DATABASE DESIGN AND DEVELOPMENT (IT2140)

LECTURE 02 - SQL

LECTURE CONTENT

- Introduction to SQL
- Data definition language
- Data manipulation language

LECTURE CONTENT

- At the end of this lecture students should be able to
  - Write syntactically correct SQL statements to create and modify relations in a RDBMS
  - Write syntactically correct SQL statements to answer user defined queries in a RDBMS

SQL

- SQL Initially called SEQUEL (for Structured English QUEry Language)
- It was developed for an experimental relational database system called System R
- A joint effort between ANSI (American National Standard Institute) and ISO (International Standards Organization) led to a standard version of SQL in 1986 (SQL1, SQL-86, etc.)
- Major revisions have been proposed and SQL2 (also called SQL-92) has subsequently been developed

SQL: REVIEW (CONTD.)

SQL is a comprehensive database language:

- Data Definition Language (DDL)
- Data Manipulation Language (DML)
- Facilities for security & authorization
- Facilities for transaction processing
- Facilities for embedding SQL in general purpose languages (Embedded SQL)
- …

DATA DEFINITION LANGUAGE (DDL)

- DDL is the subset of SQL that supports the creation, deletion and modifications for tables and views.
- Constraints can be defined on the tables

Constraint	Purpose
Not Null	Ensure that column doesn't have null values
Unique	Ensure that column doesn't have duplicate values
Primary key	Defines the primary key
Foreign key	Defines a foreign key
Default	Defines a default value for a column (When no values are given)
Check	Validates data in a column

CREATING A TABLE - EXAMPLE

```
CREATE TABLE STUDENT
(
    studentId INTEGER PRIMARY KEY,
    sName VARCHAR (30) NOT NULL,
    nic CHAR(10) UNIQUE,
    gpa FLOAT,
    progId VARCHAR(10) DEFAULT 'IT',
   CONSTRAINT student_prog_fk FOREIGN KEY (progId)
            REFERENCES programs(id) ON DELETE SET DEFAULT ON
            UPDATE CASCADE,
    CONSTRAINT gpa_ck CHECK (gpa<= 4.0 )
)
```

MODIFICATIONS TO TABLES

- ALTER commands – to alter the definition of the object
  - Ex : Adding a new column to a table
    - **ALTER TABLE** student **ADD** age **INT**
  - Ex : Adding a new constraint to a column
    - **ALTER TABLE** student **ADD CONSTRAINT** chk_age **CHECK** (age > 18)
  - Ex : removing a column from a table
    - **ALTER TABLE** student **DROP COLUMN** age
- DROP commands – for dropping objects
  - Ex: Deleting a table
    - **DROP TABLE** Employee

DATA MANIPULATION LANGUAGE (DML)

- DML is the subset of SQL that allows users to write statements to insert, delete, modify and display rows.
  - Inserting a row
    - **INSERT INTO** student **VALUES (**1000, 'Amal', '123456789V', 3.2, 'BM'**)**
    - **INSERT INTO** student**(**studentId, sName, nic**) VALUES (**1001, 'Nimali', '234567890V'**)**

StudentID	SName	nic	gpa	progId
1000	Amal	123456789V	3.2	BM
1001	Nimali	234567890V	Null	IT

DATA MANIPULATION LANGUAGE (DML)(CONTD.)

- Deleting a row
  - **DELETE** student **WHERE** studentId=1000
- Updating a row
  - **UPDATE** student

    SET gpa=2.8

    WHERE studentId=1001

SELECT CLAUSE

- Select clause in SQL is the basic statement for retrieving information from a database
- Basic form

  SELECT <attributes>

  FROM <one or more relations>

  WHERE <conditions>

- Ex : display ids of all students whose gpa is above 3.0
  - Select StudentId from student where gpa> 3.0

CLAUSES AND OPERATORS USED WITH SELECT

- LIKE operator
- IS [NOT] NULL operator
- DISTINCT operators
- BETWEEN operator
- ORDER BY clause
- Joins (inner & outer)
- Nested query (IN/SOME/ANY, ALL), [NOT] EXISTS
- Aggregate functions
- GROUP BY – HAVING clauses

LIKE OPERATOR

- Used for matching patterns
- Syntax : <string> LIKE <pattern>
  - <pattern> may contain two special symbols:
    - % = any sequence of characters
    - _ = any single character
- Ex : Find students whose name starts with a 'A'
  - Select Name From student where Name Like 'A%'

Student

StudentID	Name	gpa	progId
1000	Amal	3.2	BM
1001	Nimali	Null	IT
1002	Aruni	3.0	SE
1003	Surani	2.5	IT

Name
Amal
Aruni

IS [NOT] NULL OPERATOR

- IS NULL :Used to check whether attribute value is null
- Ex : Find studentIDs of the students who have not completed a semester yet.
  - Select studentId

    From student

    Where gpa IS NULL

StudentID
1001
1004

Student

StudentID	Name	gpa	progId
1000	Amal	3.2	BM
1001	Nimali	Null	IT
1002	Aruni	3.0	SE
1003	Surani	2.5	IT
1004	Imali	Null	BM

DISTINCT OPERATOR

- In a table, a column may contain many duplicate values.
- Duplicates in results can be eliminated using DISTINCT operator
- Ex :

Select progId

From student

ProgId
BM
IT
SE
IT
BM

Student

StudentID	Name	gpa	progId
1000	Amal	3.2	BM
1001	Nimali	Null	IT
1002	Aruni	3.0	SE
1003	Surani	2.5	IT
1004	Imali	Null	BM

Select DISTINCT progId

From student

ProgId
BM
IT
SE

BETWEEN OPERATOR

- Used to check whether attribute value is within a range
- Ex :Find the students who will be obtaining a first class (3.7<=gpa<=4.0)

```
Select studentID
From student
    Where gpa between 3.7 and 4.00
```

Student

StudentID	Name	gpa	progId
1000	Amal	3.2	BM
1001	Nimali	Null	IT
1002	Aruni	3.8	SE
1003	Surani	2.5	IT
1004	Imali	4.0	BM

StudentID
1002
1004

ORDER BY CLAUSE

- Used to order results based on a given field
- Ordering is ascending (ASC), unless you specify the DESC keyword
- Ex : display the student names and gpa's in the ascending order of gpa's.

```
Select Name, gpa
From student
    Order by gpa
```

Name	gpa
Surani	2.5
Nimali	2.8
Amal	3.2
Aruni	3.8
Imali	4.0

Student

StudentID	Name	gpa	progId
1000	Amal	3.2	BM
1001	Nimali	2.8	IT
1002	Aruni	3.8	SE
1003	Surani	2.5	IT
1004	Imali	4.0	BM

AGGREGATION

- An aggregate function summarizes the results of an expression over a number of rows, returning a single value.
- Some of the commonly used aggregate functions are SUM, COUNT, AVG, MIN and MAX

AGGREGATION (CONTD.)

- Ex : Find the average, minimum, maximum gpa of students

Student

StudentID	Name	gpa	progId
1000	Amal	3.2	BM
1001	Nimali	2.8	IT
1002	Aruni	3.8	SE
1003	Surani	2.5	BM
1004	Imali	4.0	IT

Select AVG(gpa), MIN(gpa), MAX(gpa)

From student

AVG(gpa)	MIN(gpa)	MAX(gpa)
3.26	2.5	4.0

GROUPING (GROUP BY CLAUSE)

- Groups the data in tables and produces a single summary row for each group.
- Grouping is done based on a values in a given field
- When using group by
  - Each item in the SELECT list must be single valued per group.
  - SELECT clause may only contain Columns names, aggregate function, constants or an expression involving combinations of the above.
  - All column names in SELECT list must appear in the GROUP BY clause unless the name is used only in the aggregate function.

GROUPING (CONTD.)

- Ex: Count the number of students who has followed each module.

Student

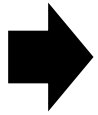
SID	CID	Grade
1000	DBII	A
1000	SEI	B
1001	DBII	A
1002	DBII	C
1002	SPD	C

SID	CID	Grade
1000	DBII	A
1001	DBII	A
1002	DBII	C
1000	SEI	B
1002	SPD	C

Select CID, Count(SID)

From Student

Group by CID



CID	Count (SID)
DBII	3
SEI	1
SPD	1

HAVING CLAUSE

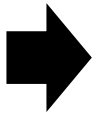
- Used to apply conditions on the groupings
- Ex: Find courses which is followed by more than two students

Student

SID	CID	Grade
1000	DBII	A
1000	SEI	B
1001	DBII	A
1002	DBII	C
1002	SPD	C

SID	CID	Grade
1000	DBII	A
1001	DBII	A
1002	DBII	C
1000	SEI	B
1002	SPD	C

```
Select CID, Count(SID)
From course
Group by CID
Having count(SID)>2
```



CID	Count (SID)
DBII	3

SQL: REVIEW (CONTD.)

Summary of SQL Queries…

```
SELECT <attribute-list>
FROM   <table-list>
[WHERE     <condition>]
[GROUP BY     <group attribute(s)>]
[HAVING    <group condition>]
[ORDER     BY <attribute list>];
```

WHAT YOU HAVE TO DO BY NEXT WEEK

- Try out the self-test questions on the courseweb.
- Complete the tutorial.