SECTION A

Attempt All Questions

Multiple Choice Questions **[30 x 1 = 30]**

1. Which one of the following refers to the duplicate data?
   a) **Data Redundancy**
   b) Data Repository
   c) Atomicity
   d) Data Inconsistency
2. In an ER diagram, an oval represents:
   a) **Attribute**
   b) Entity
   c) Relationship
   d) Constraint
3. Which normal form eliminates repeating groups?
   a) **1NF**
   b) 2NF
   c) 3NF
   d) BCNF
4. The Relational Algebra is a _____ Query language.
   a) Structured
   b) **Procedural**
   c) Logical
   d) Relational
5. Which SQL clause filters records before grouping?
   a) **WHERE**
   b) HAVING
   c) GROUP BY
   d) ORDER BY
6. In DBMS, table is known as _____ and row is known as _____.
   a) Relation, Relation
   b) **Relation, Tuple**

c) Tuple, Relation

d) Tuple, Tuple

7. Which operator performs pattern matching?

   a) BETWEEN

   b) **LIKE**

   c) EXISTS

   d) IN

8. 2NF eliminates:

   a) Transitive dependencies

   b) **Partial dependencies**

   c) Multi-valued dependencies

   d) Join dependencies

9. The Conceptual Database Model is developed _____ of hardware.

   a) Dependently

   b) **Independently**

   c) Concurrently

   d) Sequentially

10. Which is not a constraint in SQL?

    a) PRIMARY KEY

    b) **NULL**

    c) UNIQUE

    d) CHECK

11. Which SQL statement adds a new column to a table?

    a) MODIFY TABLE

    b) INSERT COLUMN

    c) **ALTER TABLE**

    d) UPDATE TABLE

12. What is the default sorting order of ORDER BY?

    a) Random

    b) Descending

c) **Ascending**

d) Alphabetical

13. Which function returns the current date?

a) NOW()

b) TIME()

c) **CURDATE()**

d) DATETIME()

14. A transaction is completed successfully using:

a) ROLLBACK

b) ABORT

c) **COMMIT**

d) EXIT

15. Which operator checks for NULL values?

a) =

b) !=

c) **IS NULL**

d) <>

16. Which normal form eliminates transitive dependencies?

a) 1NF

b) 2NF

c) BCNF

d) **3NF**

17. Which SQL command grants user permissions?

a) REVOKE

b) DENY

c) ACCESS

d) **GRANT**

18. What does ACID stand for in databases?

a) Accuracy, Consistency, Isolation, Durability

b) Atomicity, Correctness, Integrity, Durability

c) Atomicity, Consistency, Integrity, Data

d) **Atomicity, Consistency, Isolation, Durability**

19. Which SQL command is used to add a primary key constraint to an existing table?

a) **ADD CONSTRAINT**

b) CREATE KEY

c) INSERT PRIMARY

d) ALTER TABLE

20. OLAP is used for:

a) Real-time transactions

b) Data entry

c) Backup recovery

d) **Business analytics**

21. Which normal form addresses transitive dependencies?

a) **3NF**

b) 2NF

c) 1NF

d) 4NF

22. The correct SQL syntax to insert data is:

a) **INSERT INTO table VALUES (...)**

b) ADD ROW TO table (...)

c) CREATE DATA IN table (...)

d) NEW RECORD table (...)

23. In relational algebra, π represents:

a) **Projection**

b) Selection

c) Join

d) Division

24. A foreign key can:

a) **Contain NULL values**

b) Be non-unique

c) Reference non-primary keys

d) Violate referential integrity

25. Data cleaning is part of:

a) **ETL processes**

b) Query optimization

c) Transaction management

d) Index creation

26. The primary goal of normalization is to:

a) Increase query speed

b) **Minimize redundancy**

c) Simplify backups

d) Enhance security

27. In client-server architecture:

a) Clients manage data

b) **Servers process requests**

c) Peer-to-peer communication

d) No centralized control

28. The durability property ensures:

a) Fast transactions

b) **Permanent changes**

c) Concurrent access

d) Immediate consistency

29. Black box testing examines:

a) Database schema

b) **Input-output behavior**

c) Code structure

d) Query execution plans

30. Queries for purchases/downloads are:

a) Navigational

b) **Transactional**

c) Informational

d) Diagnostic

SECTION B

Comprehensive Answer Questions

Attempt any five (5) questions out of eight (8) questions [5 x 6 = 30]

1. A database is an organized collection of information designed to allow easy access, storage, and modification of data. Describe the functionalities of a database system and provide a brief overview of various fields where such systems are commonly applied. [Unit-1: Introduction to Database Systems] (6 marks)
2. In Relational Algebra, union and intersection operations are used to combine or compare two data sets. Describe how these operations are carried out in Relational Algebra, supporting your explanation with suitable examples. [Unit-3: Relational Algebra & Calculus] (6 marks)
3. Conceptual design is a high-level representation of a database structure that outlines the entities and relationships without focusing on implementation details. Provide a brief explanation of conceptual design, along with an appropriate example. [Unit-5: Conceptual and Logical Design] (6 marks)
4. Artificial Intelligence (AI) and Machine Learning (ML) are emerging technologies that are transforming how developers approach problem-solving and automation. Provide a brief overview of AI and ML, highlighting their significance in modern software development. [Unit-8: Database Technology] (6 marks)
5. DDBMSs provide several benefits over traditional centralized database systems. Explain the advantages and disadvantages of using a DDBMS. [Unit-9: Distributed Architecture] (6 marks)
6. ACID properties play a crucial role in maintaining the integrity and consistency of database transactions. Without these principles, databases may become unreliable, leading to potential data loss or corruption. Briefly explain the concept of ACID. [Unit-10: Database Evaluation and Transaction] (6 marks)

7. Data analysis plays a vital role in interpreting information, detecting issues, forecasting future trends, and guiding decision-making. How many types of data analysis do you know? Provide a brief explanation of any two of them. [Unit-11: Data Analysis] (6 marks)
8. Web crawlers are essential tools used to systematically browse and index content from websites, enabling efficient search and retrieval. Provide a brief introduction to web crawlers and their primary function. [Unit-12: Database and the World Wide Web] (6 marks)

SECTION C

Long Answer Questions

Attempt any two (2) questions out of three (3) questions. (Q.no. 3 is Compulsory). [2 x 20 = 40]

1. Consider the following set of data that needs to be stored in the database:

Name	Salary	Department	Department_head	Department_Location
Ram, Shyam, Hari, Krishna	8000, 1000, 9000, 8000	IT	Krishna	Pokhara
Kripa, Sujan	8000, 9000	HR	Sujan	Kathmandu

2. Explain why the data should not be stored this way. Break down the above data into appropriate tables using the 1st, 2nd, and 3rd Normal Forms. [Unit: Not Specified] (20 marks)
3. Consider a university database where each student is identified by their unique student ID, and each course is identified by a unique course code. A student can enroll in multiple courses, and a course can have multiple students. Additionally, each course is guided by a single instructor. Design an ER diagram for the university database, considering the following requirements:
    - A student can be enrolled in multiple courses, and a course can have multiple students.
    - Each student has a unique student ID, their name, and their date of birth.
    - Each course has a unique course code, a name, and the semester it is offered in.

- Each course is taught by a single instructor, identified by their unique instructor ID and their name.

  [Unit: Not Specified] (20 marks)

4. **(Case Study)** The National Sports Council of Nepal is maintaining a database of Athletes representing the country in various sports. Below is the table 'Athlete' with sample data:

Id	**Name**	**Sport**	**Address**	**Mobile**	**Join_Date**
1	Dipa	Gymnastics	Biratnagar	9812345678	5/15/2010
2	Sandesh	Football	Pokhara	9823456789	8/20/2015
3	Gaurika	Swimming	Lalitpur	9834567890	3/10/2018
4	Sagar	Cricket	Bhairahawa	9845678901	11/25/2012

Write SQL queries for the following tasks:

a. Create the 'Athlete' table with: Primary Key: Id, NOT NULL: Name, Sport, and Address, Default Date: Join_Date should default to the current date, Constraint: Mobile must be exactly 10 digits long.
b. Insert two new athletes into the table.
c. Display all records in the same format as the given table.
d. Update the record for Sandesh: New Address: Butwal, New Mobile: 9856781234.
e. Find all athletes who joined between 2010 and 2015.
f. Calculate the years of experience for each athlete (based on Join_Date) and sort them by experience (highest first).
g. Retrieve the Name and Sport of the most experienced athlete.
h. Display the Name, Sport, and Mobile of athletes whose names start with 'G'.
i. Delete all records of Gaurika if she is no longer part of the council.
j. Permanently delete all records from the table without altering its structure (ensure no rollback is possible).

[Unit: Not Specified] (20 marks)