Agenda

- DBMS
- RDBMS
- SQL
    - Categories (DDL,DML,DQL,DCL,TCL)
- Mysql History
- Installation
- Getting Started with Mysql
- Database (Physical & Logical Layout)
- Data types
- Basic Queries
- Char vs Varchar vs Text
- SQL Scripts
- DQL
    - SELECT
    - Projection
    - Computed Columns
    - DISTINT

Managing Data

- Two ways to organize and manage data

1. using file system

    - File systems are used to manage files and directories, and provide basic operations for creating, deleting, renaming, and accessing files.
    - They typically store data in a hierarchical structure, where files are organized in directories and subdirectories.
    - File systems are simple and efficient, but they lack the ability to manage complex data relationships and ensure data consistency.
    - file systems are suitable for managing small amounts of unstructured data.

2. DBMS (Database Management System)

    - DBMS is a software system designed to manage large amounts of structured data, and provide advanced operations for storing, retrieving, and manipulating data.
    - DBMS provides a centralized and organized way of storing data, which can be accessed and modified by multiple users or applications.
    - DBMS offers advanced features like data validation, indexing, transactions, concurrency control, and backup and recovery mechanisms.
    - DBMS ensures data consistency, accuracy, and integrity by enforcing data constraints, such as primary keys, foreign keys, and data types.
    - DBMS is designed for managing large amounts of structured data, and offers more advanced features for ensuring data integrity, security, and performance.

DBMS

- DBMS can be classified into two types

1. Relational Database Management System (RDBMS)
   - Data is organized in the form of tables and each table has a set of rows and columns. The data are related to each other through primary and foreign keys.
2. Non-Relational Database Management System (NoSQL or Non-SQL)
   - Data is organized in the form of key-value pairs, documents, graphs, or column-based. These are designed to handle large-scale, high-performance scenarios.

RDBMS

- Relational DataBase Management System
- It is client-server system
- eg -> Oracle, MS-SQL, MySQL, SQLite, etc
- It organizes the data in the table, rows and columns
- Multiple tables are connected to one another
- It is more secure as compared to file based.
- It also supports multi-user i.e multiple clients can work on same data.
- It provides featuers like Rowlocking, table locking, managing the transactions.
- RDBMS design is based on Codd's Rule developed at IBM in 1970
- RDBMS uses SQL language for their data storage and accessibility

SQL

- It stands for Structured Query Language
- Originally known as RQBE (Relational Query By Example)
- SQL is standaradized by ANSI in 1987 and is revised multiple times by adding new features
- SQL is case insensitive language
- SQL is divided into five categories
  - 1. DDL - Data Defination Language
    - CREATE, DROP, Truncate ALTER, RENAME
  - 2. DQL - Data Query Language
    - SELECT
  - 3. DML - Data Manipulation Language
    - INSERT, UPDATE, DELETE
  - 4. DCL - Data Control Language
    - CREATE USER, GRANT, REVOKE
  - 5. TCL - Transaction Control Langugae
    - START TRANSACTION,SAVEPOINT, COMMIT,ROLLBACK

Mysql History

- It is developed by Micheal Widenus in 1995.
- MySql is named on the combination of his daugheter's initial 'My'ia and the acronym SQL
- It was acquired by SunMicrosystem in 2008 and then later acquired by oracle in 2010
- It is free and open source database management system under GPL(General Public Licsence)
- However some closed source modules are avaible under commercial version of Mysql
- MariaDB is a clone of mysql which is completely open source

- It Supports multiple database storage and processing engines
  - For mysql version < 5.5 default storage engine was MyISAM
    - No Support for Transactions
  - For mysql version >= 5.5 default Storage engine is InnoDB
    - It Supports ACID Transactions

Installation

- Follow steps from the shared installtion file

- In Windows it is required to set the PATH for the mysql.

- Server and client both are installed on your machine.

- Server (mysqld)

  - linux -> usr/sbin
  - windows -> C:\Program Files\MySQL\MySQL Server 8.0\bin
  - run on port 3306
  - It is implemented in C/C++

- Client (mysql)

  - linux -> usr/bin
  - windows -> C:\Program Files\MySQL\MySQL Server 8.0\bin

- Data

  - linux -> var/lib/mysql
  - windows -> C:\ProgramData\MySQL\MySQL Server 8.0

Getting Started

- We can use terminal as well as the Workbench(GUI) as client to work with the MySQL Server.
- We will be using the terminal for our better understanding.
- open the terminal and give the below command

```
mysql -u root -p

//OR

mysql -h localhost -u root -p

// enter the password and hit enter
// you should be logged into mysql shell
```

- mysql
  - client tool
- -u
  - user

- root
    - name of the user
- -p
    - password
- -h
    - host
- localhost
    - current system, also we can provide other system hostip here.

```sql
-- to display all existing databases
SHOW DATABASES;

-- To display loggedin user
SELECT USER();

-- To display Selected Database
SELECT DATABASE();

-- To clear the mysql shell window
\! clear

-- to cretae a database
CREATE DATABASE classwork;

-- to use the database
USE classwork;

-- Create a table
-- CREATE TABLE table_name()
CREATE TABLE student(rollno int, name char(10));

-- to remove the entire table
DROP table student;

-- to remove database
DROP DATABASE classwork;
```

Database (Logical & Physical Layout)

- Logical

    - It is a container that stores all the data inside it in the form of multiple tables.
    - The container consists of tables, constraints, relations, stored procedures, functions, triggers
    - Their are some system databases like mysql, performance_schema, etc.
    - These contains mysql db internal/system information
    - Tables inside database can have multiple columns
    - Every column is associated with a datatype
    - Every column may or may not have constraints
    - the data in table is stored in multiple rows.

- Each row have multiple values.

- Physical

  - It is stored on the disk inside the data directory
  - Every database created have its sub directory inside data directory
  - Each table in database is stored as file on the disk.
  - For every table created inside the selected database a file is created physically inside the directory of that respective database.
  - Data is stored in binary format
  - A file maynot be contiguosly stored onto disk
  - Data rows are not contiguous, they are scattered on harddisk

- Check for physical and logical layout for the above database and tables

DataTypes

- Their are 5 different types of datatypes

  - 1. Numeric
    - tinyint (1 byte)
    - smallint (2 bytes)
    - mediumint(3 bytes)
    - int (4 bytes)
    - bigint (8 bytes)
    - float (4 bytes)
    - double (8 bytes)
    - decimal(m,n)
      - m -> no of digits
      - n -> no of digits after the decimal point
      - eg -> Decimal(4,2) -> 12.34
  - 2. String
    - char(n)
      - n -> no of characters
      - length 0-255
    - varchar(n)
      - n -> no of characters
      - length 0-65535
    - tinytext
      - length is bydefault 255
    - text
      - can store data of 64K size
    - mediumtext
      - can store data upto 16MB
    - longtext
      - can store data upto 4GB
  - 3. Binary
    - tinyblob

- blob
- mediumblob
- longblob
  - 4. DateTime type
    - date
      - yyyy-mm-dd (1000-01-01 to 9999-12-31)
    - time
      - hr::min::sec (839:59:32)
    - datatime
      - yyyy-mm-dd hr::min::sec
      - (1000-01-01 to 9999-12-31) (00:00:00 to 23:59:59)
    - Year
      - 1901 - 2155
    - Timestamp
  - 5. Misc types
    - Enum (Bike,Car,Truck) -> radio Button
    - Set (Bike,Car,Truck) -> checkbox

Mysql Basic Queries

```sql
-- cretae a table student with cols rollno,name and marks
CREATE TABLE student(rollno int, name char(10), marks decimal(5,2));

-- Add some dummy student data in table.
INSERT INTO student VALUES(1,"s1", 50);
INSERT INTO student VALUES(2,"s2", 60);
INSERT INTO student VALUES(3,"s3", 70);

-- display all the data from the table
SELECT * FROM student;
```

Difference between char,varchar and Text

- Diagram of char and varchar

```sql
CREATE TABLE temp(c1 CHAR(4), c2 VARCHAR(4), c3 TEXT(4));
DESCRIBE temp;
INSERT INTO temp VALUES('ab', 'ab', 'ab');
INSERT INTO temp VALUES('abc', 'abc', 'abc');
INSERT INTO temp VALUES('abcd', 'abcd', 'abcd');
INSERT INTO temp VALUES('abcde', 'abcd', 'abcd'); -- error
INSERT INTO temp VALUES('abcd', 'abcde', 'abcd'); -- error
INSERT INTO temp VALUES('abcd', 'abcd', 'abcde'); --OK
SELECT * FROM temp;
```

SQL Scripts

```
USE classwork;
SELECT DATABASE();

SOURCE D:/classwork-db.sql

SHOW TABLES;
SELECT * FROM books;
SELECT * FROM dept;
```

Projection

- using DQL SELECT query we can select required columns (projections)

```
-- display all the data from dept table
SELECT * FROM dept;
SELECT deptno,dname,loc from dept

-- display all the data from emp;
SELECT * FROM emp;

-- display empno,ename,sal and deptno from emp
SELECT empno,ename,sal,deptno from emp;

-- display ename,deptno,deptname(10=ACCOUTING, 20=RESEARCH, 30=SALES)
-- Why to use alias
-- display ename,deptno,deptname(10=ACCOUTING, 20=RESEARCH, 30=SALES)
SELECT ename,deptno, CASE
WHEN deptno=10 THEN "ACCOUNTING"
WHEN deptno=20 THEN "RESEARCH"
WHEN deptno=30 THEN "SALES"
ELSE "UNKNOWN"
END FROM emp;

SELECT ename,deptno, CASE
WHEN deptno=10 THEN "ACCOUNTING"
WHEN deptno=20 THEN "RESEARCH"
WHEN deptno=30 THEN "SALES"
ELSE "UNKNOWN"
END AS dname FROM emp;
```

Distinct

- To find unique data

```
-- find all unique jobs from emp;
SELECT DISTINCT job FROM emp;
```

```sql
-- find all unique deptno from emp;
SELECT DISTINCT deptno FROM emp;

-- find unique jobs in every depts from emp.
SELECT DISTINCT job,deptno FROM emp;
```