Q.(7) Differentiate between data & database.

Data	Database
(i) It is raw, unprocessed facts & figures.	(i) It is organized collection of structured information.
(ii) It is unorganized, fragmented.	(ii) It is systematically organized with relationship.
(iii) It can exist in various formats. (text, files).	(iii) It is stored in tables with defined schema.
(iv) The processing requires manual interpretation.	(iv) The processing supports complex queries & operations.
(v) It is difficult to manage.	(v) Provides robust mangement & control.
(vi) It represents individual piece of information.	(vi) It enables efficient data storage, retrieval & analysis.

Q.N(8) What are the advantages of DBMS over the traditional File based system?

→ The advantages of DBMS over the traditinal File based system are:-

1) Data Independence.
- Logical & Physical data separation
- Easier System modification
- Flexibility in data storage & retrieval.

2) Data Redundancy Reduction
- Minimize dulpicate data
- Saves storage space
- Improves data consistency

3) Data security
- Advanced access controls
- User authentication
- Role-based permissions
- Encryption capabilities

4) Concurrent Access
- Multiple users can access simultaneously
- Transaction management
- Prevents data conflicts

5) Complex Query capabilities
- Powerful SQL quering
- Advanced data manipulation
- Complex relationship management
- Efficient data filtering & sorting

6) Data Integrity
- Enforce Validation rules
- Implements constraints
- Maintains referential integrity
- Ensures data accuracy

7) Performance optimization
- Indexing mechanisms
- Query optimization
- Faster data retrieval
- Efficient storage management

8) Scalability
- Handles large data values
- Supports distributed databases
- Easy data expansion.

These are few Advantages of DBMS.

Q.(9) Explain schema vs instances.

→

Schema	Instance
(i) It is structural design of database.	(i) It is actual data stored in the database.
(ii) It is a blueprint or template.	(ii) It is concrete or a real world data.
(iii) It is relatively static.	(iii) It is dynamically changing.
(iv) It is represented in database structure & relationships.	(iv) It is represented by specific data values of a given time.
(v) Eg: Table design with column types.	(v) Eg: It is actual rows of data in those column.

Q. (10) How does data independence help in DBMS schema? Explain.

→ Data independence in DBMS helps by providing two critical layers of abstraction.

1) Physical Data Independence
- Separates database physical storage structure from logical schema.
- Allows changing storage methods without modifying application.
- Enables database administrators to:
  - Optimize storage structure.
  - Implement new storage technologies.
  - Reorganize physical storage without disrupting applications.

2) Logical database Independence
- Separates conceptual schema from external user views.
- Permits modifying logical structure without changing external applications.
- Enables database designers to:
  - Add / remove tables
  - Modify data relationships
  - Change database design

Q.(11) Differentiate between 1, 2, 3 tier dbms architecture

1st tier	2nd tier	3rd tier
• All components (database, application, UI) on same system.	• Client server model with two layers	• Separate presentation, application & data layer.
• Limited scalability	• Moderate scalability	• High scalability
• Simple complexity	• Moderately complex	• Most complex
• Lowest security	• Improved security	• Highest security
• Single user access	• Multiple user	• Multiple user with advanced access control
• Easiest to maintain.	• Moderate maintenance.	• Most complex maintainan
• No Network required	• Requires network connection.	• Requires robust network infrastracture.

Q.(12) Why there is multilayer architecture present in DBMS ? Describe the 3 schema architecture.

→ Multilayer architecture in DBMS exists for several key reasons:

1) Abstraction : separate different levels of data representation.
2) Data Independences : Allows changes in one layer without affecting others.
3) Security : Provides Multiple levels of access control.
4) Scalability : Enables easier system modification and expansion.

5) Performance optimization : Allows independent optimization of each layer.

Also,

3 Schema architecture are:

1) External schema (View level)
- User-specific view of database
- Customized representation for different user groups
- Provides data privacy & security
- Hides complexity of underlying database structure.

2) Conceptual schema (Logical Level)
- Unified organization view of entire database
- Describe data relationships, constraints.
- Independent of physical storage details.
- Represents logical structure of entire database.

3) Internal schema (Physical level)
- Actual physical storage representation
- Details of data storage & access methods.
- Defines how data is stored on storage devices.
- Includes storage structures, indexing, compression techniques.

Q.(13) Describe the 3 levels of DBMS (Physical, logical and external)

→ The 3 levels of DBMS are:

1) Physical level
- Lowest level of data abstraction.
- Describes how data is actually stored physically.
- Details storage structure, File organization.
- Manages data storage mechanisms.

2) Logical Level
- Intermediate level of data representation.
- Describes overall logical structure of database.
- Defines relationships between data entities.
- Independent of physical details.

3) External level
- Highest level of data abstraction.
- User-specific view of database.
- Provides customized data representation.
- Supports multiple user perspectives.

Q.(14) What is data Model? Explain any 4 different kinds of data models in detail with characteristics & merits and demerits of data model.

→ A data model is a conceptual representation of how data is organized, structured, & relationships are managed within a database system.

• Four different kind of data models are:

1) Hierarchical Data Models

□ Characteristics

(a) Tree-like structure
(b) Parent-child relationships
(c) One-to-many relationships
(d) Top-down approach.

□ Merits

(a) Simple data representation
(b) Fast data retrieval
(c) Clear data hierarchy

□ Demerits

(a) Limited flexibility
(b) Complex data modification
(c) Rigid structure
(d) Difficult to Represent many-many relationships.

2) Network Data Model

□ Characteristics

(a) Graph-like structure
(b) Multiple parent-child relationship
(c) Complex interconnections
(d) Supports many-to-many relationships.

□ Merits

(a) More flexible than hierarchial model
(b) Better data representation

(c) Support complex relationships.

- Demerits
(a) Complex implementation
(b) High maintenance overhead
(c) Difficult schema modifications
(d) Increased complexity in data navigation

3) Relational Data Model:
- Characteristics
(a) Table-based structure
(b) Rows & column
(c) Primary & foreign.
(d) User SQL for data manipulation.

- Merits
(a) Highly flexible
(b) Easy data manipulation
(c) Strong data integrity
(d) Supports complex queries

- Demerits
(a) Performance overhead for complex relationships
(b) Scaling challenges
(c) Limited support for unstructured data

4) Object-Oriented Data Model

- Characteristics:
  (a) Based on object-oriented Programming
  (b) Supports inheritance
  (c) Better representation of real-world entities
  (d) Supports inheritance

- Merits
  (a) Supports complex data structures
  (b) Rich semantic modeling
  (c) Encapsulation of data & methods

- Demerits
  (a) High complexity
  (b) Performance overhead
  (c) Lack of Standardization
  (d) Steep learning curve.

Q. (15) Differentiate between External, Logical & Physical schemas.

→

External schema	Logical schema	Physical schema
• This is user-specific view of database. • Highest level of abstraction.	• It is conceptual database structure. • Intermediate level of abstraction	• It is actual data storage representation. • Lowest level of abstraction.

• It's purpose is customization data presentation.	• It describes the overall database structure.	• It defines actual data storage mechanism.
• It's visibility is to end user level.	• Database administrator level.	• System level implementation.
• It's main content is user specific views & subsets.	• It's content is about complete database structure.	• It's content is about storage details and access methods.

Q.16) Difference between physical & logical Data independence Any 5 points. Also List the major steps you would take to set up a database for a particular enterprise.

↳

Physical Data Independence	Logical Data independance
• It has ability physical storage structures without changing logical database schema.	• It has ability to modify logical schema without changing external views.
• We can modify in storage devices, file organizations, indexing methods.	• We can modify in database structure, tables, relationships.

• It's impact scope is in internal database storage mechanisms.	• It's impact scope is on conceptual database design & structure.
• It sheilds logical schema from physical storage changes.	• It protects external view from logical schema modification.
• It has minimal impact on application functionality	• It has minimal disruption to user interface & application

∴ The major steps I would take to setup a database for a particular exterprise are:

1) Requirements Gathering
   - Identify business needs
   - Analyze data collection requirements
   - Determine user groups & access levels.

2) Conceptual design
   - Create ER-diagram
   - Define primary entities
   - Establish relationships between entities

3) Logical Design
   - Select database management system
   - Define tables, columns and data types.
   - Establish primary & foreign key relationship

4) Physical design
- Select database Management system.
- Create physical database schema.
- Define storage structures & indexing

5) Implementation
- Install database management system
- Create database & tables
- Set up user access & security permissions.

6) Data Migration
- Clean & transform existing data.
- Import data into new data base.
- Validate data integrity.

7) Testing & optimization
- Performance testing
- Query optimization
- Security assessment

8) Deployment & Maintainance.
- Launch production database
- Implement regular backups
- Continuous monitoring.

Q. (17) Importance of Data Independance? Also mention their pros & cons.

→ Important:-

1) Structural Flexibility
2) Abstraction Level
3) Performance optimization
4) Security Enhancement
5) Cost-Effectiveness
6) Types of independences

□ Pros:-

i) Flexibility in Database design
ii) Abstraction & seperation of concerns
iii) Enhanced security

□ Cons:-

i) Complexity
ii) Performance overhead
iii) Learning curve
iv) System Limitation
v) Initial Development Cost

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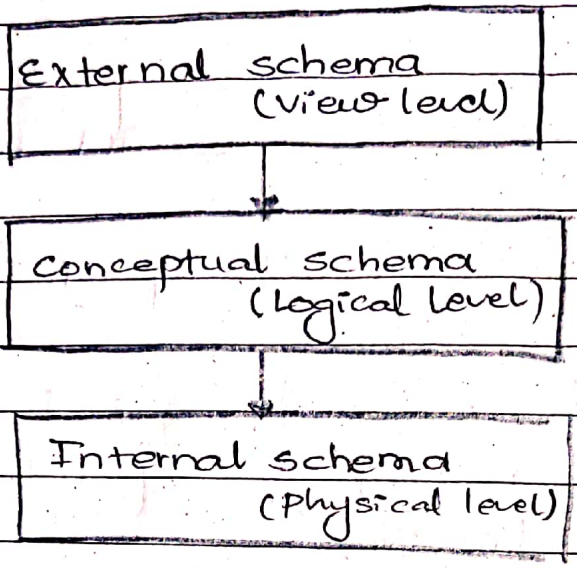
Q) Data abstraction Vs Data independence : Any 5

Ans The differences are:

S.N	Data abstraction	Data independence
1)	It is the process of hiding complex implemention details.	It is ability to modify database structure without impacting applications.
2)	It focuses on simplyfing data representation.	It focuses on minizing change propagation across database level.
3)	It's key purpose is to reduce complexity for users.	It's key purpose is to provide flexibility in database design.
4)	It scopes to represents data at different abstraction levels.	It scopes to support modification across database layers.
5)	It's levels are: External, Conceptual, Internal schemas.	It's levels are: physical & logical independence.
6)	It involves schema definitions.	Involves architectural design strategies.

19) Explain the structure of DBMS with the appropriate figure.

Ans. The structure of DBMS:



1) External schema (view level):-
- User-specific view of database
- Customized data representation
- Provides data privacy & security.

2) Conceptual schema (Logical Level):
- Unfied organizational database view
- Describes data relationships & constraints
- Independent of physical storage details

3) Internal schema (physical level)
- Actual physical storage representation
- Details of data storage & access methods
- Defines storage structures & indexing.

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20) What are the major responsibilities of DBMS? For each responsibility? Explain the problem that would aries if the responsibility were not discharged for each responsibility.

Ans Major Responsibility with associated problems are:

1) Data storage:
- Responsibility: Efficiently store & manage data
- Problem if not discharge: Data loss, inconsistent storage, inability to retrive information.

2) Data Retrieval:
- Responsibility:- Quick & accurate data access.
- Problem :- Slow query processing, incomplete or incorrect data extraction.

3) Data security:
- Responsibility: Protect data from unauthorized access
- Problem if not discharged: Data breaches, privacy violations, potential information theft.

4) ~~Data integrity~~ Concurrency Control:
- Responsibility: Manage simultaneous user access.
- Problem: ~~Data conflicts, race conditions, transaction failures, corruped~~ Data conflict, race conditions, transaction failures, corrupted

5 6) Transaction Manggement.
- Responsibility: Ensure reliable transaction processing

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- Problem :- Incomplete transactions, data inconsistency, system failures.

6) Backup & Recovery :-
- Responsibility :- Protect against data loss.
- Problem :- Permanent data loss, inability to restor system state.

7) Data Abstraction
- Responsibility :- Provide simplified data representation
- Problem :- Complex data understanding, increased user complexity.

These are few major responsibilities of DBMS.

21) Compare hierarchial, Network & Relational models with examples & difference.

Aspect	Hierarchial model	Network model	Relational model.
structure	Tree like structure	Graph like structure	Table based structure
Relationship	one to many	many to many	Multiple relationship
Data Access	Navigational access	complex path-based access	Set-based access
Performance:	Fast for predefined paths.	Moderate flexibility.	Highly flexible.
complexity	Low	Moderate	High
Primary use	Mainframe system	Complex interconnected data	Most modern application.

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22) Explain Database system Architecture & Database Application Architecture with example and differ

Ans → Database System Architecture:

This is the internal architecture of DBMS:-

a) User Interface Layer
b) Query processer
c) Storage Manager
d) Buffer Manager

→ Database Application Architecture:

This is typically a three tier Architecture.

a) Client Tier
   ↳ Presentation layer.
b) Application Tier
   ↳ Business logic Layer.
c) Database Tier
   ↳ Data layer

Eg:- Let's consider an e-commerse website.

1) Client tier:
   - Web interface showing products.
   - shopping cart interface
   - User login forms

2) Application Tier:
   - Product search logic
   - Order processing
   - Payment gateway integration

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- Inventory management.

3) Database tier:
- Customer information tables
- Product catalog
- Order history
- Inventory levels.

Ans. Differences are:

Database system Architecture	Database Application Architecture
It is internal structure of a database management system that manages how data is stored, accessed & manipulated.	It is overal structure of a database driven application showing how different components interact with the database
It's components are: UI layer, Query processor, storage Manager & Buffer manager	It's component are: client Tier, Application tier & Database tier.
It's scope is limited to database system & operation.	It's scope encompass entire application ecosystem.
It's users are database adminstrator & system developer.	It's user are end-users and application developers

Q.23) Explain the object-based data model & semi-structured data model.

Ans 1) Object-base data model:

- key characterstics:

a) Combines object-oriented programming concepts with database capabilities.
b) supports encapsulation, inheritance, & polymorphism
c) object have both attributes (data) & methods (behavior)
d) Maintains complex relationships between objects.

- Components:

a) Object
b) Classes
c) Relationships

2) Semi-structured Data Model

- key characterstics:

a) Flexible schema
b) Self-describing data
c) Irregular or incomplete data support
d) Hierarchical structure with varying depth
e) Dynamic schema evolution

- Components:

a) Data Element
b) Document structure

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24) Write short notes on:-

a) Distributed & centralized database model

- Distributed database model

It is a database divided across multiple locations but logically connected.

↳ Characterstics:

- Database spread across sites.
- Local data control
- Location transparency
- Replicated or partitioned data.

↳ Advantages:-

- Better performance
- Higher availability
- Improved reliability
- Local data access
- Better scalability

↳ Disadvantages:-

- Complex management
- Data consistency challanges
- Higher implementation costs
- Security complications

- Centralized database model:

It is a database model where single database stored at one location that serves all users.

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↳ Characterstics:
- Single point of control
- Centralized management
- Direct access to all data
- Simplified data consistency

↳ Advantages:
- Easier data management
- Better data integrity
- Simpler backup & recovery
- Lower hardware costs
- Easier security implementation.

↳ Disadvantages:
- Single point of failure
- performance bottleneck
- Limited scability
- Network dependency
- Higher network traffic at central point.

b) Data Dictionary:
It is a centralized repository of metadata which contains information about the database structure & stores data about data. It is also known as system catalog.

Functions & uses of data dictionary are:

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- Functions:

a) Documentation:
   → Database structure
   → Data relationships
   → Business rules.

b) Management
   → version contrd
   → change tracking
   → Impact analysis

c) Security
   → Access controls
   → User permissions
   → Role definations

- Uses:

1) System Development
2) Database Adminstration
3) Application Maintenance
4) Data Governance
5) User Training

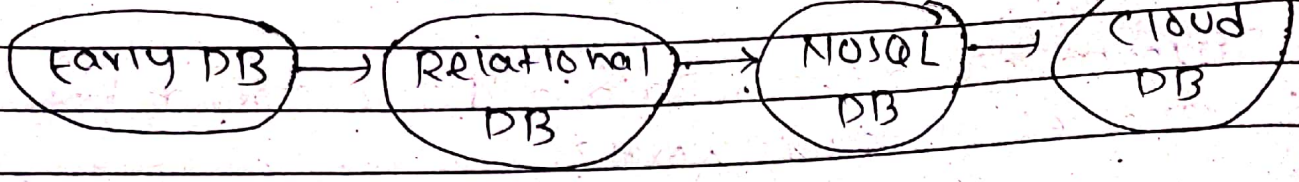
Name: Sanjog Sharma
Roll no.: 36

Q.(1) Differentiate between Data and information. How database is evolved in today's world?

→

Data	Information
i) It is a collection of facts or statistics.	i) It is the result of analyzing and interpreting data.
ii) It is unorganized and has no context.	ii) It is organized and has context.
iii) It is low level knowledge.	iii) It is second level knowledge.
iv) It doesn't depend on information.	iv) Information depends on data.
v) It isn't sufficient for decision making.	v) It is sufficient for decision making.
vi) E.g.:- no. of website visitors etc.	vi) E.g.:- website traffic changes etc.

Database is today's world is evolved from simple file systems to complex cloud-base systems that can be store & manage large amounts of data efficiently.



Q.(2) Explain the importances of DBMS. How DBMS helps in the field of IT? Also explain how DBMS is accessed using various DDL, DML & DCL languages.

→ The importance of DBMS is:- It helps organizations manage and analyze data efficiently, which can lead to better decision making and improved performances.

Also, it is important because of following points:

1) Data Organization
→ It helps to organize & structure data. So it's easier to store, retrive & manage.

2) Data security
→ It helps to protect data from unauthorized access and modification.

3) Data integrity
→ It enforces data integrity conitraints to ensure that data is accurate and consistent.

4) Data sharing
→ It allows user to share data more easier, which can help management make better business decisio

5) Backup & recovery
→ It provides automatic backup and recovery features, which can help minimize the need for manual backups.

6) ACID properties
→ It adhere the concept of Atomicity, consistency, isolation & Durability

7) Data redundancy
→ It reduces duplicate data, saving storage and ensuring consistency.

8) Scalability
→ Modern DBMS solutions can handle growing data needs without performances issues.

9) Central storage
→ It provides a central store that multiple users can access in controlled manner.

10) Automated Process
→ It can contribute to enhanced decision making & end-user productivity through automatic process & efficient query optimization.

These are the importances of DBMS & how it can help in IT field.

DBMS can be accessed using various DDL, DML, & DCL languages.

1) DDL (Data Definition Language)
- It is used to define and modify database structure.
- Key commands :- CREATE, ALTER, DROP, TRUNCATE
- E.g: CREATE TABLE employees
  (
  int id,
  name varchar(50),
  );

2) DML (Data Manipulation Language)
- It is used to manipulate data within database objects.
- Key commands : SELECT, DELETE, INSERT, UPDATE
- E.g:- INSERT into employee
  Values
  (1, 'Sanjog');

3) DCL (Data control Language)
- It is used to ~~create~~ control access & permissions.
- Key commands : GRANT, REVOKE
- E.g:- GRANT SELECT ON employee TO User1.

3) How can you apply database in Education, Bank, Airlines, Business, Entertainment? Explain in details.

→ We can apply database in various sector in following ways:

1) Education sector
- Student Information system (SIS)
- Academic Management
- Administrative Functions

2) Banking Sector
- Customer Account Management
- Transaction Processing
- Security & Compliance

3) Airlines Industry
- Fight Operations
- Passenger Services
- Operation Management

4) Business Applications:
- Customer Relationship Management (CRM)
- Supply chain Management
- Financial Management

5) Entertainment Industry
- Content Management
- User Engagement
- Revenue Management

Q.(4) Is data redundancy always a problem? How to remove those problems using DBMS.

→ Data redundancy isn't always a problem in DBMS. It can be beneficial or harmful depending on context.

* Beneficial Redundancy
- Improve data availability
- Enhance system performance
- Supports faster query execution
- Enable data recovery
- Helps in distributed database system

* Problematic Redundancy
- Wastes storage space
- Increases data inconsistency risk.
- complicates update processes
- Raises Maintenance costs
- Can create data anomalies.

Also,
We can remove data redundancy in DBMS.

1) Normalization Techniques (1NF ... 3NF, BCNF)
2) Database Design Strategies
   - Use primary & foreign keys
   - Create separate table for related data
   - Implement proper table relationships.
3) Practical Implementation.
4) Implement database View
5) Use stored procedure.

6) Apply proper indexing

Q.5 What is data integrity problem? How to remove those problems using DBMS?

→ The problem in DBMS like human error, cyber attacks, compromised hardware, data transfer errors, data replication; lack of data integrations, poor auditing etc is data integrity problem.

We can remove those problems using DBMS by following ways:-

1) Constraint Mechanism
2) Integrity Maintenacy Techniques
   - Implement strict validation rules
   - Use database triggers
   - Apply stored procedure
   - Create complex check constraints
   - Regular data audit
3) Prevention strategies
   - Normalize database design
   - Use transaction management
   - Implement access control
   - Input sanitization
4) Advance Integration protection
   - Use view for restricted data access
   - Creative audit logs
   - Use encryption for sensitive data

5) Referential Integrity Methods
- Restrict modification
- Custom error handling
- Cascade update / delete.

Q.6 Differentiate between the File system & DBMS.

↳

File system	DBMS
(i) Store data in separate File.	(i) Store data in integrated structured tables.
(ii) High redundancy	(ii) Minimized data redundancy through normalization.
(iii) Limited or no relationships between data.	(iii) supports complex relationships between data.
(iv) Basic file-level permission.	(iv) Advanced access control User authentication.
(v) Limited searching & Filtering	(v) Powerful querying using SQL.
(vi) Difficult to maintain.	(vi) Ensures data integrity through constraints.