

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

A database is a structured collection of data that allows efficient storage, retrieval, and management of information. It organizes data systematically and supports various operations like insertion, deletion, updating, and querying.

Example: Consider a university that maintains student records. If all student details (name, roll number, courses, grades) are stored in a single spreadsheet, it becomes difficult to manage as the number of students increases. Using a database helps to store and retrieve information efficiently without redundancy and inconsistency.

Why do we need a database?

- Data organization and storage
 - Efficient data retrieval
 - Data consistency and integrity
 - Multi-user access
 - Enhanced security
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2. Write a short note on file-based storage system. Explain the major challenges of a file-based storage system.

A file-based storage system stores data in individual files rather than a centralized database. It is a simple way to manage data using files and folders.

Challenges of a File-Based Storage System:

1. **Data Redundancy and Inconsistency:** Same data stored in multiple files leads to duplication and inconsistency.
 2. **Data Isolation:** Difficult to access and retrieve related data from different files.
 3. **Lack of Security:** Files do not provide user authentication and authorization features.
 4. **Concurrent Access Issues:** Multiple users accessing and modifying data simultaneously can lead to data corruption.
 5. **Limited Querying Capabilities:** Searching and retrieving data is complex without a structured system like SQL.
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3. What is DBMS? What was the need for DBMS?

A Database Management System (DBMS) is software that facilitates the creation, management, and manipulation of databases. It provides users with a systematic way to store, retrieve, and manage data efficiently.

Need for DBMS:

- Eliminates redundancy by centralizing data storage
 - Maintains data integrity and consistency
 - Supports multiple users accessing data simultaneously
 - Ensures security through authentication and authorization
 - Provides powerful query processing for efficient data retrieval
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4. Explain 5 challenges of file-based storage system which was tackled by DBMS.

1. **Data Redundancy and Inconsistency:** DBMS uses normalization techniques to minimize redundancy.
 2. **Data Isolation:** DBMS organizes data in a structured format, making it easier to retrieve related data.
 3. **Security Issues:** DBMS offers role-based access control for better security.
 4. **Concurrent Access Problems:** DBMS allows multiple users to work on the same data without conflicts.
 5. **Data Integrity Issues:** DBMS enforces constraints like primary keys and foreign keys to maintain integrity.
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5. List out the different types of classification in DBMS and explain.

DBMS can be classified based on various factors:

1. **Based on Data Model:**
 - **Hierarchical DBMS:** Data is structured in a tree-like format.
 - **Network DBMS:** Data is organized as a graph.
 - **Relational DBMS (RDBMS):** Uses tables to store data (e.g., MySQL, PostgreSQL).
 - **Object-Oriented DBMS:** Stores data as objects (e.g., MongoDB).
 2. **Based on Number of Users:**
 - **Single-user DBMS:** Supports one user at a time.
 - **Multi-user DBMS:** Allows multiple users simultaneously.
 3. **Based on Distribution:**
 - **Centralized DBMS:** Data is stored in a single location.
 - **Distributed DBMS:** Data is stored across multiple locations.
 4. **Based on Usage:**
 - **OLTP (Online Transaction Processing):** Handles real-time transactions.
 - **OLAP (Online Analytical Processing):** Used for complex queries and data analysis.
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6. What is the significance of Data Modeling and explain the types of Data Modeling?

Significance of Data Modeling:

- Helps in designing a structured and efficient database.
- Ensures data consistency and minimizes redundancy.
- Enhances performance by optimizing queries.
- Helps in better understanding of data relationships.

Types of Data Modeling:

1. **Conceptual Data Model:** High-level design showing entities and relationships.
 2. **Logical Data Model:** Defines data attributes, tables, and relationships.
 3. **Physical Data Model:** Specifies how data is stored in the database.
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7. Explain 3-schema architecture along with its advantages.

3-Schema Architecture: It provides an abstraction to separate the database system into three levels:

1. **Internal Level (Physical Schema):** Defines how data is stored physically on disk.
2. **Conceptual Level (Logical Schema):** Describes data structure and relationships without focusing on storage details.
3. **External Level (View Schema):** Provides different views for users based on their needs.

Advantages of 3-Schema Architecture:

- Provides data abstraction and hides implementation details.
- Supports multiple user views and security.
- Enhances database independence and reduces data dependency.

This architecture helps in better database management by separating physical storage, logical representation, and user interaction.