Database Concepts and Storage Systems

1. What is a database? Explain with an example on why should we need a database.

A database is an organized collection of data, typically stored and accessed electronically from a computer system. A database allows for easy access, management, and updating of the stored information. Example: In a bank, all customer information (account number, balance, transactions) is stored in a database for efficient management.

Why should we need a database: Databases are crucial as they allow structured data storage, quick access, and management of large amounts of data, which is important for organizations like banks, hospitals, and e-commerce websites.

2. Write a short note on file based storage system. Explain the major challenges of a file based storage system.

File-based storage systems manage data using files in different formats. Each application in a system uses its own files to store data. This system lacks coordination between data across the system.

Challenges:

- Data redundancy: Multiple copies of the same data.
- Inconsistent data: Due to redundancy, different files might contain different versions of the same data.
- Lack of data sharing: Difficult to share data across applications.
- Poor security: No control over access to data.
- Complex queries: Difficult to perform complex searches or queries.

3. What is DBMS? What was the need for DBMS?

DBMS (Database Management System) is a software used to store, manage, and retrieve data efficiently. It provides an interface between users and databases, allowing users to create, retrieve, update, and manage data systematically.

Need for DBMS:

- To solve problems like data redundancy and inconsistency.
- To ensure better data security and data sharing.
- To allow efficient querying and management of large datasets.

4. Explain 5 challenges of file-based storage system which was tackled by DBMS:

- Data Redundancy: DBMS uses a centralized approach to reduce duplication of data.
- Data Inconsistency: By reducing redundancy, DBMS ensures that different applications have access to the same version of the data.
- Data Isolation: DBMS integrates data, making it accessible to multiple users in different applications.
- Security: DBMS offers controlled access through authentication and authorization mechanisms.
- Complex Queries: DBMS allows for efficient query processing using SQL.

5. List out the different types of classification in DBMS and explain:

- Hierarchical DBMS: Data is organized in a tree-like structure, with a parent-child relationship between data.
- Network DBMS: More flexible than hierarchical, it allows many-to-many relationships.
- Relational DBMS: Data is stored in tables (relations) with rows and columns. This is the most popular model.

- Object-oriented DBMS: Data is stored in objects, similar to object-oriented programming.

6. What is the significance of Data Modelling and explain the types of Data Modelling:

Data modelling is the process of creating a data model to visually represent the structure of a database. It helps design databases logically and physically. The significance includes ensuring data consistency, improving data quality, and enabling efficient database design.

Types of Data Modelling:

- Conceptual Data Modelling: Focuses on the high-level structure of data and the relationships between entities.
- Logical Data Modelling: Provides detailed structure, including entities, attributes, and relationships.
- Physical Data Modelling: Focuses on the physical storage of data, specifying how the data will be stored in a database.

7. Explain 3-schema architecture along with its advantages:

The 3-schema architecture is a framework for organizing the structure of a database system:

- Internal Schema: Deals with physical storage of data.
- Conceptual Schema: Focuses on the logical structure of the database.
- External Schema: Represents the user's view of the database.

Advantages:

- Data abstraction: Separates data from the actual structure.
- Flexibility: Changes at one level don't impact other levels.
- Security: Controls access at different levels.