

## Question 1

Create a new user named Computer Science and include the following tables.

### STUDENT

Name	Student_number	Class	Specialism
Smith	10	A	Computer-Science
Allan	57	B	Computer-Science

Name	Student_number	Class	Specialism
Smith	10	A	Computer-Science
Allan	57	B	Computer-Science

INSERT INTO 'student'  
('Name', 'student\_number', 'class', 'specialism')  
VALUES ('smith', 10, 'A', 'computer-Science'),  
'Allan', 57, 'B', 'computer-Science');

### COURSE

Course_number	Course_name	Credit_points	Department
DBA1202	Collaborative Development	10	Computer-Science
CS5000	Concepts of AI	10	Computer-Science
DA20221	Programming	8	Maths
MC4100	Advanced Databases	10	Computer-Science

Course_name	Credit_points	Department	course_number
Collaborative Development	10	Computer-Science	DBA1202
Concepts of AI	10	Computer-Science	CS5000
Programming	8	Maths	DA20221
Advanced Databases	10	Computer-Science	MC4100

```

INSERT INTO 'course'
('Id', 'course_name', 'credit_points',
'Department', 'course_number')
VALUES (1, 'collaborative Development', 10,
'computer-Science', 'DBA1202'),
(2, 'concepts of AI', 10, 'computer-Science',
'CS5000'),
(3, 'Programming', 8, 'Maths', 'DA20221'),
(4, 'Advanced Databases', 10, 'computer-
science', 'MC4100');

```

## STUDENT\_GRADE

Student-number	Course_number	Grade
10	DBA1202	D
10	CS5000	A
10	MC4100	B
57	DBA1202	C
57	MC4100	F
10	DA20221	E

Student_number	Course_number	Grade
10	DBA1202	D
10	CS5000	A
10	MC4100	B
57	DBA1202	C
57	MC4100	F
10	DA20221	E

```

INSERT INTO 'student_grade'
('student-number', 'course-number', 'grade')
VALUES (10, 'DBA1202', 'D'),
       (10, 'CS5000', 'A'),
       (10, 'MC4100', 'B'),
       (57, 'DBA1202', 'C'),
       (57, 'MC4100', 'F'),
       (10, 'DA20221', 'E');
    
```

## Question 2: Answer the Following questions

a) Define the following terms and explain with an example

i. Application

**Niraj Chaudhary**      mahak™  
 Date: \_\_\_\_\_  
 Page: \_\_\_\_\_  
 Q.No:- 2 (a)  
  
 Ans(?) :- An application is also referred to as an application program or application software. It is a computer software package that performs a specific function directly for an end user or, in some cases, for another application. An application can be self-contained or a group of programs.  
 Eg:- Word Processor, Data Programs, Web Browsers, etc.

## ii. Data vs Information

Ans (99) :- Data can be defined as <sup>raw</sup> fact that can be recorded or stored.  
eg :- Person Name, Age, Gender, etc.

Information can be defined as processed data that has a purpose and meaning. Information is dependent on data. Eg:- If we have a dataset of customer purchases (data), analyzing that data to identify customer preferences, purchasing patterns and trends would yield valuable information. This information can then be used to personalize marketing campaigns, optimize inventory or improve customer satisfaction.

## iii. Database

Ans (99) :- Databases are structured collections of data organized and stored in a systematic way, allowing for efficient storage, retrieval and manipulation of information. They serve as centralized repositories that enables the management and organization of data for various applications. For eg:- A customer database for an e-commerce company may store information such as customer names, contact details, purchase history and preferences. This database allows for easy retrieval of customer information, enabling personalized marketing, order processing and customer support. Similarly, a healthcare database may store patient records, medical histories, and test results, facilitating efficient healthcare management and analysis.

## iv. DBMS

Ans(9v) :- A DBMS is a software that facilitates the creation, organization, management and manipulation of databases. It provides an interface for users and applications to interact with databases, allowing for efficient storage, retrievals, modification, and querying of data. Eg of popular DBMS includes Oracle, MySQL, Microsoft SQL Server, and

PostgreSQL. These systems handle tasks such as data storage, data integrity, data security, concurrency control and query optimization.

- b) Explain the Database Design process and importance of the Database Management system

Q.No :- 2 (b)

Ans:- The database design process involves the systematic planning, structuring and organization of data within a database system to meet specific requirement and ensure efficient data management. It typically includes the following steps:

i) Requirements Gathering:-

Understanding the data requirement and objectives of the system, including the entities, relationship and constraints involved.

ii) Conceptual Design:-

Creating a high-level conceptual model that represents the entities, attributes and relationship between data element using techniques such as entity relationship diagrams.

### iii) Logical Design:-

Translating the conceptual model into a logical data model, specifying the structure and integrity constraints of the database, such as tables, columns, primary keys, foreign keys and normalization.

### iv) Physical Design:-

Implementing the logical design by determining how the database will be stored on physical storage medium, such as disk allocation, indexing strategies and optimization techniques.

The importance of a Database Management System (DBMS) in the database design process and beyond cannot be overstated. Here are some key reasons:-

#### i) Data Organization and Efficiency:-

A DBMS provides a structured framework for organizing and storing data allowing for efficient data retrieval, modification and querying.

#### ii) Data Consistency and Integrity:-

DBMS enforces data integrity rules, such as constraints and validations to ensure that data remain consistent.

and accurate across the database.

iii) Data Security and Access Control :-

DBMS can offer robust security features including user authentication, authorization and encryption to protect sensitive data from unauthorized access or modification.

iv) Data Backup and Recovery :-

DBMS provide mechanism for data backup, restore and disaster recovery. Regular backup and recovery options ensure data durability and minimize the risk of data loss.

- c) What is the role of a database administrator? Explain in detail.

Q.NO :- 2c

Ans:- A DBA plays a crucial role in the management, maintenance and optimization of database system. Their responsibilities typically includes -

i. Database Installation and configuration :-

DBA are responsible for installing and configuration the data base.

management system (DBMS) software on servers or computing systems.

## 2. Database Design and Planning:-

DBA is a participate in the database design process working closely with developers and stakeholder to define the database structure, schema and relationship.

## 3. Data Security and Access control:

DBA implement security measure to protect the database and its data. They monitor the database for any security breaches or vulnerabilities and take appropriate actions to mitigate risks.

## 4) Data Backup and Recovery:-

DBA can be establish backup and recovery procedures to ensure data durability and availability in case of system failure, disaster or human errors.

## 5) Capacity Planning and Scalability:-

DBA is a monitor database growth pattern, assess resource requirement and plan for future capacity needs.

- d) List and explain the advantages of DBMS over file based systems. **OR** Explain disadvantages of files based systems.

Q.No:- 2d

Ans:- File-based systems in which were prevalent before the advent of modern database management system (DBMS). Some disadvantages as follow:-

1. Data Redundancy and Inconsistency:-

In a file-based system, data is often duplicated across multiple files, leading to redundancy. This redundancy increases storage requirement.

2) Data Isolation and Inflexibility:-

File-based system lack a centralized data repository and impose data isolation. Each application or user typically has its own set of files, resulting in data fragmentation and limited data sharing.

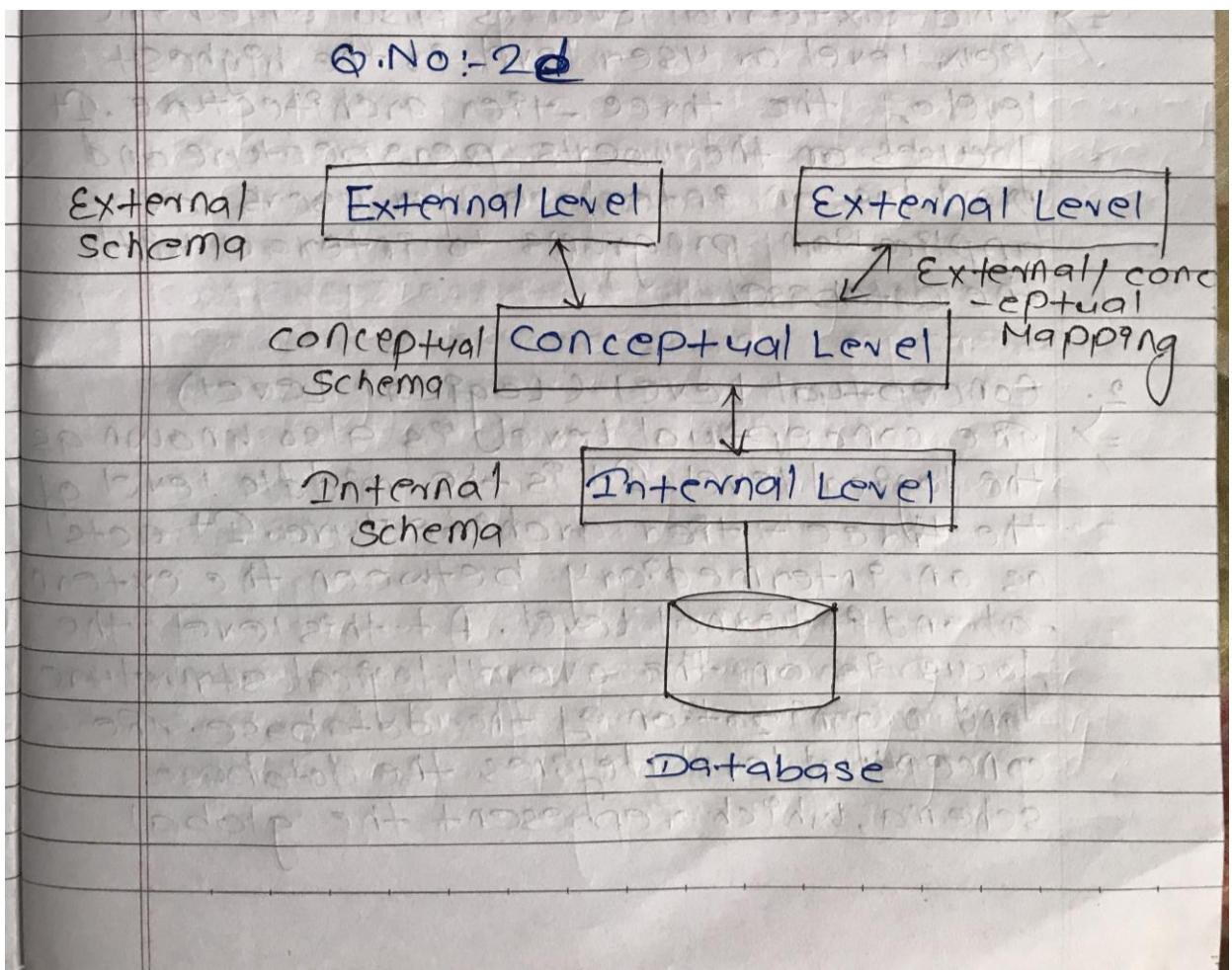
3) Data Dependence:-

In file-based system, applications are closely tied to the physical structure and format of the data files. This data dependence makes the system rigid and difficult to maintain or evolve.

4) Lack of Data Integrity and Security:-  
 File-based systems often lack built-in mechanisms for ensuring data integrity and enforcing security measures.

5) Difficulty in Querying and Reporting:-  
 Retrieving specific data or generating complex reports from file-based systems can be cumbersome. This increases development time and complexity.

- e) Draw and explain 3 level architecture of DBMS.



Ans:- The three-level architecture is also known as ANSI/SPARC architecture, is a conceptual framework that describes the organization and structure of a database Management system (DBMS). It separates the DBMS into three distinct levels, each with its own set of functions and responsibilities. The three levels are as follows:-

#### 1. External Level (View Level)

⇒ The external level is also called the view level or user level. It is the highest level of the three-tier architecture. It focuses on the user's perspective and provides an interface for users or application programs to interact with the database.

#### 2. Conceptual Level (Logical Level)

⇒ The conceptual level is also known as the logical level. It is the middle level of the three-tier architecture. It acts as an intermediary between the external and internal level. At this level, the focus is on the overall logical structure and organization of the database. The conceptual level defines the database schema, which represents the global

View of the entire database.

### 3) Internal Level (Physical level)

The internal level is also referred as the physical level. It is the lowest level of the three-tier architecture. It deals with the physical storage and representation of data in the database system. The internal level defines how the data is stored on the physical storage media, such as disks or tapes.

- f) List and explain different categories/types of database users.

Q. NO: 2

Ans:- Database users can be classified into various types based on their roles, responsibilities, and level of interaction with the database. Here are some common types of database users:-

#### 1. End User:-

##### a) Casual Users:-

These users have limited interaction with the database and require predefined queries or reports. They access the database through user-friendly interfaces or applications to retrieve information.

- Naïve Users:-  
Naïve users have basic knowledge by the database system and require guide assistance to perform specific tasks.

## 2.) Application Programmers:-

- Database Application Developers:-

These users are responsible for designing, developing and maintaining database applications. They interact with the database using programming language.

- Database Administrators (DBAs) :-

DBAs are responsible for the installation, configuration, security and maintenance of the database system. They manage user accounts, backup and recovery procedures, performance optimization.

## 3.) Data Analysts and Data Scientists:-

- Data Analysts:-

Data Analysts extracts, analyzes and interpret data from databases to generate insights and supports decision-making.

- Data Scientists!:-

Data scientists utilize advanced statistical and analytical techniques to extract knowledge and insights from databases.

#### 4) Database Managers and Executives!

- Database Managers!:-

Database Managers oversee the overall management and administration of the database system. They are responsible for strategic planning.

- Executives!:-

Executives such as CEOs, CTOs or department heads, may have a level of interest in the database system. They require summarized reports, dashboards.

#### 5) External Stakeholders!:-

- Business Partners!:-

Business partners or external stakeholders may have limited access to specific data or reports to support collaboration, decision-making or contractual obligation.

- Customers!:-

In some cases, customers may have access to self-service portals or systems that allow them to interact with their own data or perform certain actions within the databases.

g) List and explain different tasks/roles/functions/duties of a DBA (Database Administrator).

Q.No:-2g.

Ans:- Database administrators (DBAs) perform various tasks and fulfill multiple roles and responsibilities to ensure the efficient and secure operation of a database system. Here are some common tasks and roles of DBAs.

1. Database Installation and Configuration

- Setting up database parameters, storage structures and security settings.
- Performing initial system setup and configuration.

2. Database Design and Planning:-

- Collaborating with developers and stakeholders to design the database structure, schema and relationships.
- Defining data models, entities, attributes and constraints.

### 3) Security and Access control:-

- Managing users accounts, role, and permissions to control access to the database.
- Implementing security measures such as data encryption, authentication and authorization.

### 4) Data Backup and Recovery:-

- Establishing backup and recovery procedures to ensure data durability and availability.
- Implementing disaster recovery plans and strategies.

### 5) Performance Monitoring and Tuning:-

- Analyzing query execution plans, optimizing and data archiving to maintain optimal performance.
- Monitoring database performance and identifying bottlenecks, inefficient queries or resource utilization issues.

### 6) Capacity Planning and Scalability:-

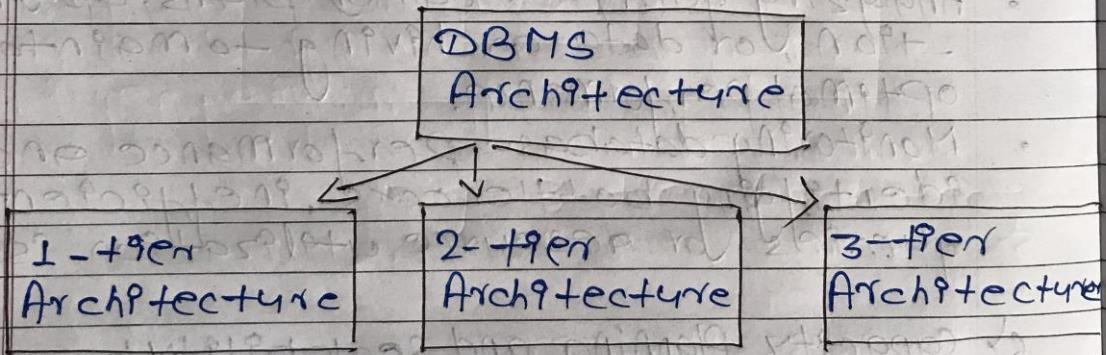
- Collaborating with system administrators to allocate appropriate hardware resources.
- Scaling the database system as the workload increases.

h) Explain DBMS architecture with block diagrams. **OR** Explain Database System architecture with block diagrams.

Q.No:- 2 h

Ans:- DBMS Architecture is the DBMS design depends upon 9+ts architecture. The basic client/server architecture is used to deal with a large number of PCs web servers, database servers and other components that are connected with network. DBMS architecture depends upon how users are connected to the database to get their requests done.

### Types of DBMS Architectures



1-tier Architecture:- In this architecture the database is directly available to the user. It means the user can be directly sit on the DBMS and uses it.

### iii) 2-Tier Architecture

The 2-tier architecture is same as basic client-server. In the two-tier architecture, applications on the client end can directly communicate with the database at the server side. For this interaction API's like: ODBC, JDBC are used.

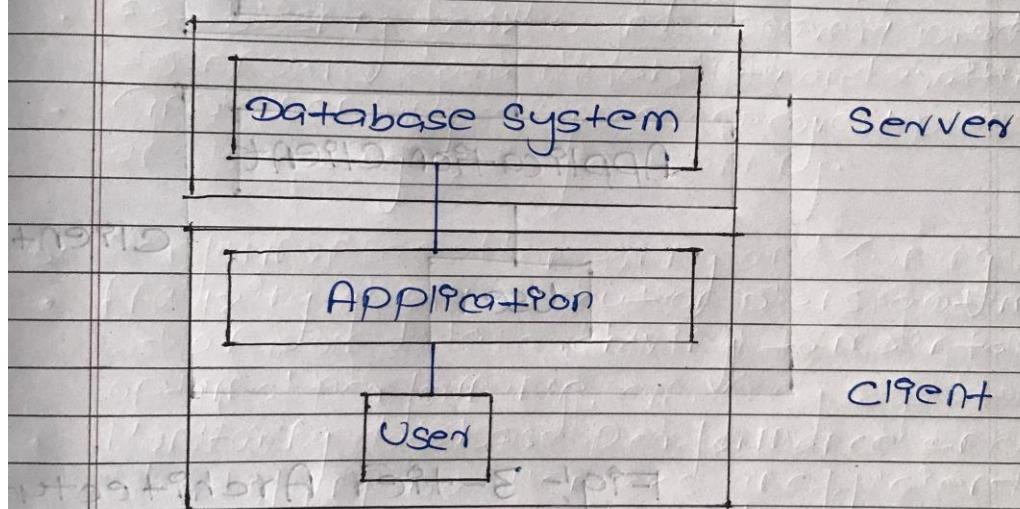


Fig:- 2-tier Architecture

### iv) 3-Tier Architecture :-

The 3-tier architecture contains another layer between the client and server. In this architecture, client can't directly communicate with the server. The application on the client-end interacts with an application

server which further communicates with the database system.

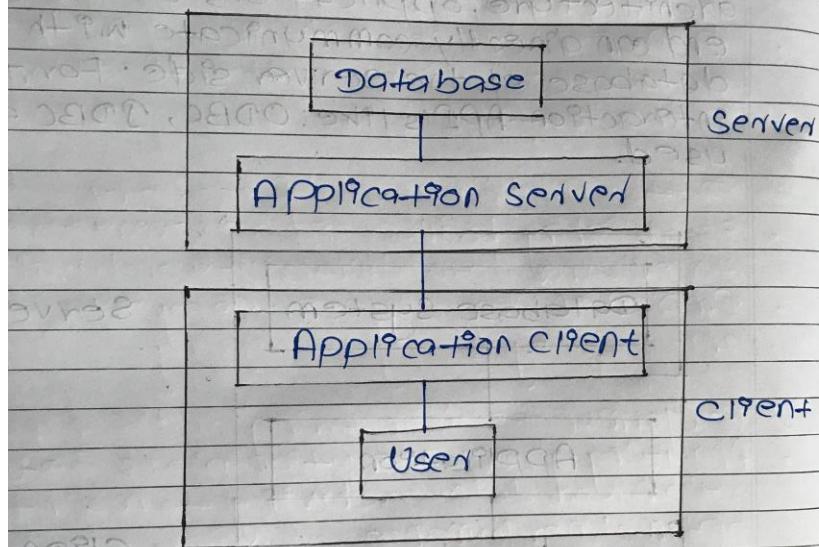


Fig:- 3-tier Architecture