ENSF 608: SQL

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Specifying Constraints as Assertions and Actions as Triggers

- Semantic Constraints: The following are beyond the scope of the EER and relational model
- **`CREATE ASSERTION`**
  - Specify additional types of constraints outside scope of built-in relational model constraints
- **`CREATE TRIGGER`**
  - Specify automatic actions that database system will perform when certain events and conditions occur

Specifying General Constraints as Assertions in SQL

- **`CREATE ASSERTION`**
  - Specify a query that selects any tuples that violate the desired condition
  - Use only in cases where it goes beyond a simple `CHECK` which applies to individual attributes and domains

```
CREATE ASSERTION SALARY_CONSTRAINT
CHECK ( NOT EXISTS  ( SELECT     *
                      FROM       EMPLOYEE E, EMPLOYEE M,
                                 DEPARTMENT D
                      WHERE      E.Salary>M.Salary
                                 AND E.Dno=D.Dnumber
                                 AND D.Mgr_ssn=M.Ssn ) );
```

Introduction to Triggers in SQL

- `CREATE TRIGGER` statement
  - Used to monitor the database
- Typical trigger has three components which make it a rule for an “active database “ (more on active databases in section 26.1):
  - **Event(s)**
  - **Condition**
  - **Action**

Use of TRIGGERS

- An EXAMPLE with standard Syntax.(Note : other SQL implementations like PostgreSQL use a different syntax.)

```
R5:
CREATE TRIGGER SALARY_VIOLATION
BEFORE INSERT OR UPDATE OF Salary, Supervisor_ssn ON
EMPLOYEE

FOR EACH ROW
WHEN (NEW.SALARY > ( SELECT Salary FROM EMPLOYEE
                     WHERE Ssn = NEW. Supervisor_Ssn))
INFORM_SUPERVISOR (NEW.Supervisor.Ssn, New.Ssn)
```

Views (Virtual Tables) in SQL

- Concept of a view in SQL
  - Single table derived from other tables called the **defining tables**
  - Considered to be a virtual table that is not necessarily populated

Specification of Views in SQL (1 of 2)

- **`CREATE VIEW`** command
  - Give table name, list of attribute names, and a query to specify the contents of the view
  - In V1, attributes retain the names from base tables. In V2, attributes are assigned names

```
V1:   CREATE VIEW   WORKS_ON1
      AS SELECT     Fname, Lname, Pname, Hours
          FROM      EMPLOYEE, PROJECT, WORKS_ON
          WHERE     Ssn=Essn AND Pno=Pnumber;

V2:   CREATE VIEW   DEPT_INFO(Dept_name, No_of_emps, Total_sal)
      AS SELECT     Dname, COUNT (*), SUM (Salary)
          FROM      DEPARTMENT, EMPLOYEE
          WHERE     Dnumber=Dno
          GROUP BY  Dname;
```

Specification of Views in SQL (2 of 2)

- Once a View is defined, SQL queries can use the View relation in the FROM clause
- View is always up-to-date
  - Responsibility of the DBMS and not the user
- **`DROP VIEW`** command
  - Dispose of a view

Views as Authorization Mechanism

- SQL query authorization statements (GRANT and REVOKE) are described in detail in Chapter 30
- Views can be used to hide certain attributes or tuples from unauthorized users
- E.g., For a user who is only allowed to see employee information for those who work for department 5, he may only access the view

DEPT5EMP:

```
CREATE VIEW   DEPT5EMP   AS
SELECT        *
FROM          EMPLOYEE
WHERE         Dno = 5;
```

Schema Change Statements in SQL

- **Schema evolution commands**
  - DBA may want to change the schema while the database is operational
  - Does not require recompilation of the database schema

The DROP Command

- `DROP` command
  - Used to drop named schema elements, such as tables, domains, or constraint
- Drop behavior options:
  - `CASCADE`
  - `RESTRICT`
- Example:
  - `DROP SCHEMA COMPANY CASCADE;`
  - This removes the schema and all its elements including tables, views, constraints, etc.

The ALTER Table Command

- **Alter table actions** include:
  - Adding or dropping a column (attribute)
  - Changing a column definition
  - Adding or dropping table constraints
- Example:
  - ```
    ALTER TABLE COMPANY.EMPLOYEE ADD COLUMN
    Job VARCHAR(12);
    ```
    ```

Adding and Dropping Constraints

- Change constraints specified on a table
  - Add or drop a named constraint

```
ALTER TABLE COMPANY.EMPLOYEE
DROP CONSTRAINT EMPSUPERFK CASCADE;
```

Dropping Columns, Default Values

- To drop a column
  - Choose either `CASCADE` or `RESTRICT`
  - `CASCADE` would drop the column from views etc. `RESTRICT` is possible if no views refer to it.

```
ALTER TABLE COMPANY.EMPLOYEE DROP COLUMN
Address CASCADE;
```

- Default values can be dropped and altered :

```
ALTER TABLE COMPANY.DEPARTMENT ALTER COLUMN Mgr_ssn
    DROP DEFAULT;
ALTER TABLE COMPANY.DEPARTMENT ALTER COLUMN Mgr_ssn
    SET DEFAULT '333445555';
```

Table 7.2 Summary of SQL Syntax (1 of 2)

CREATE TABLE <table name> (<column name> <column type> [<attribute constraint>] { , <column name> <column type> [<attribute constraint>] } [<table constraint> { , <table constraint> }])
DROP TABLE <table name> ALTER TABLE <table name> ADD <column name> <column type>
SELECT [DISTINCT] <attribute list> FROM (<table name> { <alias> } | <joined table>) { , (<table name> { <alias> } | <joined table>) } [WHERE <condition>] [GROUP BY <grouping attributes> [HAVING <group selection condition>]] [ORDER BY <column name> [<order>] { , <column name> [<order>] }]
<attribute list> ::= (* | (<column name> | <function> (([DISTINCT] <column name> | *))) { , (<column name> | <function> (([DISTINCT] <column name> | *)) }))
<grouping attributes> ::= <column name> { , <column name> }
<order> ::= (ASC | DESC)
INSERT INTO <table name> [(<column name> { , <column name> })] (VALUES (<constant value> , { <constant value> }) { , (<constant value> { , <constant value> }) } | <select statement>)

Table 7.2 Summary of SQL Syntax (2 of 2)

DELETE FROM <table name> [WHERE <selection condition>]
UPDATE <table name> SET <column name> = <value expression> { , <column name> = <value expression> } [WHERE <selection condition>]
CREATE [UNIQUE] INDEX <index name> ON <table name> (<column name> [<order>] { , <column name> [<order>] }) [CLUSTER]
DROP INDEX <index name>
CREATE VIEW <view name> [(<column name> { , <column name> })] AS <select statement>
DROP VIEW <view name>

Note: The commands for creating and dropping indexes are not part of standard SQL.

Topic 5 Summary

- SQL
  - A comprehensive language for relational database management
  - Data definition, queries, updates, constraint specification, and view definition
- Covered:
  - Data definition commands for creating tables
  - Commands for constraint specification
  - Simple retrieval queries
  - Database update commands

Topic 5 Summary

- Complex SQL:
  - Nested queries, joined tables (in the FROM clause), outer joins, aggregate functions, grouping
- Handling semantic constraints with `CREATE ASSERTION` and `CREATE TRIGGER`
- `CREATE VIEW` statement
- Schema modification for the DBAs using `ALTER TABLE, ADD AND DROP COLUMN, ALTER CONSTRAINT` etc.

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