# 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
  - Understand 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

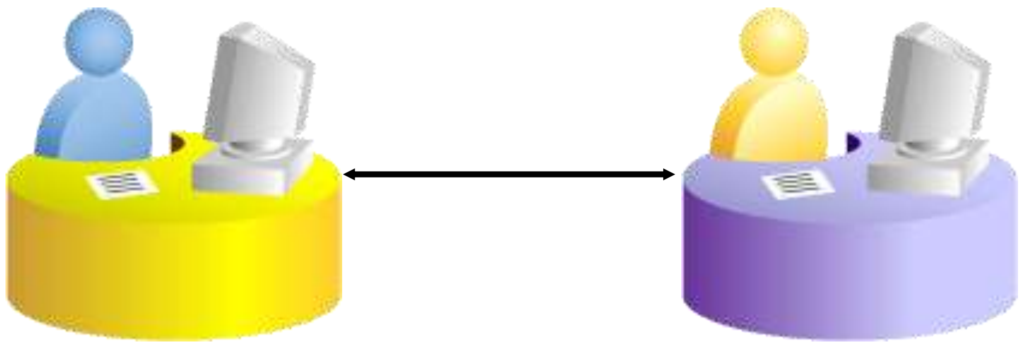
- You must have:
  - CREATE TABLE privilege
  - A storage area

```
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.



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

```
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);
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  -- not SQL statement
```

| 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 |

# 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 |

# Datetime Data Types

- The `TIMESTAMP` data type is an extension of the `DATE` data type.
- It stores the year, month, and day of the `DATE` data type plus hour, minute, and second values as well as the fractional second value.
- You can optionally specify the time zone.

```
TIMESTAMP[(fractional_seconds_precision)]
```

```
TIMESTAMP[(fractional_seconds_precision)]
WITH TIME ZONE
```

```
TIMESTAMP[(fractional_seconds_precision)]
WITH LOCAL TIME ZONE
```

# Datetime Data Types

- The `INTERVAL YEAR TO MONTH` data type stores a period of time using the `YEAR` and `MONTH` datetime fields:

```
INTERVAL YEAR [(year_precision)] TO MONTH
```

- The `INTERVAL DAY TO SECOND` data type stores a period of time in terms of days, hours, minutes, and seconds:

```
INTERVAL DAY [(day_precision)]
   TO SECOND [(fractional_seconds_precision)]
```

# 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));
```

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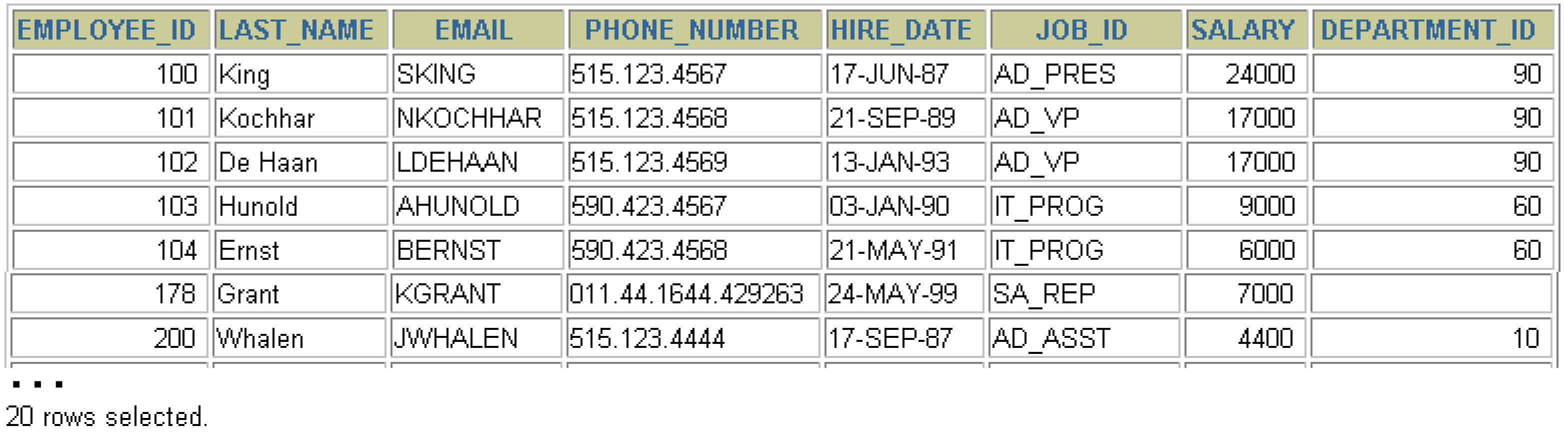
# NOT NULL Constraint

- 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 |

...

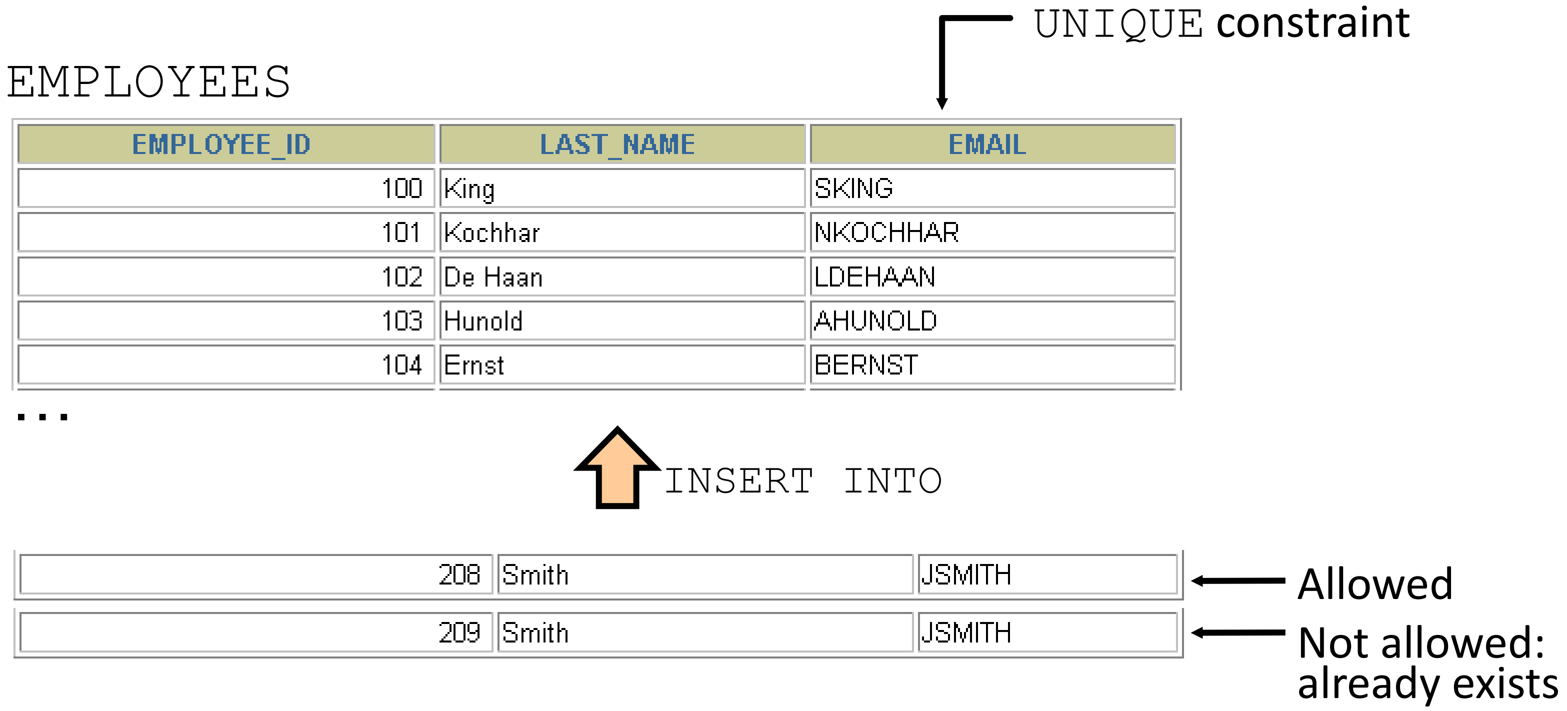
20 rows selected.

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



| EMPLOYEE_ID | LAST_NAME | EMAIL |
|---|---|---|
| 100 | King | SKING |
| 101 | Kochhar | NKOCHHAR |
| 102 | De Haan | LDEHAAN |
| 103 | Hunold | AHUNOLD |
| 104 | Ernst | BERNST |

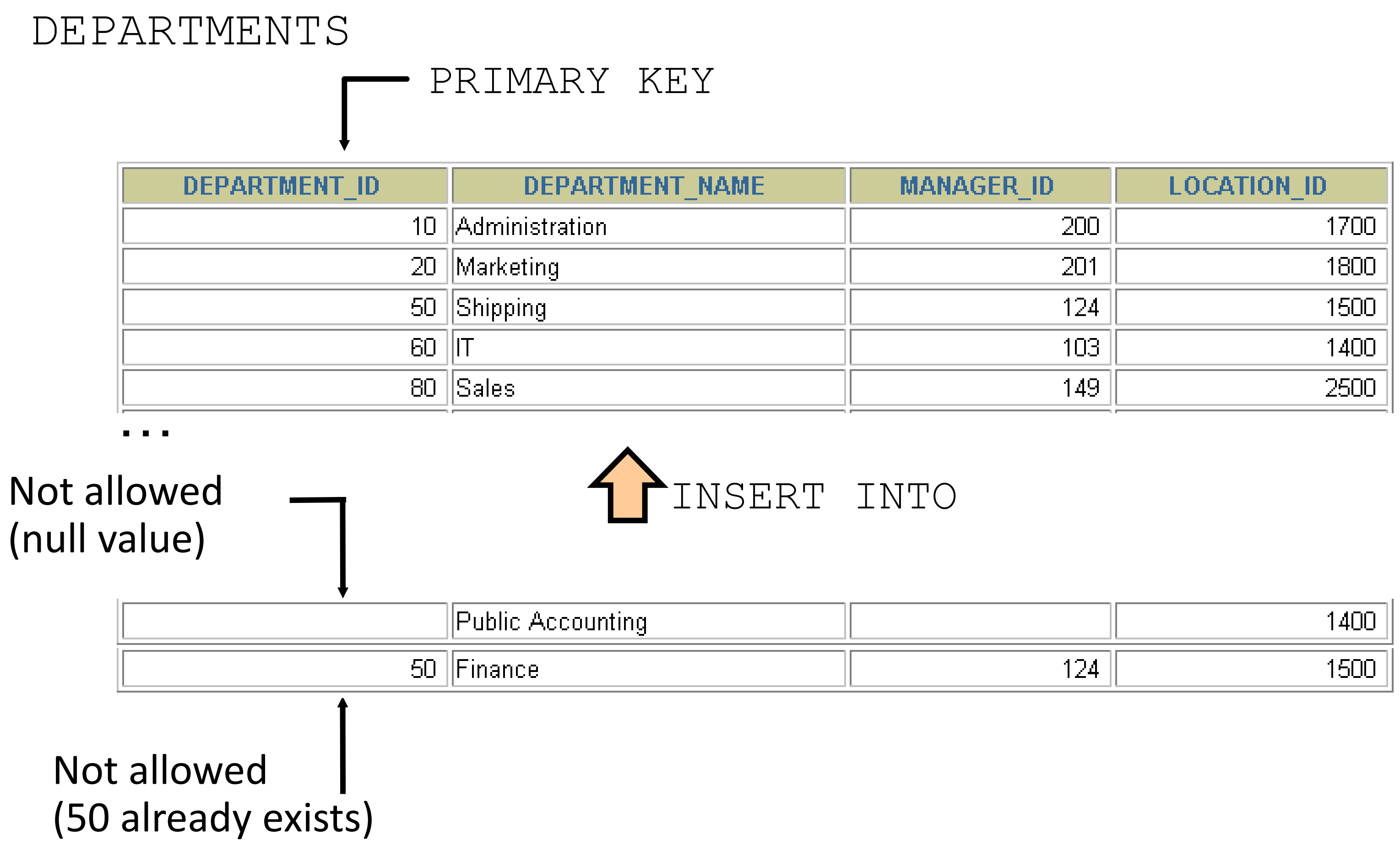
| | | |
|---|---|---|
| 208 | Smith | JSMITH |
| 209 | Smith | JSMITH |

# 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



| 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 |

...

| | | | |
|---|---|---|---|
| | Public Accounting | | 1400 |
| 50 | Finance | 124 | 1500 |

# FOREIGN KEY Constraint

DEPARTMENTS

PRIMARY KEY

| 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 |

...

EMPLOYEES

FOREIGN KEY

| 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 |

...

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

```
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
  - Understand how constraints are created at the time of table creation
  - Describe how schema objects work