SQL THEORY – FUNDAMENTALS

Introduction to SQL

SQL (Structured Query Language) is a standard language used to store, retrieve, manage, and manipulate data in relational databases. It allows users to create databases, define table structures, insert data, and perform analytical queries efficiently.

Types of SQL Commands

DDL (Data Definition Language): Used to define database structures such as CREATE, ALTER, DROP, and TRUNCATE.

DML (Data Manipulation Language): Used to manipulate data using INSERT, UPDATE, and DELETE.

DQL (Data Query Language): Used to retrieve data using SELECT.

DCL (Data Control Language): Used to control access using GRANT and REVOKE.

TCL (Transaction Control Language): Used to manage transactions using COMMIT, ROLLBACK, and SAVEPOINT.

Database and Schema

A database is an organized collection of data. A schema is the logical structure of a database that defines how data is organized. CREATE DATABASE is used to create a new database, and USE is used to select it.

Tables, Rows, and Columns

Tables store data in rows and columns. Each row represents a record, and each column represents an attribute. Tables are created using CREATE TABLE with appropriate data types.

Data Types in SQL

Common data types include INT for numbers, VARCHAR for text, DATE for dates, FLOAT/DECIMAL for decimal values, and BOOLEAN for true/false values.

Constraints

Constraints ensure data integrity. PRIMARY KEY uniquely identifies records, FOREIGN KEY maintains relationships, UNIQUE prevents duplicate values, NOT NULL ensures mandatory fields, and DEFAULT assigns default values.

Primary Key and Foreign Key

A Primary Key uniquely identifies each record in a table. A Foreign Key establishes a relationship between two tables by referencing the primary key of another table.

INSERT, UPDATE, DELETE

INSERT is used to add new records into a table. UPDATE modifies existing records using conditions. DELETE removes specific records, while TRUNCATE removes all records from a table.

SELECT Statement

SELECT is used to retrieve data from tables. It can be combined with WHERE, DISTINCT, ORDER BY, LIMIT, AND, OR, IN, BETWEEN, LIKE, and NOT for filtering and sorting.

SQL Functions

Arithmetic Functions: ROUND(), POWER(), ABS(). String Functions: LENGTH(), SUBSTRING(), TRIM(), UPPER(), LOWER(). Date Functions: NOW(), CURDATE(), DATE().

Joins

Joins are used to combine data from multiple tables. INNER JOIN returns matching records, LEFT JOIN returns all records from the left table, RIGHT JOIN returns all records from the right table.

Indexes

Indexes improve query performance by allowing faster data retrieval. CREATE INDEX is used to create an index, and DROP INDEX removes it.

Views

A view is a virtual table created using SELECT queries. Views simplify complex queries and improve security.

Data Integrity and Referential Integrity

Referential integrity ensures consistency between related tables using foreign keys. It prevents invalid data insertion or deletion.

Advantages of SQL

SQL is easy to learn, supports large datasets, provides data security, ensures data consistency, and is widely supported across database systems.

Conclusion

SQL is a powerful and essential tool for data management and analytics. Understanding SQL fundamentals is crucial for roles in data analysis, data science, and software development.