Chapter 9

Structured Query Language

SQL is a language designed for communicating with a database.It is a standard language used by most database systems.It is a powerful tool for implementing RDBMS.It enables to create, access ,alter,update, a database.

Features of SQL

- It is a relational database lamguage not a programming language.
- It is simple and powerful.
- It is non-procedural.
- It provides concept of view(Virtual Table).
- It allows the user to create, update, delete, and retrieve data from a database.
- It works with database programs like DB2, Oracle,MS Access, Sybase etc.

Components of SQL

SQL consists of three components Data Definition Language(DDL),Data Manipulation Language(DML) and Data Control Language(DCL).

Data Definition Language(DDL)

DDL is a component of SQL used to specify the schema(Structure) of a database.DDL commands are used to create,modify and remove database objects like tables,views and keys.The commonly used DDL commands are CREATE,ALTER and DROP.

Data Manipulation Language(DML)

DML is a component of SQL used to interact with database.It enables to insert,delete and retrieve data from a database.The commonly used DML commands are SELECT,INSERT,UPDATE and DELETE.

Data Control Language(DCL)

DCL is used to control access to database.It is used to control administractive privileges in a database.The commonly used DCL commands are GRANT,COMMIT and REVOKE.

MySQL

MySQL is an is an open-source relational database management system (RDBMS).The main features of SQL are

- It is released under an open source license.
- It is portable and works with many languages such as PHP,PERL,C,C++,JAVA etc.
- It is used for web applications.
- It is a central component of the widely used LAMP open source web application software.

Opening My SQL

My SQL commands are given at mysql prompt.In Ubuntu it can be opened using

Applications->Accessories->Terminal

In Windows it can be started using the command

Mysql –u root –p

To exit from My SQL type **QUIT** or **EXIT** at the prompt.

Creating a database

A database in MY SQL is created using the CREATE DATABASE command.The syntax is

CREATE DATABASE <Database Name> ;

Note:-The database name must be unique and meaningful.

Opening a database

A database can be using the **USE** command.A database becomes active when we opens it.

The syntax is

USE <Database_Name> ;

The **SHOW DATABASE** command is used to check the existence of a database.

The Syntax is

SHOW DATABASES;

Data types in SQL

Data type specifies the type of value that can be entered in a column in a table.It ensures the correctness of data.Data types in SQL are classified into three ,Numeric data type,String data type ,Date and time data type.

Numeric data type

The commonly used numeric data types in MySQL are INTEGER(INT) and DECIMAL(DEC)

INT(INTEGERS) data type

Integers are represented in My SQL by INT data type.They are whole numbers ie,without fractional part.They can be positive,negative or zero.

DEC (DECIMAL) data type

The DEC data type represents fractions. Numbers.The syntax is DEC(Size,Scale),where Size is the total number of digits and scale is the number of digits after the decimal point.For example DEC(5,2), where the total number of digits is 5 and the number of digits after the decimal point will be 2.

String data types

A string is a group of characters.The two comonly used string data types in MYSQL are CHAR(CHARACTER) and VARCHAR.

1)**CHAR(CHARACTER) data type**

Character includes letters,digits,special symbols etc.It is a fixed length data type.The syntax is CHAR(Size) where Size represent the maximum number of characters.The default size of CHAR data type is 1.

2)VARCHAR data type

The VARCHAR data type reprsent variable length strings.It is similar to CHAR data type but only allocates memory according to the size of the string.It saves memory space.

Date and Time data type

The date data type is used for storing date and time data type is used for storing time.

1)Date data type:-The date data type is used for storing date.The date in MySQL is represented in YYY-MM-DD format(Standard format).

2)Time data type**:-**The time data type is used for storing time.The format is HH:MM:SS.

SQL commands

Commands in SQL are classified into three types DDL commands,DML commands and DCL commands.

DDL Commands:-DDL command deals with structure of database.It consists of three commands CREATE,ALTER and DROP.

CREATE TABLE Command

The CREATE TABLE Command is used to create a table(relation).The syntax is

CREATE TABLE <TableName>

(<ColumnName1> <DataType> [<Constraints>] , <ColumnName2> <DataType> [<Constraints>] ,.....);

Here **TableName** represents the name of the table to be created,**ColumnName** the name of the column and so on.A **Constraint** is a **Condition(check)** applied to a column or group of columns.

Example:-CREATE TABLE STUDENT(ROLLNO INT,NAME VARCHAR(20),TOTAL_MARK INT,PERCENTAGE DEC(5,2));

Rules for naming a table

The following rules are used while naming a table

1.The name must not be an SQL keyword.

2.The name must begin with alplabets(A-Z or a-z).

3.The name may contain a character,under score(_) and dollar ($) sign.

4.The name should not be the name of an existing table(duplicate).

5.The name of the table must not contain white space,special symbols.

Constraints

A constraint is a condition applied to a column or group of columns.Constraints are classified into Table Constraints and Column Constraints.A table constraint is applied to a table where as a column constraint is applied to a column.Constraints ensure the database integrity hence they are also called database integrity constraints.The following are the column constraints

1)**NOT NULL**:-This constraint ensures that a column can never have NULL(empty) values.

2)**AUTO_INCREMENT:-**The AUTO_INCREMENT keyword perform an auto increment ie,it automatically assigns a series of number automaticallyand insert it to column.The default starting value is 1.The auto increment column must be defined as primary key of the table.Only one auto_increment column is allowed in a table.

3)**UNIQUE:**-This constraint ensures that no two rows have the same value in a specified column.This constraint can be applied to those columns that have been declared NOT NULL.

4)**DEFAULT:-**This constraint is used to specify a default value for a column.

Table Constraints

A table constraint is applied to a table .It usually appears at the end of table definition.The important table constraints are PRIMARY Key and CHECK

PRIMARY KEY:-It declares a column as the primary key of a table.The primary key cannot contain NULL value ie ,this constraint must be applied on to a column defined as NOT NULL.

CHECK:-This constraint limits the values that can be inserted into a column of a table.

Example:-

DESC or DESCRIBE Command

The DESC or DESCRIBE Command is used view(display) the structure of a table.

DML Commands

Data Manipulation Language (DML) commands are used for manipulating data in database.The important DML commands are,

1)INSERT INTO Command

This command is used to insert a row(tuple) into a table.The syntax is:

INSERT INTO <TABLENAME> VALUES(<Value1>,<Value2>,....);

Example:-

INSERT INTO STUDENT VALUES(1106,'ANISH',599);

The above command can also be written as

INSERT INTO
STUDENT(ROLLNO,NAME,TOTALMARK)VALUES(1106,'ANISH',599);

MySQL allows to insert values into multiple rows as,

STUDENT(ROLLNO,NAME,TOTALMARK)VALUES(1106,'ANISH',599),(1109,'ANUJ',514);

The above command creates two rows into the table STUDENT.

2)SELECT Command

The SE|LECT Command is used to select rows(tuples or records) from a table.The syntax is

SELECT <ColumnName1>,[<ColumnName2>,....] FROM <TableName> ;

Example:-SELECT ROLLNO,NAME,TOTALMARK from STUDENT ;

The output is

ROLLNO NAME TOTALMARK

1106	ANISH	599
1109	ANUJ	514

Note:-To select all columns instead of column name asterisk(*) can be used .

Example :-SELECT * FROM STUDENT ;

The DISTINCT Keyword

The Keyword **DISTINCT** is used to avoid duplicate rows from the result of a select command.

The keyword ALL is used to display duplicate rows in a select command.

WHERE Clause

The WHERE clause is used to select rows or columns from atable which satisfy a specific condition.The Syntax is

SELECT <Columnname>,[<ColumnName>,.....] FROM <TableName> WHERE

<Condition> ;

The conditions can be expressed with the help of relational operators.The list of operators used in SQL are

Operators used with condition are

=	for checking value is equal to value of the mentioned column
<>	not equal to
>	greater than
<	Less than
>=	greater than or equal to
<=	less than or equal to
LIKE	pattern matching
BETWEEN ... AND	value between a range
IN	match with list of values.
NOT IN	not matching with list of values
IS NULL	is a null value
NOT	true condition
AND	true if both conditions are true
OR	true if either of the operand condition is true

The Like keyword

The Like keyword is used to search for a specified pattern in a column.

Examples:-

Select * from STUDENT where place='kannur';

Selects all from student table whose place is equal to 'kannur'

Select * from STUDENT where name like 'A%';

Selects all from student table whose Name start with A, (% replace for any number of characters).

Select * from STUDENT where name like '%m';

Selects all from student table whose name end with m

Select * from STUDENT where name like '%la%';

Selects all from student table whose name contains la.

BETWEEN ..... AND Operator

The BETWEEN ..... AND operator is used to specify a range .

Example:-

Select * from STUDENT where mark1 between 40 and 50;

Selects all from student table whose mark in between 40 and 50

The IN Operator

The IN operator is used for setting a condition satisfying any list of values.

Example:-

SELECT Name,Total_Mark FROM STUDENT WHERE COURSE IN('COMMERCE','HUMANITIES') ;

Displays name,totalmark of all students studying in either Commerce or Humanities.

Select * from STUDENT where mark1 not between 20 and 35;

Selects all from student table whose mark is not in between 20 and 35

IS NULL Operator

The SQL **NULL** is the term used to represent a missing value.The IS NULL operator in a WHERE clause to find rows containing a **null value** in a particular column.

Example:-

SELECT * FROM STUDENT WHERE Course IS NULL ;

Display details of students whose course is not specified.

ORDER BY Clause

The ORDER BY clause is used to sort the result of a select statement in ascending or descending order.The default order is ascending.The ascending order is specified by the ASC keyword and descending order by DESC keyword.

COUNT ( ) Function

The COUNT() function returns the number of rows that matches a specified condition. The COUNT(*) function returns the number of records in a table.

Note:- When the COUNT function is used with the DISTINCT command, only the distinct rows are counted .

Example:

SELECT COUNT(*) from Student ;

Display the total number of Students in the Students table.

GROUP BY Clause

The GROUP BY clause is used to group the rows of a table based on a common value.

Example:-

SELECT Course,COUNT(*) FROM STUDENT GROUP BY Course

Display each Course and Number of Students in each Course.

Aggregate Functions

The aggregate functions acts on a group of data and returns a single data.They are also called summary functions.

Commonly used aggregate functions

- AVG() - Returns the average value
- COUNT() - Returns the number of rows
- FIRST() - Returns the first value
- LAST() - Returns the last value
- MAX() - Returns the largest value
- MIN() - Returns the smallest value
- SUM() - Returns the sum

Note:- Except for COUNT, aggregate functions ignore null values.

Changing the structure of a table

The structure of a table can be changed by using DDL Commands.It includes adding or removing columns,Changing data type and size of existing columns,renaming table etc.

ALTER TABLE Command

The ALTER TABLE Command is used to add new columns or modify existing columns in a table.The ALTER TABLE Command with ADD keyword is used to add columns and ALTER TABLE Command with MODIFY keyword is used to modify an existing column.

The Syntax is:

ALTER TABLE <TableName> ADD (<ColumnName> <NewDataType> [(<Size>)]

<ColumnConstraint>);

ALTER TABLE <TableName> MODIFY (<ColumnName> <NewDataType> [(<NewSize>)]) ;

*Example:-*ALTER TABLE STUDENT ADD (Grade CHAR(2));

To add a new column Grade to the table STUDENT .

Removing column from a table

The ALTER TABLE command with DROP Clause can be used to remove a column from a table.The Syntax is

ALTER TABLE <TableName> DROP <ColumnName> ;

Example:-ALTER TABLE STUDENT DROP Total_Mark ;

To remove the column Total_Mark from the table STUDENT.

Renaming a table

The ALTER TABLE command can be used to rename a table.The Syntax is

ALTER TABLE <TableName> RENAME TO <New_Table_Name> ;

Example:-

ALTER TABLE STUDENT RENAME TO STUDENT1;

To rename STUDENT table to STUDENT 1.

Deleting rows from a table

The DELETE command can be used to remove individual rows from a table.

The Syntax is:

DELETE FROM <Table_Name> [WHERE <condition>] ;

Note:-If Where Clause is not used all the rows in the table will be deleted.

Example:-DELETE FROM STUDENT Where RollNO=1109 ;

To remove the details of student with RollNo 1109.

UPDATE Command

The UPDATE command is used to change the values in a column of specified rows.The rows are set to new values using the SET keyword.The syntax is:

UPDATE <TableName> SET <ColumnName> =<value>[,<ColumnName>=<value> ....]

[Where <Condition>];

Example:-

UPDATE STUDENT SET ROLLNO=1114 WHERE Name='Manu' ;

To change the rollno of a student named Manu from the table student.

Removing table from a database

A table can be removed from a database by using the DROP TABLE Command.It is a DDL which permanently removes table from the database.The syntax is

DROP TABLE <TableName> ;

Example:-

DROP TABLE STUDENT;

To remove the table STUDENT from the table.

Nested Queries

A Nested query is a query placed within another SQL query.The query that contains the subquery is called outer query and the inner query is called subquery.The inner query is evaluated first and then the outer query is evaluated.

Example:-

UPDATE STUDENT SET Total_Mark=Total_Mark + 25 WHERE AGE IN (SELECT AGE FROM STUDENT WHERE AGE >=21) ;

Update Total_Mark by 25 marks in Students table for all students whose age is greater than or equal to 27.

Concept of Views

A view is a virtual table which is derived from an existing table(**Base table**).The CREATE VIEW Command is used to create a VIEW .The Syntax is

CREATE VIEW <View_Name> AS SELECT <ColumnName1> [,<ColumnName2>,.....] FROM <TableName> [Where <Condition>] ;

Example:-

CREATE VIEW Student1 AS SELECT * FROM STUDENT Where Course='Science ' ;

The DROP VIEW Command can be used to remove view

Advantages of View are

Views allows to setup different security levels for a table.

Views allows to see the same data in a different way.

It helps to hide complexity.