1. State and Explain the components of a DBMS(Database Management System)

key components of DBMS:

1. **Database Engine:** Handles CRUD operations (Create, Read, Update, Delete), query processing, and transaction management.
2. **Database Schema:** Defines the structure of the database, including tables, relationships, and constraints.
3. **Query Processor:** Interprets and executes SQL queries through parsing, optimization, and execution.
4. **Transaction Management:** Ensures the integrity and consistency of the database through ACID properties (Atomicity, Consistency, Isolation, Durability).
5. **Storage Manager**: Manages physical data storage, memory buffers, and data retrieval.
6. **Data Dictionary:** Stores metadata about the database’s structure, such as table definitions and constraints.
7. **User Interface (UI):** Allows users to interact with the DBMS via a GUI, CLI, or API.
8. **DBA Tools:** Provide tools for database administration, performance monitoring, and security.
9. **Backup and Recovery System:** Ensures data can be backed up and restored after failures.
10. **Security Management:** Controls user access and ensures data protection through authentication, authorization, and encryption.
11. What is a relational database? Give 4 examples.

* A relational database is a type of database that stores data in tables which are organized into rows and columns. Each table represents a different entity (such as customers, orders, or products), and relationships between data in different tables are established using keys (primary and foreign keys).
* The relational model uses Structured Query Language (SQL) for querying and managing the data.

### Examples of Relational Databases:

1. **MySQL**: A popular open-source relational database system widely used for web applications.
2. **PostgreSQL**: An open-source, advanced relational database known for its robustness and support for complex queries.
3. **Oracle Database**: A commercial relational database system used by large enterprises for handling vast amounts of data.
4. **Microsoft SQL Server**: A relational database management system developed by Microsoft, used for enterprise-level applications and business data management.
5. State and Explain three classifications of SQL?

Sql classified into three main categories based on its functionality:

### 1. ****Data Definition Language (DDL)****

* **Explanation**: DDL deals with the structure of the database, allowing users to define and modify database objects like tables, indexes, and schemas.
* **Key Commands**:
* **CREATE**: Creates a new database object (e.g., table, index).
* **ALTER**: Modifies an existing database object.
* **DROP**: Deletes a database object.
* **TRUNCATE**: Removes all records from a table but does not remove the table itself.

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

* **Explanation**: DML is used for managing and manipulating the data within database objects (e.g., inserting, updating, or deleting data).
* **Key Commands**:
* **SELECT**: Retrieves data from a database.
* **INSERT**: Adds new records into a table.
* **UPDATE**: Modifies existing data within a table.
* **DELETE**: Removes records from a table.

### 3. ****Data Control Language (DCL)****

* **Explanation**: DCL is used for controlling access to data within the database, such as granting or revoking permissions.
* **Key Commands**:
* **GRANT**: Gives specific permissions (e.g., SELECT, INSERT) to users or roles.
* **REVOKE**: Removes specific permissions from users or roles.

1. What is the difference between a Primary Key and a Foreign Key?

### Differences

| **Feature** | **Primary Key** | **Foreign Key** |
| --- | --- | --- |
| **Purpose** | Uniquely identifies records within the same table. | Links records from one table to another. |
| **Uniqueness** | Must have unique values. | Can have duplicate values. |
| **Nullability** | Cannot contain NULL values. | Can contain NULL values. |
| **Table** | Used in a single table. | Used to reference a primary key in another table. |

1. What is an Entity-Relationship Diagram?

An Entity-Relationship Diagram (ERD) is a visual representation of the entities (objects or concepts) within a system and the relationships between them. It is commonly used in database design to model the structure of data and to illustrate how data is related within a database.

1. What are the advantages of relational databases?

· **Data Integrity**: Constraints like primary and foreign keys ensure accurate and consistent data.

· **Flexibility and Scalability**: They handle large datasets and complex queries efficiently.

· **SQL Support**: Use of the standard SQL language makes data management easier and more compatible across systems.

· **Reduced Redundancy**: Normalization minimizes data duplication and ensures efficient storage.

· **Data Management**: Simple data manipulation with SQL commands makes it easy to add, update, or retrieve data.

· **Complex Queries**: Ability to perform advanced queries using joins, aggregations, and subqueries.

· **Security**: Provides robust security with user authentication and access control.

· **Transaction Management**: Ensures reliable and consistent transactions with ACID properties.

· **Data Independence**: Logical and physical data models are separate, allowing flexibility in data storage.

· **Wide Adoption**: Relational databases are widely used, with strong community support.

1. State four types of data type used to store data in tables?

**Integer**: **Description**: Stores whole numbers (positive, negative, or zero).

**Example**: INT, SMALLINT, BIGINT.

**Varchar (Variable-length character)**: **Description**: Stores strings of variable length, such as names or addresses.

**Example**: VARCHAR(255), TEXT.

**Date/Time**: **Description**: Stores dates, times, or both (useful for tracking events or transactions).

**Example**: DATE, TIME, DATETIME, TIMESTAMP.

**Decimal/Float**: **Description**: Stores numbers with decimal points (for precise calculations like currency or measurements).

**Example**: DECIMAL, FLOAT, NUMERIC.

1. What is the purpose of a database management system (DBMS)?

* Data Storage: Organizes and stores data in structured formats (tables, rows, columns) for easy retrieval and management.
* Data Retrieval: Allows users to query the database to retrieve specific information using languages like SQL.
* Data Integrity: Ensures the accuracy and consistency of data through constraints, validation, and relationships between tables.
* Security: Protects data by controlling access through authentication, authorization, and encryption.
* Concurrency Control: Manages simultaneous data access by multiple users without conflicts or data corruption.
* Backup and Recovery: Provides mechanisms for backing up data and restoring it after failures to prevent data loss.
* Data Independence: Abstracts the physical storage of data from the logical view, enabling easier management and changes without affecting applications.