UNIT III - SQL & MYSQL NOTES

MYSQL

It is freely available open source Relational Database Management System (RDBMS) that uses **Structured Query Language(SQL).** In MySQL database , information is stored in Tables. A single MySQL database can contain many tables at once and store thousands of individual records.

SQL (Structured Query Language)

SQL is a language that enables you to create and operate on relational databases, which are sets of related information stored in tables.

DIFFERENT DATA MODELS

A **data model refers to a set of concepts to describe the structure of a database**, and certain constraints (restrictions) that the database should obey. The four data model that are used for database management are :

1. **Relational data model** : In this data model, the data is organized into tables (i.e. rows and columns). These tables are called relations.

2. **Hierarchical data model 3. Network data model 4. Object Oriented data model**

RELATIONAL MODEL TERMINOLOGY

1. **Relation :** A table storing logically related data is called a Relation.

2. **Tuple :** A **row of a relation** is generally referred to as a tuple.

3. **Attribute :** A **column** of a relation is generally referred to as an attribute.

4. **Degree :** This refers to the **number of attributes** in a relation.

5. **Cardinality :** This refers to the **number of tuples** in a relation.

6. **Primary Key :** This refers to a set of one or more attributes that can uniquely identify tuples within the relation.

7. **Candidate Key :** All attribute combinations inside a relation that can serve as primary key are candidate keys as these are candidates for primary key position.

8. **Alternate Key :** A candidate key that is not primary key, is called an alternate key.

9. **Foreign Key :** A non-key attribute, whose values are derived from the primary key of some other table, is known as foreign key in its current table.

REFERENTIAL INTEGRITY

- A referential integrity is a system of rules that a DBMS uses to ensure that relationships between records in related tables are valid, and that users don't accidentally delete or change related data. This integrity is ensured by foreign key.

CLASSIFICATION OF SQL STATEMENTS

SQL commands can be mainly divided into following categories:

1. Data Definition Language(DDL) Commands

Commands that allow you to perform task, related to data definition e.g;

- Creating, altering and dropping.
- Granting and revoking privileges and roles.
- Maintenance commands.

2. **Data Manipulation Language(DML) Commands**

   Commands that allow you to perform data manipulation e.g., retrieval, insertion, deletion and modification of data stored in a database.

3. **Transaction Control Language(TCL) Commands**

   Commands that allow you to manage and control the transactions e.g.,

   - Making changes to database, permanent
   - Undoing changes to database, permanent
   - Creating savepoints
   - Setting properties for current transactions.

MySQL ELEMENTS

1. Literals 2. Datatypes 3. Nulls 4. Comments

LITERALS

It refer to a fixed data value. This fixed data value may be of character type or numeric type. For example, 'replay' , 'Raj', '8' , '306' are all character literals.

Numbers not enclosed in quotation marks are numeric literals. E.g. 22 , 18 , 1997 are all numeric literals.

Numeric literals can either be integer literals i.e., without any decimal or be real literals i.e. with a decimal point e.g. 17 is an integer literal but 17.0 and 17.5 are real literals.

DATA TYPES

Data types are means to identify the type of data and associated operations for handling it. MySQL data types are divided into three categories:

- Numeric
- Date and time
- String types

Numeric Data Type

1. int – used for number without decimal.
2. Decimal(m,d) – used for floating/real numbers. m denotes the total length of number and d is number of decimal digits.

Date and Time Data Type

1. date – used to store date in YYYY-MM-DD format.
2. time – used to store time in HH:MM:SS format.

String Data Types

1. char(m) – used to store a fixed length string. **m** denotes max. number of characters.
2. varchar(m) – used to store a variable length string. **m** denotes max. no. of characters.

DIFFERENCE BETWEEN CHAR AND VARCHAR DATA TYPE

S.NO.	Char Datatype	Varchar Datatype
1.	It specifies a **fixed length** character String.	It specifies a **variable length** character string.
2.	When a column is given datatype as CHAR(**n**), then MySQL ensures that all values stored in that column have this length i.e. **n** bytes. If a value is shorter than this length **n** then blanks are added, but the size of value remains **n** bytes.	When a column is given datatype as VARCHAR(**n**), then the maximum size a value in this column can have is **n** bytes. Each value that is stored in this column store exactly as you specify it i.e. no blanks are added if the length is shorter than maximum length **n**.

NULL VALUE

If a column in a row has no value, then column is said to be **null** , or to contain a null. **You should use a null value** when the actual value is not known or when a value would not be meaningful.

DATABASE COMMNADS

1. VIEW EXISTING DATABASE

To view existing database names, the command is : **SHOW DATABASES ;**

2. CREATING DATABASE IN MYSQL

For creating the database in MySQL, we write the following command : **CREATE DATABASE** <databasename> ;

e.g. In order to create a database Student, command is :

CREATE DATABASE Student ;

3. ACCESSING DATABASE

For accessing already existing database , we write :

USE <databasename> ;

e.g. to access a database named Student , we write command as :

USE Student ;

4. DELETING DATABASE

For deleting any existing database , the command is :

DROP DATABASE <databasename> ;

e.g. to delete a database , say student, we write command as ; **DROP DATABASE** Student ;

5. VIEWING TABLE IN DATABASE

In order to view tables present in currently accessed database , command is : **SHOW TABLES ;**

CREATING TABLES IN MYSQL

- Tables are created with the CREATE TABLE command. When a table is created, its columns are named, data types and sizes are supplied for each column.

Syntax of CREATE TABLE command is : CREATE TABLE <table-name>

(<column name> <data type> ,
<column name> <data type> ,
…… **) ;**

E.g. in order to create table EMPLOYEE given below :

ECODE	ENAME	GENDER	GRADE	GROSS

We write the following command :

```
CREATE TABLE employee
(    ECODE integer ,
     ENAME varchar(20) ,
     GENDER char(1) ,
     GRADE char(2) ,
     GROSS integer    ) ;
```

INSERTING DATA INTO TABLE

- The rows are added to relations(table) using INSERT command of SQL. Syntax of
  INSERT is : INSERT INTO <tablename> [<column list>]
  VALUE (<value1> , <value2> , …..) ;

e.g. to enter a row into EMPLOYEE table (created above), we write command as :

```
INSERT INTO employee
VALUES(1001 , 'Ravi' , 'M' , 'E4' , 50000);
```

OR

```
INSERT INTO employee (ECODE , ENAME , GENDER , GRADE , GROSS)
VALUES(1001 , 'Ravi' , 'M' , 'E4' , 50000);
```

ECODE	ENAME	GENDER	GRADE	GROSS
1001	Ravi	M	E4	50000

In order to insert another row in EMPLOYEE table , we write again INSERT command :

```
INSERT INTO employee
VALUES(1002 , 'Akash' , 'M' , 'A1' , 35000);
```

ECODE	ENAME	GENDER	GRADE	GROSS
1001	Ravi	M	E4	50000
1002	Akash	M	A1	35000

INSERTING NULL VALUES

- To insert value NULL in a specific column, we can type NULL without quotes and NULL will be inserted in that column. E.g. in order to insert NULL value in ENAME column of above table, we write INSERT command as :

```
INSERT INTO EMPLOYEE
VALUES (1004 , NULL , 'M' , 'B2' , 38965 ) ;
```

ECODE	ENAME	GENDER	GRADE	GROSS
1001	Ravi	M	E4	50000
1002	Akash	M	A1	35000
1004	NULL	M	B2	38965

SIMPLE QUERY USING SELECT COMMAND

- The SELECT command is used to pull information from a table. Syntax of SELECT command is : SELECT <column name>,<column name>
  FROM <tablename>
  WHERE <condition name> ;

SELECTING ALL DATA

- In order to retrieve everything (all columns) from a table, SELECT command is used as : **SELECT * FROM** <tablename> ;

e.g.

In order to retrieve everything from **Employee** table, we write SELECT command as :

EMPLOYEE

ECODE	ENAME	GENDER	GRADE	GROSS
1001	Ravi	M	E4	50000
1002	Akash	M	A1	35000
1004	NULL	M	B2	38965

SELECT * FROM Employee ;

SELECTING PARTICULAR COLUMNS

EMPLOYEE

ECODE	ENAME	GENDER	GRADE	GROSS
1001	Ravi	M	E4	50000
1002	Akash	M	A1	35000
1004	Neela	F	B2	38965
1005	Sunny	M	A2	30000
1006	Ruby	F	A1	45000
1009	Neema	F	A2	52000

- A particular column from a table can be selected by specifying column-names with SELECT command. E.g. in above table, if we want to select ECODE and ENAME column, then command is :

SELECT ECODE , ENAME
FROM EMPLOYEE ;

E.g.2 in order to select only ENAME, GRADE and GROSS column, the command is :

SELECT ENAME , GRADE ,
GROSS **FROM** EMPLOYEE ;

SELECTING PARTICULAR ROWS

We can select particular rows from a table by specifying a condition through **WHERE clause** along with SELECT statement. **E.g.** In employee table if we want to select rows where Gender is female, then command is :

SELECT * FROM **EMPLOYEE**
WHERE **GENDER = 'F' ;**

E.g.2. in order to select rows where salary is greater than 48000, then command is :

SELECT * FROM **EMPLOYEE**
WHERE **GROSS > 48000 ;**

ELIMINATING REDUNDANT DATA

The **DISTINCT** keyword eliminates duplicate rows from the results of a SELECT statement. For example ,

SELECT GENDER **FROM** EMPLOYEE ;

GENDER
M
M
F
M
F
F

SELECT DISTINCT(GENDER) **FROM** EMPLOYEE ;

DISTINCT(GENDER)
M
F

VIEWING STRUCTURE OF A TABLE

- If we want to know the structure of a table, we can use DESCRIBE or DESC command, as per following syntax :

DESCRIBE | **DESC** <tablename> ;

e.g. to view the structure of table **EMPLOYEE**, command is : **DESCRIBE** EMPLOYEE ; **OR DESC** EMPLOYEE ;

USING COLUMN ALIASES

- The columns that we select in a query can be given a different name, i.e. column alias name for output purpose.

Syntax :

SELECT <columnname> **AS** column alias , <columnname> **AS** column alias …..
FROM <tablename> ;

e.g. In output, suppose we want to display ECODE column as EMPLOYEE_CODE in output , then command is :

SELECT **ECODE AS "EMPLOYEE_CODE"**
FROM **EMPLOYEE ;**

CONDITION BASED ON A RANGE

- The **BETWEEN** operator defines a range of values that the column values must fall in to make the condition true. The range include both lower value and upper value.

e.g. to display ECODE, ENAME and GRADE of those employees whose salary is between 40000 and 50000, command is:

SELECT ECODE , ENAME ,GRADE
FROM **EMPLOYEE**
WHERE GROSS **BETWEEN** 40000 AND 50000 ;

Output will be :

ECODE	ENAME	GRADE
1001	Ravi	E4
1006	Ruby	A1

CONDITION BASED ON A LIST

- To specify a list of values, IN operator is used. The IN operator selects value that match any value in a given list of values. E.g.

SELECT * FROM EMPLOYEE
WHERE GRADE **IN** ('A1' , 'A2');

Output will be :

ECODE	**ENAME**	**GENDER**	**GRADE**	**GROSS**
1002	Akash	M	A1	35000
1006	Ruby	F	A1	45000
1005	Sunny	M	A2	30000
1009	Neema	F	A2	52000

- The **NOT IN** operator finds rows that do not match in the list. E.g.

SELECT * FROM EMPLOYEE
WHERE GRADE **NOT IN** ('A1' , 'A2');

Output will be :

ECODE	**ENAME**	**GENDER**	**GRADE**	**GROSS**
1001	Ravi	M	E4	50000
1004	Neela	F	B2	38965

CONDITION BASED ON PATTERN MATCHES

- LIKE operator is used for pattern matching in SQL. Patterns are described using two special wildcard characters:

1. percent(%) – The % character matches any substring.
2. underscore(_) – The _ character matches any character.

e.g. to display names of employee whose name starts with R in EMPLOYEE table, the command is :

SELECT ENAME
FROM **EMPLOYEE**
WHERE ENAME **LIKE 'R%' ;**

Output will be :

ENAME
Ravi
Ruby

e.g. to display details of employee whose second character in name is 'e'.

SELECT *
FROM **EMPLOYEE**
WHERE **ENAME LIKE '_e%' ;**

Output will be :

ECODE	ENAME	GENDER	GRADE	GROSS
1004	Neela	F	B2	38965
1009	Neema	F	A2	52000

e.g. to display details of employee whose name ends with 'y'.

SELECT *
FROM **EMPLOYEE**
WHERE **ENAME LIKE '%y' ;**

Output will be :

ECODE	ENAME	GENDER	GRADE	GROSS
1005	Sunny	M	A2	30000
1006	Ruby	F	A1	45000

SEARCHING FOR NULL

- The NULL value in a column can be searched for in a table using IS NULL in the WHERE clause. E.g. to list employee details whose salary contain NULL, we use the command :

SELECT ***
FROM **EMPLOYEE**
WHERE GROSS **IS NULL ;**

e.g.

STUDENT

Roll_No	Name	Marks
1	ARUN	NULL
2	RAVI	56
4	SANJAY	NULL

to display the names of those students whose marks is NULL, we use the command :

SELECT **Name**
FROM **EMPLOYEE**
WHERE Marks **IS NULL ;**

Output will be :

Name
ARUN
SANJAY

SORTING RESULTS

Whenever the SELECT query is executed , the resulting rows appear in a predecided order.The **ORDER BY clause** allow sorting of query result. The sorting can be done either in ascending or descending order, the default is ascending.

The **ORDER BY clause is used as :**

```
SELECT <column name> , <column name>….
FROM <tablename>
WHERE <condition>
ORDER BY <column name> ;
```

e.g. to display the details of employees in EMPLOYEE table in alphabetical order, we use command :

```
SELECT *
FROM EMPLOYEE
ORDER BY ENAME ;
```

Output will be :

ECODE	ENAME	GENDER	GRADE	GROSS
1002	Akash	M	A1	35000
1004	Neela	F	B2	38965
1009	Neema	F	A2	52000
1001	Ravi	M	E4	50000
1006	Ruby	F	A1	45000
1005	Sunny	M	A2	30000

e.g. display list of employee in descending alphabetical order whose salary is greater than 40000.

```
SELECT ENAME
FROM EMPLOYEE
WHERE GROSS > 40000
ORDER BY ENAME desc ;
```

Output will be :

ENAME
Ravi
Ruby
Neema

MODIFYING DATA IN TABLES

you can modify data in tables using UPDATE command of SQL. The UPDATE command specifies the rows to be changed using the WHERE clause, and the new data using the SET keyword. Syntax of update command is :

```
UPDATE <tablename>
SET <columnname>=value , <columnname>=value
WHERE <condition> ;
```

e.g. to change the salary of employee of those in EMPLOYEE table having employee code 1009 to 55000.

```
UPDATE EMPLOYEE
SET GROSS = 55000
WHERE ECODE = 1009 ;
```

UPDATING MORE THAN ONE COLUMNS

e.g. to update the salary to 58000 and grade to B2 for those employee whose employee code is 1001.

```
UPDATE EMPLOYEE
SET GROSS = 58000, GRADE='B2'
WHERE ECODE = 1009 ;
```

OTHER EXAMPLES

e.g.1. Increase the salary of each employee by 1000 in the EMPLOYEE table.

UPDATE EMPLOYEE
SET GROSS = GROSS +100 ;

e.g.2. Double the salary of employees having grade as 'A1' or 'A2' .

UPDATE EMPLOYEE
SET GROSS = GROSS * 2 ;
WHERE GRADE='A1' **OR** GRADE='A2' ;

e.g.3. Change the grade to 'A2' for those employees whose employee code is 1004 and name is Neela.

UPDATE EMPLOYEE
SET GRADE='A2'
WHERE ECODE=1004 **AND** GRADE='NEELA' ;

DELETING DATA FROM TABLES

To delete some data from tables, DELETE command is used. **The DELETE command removes rows from a table.** The syntax of DELETE command is :

DELETE FROM <tablename>
WHERE <condition> ;

For example, to remove the details of those employee from EMPLOYEE table whose grade is A1.

DELETE FROM EMPLOYEE
WHERE GRADE ='A1' ;

TO DELETE ALL THE CONTENTS FROM A TABLE

DELETE FROM EMPLOYEE ;

So if we do not specify any condition with WHERE clause, then all the rows of the table will be deleted. Thus above line will delete all rows from employee table.

DROPPING TABLES

The DROP TABLE command lets you drop a table from the database. The **syntax of DROP TABLE** command is :

DROP TABLE <tablename> ;

e.g. to drop a table employee, we need to write :

DROP TABLE employee ;

Once this command is given, the table name is no longer recognized and no more commands can be given on that table. After this command is executed, all the data in the table along with table structure will be deleted.

S.NO.	DELETE COMMAND	DROP TABLE COMMAND
1	It is a DML command.	It is a DDL Command.
2	This command is used to delete only rows of data from a table	This command is used to delete all the data of the table along with the structure of the table. The table is no longer recognized when this command gets executed.
3	Syntax of DELETE command is: **DELETE FROM** <tablename> **WHERE** <condition> ;	Syntax of DROP command is : **DROP TABLE** <tablename> ;

ALTER TABLE COMMAND

The ALTER TABLE command is used to change definitions of existing tables.(adding columns,deleting columns etc.). The ALTER TABLE command is used for :

1. adding columns to a table

2. Modifying column-definitions of a table.
3. Deleting columns of a table.
4. Adding constraints to table.
5. Enabling/Disabling constraints.

ADDING COLUMNS TO TABLE

To add a column to a table, ALTER TABLE command can be used as per following syntax:

ALTER TABLE <tablename>
ADD <Column name> <datatype> <constraint> ;

e.g. to add a new column ADDRESS to the EMPLOYEE table, we can write command as :

ALTER TABLE EMPLOYEE
ADD ADDRESS VARCHAR(50);

A new column by the name ADDRESS will be added to the table, where each row will contain NULL value for the new column.

ECODE	ENAME	GENDER	GRADE	GROSS	ADDRESS
1001	Ravi	M	E4	50000	NULL
1002	Akash	M	A1	35000	NULL
1004	Neela	F	B2	38965	NULL
1005	Sunny	M	A2	30000	NULL
1006	Ruby	F	A1	45000	NULL
1009	Neema	F	A2	52000	NULL

However **if you specify NOT NULL constraint while adding a new column**, MySQL adds the new column with the default value of that datatype e.g. for INT type it will add 0 , for CHAR types, it will add a space, and so on.

e.g. Given a table namely Testt with the following data in it.

Col1	Col2
1	A
2	G

Now following commands are given for the table. Predict the table contents after each of the following statements:

(i) ALTER TABLE testt ADD col3 INT ;
(ii) ALTER TABLE testt ADD col4 INT NOT NULL ;
(iii) ALTER TABLE testt ADD col5 CHAR(3) NOT NULL ;
(iv) ALTER TABLE testt ADD col6 VARCHAR(3);

MODIFYING COLUMNS

Column name and data type of column can be changed as per following syntax :

ALTER TABLE <table name>
CHANGE <old column name> <new column name> <new datatype>;

If **Only data type of column need to be changed**, then

ALTER TABLE <table name>
MODIFY <column name> <new datatype>;

e.g.1. In table EMPLOYEE, change the column GROSS to SALARY.

ALTER TABLE EMPLOYEE
CHANGE GROSS SALARY INTEGER;

e.g.2. In table EMPLOYEE , change the column ENAME to EM_NAME and data type from VARCHAR(20) to VARCHAR(30).

ALTER TABLE EMPLOYEE
CHANGE ENAME EM_NAME VARCHAR(30);

e.g.3. In table EMPLOYEE , change the datatype of GRADE column from CHAR(2) to VARCHAR(2).

ALTER TABLE EMPLOYEE
MODIFY GRADE VARCHAR(2);

DELETING COLUMNS

To delete a column from a table, the ALTER TABLE command takes the following form :

ALTER TABLE <table name>
DROP <column name>;

e.g. to delete column GRADE from table EMPLOYEE, we will write :

ALTER TABLE EMPLOYEE
DROP GRADE ;

ADDING/REMOVING CONSTRAINTS TO A TABLE

ALTER TABLE statement can be used to add constraints to your existing table by using it in following manner:

- **TO ADD PRIMARY KEY CONSTRAINT**

  ALTER TABLE <table name>
  ADD PRIMARY KEY (Column name);

e.g. to add PRIMARY KEY constraint on column ECODE of table EMPLOYEE , the command is :

ALTER TABLE EMPLOYEE
ADD PRIMARY KEY (ECODE) ;

- **TO ADD FOREIGN KEY CONSTRAINT**

  ALTER TABLE <table name>
  ADD FOREIGN KEY (Column name) REFERENCES Parent Table (Primary key of Parent Table);

REMOVING CONSTRAINTS

- To remove primary key constraint from a table, we use ALTER TABLE command as : **ALTER TABLE** <table name>
  DROP PRIMARY KEY ;
- To remove foreign key constraint from a table, we use ALTER TABLE command as : **ALTER TABLE** <table name>
  DROP FOREIGN KEY ;

ENABLING/DISABLING CONSTRAINTS

Only foreign key can be disabled/enabled in MySQL.

To disable foreign keys : **SET** FOREIGN_KEY_CHECKS = 0 ;
To enable foreign keys : **SET** FOREIGN_KEY_CHECKS = 1 ;

INTEGRITY CONSTRAINTS/CONSTRAINTS

- A constraint is a condition or check applicable on a field(column) or set of fields(columns).
- Common types of constraints include :

S.No.	Constraints	Description
1	NOT NULL	Ensures that a column cannot have NULL value
2	DEFAULT	Provides a default value for a column when none is specified
3	UNIQUE	Ensures that all values in a column are different
4	CHECK	Makes sure that all values in a column satisfy certain criteria
5	PRIMARY KEY	Used to uniquely identify a row in the table
6	FOREIGN KEY	Used to ensure referential integrity of the data

NOT NULL CONSTRAINT

By default, a column can hold NULL. It you not want to allow NULL value in a column, then NOT NULL constraint must be applied on that column. E.g.

```
CREATE TABLE Customer
(       SID integer NOT NULL ,
        Last_Name varchar(30)   NOT NULL ,
        First_Name varchar(30)      ) ;
```

Columns **SID** and **Last_Name** cannot include NULL, while **First_Name** can include NULL.

An attempt to execute the following SQL statement,

```
INSERT INTO Customer
VALUES (NULL , 'Kumar' , 'Ajay');
```

will result in an error because this will lead to column SID being NULL, which violates the NOT NULL constraint on that column.

DEFAULT CONSTARINT

The DEFAULT constraint provides a default value to a column when the INSERT INTO statement does not provide a specific value. **E.g.**

```
CREATE TABLE Student
( Student_ID integer ,
   Name varchar(30) ,
   Score integer DEFAULT 80);
```

When following SQL statement is executed on table created above:

```
INSERT INTO Student
VALUES (10 , 'Ravi' );
```

no value has been provided for score field.

Then table **Student** looks like the following:

Student_ID	Name	Score
10	Ravi	**80**

score field has got the default value

UNIQUE CONSTRAINT

- The UNIQUE constraint ensures that all values in a column are distinct. In other words, no two rows can hold the same value for a column with UNIQUE constraint.

e.g.

```
CREATE TABLE Customer
(       SID integer Unique ,
        Last_Name varchar(30) ,
        First_Name varchar(30) ) ;
```

Column SID has a unique constraint, and hence cannot include duplicate values. So, if the table already contains the following rows :

SID	Last_Name	First_Name
1	Kumar	Ravi
2	Sharma	Ajay
3	Devi	Raj

The executing the following SQL statement,

```
INSERT INTO Customer
VALUES ('3' , 'Cyrus' , 'Grace') ;
```

will result in an error because the value 3 already exist in the SID column, thus trying to insert another row with that value violates the UNIQUE constraint.

CHECK CONSTRAINT

- The CHECK constraint ensures that all values in a column satisfy certain conditions. Once defined, the table will only insert a new row or update an existing row if the new value satisfies the CHECK constraint.

e.g.

```
CREATE TABLE Customer
(       SID integer CHECK (SID > 0),
        Last_Name varchar(30) ,
        First_Name varchar(30) ) ;
```

So, attempting to execute the following statement :

```
INSERT INTO Customer
VALUES (-2 , 'Kapoor' , 'Raj');
```

will result in an error because the values for SID must be greater than 0.

PRIMARY KEY CONSTRAINT

- A primary key is used to identify each row in a table. A primary key can consist of one or more fields(column) on a table. When multiple fields are used as a primary key, they are called a **composite key.**

- You can define a primary key in CREATE TABLE command through keywords PRIMARY KEY. e.g.

```
CREATE TABLE Customer
(       SID integer NOT NULL PRIMARY KEY,
        Last_Name varchar(30) ,
        First_Name varchar(30) ) ;
```

Or

```
CREATE TABLE Customer
(       SID integer,
        Last_Name varchar(30) ,
        First_Name varchar(30),
        PRIMARY KEY (SID) ) ;
```

- The latter way is useful if you want to specify a composite primary key, **e.g.**

```
CREATE TABLE Customer
(       Branch integer NOT NULL,
        SID integer NOT NULL ,
        Last_Name varchar(30) ,
        First_Name varchar(30),
        PRIMARY KEY (Branch , SID) ) ;
```

FOREIGN KEY CONSTRAINT

- Foreign key is a non key column of a table (**child table**) that draws its values from **primary key** of another table(**parent table).**
- The table in which a foreign key is defined is called a **referencing table or child table.** A table to which a foreign key points is called **referenced table or parent table.**

e.g.

TABLE: STUDENT ← **Parent Table**

ROLL_NO ← **Primary key**	NAME	CLASS
1	ABC	XI
2	DEF	XII
3	XYZ	XI

Child Table

TABLE: SCORE

ROLL_NO	MARKS
1	55
2	83
3	90

Here column Roll_No is a foreign key in table SCORE(Child Table) and it is drawing its values from Primary key (ROLL_NO) of STUDENT table.(Parent Key).

```
CREATE TABLE STUDENT
(   ROLL_NO integer NOT NULL PRIMARY KEY ,
    NAME VARCHAR(30) ,
    CLASS VARCHAR(3) );
```

```
CREATE TABLE SCORE
  ( ROLL_NO integer ,
    MARKS integer ,
    FOREIGN KEY(ROLL_NO) REFERNCES STUDENT(ROLL_NO) ) ;
```

**** Foreign key is always defined in the child table.***

Syntax for using foreign key

FOREIGN KEY(column name) REFERENCES Parent_Table(PK of Parent Table);

REFERENCING ACTIONS

Referencing action with ON DELETE clause determines what to do in case of a DELETE occurs in the parent table.
Referencing action with ON UPDATE clause determines what to do in case of a UPDATE occurs in the parent table.

Actions:

1. **CASCADE :** This action states that if a DELETE or UPDATE operation affects a row from the parent table, then automatically delete or update the matching rows in the child table i.e., cascade the action to child table.
2. **SET NULL :** This action states that if a DELETE or UPDATE operation affects a row from the parent table, then set the foreign key column in the child table to NULL.
3. **NO ACTION :** Any attempt for DELETE or UPDATE in parent table is not allowed.
4. **RESTRICT :** This action rejects the DELETE or UPDATE operation for the parent table.

Q: Create two tables

Customer(customer_id, name)
Customer_sales(transaction_id, amount , **customer_id**)

Underlined columns indicate primary keys and bold column names indicate foreign key.
Make sure that no action should take place in case of a DELETE or UPDATE in the parent table.

Sol :
```
CREATE TABLE Customer (
        customer_id int Not Null Primary Key ,
        name varchar(30) ) ;

    CREATE TABLE Customer_sales (
        transaction_id Not Null Primary Key ,
        amount int ,
        customer_id int ,
        FOREIGN KEY(customer_id) REFERENCES Customer (customer_id)
        ON DELETE NO ACTION
        ON UPDATE NO ACTION );
```

Q: Distinguish between a Primary Key and a Unique key in a table.

S.NO.	PRIMARY KEY	UNIQUE KEY
1.	Column having Primary key can't contain NULL value	Column having Unique Key can contain NULL value
2.	There can be only one primary key in Table.	Many columns can be defined as Unique key

Q: Distinguish between ALTER Command and UPDATE command of SQL.

S.NO.	ALTER COMMAND	UPDATE COMMAND
1.	It is a DDL Command	It is a DML command
2.	It is used to change the definition of existing table, i.e. adding column, deleting column, etc.	It is used to modify the data values present in the rows of the table.
3.	Syntax for adding column in a table: ALTER TABLE <tablename> ADD <Column name><Datatype> ;	Syntax for using UPDATE command: UPDATE <Tablename> SET <Columnname>=value WHERE <Condition> ;

AGGREGATE / GROUP FUNCTIONS

Aggregate / Group functions work upon groups of rows , rather than on single row, and return one single output. Different aggregate functions are : COUNT( ) , AVG( ) , MIN( ) , MAX( ) , SUM ( )

Table : EMPL

EMPNO	ENAME	JOB	SAL	DEPTNO
8369	SMITH	CLERK	2985	10
8499	ANYA	SALESMAN	9870	20
8566	AMIR	SALESMAN	8760	30
8698	BINA	MANAGER	5643	20
8912	SUR	NULL	3000	10

1. **AVG( )**

   This function computes the average of given data. e.g. SELECT AVG(SAL)
   FROM EMPL ;

   Output

AVG(SAL)
6051.6

2. **COUNT( )**

   This function counts the number of rows in a given column.

   If you specify the COLUMN name in parenthesis of function, then this function returns rows where COLUMN is not null.

   If you specify the asterisk (*), this function returns all rows, including duplicates and nulls.

   e.g. SELECT COUNT(*)
   FROM EMPL ;

   Output

COUNT(*)
5

   e.g.2 SELECT COUNT(JOB)
   FROM EMPL ;

   Output

COUNT(JOB)
4

3. **MAX( )**

   This function returns the maximum value from a given column or expression.

   e.g. SELECT MAX(SAL)
   FROM EMPL ;

   Output

MAX(SAL)
9870

4. **MIN( )**

This function returns the minimum value from a given column or expression.

e.g. SELECT MIN(SAL)
FROM EMPL ;

Output

MIN(SAL)
2985

5. **SUM( )**

This function returns the sum of values in given column or expression.

e.g. SELECT SUM(SAL)
FROM EMPL ;

Output

SUM(SAL)
30258

GROUPING RESULT – GROUP BY

The GROUP BY clause combines all those records(row) that have identical values in a particular field(column) or a group of fields(columns).

GROUPING can be done by a column name, or with aggregate functions in which case the aggregate produces a value for each group.

Table : EMPL

EMPNO	ENAME	JOB	SAL	DEPTNO
8369	SMITH	CLERK	2985	10
8499	ANYA	SALESMAN	9870	20
8566	AMIR	SALESMAN	8760	30
8698	BINA	MANAGER	5643	20

e.g. Calculate the number of employees in each grade.

SELECT JOB, COUNT(*)
FROM EMPL
GROUP BY JOB ;

Output

JOB	COUNT(*)
CLERK	1
SALESMAN	2
MANAGER	1

e.g.2. Calculate the sum of salary for each department.

SELECT DEPTNO , SUM(SAL)
FROM EMPL
GROUP BY DEPTNO ;

Output

DEPTNO	SUM(SAL)
10	2985
20	15513
30	8760

e.g.3. find the average salary of each department.
Sol:

*** One thing that you should keep in mind is that while grouping , you should include only those values in the SELECT list that either have the same value for a group or contain a group(aggregate) function. Like in e.g. 2 given above, DEPTNO column has one(same) value for a group and the other expression SUM(SAL) contains a group function.*

NESTED GROUP

- To create a group within a group i.e., nested group, you need to specify multiple fields in the GROUP BY expression. e.g. To group records **job wise** within **Deptno wise**, you need to issue a query statement like :

```
SELECT DEPTNO , JOB , COUNT(EMPNO)
FROM EMPL
GROUP BY DEPTNO , JOB ;
```

Output

DEPTNO	JOB	COUNT(EMPNO)
10	CLERK	1
20	SALESMAN	1
20	MANAGER	1
30	SALESMAN	1

PLACING CONDITION ON GROUPS – HAVING CLAUSE

- The **HAVING clause places conditions on groups** in contrast to WHERE clause that places condition on individual rows. While **WHERE conditions cannot include aggregate functions, HAVING conditions can do so.**
- e.g. To display the jobs where the number of employees is less than 2,

```
SELECT JOB, COUNT(*)
FROM EMPL
GROUP BY JOB
HAVING COUNT(*) < 2 ;
```

Output

JOB	COUNT(*)
CLERK	1
MANAGER	1

DATABASE TRANSACTIONS

TRANSACTION

A Transaction is a logical unit of work that must succeed or fail in its entirety. This statement means that a transaction may involve many sub steps, which should either all be carried out successfully or all be ignored if some failure occurs. A Transaction is an atomic operation which may not be divided into smaller operations.

Example of a Transaction

```
Begin transaction
    Get balance from account X
    Calculate new balance as X – 1000
    Store new balance into database file
    Get balance from account Y
    Calculate new balance as Y + 1000
    Store new balance into database file
End transaction
```

TRANSACTION PROPERTIES (ACID PROPERTIES)

1. **A**TOMICITY(All or None Concept) – This property ensures that either all operations of the transaction are carried out or none are.

2. **C**ONSISTENCY – This property implies that if the database was in a consistent state before the start of transaction execution, then upon termination of transaction, the database will also be in a consistent state.

3. **I**SOLATION – This property implies that each transaction is unaware of other transactions executing concurrently in the system.

4. **D**URABILITY – This property of a transaction ensures that after the successful completion of a transaction, the changes made by it to the database persist, even if there are system failures.

TRANSACTION CONTROL COMMANDS (TCL)

The TCL of MySQL consists of following commands :

1. BEGIN or START TRANSACTION – marks the beginning of a transaction.
2. COMMIT – Ends the current transaction by saving database changes and starts a new transaction.
3. ROLLBACK – Ends the current transaction by discarding database changes and starts a new transaction.
4. SAVEPOINT – Define breakpoints for the transaction to allow partial rollbacks.
5. SET AUTOCOMMIT – Enables or disables the default auto commit mode

35. SQL – Transactions

A transaction is a unit of work that is performed against a database. Transactions are units or sequences of work accomplished in a logical order, whether in a manual fashion by a user or automatically by some sort of a database program.

A transaction is the propagation of one or more changes to the database. For example, if you are creating a record or updating a record or deleting a record from the table, then you are performing a transaction on that table. It is important to control these transactions to ensure the data integrity and to handle database errors.

Practically, you will club many SQL queries into a group and you will execute all of them together as a part of a transaction.

Properties of Transactions

Transactions have the following four standard properties, usually referred to by the acronym **ACID**.

- **Atomicity:** ensures that all operations within the work unit are completed successfully. Otherwise, the transaction is aborted at the point of failure and all the previous operations are rolled back to their former state.
- **Consistency:** ensures that the database properly changes states upon a successfully committed transaction.
- **Isolation:** enables transactions to operate independently of and transparent to each other.
- **Durability:** ensures that the result or effect of a committed transaction persists in case of a system failure.

Transaction Control

The following commands are used to control transactions.

- **COMMIT:** to save the changes.
- **ROLLBACK:** to roll back the changes.
- **SAVEPOINT:** creates points within the groups of transactions in which to ROLLBACK.
- **SET TRANSACTION:** Places a name on a transaction.

Transactional Control Commands

Transactional control commands are only used with the **DML Commands** such as – INSERT, UPDATE and DELETE only. They cannot be used while creating tables or dropping them because these operations are automatically committed in the database.

The COMMIT Command

The COMMIT command is the transactional command used to save changes invoked by a transaction to the database. The COMMIT command saves all the transactions to the database since the last COMMIT or ROLLBACK command.

The syntax for the COMMIT command is as follows.

```
COMMIT;
```

Example

Consider the CUSTOMERS table having the following records:

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  32 | Ahmedabad |  2000.00 |
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

Following is an example which would delete those records from the table which have age = 25 and then COMMIT the changes in the database.

```
SQL> DELETE FROM CUSTOMERS
     WHERE AGE = 25;
SQL> COMMIT;
```

Thus, two rows from the table would be deleted and the SELECT statement would produce the following result.

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  32 | Ahmedabad |  2000.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
```

```
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

The ROLLBACK Command

The ROLLBACK command is the transactional command used to undo transactions that have not already been saved to the database. This command can only be used to undo transactions since the last COMMIT or ROLLBACK command was issued.

The syntax for a ROLLBACK command is as follows:

```
ROLLBACK;
```

Example

Consider the CUSTOMERS table having the following records:

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  32 | Ahmedabad |  2000.00 |
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

Following is an example, which would delete those records from the table which have the age = 25 and then ROLLBACK the changes in the database.

```
SQL> DELETE FROM CUSTOMERS
     WHERE AGE = 25;
SQL> ROLLBACK;
```

Thus, the delete operation would not impact the table and the SELECT statement would produce the following result.

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  32 | Ahmedabad |  2000.00 |
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

The SAVEPOINT Command

A SAVEPOINT is a point in a transaction when you can roll the transaction back to a certain point without rolling back the entire transaction.

The syntax for a SAVEPOINT command is as shown below.

```
SAVEPOINT SAVEPOINT_NAME;
```

This command serves only in the creation of a SAVEPOINT among all the transactional statements. The ROLLBACK command is used to undo a group of transactions.

The syntax for rolling back to a SAVEPOINT is as shown below.

```
ROLLBACK TO SAVEPOINT_NAME;
```

Following is an example where you plan to delete the three different records from the CUSTOMERS table. You want to create a SAVEPOINT before each delete, so that you can ROLLBACK to any SAVEPOINT at any time to return the appropriate data to its original state.

Example

Consider the CUSTOMERS table having the following records.

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  32 | Ahmedabad |  2000.00 |
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
```

```
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

The following code block contains the series of operations.

```
SQL> SAVEPOINT SP1;
Savepoint created.
SQL> DELETE FROM CUSTOMERS WHERE ID=1;
1 row deleted.
SQL> SAVEPOINT SP2;
Savepoint created.
SQL> DELETE FROM CUSTOMERS WHERE ID=2;
1 row deleted.
SQL> SAVEPOINT SP3;
Savepoint created.
SQL> DELETE FROM CUSTOMERS WHERE ID=3;
1 row deleted.
```

Now that the three deletions have taken place, let us assume that you have changed your mind and decided to ROLLBACK to the SAVEPOINT that you identified as SP2. Because SP2 was created after the first deletion, the last two deletions are undone:

```
SQL> ROLLBACK TO SP2;
Rollback complete.
```

Notice that only the first deletion took place since you rolled back to SP2.

```
SQL> SELECT * FROM CUSTOMERS;
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
+----+----------+-----+-----------+----------+
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
```

```
|  6 | Komal    |  22 | MP         |  4500.00 |
|  7 | Muffy    |  24 | Indore     | 10000.00 |
+----+----------+-----+-----------+----------+
6 rows selected.
```

The RELEASE SAVEPOINT Command

The RELEASE SAVEPOINT command is used to remove a SAVEPOINT that you have created.

The syntax for a RELEASE SAVEPOINT command is as follows.

```
RELEASE SAVEPOINT SAVEPOINT_NAME;
```

Once a SAVEPOINT has been released, you can no longer use the ROLLBACK command to undo transactions performed since the last SAVEPOINT.

The SET TRANSACTION Command

The SET TRANSACTION command can be used to initiate a database transaction. This command is used to specify characteristics for the transaction that follows. For example, you can specify a transaction to be read only or read write.

The syntax for a SET TRANSACTION command is as follows.

```
SET TRANSACTION [ READ WRITE | READ ONLY ];
```

* Inbuilt functions in SQL (aggregate fun^c)

1) maximum : returns maximum value
2) minimum : " minimum "
3) average : " : avg value of the attribute
4) sum : " sum " " " "
5) count : counts no. of " in " "

Q2) Calculate the average Salary of employees

```
select avg(salary) from emp;
select avg(salary) "average salary" from emp;
```

Q=) List the minimum and maximum salary of employees

```
select min(salary) from emp;
select max(salary) from emp;
```

Q=) Calculate the total salary of the employees

```
select sum(salary) from emp;
```

Q=) Determine how many records are there in the table.

```
select count(*) from emp;
select count(distinct salary) from emp;
select count(distinct e_no) from emp;
select * from dual;
```

D
X

```
select 2*2 from dual;
```

2*2
4

```
select 4/2 from dual;
```

4/2
2

```
desc dual;
```

NAME	Null?	Type
DUMMY		VARCHAR2(1)

Q=) When you want to check the date of the system.

1) Sysdate

```
select sysdate from dual;
```

SYSDATE
01-FEB-21

Aggregate inbuilt functions

2) Numeric function

(a) absolute (b) power (c) round (d) squareroot (e) exponent (f) greatest (g) least (h) mod

(i) floor (j) ceil

(a) absolute = returns the absolute value of func
(g) mod : returns remainder of 1st no. divided by a second no passed on a parameter.

Select abs(-15) from dual;

ABS(-15)
15

Select power(2,3) from dual;

POWER(2,3)
8

select power(3,3) from dual;

POWER(3,3)
27

select round(15.91,1) from dual;

ROUND(15.91,1)
15.9

Select round(15.918,3) from dual;

ROUND(15.918,3)
15.918

select round(15.918,2) from dual;

ROUND(15.918,2)
15.92

Select sqrt(25) from dual;

SQRT(25)
5

select exp(5) from dual;

EXP(5)
148.413159

Select exp(2) from dual;

EXP(2)
7.389056

select greatest (4,5,17) from dual;
GREATEST(4,5,17)
17

select least (4,5,17) from dual;
LEAST(4,5,17)
4

select mod(15,7) from dual;
MOD(15,7)
1

select mod(4,7) from dual;
MOD(4,7)
4

select floor (24.8) from dual;
FLOOR(24.8)
24

select ceil (24.8) from dual;
CEIL(24.8)
25

* String functions

(a) lower (b) initcap (c) upper (d) substring (e) length.

select lower ('IVAN BAYROSS') FROM DUAL;
LOWER('IVANB
ivanbayross

select lower ('MEGHA') FROM DUAL;
LOWER
megha

select upper('megha') from dual;
UPPER
MEGHA

select initcap('megha') from dual;
Megha

select initcap('IVAN BAYROSS') FROM DUAL;

INITCAP('IVA
Ivan Bayross

Select Substr('megha', 3, 3) FROM DUAL;

SUB
gha

Select Substr('megha', 3, 2) from dual;

Su
gh

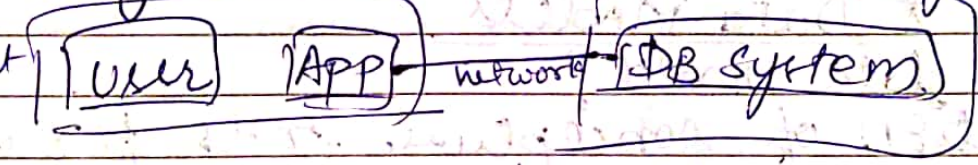
Select length('MEGH') from dual;

length('Megha')
5

3-2-21 Database Applications

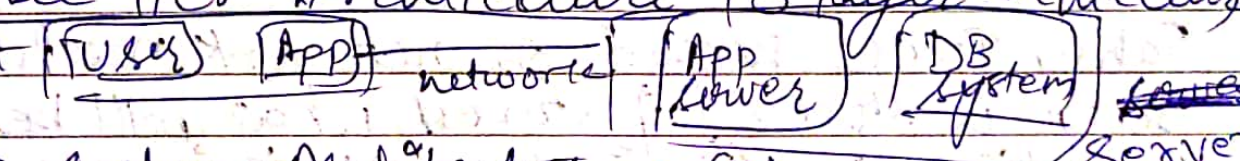
Last lecture Types of DB users
where DB uses divided into 2-3 parts

(1) Two tier Architecture (2 layer architecture) directly connected to DB through network



several clients can directly access DB

(2) Three Tier Architecture (3 layer architecture)



* DB System Architecture (2s)

2 tier
Adv

Q => why maintenance is adv?
DB can be easily modified in 2 tier direct interaction

disadv → scalability & security
if no of users ↑ so can't be scalable

CHAPTER

40

SQL Sub Queries

A Subquery or Inner query or Nested query is a query within another SQL query and embedded within the WHERE clause.

A subquery is used to return data that will be used in the main query as a condition to further restrict the data to be retrieved.

Subqueries can be used with the SELECT, INSERT, UPDATE, and DELETE statements along with the operators like =, <, >, >=, <=, IN, BETWEEN etc.

There are a few rules that subqueries must follow:

- Subqueries must be enclosed within parentheses.
- A subquery can have only one column in the SELECT clause, unless multiple columns are in the main query for the subquery to compare its selected columns.
- An ORDER BY cannot be used in a subquery, although the main query can use an ORDER BY. The GROUP BY can be used to perform the same function as the ORDER BY in a subquery.
- Subqueries that return more than one row can only be used with multiple value operators, such as the IN operator.
- The SELECT list cannot include any references to values that evaluate to a BLOB, ARRAY, CLOB, or NCLOB.
- A subquery cannot be immediately enclosed in a set function.
- The BETWEEN operator cannot be used with a subquery; however, the BETWEEN operator can be used within the subquery.

Subqueries with the SELECT Statement:

Subqueries are most frequently used with the SELECT statement. The basic syntax is as follows:

```
SELECT column_name [, column_name ]
FROM   table1 [, table2 ]
WHERE  column_name OPERATOR
```

```
      (SELECT column_name [, column_name ]
      FROM table1 [, table2 ]
      [WHERE])
```

Example:

Consider the CUSTOMERS table having the following records:

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  35 | Ahmedabad |  2000.00 |
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

Now, let us check the following subquery with SELECT statement:

```
SQL> SELECT *
     FROM CUSTOMERS
     WHERE ID IN (SELECT ID
                  FROM CUSTOMERS
                  WHERE SALARY > 4500) ;
```

This would produce the following result:

```
+----+----------+-----+---------+----------+
| ID | NAME     | AGE | ADDRESS | SALARY   |
+----+----------+-----+---------+----------+
|  4 | Chaitali |  25 | Mumbai  |  6500.00 |
|  5 | Hardik   |  27 | Bhopal  |  8500.00 |
|  7 | Muffy    |  24 | Indore  | 10000.00 |
+----+----------+-----+---------+----------+
```

Subqueries with the INSERT Statement:

Subqueries also can be used with INSERT statements. The INSERT statement uses the data returned from the subquery to insert into another table. The selected data in the subquery can be modified with any of the character, date or number functions.

The basic syntax is as follows:

```
INSERT INTO table_name [ (column1 [, column2 ]) ]
           SELECT [ *|column1 [, column2 ]
           FROM table1 [, table2 ]
           [ WHERE VALUE OPERATOR ]
```

Example:

Consider a table CUSTOMERS_BKP with similar structure as CUSTOMERS table. Now to copy complete CUSTOMERS table into CUSTOMERS_BKP, following is the syntax:

```
SQL> INSERT INTO CUSTOMERS_BKP
     SELECT * FROM CUSTOMERS
```

```
     WHERE ID IN (SELECT ID
                  FROM CUSTOMERS) ;
```

Subqueries with the UPDATE Statement:

The subquery can be used in conjunction with the UPDATE statement. Either single or multiple columns in a table can be updated when using a subquery with the UPDATE statement.

The basic syntax is as follows:

```
UPDATE table
SET column_name = new_value
[ WHERE OPERATOR [ VALUE ]
   (SELECT COLUMN_NAME
   FROM TABLE_NAME)
   [ WHERE) ]
```

Example:

Assuming, we have CUSTOMERS_BKP table available which is backup of CUSTOMERS table.

Following example updates SALARY by 0.25 times in CUSTOMERS table for all the customers whose AGE is greater than or equal to 27:

```
SQL> UPDATE CUSTOMERS
     SET SALARY = SALARY * 0.25
     WHERE AGE IN (SELECT AGE FROM CUSTOMERS_BKP
                   WHERE AGE >= 27 );
```

This would impact two rows and finally CUSTOMERS table would have the following records:

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  35 | Ahmedabad |   125.00 |
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  2125.00 |
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

Subqueries with the DELETE Statement:

The subquery can be used in conjunction with the DELETE statement like with any other statements mentioned above.

The basic syntax is as follows:

```
DELETE FROM TABLE_NAME
[ WHERE OPERATOR [ VALUE ]
   (SELECT COLUMN_NAME
   FROM TABLE_NAME)
   [ WHERE) ]
```

Example:

Assuming, we have CUSTOMERS_BKP table available which is backup of CUSTOMERS table.

Following example deletes records from CUSTOMERS table for all the customers whose AGE is greater than or equal to 27:

```
SQL> DELETE FROM CUSTOMERS
     WHERE AGE IN (SELECT AGE FROM CUSTOMERS_BKP
                   WHERE AGE > 27 );
```

This would impact two rows and finally CUSTOMERS table would have the following records:

```
+----+----------+-----+---------+----------+
| ID | NAME     | AGE | ADDRESS | SALARY   |
+----+----------+-----+---------+----------+
|  2 | Khilan   |  25 | Delhi   |  1500.00 |
|  3 | kaushik  |  23 | Kota    |  2000.00 |
|  4 | Chaitali |  25 | Mumbai  |  6500.00 |
|  6 | Komal    |  22 | MP      |  4500.00 |
|  7 | Muffy    |  24 | Indore  | 10000.00 |
+----+----------+-----+---------+----------+
```

CHAPTER

33

SQL - Using Views

A view is nothing more than a SQL statement that is stored in the database with an associated name. A view is actually a composition of a table in the form of a predefined SQL query.

A view can contain all rows of a table or select rows from a table. A view can be created from one or many tables which depends on the written SQL query to create a view.

Views, which are kind of virtual tables, allow users to do the following:

- Structure data in a way that users or classes of users find natural or intuitive.
- Restrict access to the data such that a user can see and (sometimes) modify exactly what they need and no more.
- Summarize data from various tables which can be used to generate reports.

Creating Views:

Database views are created using the **CREATE VIEW** statement. Views can be created from a single table, multiple tables, or another view.

To create a view, a user must have the appropriate system privilege according to the specific implementation.

The basic CREATE VIEW syntax is as follows:

```
CREATE VIEW view_name AS
SELECT column1, column2.....
FROM table_name
WHERE [condition];
```

You can include multiple tables in your SELECT statement in very similar way as you use them in normal SQL SELECT query.

Example:

Consider the CUSTOMERS table having the following records:

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
```

```
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  32 | Ahmedabad |  2000.00 |
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

Now, following is the example to create a view from CUSTOMERS table. This view would be used to have customer name and age from CUSTOMERS table:

```
SQL > CREATE VIEW CUSTOMERS_VIEW AS
SELECT name, age
FROM  CUSTOMERS;
```

Now, you can query CUSTOMERS_VIEW in similar way as you query an actual table. Following is the example:

```
SQL > SELECT * FROM CUSTOMERS_VIEW;
```

This would produce the following result:

```
+----------+-----+
| name     | age |
+----------+-----+
| Ramesh   |  32 |
| Khilan   |  25 |
| kaushik  |  23 |
| Chaitali |  25 |
| Hardik   |  27 |
| Komal    |  22 |
| Muffy    |  24 |
+----------+-----+
```

The WITH CHECK OPTION:

The WITH CHECK OPTION is a CREATE VIEW statement option. The purpose of the WITH CHECK OPTION is to ensure that all UPDATE and INSERTs satisfy the condition(s) in the view definition.

If they do not satisfy the condition(s), the UPDATE or INSERT returns an error.

The following is an example of creating same view CUSTOMERS_VIEW with the WITH CHECK OPTION:

```
CREATE VIEW CUSTOMERS_VIEW AS
SELECT name, age
FROM  CUSTOMERS
WHERE age IS NOT NULL
WITH CHECK OPTION;
```

The WITH CHECK OPTION in this case should deny the entry of any NULL values in the view's AGE column, because the view is defined by data that does not have a NULL value in the AGE column.

Updating a View:

A view can be updated under certain conditions:

- The SELECT clause may not contain the keyword DISTINCT.
- The SELECT clause may not contain summary functions.
- The SELECT clause may not contain set functions.
- The SELECT clause may not contain set operators.
- The SELECT clause may not contain an ORDER BY clause.
- The FROM clause may not contain multiple tables.
- The WHERE clause may not contain subqueries.
- The query may not contain GROUP BY or HAVING.
- Calculated columns may not be updated.
- All NOT NULL columns from the base table must be included in the view in order for the INSERT query to function.

So if a view satisfies all the abovementioned rules then you can update a view. Following is an example to update the age of Ramesh:

```
SQL > UPDATE CUSTOMERS_VIEW
      SET AGE = 35
      WHERE name='Ramesh';
```

This would ultimately update the base table CUSTOMERS and same would reflect in the view itself. Now, try to query base table, and SELECT statement would produce the following result:

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  35 | Ahmedabad |  2000.00 |
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

Inserting Rows into a View:

Rows of data can be inserted into a view. The same rules that apply to the UPDATE command also apply to the INSERT command.

Here, we can not insert rows in CUSTOMERS_VIEW because we have not included all the NOT NULL columns in this view, otherwise you can insert rows in a view in similar way as you insert them in a table.

Deleting Rows into a View:

Rows of data can be deleted from a view. The same rules that apply to the UPDATE and INSERT commands apply to the DELETE command.

Following is an example to delete a record having AGE= 22.

```
SQL > DELETE FROM CUSTOMERS_VIEW
      WHERE age = 22;
```

This would ultimately delete a row from the base table CUSTOMERS and same would reflect in the view itself. Now, try to query base table, and SELECT statement would produce the following result:

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  35 | Ahmedabad |  2000.00 |
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

Dropping Views:

Obviously, where you have a view, you need a way to drop the view if it is no longer needed. The syntax is very simple as given below:

```
DROP VIEW view_name;
```

Following is an example to drop CUSTOMERS_VIEW from CUSTOMERS table:

```
DROP VIEW CUSTOMERS_VIEW;
```

CHAPTER

26

SQL Joins

The SQL **Joins** clause is used to combine records from two or more tables in a database. A JOIN is a means for combining fields from two tables by using values common to each.

Consider the following two tables, (a) CUSTOMERS table is as follows:

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  32 | Ahmedabad |  2000.00 |
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

(b) Another table is ORDERS as follows:

```
+-----+---------------------+-------------+--------+
|OID  | DATE                | CUSTOMER_ID | AMOUNT |
+-----+---------------------+-------------+--------+
| 102 | 2009-10-08 00:00:00 |           3 |   3000 |
| 100 | 2009-10-08 00:00:00 |           3 |   1500 |
| 101 | 2009-11-20 00:00:00 |           2 |   1560 |
| 103 | 2008-05-20 00:00:00 |           4 |   2060 |
+-----+---------------------+-------------+--------+
```

Now, let us join these two tables in our SELECT statement as follows:

```
SQL> SELECT ID, NAME, AGE, AMOUNT
        FROM CUSTOMERS, ORDERS
        WHERE  CUSTOMERS.ID = ORDERS.CUSTOMER_ID;
```

This would produce the following result:

```
+----+----------+-----+--------+
| ID | NAME     | AGE | AMOUNT |
+----+----------+-----+--------+
|  3 | kaushik  |  23 |   3000 |
|  3 | kaushik  |  23 |   1500 |
|  2 | Khilan   |  25 |   1560 |
```

```
|  4 | Chaitali |  25 |   2060 |
+----+----------+-----+--------+
```

Here, it is noticeable that the join is performed in the WHERE clause. Several operators can be used to join tables, such as =, <, >, <>, <=, >=, !=, BETWEEN, LIKE, and NOT; they can all be used to join tables. However, the most common operator is the equal symbol.

SQL Join Types:

There are different types of joins available in SQL:

- INNER JOIN: returns rows when there is a match in both tables.
- LEFT JOIN: returns all rows from the left table, even if there are no matches in the right table.
- RIGHT JOIN: returns all rows from the right table, even if there are no matches in the left table.
- FULL JOIN: returns rows when there is a match in one of the tables.
- SELF JOIN: is used to join a table to itself as if the table were two tables, temporarily renaming at least one table in the SQL statement.
- CARTESIAN JOIN: returns the Cartesian product of the sets of records from the two or more joined tables.

INNER JOIN

The most frequently used and important of the joins is the **INNER JOIN**. They are also referred to as an EQUIJOIN.

The INNER JOIN creates a new result table by combining column values of two tables (table1 and table2) based upon the join-predicate. The query compares each row of table1 with each row of table2 to find all pairs of rows which satisfy the join-predicate. When the join-predicate is satisfied, column values for each matched pair of rows of A and B are combined into a result row.

Syntax:

The basic syntax of **INNER JOIN** is as follows:

```
SELECT table1.column1, table2.column2...
FROM table1
INNER JOIN table2
ON table1.common_filed = table2.common_field;
```

Example:

Consider the following two tables, (a) CUSTOMERS table is as follows:

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  32 | Ahmedabad |  2000.00 |
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

(b) Another table is ORDERS as follows:

```
+-----+---------------------+-------------+--------+
```

```
| OID | DATE                |          ID | AMOUNT |
+-----+---------------------+-------------+--------+
| 102 | 2009-10-08 00:00:00 |           3 |   3000 |
| 100 | 2009-10-08 00:00:00 |           3 |   1500 |
| 101 | 2009-11-20 00:00:00 |           2 |   1560 |
| 103 | 2008-05-20 00:00:00 |           4 |   2060 |
+-----+---------------------+-------------+--------+
```

Now, let us join these two tables using INNER JOIN as follows:

```
SQL> SELECT  ID, NAME, AMOUNT, DATE
     FROM CUSTOMERS
     INNER JOIN ORDERS
     ON CUSTOMERS.ID = ORDERS.CUSTOMER_ID;
```

This would produce the following result:

```
+----+----------+--------+---------------------+
| ID | NAME     | AMOUNT | DATE                |
+----+----------+--------+---------------------+
|  3 | kaushik  |   3000 | 2009-10-08 00:00:00 |
|  3 | kaushik  |   1500 | 2009-10-08 00:00:00 |
|  2 | Khilan   |   1560 | 2009-11-20 00:00:00 |
|  4 | Chaitali |   2060 | 2008-05-20 00:00:00 |
+----+----------+--------+---------------------+
```

LEFT JOIN

The SQL **LEFT JOIN** returns all rows from the left table, even if there are no matches in the right table. This means that if the ON clause matches 0 (zero) records in right table, the join will still return a row in the result, but with NULL in each column from right table.

This means that a left join returns all the values from the left table, plus matched values from the right table or NULL in case of no matching join predicate.

Syntax:

The basic syntax of **LEFT JOIN** is as follows:

```
SELECT table1.column1, table2.column2...
FROM table1
LEFT JOIN table2
ON table1.common_filed = table2.common_field;
```

Here given condition could be any given expression based on your requirement.

Example:

Consider the following two tables, (a) CUSTOMERS table is as follows:

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  32 | Ahmedabad |  2000.00 |
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
```

```
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

(b) Another table is ORDERS as follows:

```
+-----+---------------------+-------------+--------+
| OID | DATE                | CUSTOMER_ID | AMOUNT |
+-----+---------------------+-------------+--------+
| 102 | 2009-10-08 00:00:00 |           3 |   3000 |
| 100 | 2009-10-08 00:00:00 |           3 |   1500 |
| 101 | 2009-11-20 00:00:00 |           2 |   1560 |
| 103 | 2008-05-20 00:00:00 |           4 |   2060 |
+-----+---------------------+-------------+--------+
```

Now, let us join these two tables using LEFT JOIN as follows:

```
SQL> SELECT  ID, NAME, AMOUNT, DATE
     FROM CUSTOMERS
     LEFT JOIN ORDERS
     ON CUSTOMERS.ID = ORDERS.CUSTOMER_ID;
```

This would produce the following result:

```
+----+----------+--------+---------------------+
| ID | NAME     | AMOUNT | DATE                |
+----+----------+--------+---------------------+
|  1 | Ramesh   |   NULL | NULL                |
|  2 | Khilan   |   1560 | 2009-11-20 00:00:00 |
|  3 | kaushik  |   3000 | 2009-10-08 00:00:00 |
|  3 | kaushik  |   1500 | 2009-10-08 00:00:00 |
|  4 | Chaitali |   2060 | 2008-05-20 00:00:00 |
|  5 | Hardik   |   NULL | NULL                |
|  6 | Komal    |   NULL | NULL                |
|  7 | Muffy    |   NULL | NULL                |
+----+----------+--------+---------------------+
```

RIGHT JOIN

The SQL **RIGHT JOIN** returns all rows from the right table, even if there are no matches in the left table. This means that if the ON clause matches 0 (zero) records in left table, the join will still return a row in the result, but with NULL in each column from left table.

This means that a right join returns all the values from the right table, plus matched values from the left table or NULL in case of no matching join predicate.

Syntax:

The basic syntax of **RIGHT JOIN** is as follows:

```
SELECT table1.column1, table2.column2...
FROM table1
RIGHT JOIN table2
ON table1.common_filed = table2.common_field;
```

Example:

Consider the following two tables, (a) CUSTOMERS table is as follows:

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  32 | Ahmedabad |  2000.00 |
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

(b) Another table is ORDERS as follows:

```
+-----+---------------------+-------------+--------+
|OID  | DATE                | CUSTOMER_ID | AMOUNT |
+-----+---------------------+-------------+--------+
| 102 | 2009-10-08 00:00:00 |           3 |   3000 |
| 100 | 2009-10-08 00:00:00 |           3 |   1500 |
| 101 | 2009-11-20 00:00:00 |           2 |   1560 |
| 103 | 2008-05-20 00:00:00 |           4 |   2060 |
+-----+---------------------+-------------+--------+
```

Now, let us join these two tables using RIGHT JOIN as follows:

```
SQL> SELECT  ID, NAME, AMOUNT, DATE
     FROM CUSTOMERS
     RIGHT JOIN ORDERS
     ON CUSTOMERS.ID = ORDERS.CUSTOMER_ID;
```

This would produce the following result:

```
+------+----------+--------+---------------------+
| ID   | NAME     | AMOUNT | DATE                |
+------+----------+--------+---------------------+
|    3 | kaushik  |   3000 | 2009-10-08 00:00:00 |
|    3 | kaushik  |   1500 | 2009-10-08 00:00:00 |
|    2 | Khilan   |   1560 | 2009-11-20 00:00:00 |
|    4 | Chaitali |   2060 | 2008-05-20 00:00:00 |
+------+----------+--------+---------------------+
```

FULL JOIN

The SQL **FULL JOIN** combines the results of both left and right outer joins.

The joined table will contain all records from both tables, and fill in NULLs for missing matches on either side.

Syntax:

The basic syntax of **FULL JOIN** is as follows:

```
SELECT table1.column1, table2.column2...
FROM table1
FULL JOIN table2
ON table1.common_filed = table2.common_field;
```

Here given condition could be any given expression based on your requirement.

Example:

Consider the following two tables, (a) CUSTOMERS table is as follows:

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  32 | Ahmedabad |  2000.00 |
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

(b) Another table is ORDERS as follows:

```
+-----+---------------------+-------------+--------+
|OID  | DATE                | CUSTOMER_ID | AMOUNT |
+-----+---------------------+-------------+--------+
| 102 | 2009-10-08 00:00:00 |           3 |   3000 |
| 100 | 2009-10-08 00:00:00 |           3 |   1500 |
| 101 | 2009-11-20 00:00:00 |           2 |   1560 |
| 103 | 2008-05-20 00:00:00 |           4 |   2060 |
+-----+---------------------+-------------+--------+
```

Now, let us join these two tables using FULL JOIN as follows:

```
SQL> SELECT  ID, NAME, AMOUNT, DATE
     FROM CUSTOMERS
     FULL JOIN ORDERS
     ON CUSTOMERS.ID = ORDERS.CUSTOMER_ID;
```

This would produce the following result:

```
+------+----------+--------+---------------------+
| ID   | NAME     | AMOUNT | DATE                |
+------+----------+--------+---------------------+
|    1 | Ramesh   |   NULL | NULL                |
|    2 | Khilan   |   1560 | 2009-11-20 00:00:00 |
|    3 | kaushik  |   3000 | 2009-10-08 00:00:00 |
|    3 | kaushik  |   1500 | 2009-10-08 00:00:00 |
|    4 | Chaitali |   2060 | 2008-05-20 00:00:00 |
|    5 | Hardik   |   NULL | NULL                |
|    6 | Komal    |   NULL | NULL                |
|    7 | Muffy    |   NULL | NULL                |
|    3 | kaushik  |   3000 | 2009-10-08 00:00:00 |
|    3 | kaushik  |   1500 | 2009-10-08 00:00:00 |
|    2 | Khilan   |   1560 | 2009-11-20 00:00:00 |
|    4 | Chaitali |   2060 | 2008-05-20 00:00:00 |
+------+----------+--------+---------------------+
```

If your Database does not support FULL JOIN like MySQL does not support FULL JOIN, then you can use **UNION ALL** clause to combine two JOINS as follows:

```
SQL> SELECT  ID, NAME, AMOUNT, DATE
     FROM CUSTOMERS
     LEFT JOIN ORDERS
```

```
     ON CUSTOMERS.ID = ORDERS.CUSTOMER_ID
UNION ALL
     SELECT  ID, NAME, AMOUNT, DATE
     FROM CUSTOMERS
     RIGHT JOIN ORDERS
     ON CUSTOMERS.ID = ORDERS.CUSTOMER_ID
```

SELF JOIN

The SQL **SELF JOIN** is used to join a table to itself as if the table were two tables, temporarily renaming at least one table in the SQL statement.

Syntax:

The basic syntax of **SELF JOIN** is as follows:

```
SELECT a.column_name, b.column_name...
FROM table1 a, table1 b
WHERE a.common_filed = b.common_field;
```

Here, WHERE clause could be any given expression based on your requirement.

Example:

Consider the following two tables, (a) CUSTOMERS table is as follows:

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  32 | Ahmedabad |  2000.00 |
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

Now, let us join this table using SELF JOIN as follows:

```
SQL> SELECT  a.ID, b.NAME, a.SALARY
     FROM CUSTOMERS a, CUSTOMERS b
     WHERE a.SALARY < b.SALARY;
```

This would produce the following result:

```
+----+----------+---------+
| ID | NAME     | SALARY  |
+----+----------+---------+
|  2 | Ramesh   | 1500.00 |
|  2 | kaushik  | 1500.00 |
|  1 | Chaitali | 2000.00 |
|  2 | Chaitali | 1500.00 |
|  3 | Chaitali | 2000.00 |
|  6 | Chaitali | 4500.00 |
|  1 | Hardik   | 2000.00 |
|  2 | Hardik   | 1500.00 |
|  3 | Hardik   | 2000.00 |
|  4 | Hardik   | 6500.00 |
```

```
|  6 | Hardik   | 4500.00 |
|  1 | Komal    | 2000.00 |
|  2 | Komal    | 1500.00 |
|  3 | Komal    | 2000.00 |
|  1 | Muffy    | 2000.00 |
|  2 | Muffy    | 1500.00 |
|  3 | Muffy    | 2000.00 |
|  4 | Muffy    | 6500.00 |
|  5 | Muffy    | 8500.00 |
|  6 | Muffy    | 4500.00 |
+----+----------+---------+
```

CARTESIAN JOIN

The **CARTESIAN JOIN** or **CROSS JOIN** returns the cartesian product of the sets of records from the two or more joined tables. Thus, it equates to an inner join where the join-condition always evaluates to True or where the join-condition is absent from the statement.

Syntax:

The basic syntax of **INNER JOIN** is as follows:

```
SELECT table1.column1, table2.column2...
FROM  table1, table2 [, table3 ]
```

Example:

Consider the following two tables, (a) CUSTOMERS table is as follows:

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  32 | Ahmedabad |  2000.00 |
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

(b) Another table is ORDERS as follows:

```
+-----+---------------------+-------------+--------+
|OID  | DATE                | CUSTOMER_ID | AMOUNT |
+-----+---------------------+-------------+--------+
| 102 | 2009-10-08 00:00:00 |           3 |   3000 |
| 100 | 2009-10-08 00:00:00 |           3 |   1500 |
| 101 | 2009-11-20 00:00:00 |           2 |   1560 |
| 103 | 2008-05-20 00:00:00 |           4 |   2060 |
+-----+---------------------+-------------+--------+
```

Now, let us join these two tables using INNER JOIN as follows:

```
SQL> SELECT  ID, NAME, AMOUNT, DATE
     FROM CUSTOMERS, ORDERS;
```

This would produce the following result:

```
+----+----------+--------+---------------------+
| ID | NAME     | AMOUNT | DATE                |
+----+----------+--------+---------------------+
|  1 | Ramesh   |   3000 | 2009-10-08 00:00:00 |
|  1 | Ramesh   |   1500 | 2009-10-08 00:00:00 |
|  1 | Ramesh   |   1560 | 2009-11-20 00:00:00 |
|  1 | Ramesh   |   2060 | 2008-05-20 00:00:00 |
|  2 | Khilan   |   3000 | 2009-10-08 00:00:00 |
|  2 | Khilan   |   1500 | 2009-10-08 00:00:00 |
|  2 | Khilan   |   1560 | 2009-11-20 00:00:00 |
|  2 | Khilan   |   2060 | 2008-05-20 00:00:00 |
|  3 | kaushik  |   3000 | 2009-10-08 00:00:00 |
|  3 | kaushik  |   1500 | 2009-10-08 00:00:00 |
|  3 | kaushik  |   1560 | 2009-11-20 00:00:00 |
|  3 | kaushik  |   2060 | 2008-05-20 00:00:00 |
|  4 | Chaitali |   3000 | 2009-10-08 00:00:00 |
|  4 | Chaitali |   1500 | 2009-10-08 00:00:00 |
|  4 | Chaitali |   1560 | 2009-11-20 00:00:00 |
|  4 | Chaitali |   2060 | 2008-05-20 00:00:00 |
|  5 | Hardik   |   3000 | 2009-10-08 00:00:00 |
|  5 | Hardik   |   1500 | 2009-10-08 00:00:00 |
|  5 | Hardik   |   1560 | 2009-11-20 00:00:00 |
|  5 | Hardik   |   2060 | 2008-05-20 00:00:00 |
|  6 | Komal    |   3000 | 2009-10-08 00:00:00 |
|  6 | Komal    |   1500 | 2009-10-08 00:00:00 |
|  6 | Komal    |   1560 | 2009-11-20 00:00:00 |
|  6 | Komal    |   2060 | 2008-05-20 00:00:00 |
|  7 | Muffy    |   3000 | 2009-10-08 00:00:00 |
|  7 | Muffy    |   1500 | 2009-10-08 00:00:00 |
|  7 | Muffy    |   1560 | 2009-11-20 00:00:00 |
|  7 | Muffy    |   2060 | 2008-05-20 00:00:00 |
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