SECTION A

Multiple Choice Question

Attempt all questions **(1 × 30 = 30)**

1. Which of the following best describes the primary purpose of a Database Management System (DBMS)?
   A. To design the physical layout of data on a hard drive
   B. To manage data and provide easy access, manipulation, and security
   C. To physically store data only
   D. To connect users to the internet
2. What is the key difference between a distributed database and a relational database?
   A. Distributed databases use flat files, while relational databases do not
   B. Relational databases store data across different geographical locations
   C. Distributed databases store data across multiple locations; relational databases organize data into related tables
   D. Relational databases do not support SQL
3. Which layer of database architecture defines how data is physically stored?
   A. External level
   B. Logical level
   C. Conceptual level
   D. Internal level
4. Why is data management important in modern organizations?
   A. It reduces the number of computers needed
   B. It eliminates the need for software
   C. It ensures data consistency, integrity, security, and efficient access
   D. It allows random storage of files without any structure
5. What is the primary purpose of an Entity-Relationship (ER) Diagram?
   A. To perform mathematical operations on data
   B. To visualize the physical structure of a database
   C. To graphically represent entities, relationships, and attributes in a database design
   D. To execute SQL queries efficiently
6. Which of the following is a major advantage of the E-R data model?
   A. It reduces the need for primary keys
   B. It allows for complex computations on data

C. It simplifies the design and understanding of database structure before implementation

D. It replaces the need for a relational database

7. Which relational algebra operation is used to retrieve specific columns from a relation?

A. Select (σ)

B. Project (π)

C. Join (⋈)

D. Rename (ρ)

8. In relational algebra, which of the following is a binary operator?

A. Select

B. Project

C. Union

D. Rename

9. What does the Cartesian Product operation return in relational algebra?

A. Only common rows from two relations

B. Rows from the first relation that do not match the second

C. All possible combinations of rows from two relations

D. Only matching rows based on a condition

10. Which of the following SQL statements is used to retrieve data from a table?

A. INSERT

B. SELECT

C. DELETE

D. UPDATE

11. What does the SQL BETWEEN operator do?

A. Tests if a value matches a pattern

B. Compares two columns for equality

C. Tests if a value lies within a specified range

D. Checks if a column has a NULL value

12. Which clause in SQL is used to sort the result of a query?

A. GROUP BY

B. ORDER BY

C. HAVING

D. SORT BY

13. What is the main goal of the conceptual design process in database development?

A. To write SQL queries for data retrieval

B. To implement data storage on physical devices

C. To create a high-level data model that represents user requirements

D. To manage user access permissions

14. During the requirement analysis phase, what is the primary task of the database designer?

A. Identify the database schema syntax

B. Understand and document what data the system should store and how users will interact with it

C. Normalize the tables into third normal form

D. Create indexing for faster search

15. What is the main purpose of the logical design phase in database development?

A. To define how data is physically stored on the disk

B. To design queries for report generation

C. To transform the conceptual model into a logical schema including tables, attributes, and relationships

D. To create backup and recovery plans

16. What is a referential key used for in a relational database?

A. To allow users to log in

B. To maintain data consistency by linking foreign keys to primary keys in related tables

C. To create indexes for faster retrieval

D. To sort the data alphabetically

17. What is the main purpose of normalization in database design?

A. To create duplicate copies of data for backup

B. To increase the size of the database

C. To eliminate data redundancy and ensure data integrity

D. To convert tables into charts and graphs

18. What is the primary difference between OLAP and OLTP systems?

A. OLAP is used for real-time transaction processing; OLTP is used for data analysis

B. OLTP supports complex queries; OLAP focuses on simple transactions

C. OLTP is used for day-to-day operations, while OLAP is used for analytical and decision-making purposes

D. OLAP stores data in rows; OLTP stores data in columns

19. In a client-server database architecture, what is the main role of the client?

A. To store and manage the database files

B. To handle database backup and recovery

C. To request data and display results to the user

D. To enforce referential integrity

20. Which of the following is an advantage of a distributed database system?

A. Centralized control of all data

B. Faster backup and recovery due to single storage

C. Improved data availability and reliability due to data distribution

D. Simpler database design

21. What is one major disadvantage of distributed database systems?

A. Reduced system availability

B. Higher complexity in data management and synchronization

C. Limited data access for users

D. Inability to use SQL

22. Which of the following is not a part of the ACID properties in transaction management?

A. Atomicity

B. Consistency

C. Isolation

D. Distribution

23. What does the “Atomicity” property ensure in a database transaction?

A. Only selected data is modified

B. Transaction is broken into multiple sub-queries

C. A transaction is either fully completed or fully rolled back

D. Changes are visible only to the user

24. What is the purpose of the database evaluation process?

A. To reduce the cost of storage

B. To verify and improve database performance, structure, and effectiveness

C. To create HTML web pages

D. To export database to Excel

25. What is the first step in the data analysis process?

A. Visualizing the data

B. Interpreting results

C. Collecting and cleaning data

D. Creating database reports

26. Descriptive, diagnostic, predictive, and prescriptive are types of what?
    A. Data models
    B. Data visualizations
    C. Data types
    D. Data analysis
27. Which type of data analysis helps answer the question: “What is likely to happen?”
    A. Descriptive analysis
    B. Predictive analysis
    C. Diagnostic analysis
    D. Prescriptive analysis
28. What is the main goal of data analysis?
    A. To delete irrelevant data
    B. To identify patterns and support decision-making
    C. To design user interfaces
    D. To sort the database tables
29. What is the role of web crawling in web data management?
    A. Encrypting website data
    B. Fetching web pages for indexing and search
    C. Compressing web content
    D. Deleting outdated web pages
30. Which of the following refers to managing and integrating data across the web for easy retrieval?
    A. Web design
    B. Web crawling
    C. Web data management
    D. HTML scripting

SECTION B

Short Answer Question

Attempt any five (5) questions **(6 × 5 = 30)**

1. Draw an ER diagram for a database showing a bank. Each bank can have multiple branches, and each branch can have multiple accounts and loans. **(Chapter 2- The Relational Data Models:)**

2. What is the participation constraint? Explain the different types of participation constraints. **(Chapter: 5 – Conceptual Design)**

3. Determine the normal form of the following student table. If it is not in 3NF, then normalize to 3NF. **(Chapter: 7 – Normalization)**

StudentID	StudentName	CourseID	CourseName	Credit	Contact_No
101	Ram	IT220	DBMS	3	9841XXXXXX, 9701XXXXXX
102	Sita	IT220	DBMS	3	9371XXXXXX
103	Hari	IT218	DSA	3	9874XXXXXX, 9871XXXXXX
104	Gita	ECO210	Economics	3	9987XXXXXX, 9765XXXXXX

Given functional dependencies:

StudentID → StudentName

CourseID →CourseName

CourseID → Credit

4. Why is concurrency control needed? Discuss with suitable examples. **(Chapter: 10 – Data Evaluation and Transaction)**

5. Explain the types of database architecture with an example. **(Chapter 1 Introduction to the Database Systems)**

6. Give one key difference between OLTP and OLAP. **(Chapter 8 Database Technology)**

7. What is the purpose of data interpretation in analysis? **(Chapter 11 Data Analysis)**

8. Write a short note **(any two)**
   a. Anomaly **(Chapter 7 Normalization)**
   b. SQL **(Chapter 4 SQL)**
   c. Unary & Binary Operator **(Chapter 3 Relation Algebra & Calculus)**

Section C

Long Answer Question

Attempt any two (2) questions (20X2=40)

1. If a multinational company consults you to design a database architecture for their company, as a Database Consultant, which architecture would you suggest between centralized and distributed, and explain why? **(Chapter 1Introduction to the Database Systems & Chapter 9 Distributed Architecture)**

2. Assume an HR database of a Company. Where primary keys are underlined: **(Chapter 4 SQL)**
   employees (EmpID, FirstName, LastName, Salary, DeptID)
   departments (DeptID, DeptName, LocationID)
   locations (LocationID, StreetAddress, PostalCode, City, ProvinceNo)
   Write the SQL queries for each of the following cases.
   a. The HR department needs a report to display the EmpID, first name, salary, for each employee whose salary is greater than 25,000 and less than 50,000.
   b. Write a query to display the last name, salary, department name of all employees whose department id is 26.
   c. Write a query to display the first name, department ID, department name, city for all employees who works in Lalitpur.
   d. Update the salary of employee with 50000 whose EmpID is 220.
   e. Create a view for employees table named as EmpView with attributes EmpID, FirstName and Salary.

3. Explain the ACID properties in the context of database transactions. Provide strategies and best practices to overcome common obstacles in the data analysis process.
   (Chapter 10: Data Evaluation & Transaction, Chapter 11: Data Analysis)