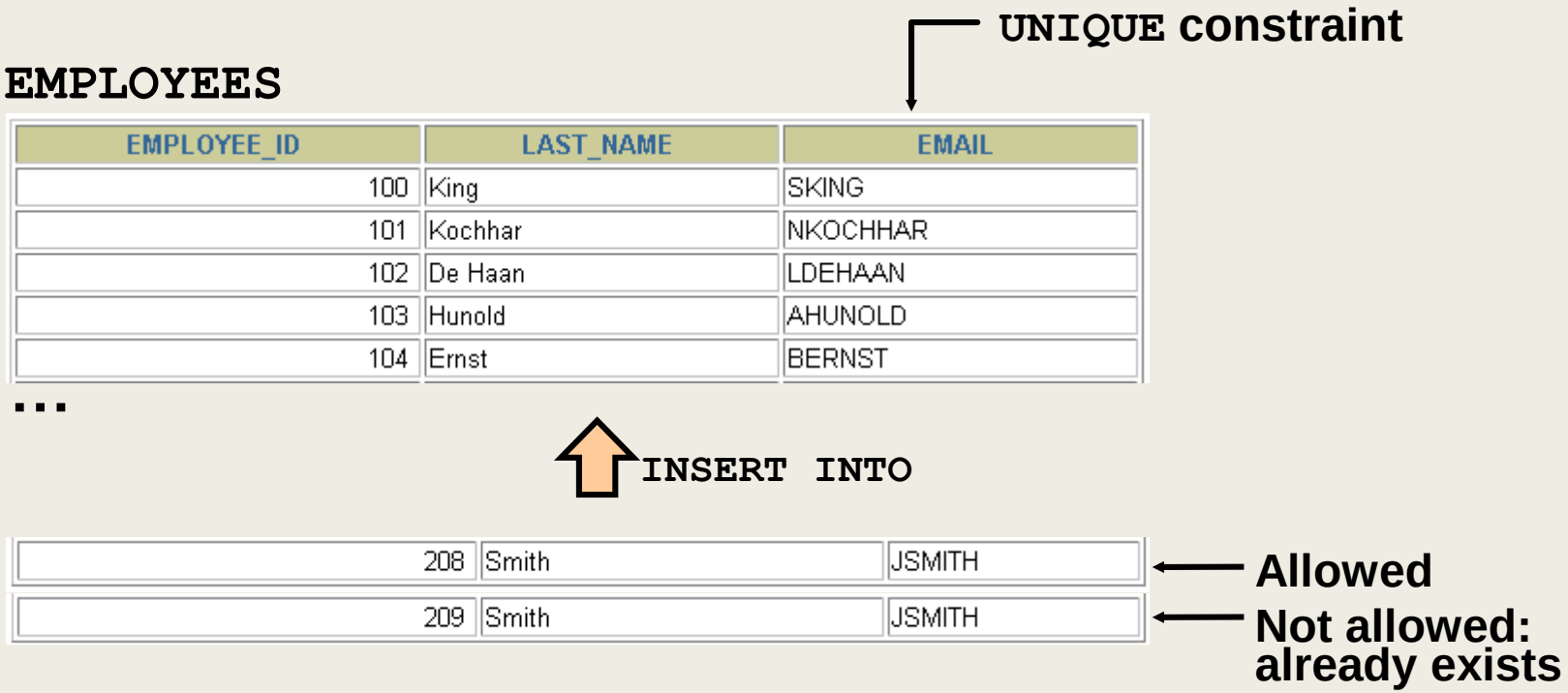
20 rows selected.

NOT NULL constraint (No row can contain a null value for this column.)

NOT NULL constraint

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

UNIQUE Constraint

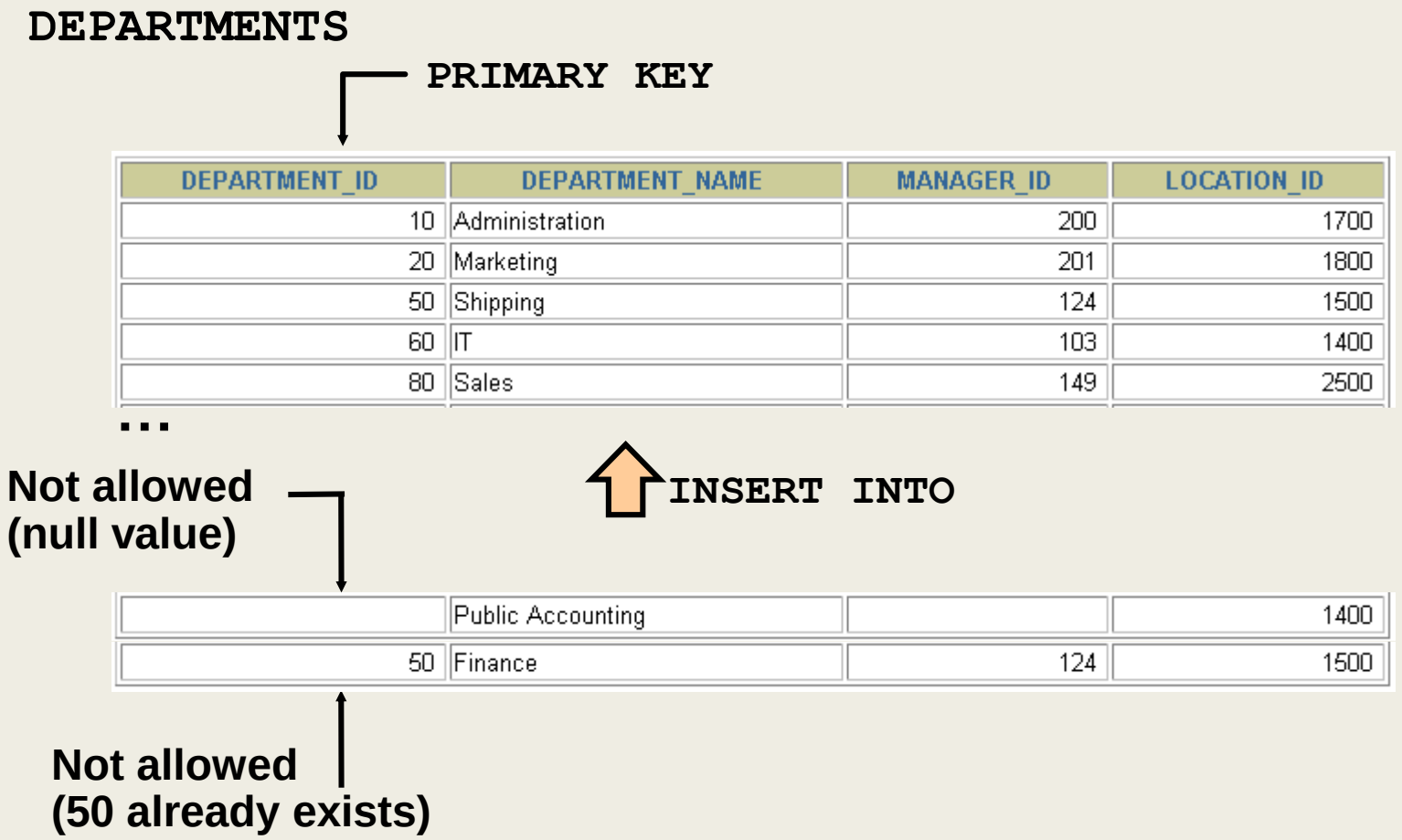


UNIQUE Constraint

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));
```

PRIMARY KEY Constraint



FOREIGN KEY Constraint

DEPARTMENTS

DEPARTMENT_ID	DEPARTMENT_NAME	MANAGER_ID	LOCATION_ID
10	Administration	200	1700
20	Marketing	201	1800
50	Shipping	124	1500
60	IT	103	1400
80	Sales	149	2500

PRIMARY KEY

...

EMPLOYEES

EMPLOYEE_ID	LAST_NAME	DEPARTMENT_ID
100	King	90
101	Kochhar	90
102	De Haan	90
103	Hunold	60
104	Ernst	60
107	Lorentz	60

FOREIGN KEY

...

INSERT INTO

200	Ford	9
201	Ford	60

Not allowed (9 does not exist)

Allowed

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));
```

`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*

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),...
```

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)
    , department_id  NUMBER(4)
        CONSTRAINT     emp_dept_fk       REFERENCES
           departments (department_id));
```

Violating Constraints

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

```
UPDATE employees
       *
ERROR at line 1:
ORA-02291: integrity constraint (HR.EMP_DEPT_FK)
violated - parent key not found
```

Department 55 does not exist.

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;
```

```
DELETE FROM departments
            *
ERROR at line 1:
ORA-02292: integrity constraint (HR.EMP_DEPT_FK)
violated - child record found
```

Creating a Table by 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.*

Creating a Table by Using a Subquery

```
CREATE TABLE  dept80
  AS
    SELECT   employee_id, last_name,
             salary*12 ANNSAL,
             hire_date
    FROM     employees
    WHERE    department_id = 80;
Table created.
```

```
DESCRIBE dept80
```

Name	Null?	Type
EMPLOYEE_ID		NUMBER(6)
LAST_NAME	NOT NULL	VARCHAR2(25)
ANNSAL		NUMBER
HIRE_DATE	NOT NULL	DATE

`ALTER TABLE` Statement

Use the `ALTER TABLE` statement to:

- *Add a new column*
- *Modify an existing column*
- *Define a default value for the new column*
- *Drop a column*

Dropping a Table

- *All data and structure in the table are deleted.*
- *Any pending transactions are committed.*
- *All indexes are dropped.*
- *All constraints are dropped.*
- *You cannot roll back the `DROP TABLE` statement.*

```
DROP TABLE dept80;
Table dropped.
```

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*

Practice 9: Overview

This practice covers the following topics:

- *Creating new tables*
- *Creating a new table by using the* `CREATE TABLE AS` *syntax*
- *Verifying that tables exist*
- *Dropping tables*