

Introduction to DBMS, RDBMS, and SQL





1. Database Management System (DBMS)

A Database Management System (DBMS) is software that allows users to store, retrieve, manipulate, and manage data efficiently. It acts as an interface between the user and the database.

Key Features of DBMS

- ✓ Efficient Data Management – Organizes and manages large amounts of data.
- ✓ Data Consistency and Integrity – Prevents data corruption.
- ✓ Multi-User Access – Allows multiple users to access data simultaneously.
- ✓ Security & Backup – Protects data and ensures recovery.

Types of DBMS

1. Hierarchical DBMS – Data is structured like a tree. 
2. Network DBMS – Data is linked like a graph. 
3. Relational DBMS (RDBMS) – Data is stored in tables. 
4. Object-Oriented DBMS – Data is stored as objects. 

2. Relational Database Management System (RDBMS)

An RDBMS is a type of DBMS that stores data in tables (relations) using rows and columns. It is based on the relational model introduced by Dr. Edgar F. Codd.

Key Features of RDBMS

- ✓ Tables with Structured Data – Data is organized in tables.
- ✓ Primary Key & Foreign Key – Ensures uniqueness and relationships.
- ✓ SQL Support – Uses Structured Query Language (SQL).
- ✓ ACID Properties – Ensures data reliability.

Popular RDBMS Software

- ◆ MySQL (Open-source, widely used for web apps)
 - ◆ PostgreSQL (Advanced, open-source)
 - ◆ Oracle DB (Enterprise-level)
 - ◆ Microsoft SQL Server (Business applications)
-

Key Database Concepts

- 1) **Table** – A structured collection of data organized in rows and columns within a database.

Example: A Students table storing student information.

StudentID	Name	Age	Grade
1	Insaan	20	A
2	Bob	22	B

- 2) **Field (Column)** – A single category of data stored in a table.

Example: Name, Age, Grade are fields in the Students table.

- 3) **Record (Row)** – A single entry in a table representing a complete set of data.

Example: (1, Alice, 20, A) is a record in the Students table.

- 4) **Attribute** – Another term for column (field), representing a property of an entity.

Example: In the Students table, StudentID, Name, Age, Grade are attributes.

- 5) **NULL Value** – A missing or unknown value in a table.

Example: If a student's Grade is not assigned, it will be NULL.

studentID	Name	Age	Grade
3	charlie	21	null

Introduction to SQL (Structured Query Language)

SQL (Structured Query Language) is a standard programming language used to store, retrieve, manipulate, and manage data in a relational database. It is widely used in RDBMS (Relational Database Management Systems) like MySQL, PostgreSQL, SQL Server, and Oracle.

Features of SQL ✨

- ✓ Easy to Learn & Use – Uses simple English-like commands (SELECT, INSERT, UPDATE, DELETE).
- ✓ Data Querying & Manipulation – Retrieves and modifies data efficiently.
- ✓ Data Definition – Allows creation and modification of database structures (CREATE, ALTER, DROP).
- ✓ Data Control & Security – Manages user permissions and access control (GRANT, REVOKE).

- ✓ Supports Transactions – Ensures data integrity with COMMIT, ROLLBACK, SAVEPOINT.
- ✓ Joins & Relationships – Connects multiple tables using JOINS.
- ✓ Scalability – Used in small and large-scale applications, from startups to enterprises.

SQL Concepts: Types of SQL, Constraints, Data Integrity & SQL Process



1. Types of SQL Languages 🏷️

SQL is divided into five categories based on functionality:

- ◆ **1. Data Query Language (DQL)** – Used for retrieving data.
 - Command: SELECT
- ◆ **2. Data Definition Language (DDL)** – Defines the database structure.
 - Commands: CREATE, ALTER, DROP, TRUNCATE
- ◆ **3. Data Manipulation Language (DML)** – Modifies existing data.
 - Commands: INSERT, UPDATE, DELETE
- ◆ **4. Data Control Language (DCL)** – Controls user access to data.
 - Commands: GRANT, REVOKE
- ◆ **5. Transaction Control Language (TCL)** – Manages database transactions.
 - Commands: COMMIT, ROLLBACK, SAVEPOINT

2. SQL Constraints 🔒

Constraints ensure data accuracy, integrity, and reliability by restricting what can be stored in a table.

◆ **Types of Constraints:**

- ✓ PRIMARY KEY – Ensures a unique identifier for each record.
- ✓ FOREIGN KEY – Establishes a relationship between two tables.
- ✓ NOT NULL – Prevents storing NULL (empty) values.
- ✓ UNIQUE – Ensures values in a column are unique.

- ✓ CHECK – Enforces a condition on values in a column.
 - ✓ DEFAULT – Assigns a default value if no value is provided.
-

3. Data Integrity in SQL

Data integrity ensures data accuracy, consistency, and reliability across the database.

◆ Types of Data Integrity:

- ✓ Entity Integrity – Ensures each table has a primary key (unique ID).
 - ✓ Referential Integrity – Maintains valid relationships using foreign keys.
 - ✓ Domain Integrity – Restricts data type and format using CHECK, NOT NULL, UNIQUE.
 - ✓ User-defined Integrity – Custom business rules enforced using triggers or stored procedures.
-

4. SQL Process (Query Execution Process)

When an SQL query is executed, it follows these steps:

- 1 .Query Parsing – SQL syntax is checked.
- 2 .Query Optimization – The best execution plan is selected.
- 3 .Query Execution – The database processes the query.
- 4 .Result Fetching – The final output is displayed to the user.