Printed Page:-05 **Subject Code**:- **ACSBS0404**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - THEORY EXAMINATION (2023 - 2024)

Subject: Database Management Systems

Time: 3 Hours **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* **three Sections -A, B, & C.** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION A **20**

1. Attempt all parts:-

1-a. DDL defined as a .....(CO1) 1

(a) Data Definition Language

(b) Dynamic Data Language

(c) Data Derivation Language

(d) Detailed Data Language

1-b. In an Entity-Relationship (E-R) diagram, a weak relationship is typically represented by using (CO2) 1

(a) Double diamonds

(b) Undivided rectangles

(c) Dashed lines

(d) Diamond

1-c. .....normal form allows for the elimination of join dependencies. (CO2) 1

(a) 1NF

(b) 2NF

(c) 3NF

(d) BCNF

1-d. In..... normal form we don't have transitive dependencies. (CO2) 1

(a) 1NF

(b) 2NF

(c) 3NF

(d) BCNF

1-e. Analyze the SQL clause responsible for removing tuples from a database table. (CO3) 1

(a) DELETE

(b) REMOVE

(c) DROP

(d) CLEAR

1-f. Differentiate among the provided options to identify the non-DDL command in SQL. (CO3) 1

(a) UPDATE

(b) TRUNCATE

(c) ALTER

(d) None

1-g. Isolation of the transactions is ensured by (CO4) 1

(a) Transaction management

(b) Application programmer

(c) Concurrency control

(d) Recovery management

1-h. ..... scheme uses locks to prevent multiple transactions from accessing the same data simultaneously. (CO4) 1

(a) Timestamp-based scheduler

(b) Optimistic concurrency control

(c) Multi-version concurrency control

(d) Lock-based concurrency control

1-i. In _____ attacks, the attacker manages to get an application to execute an SQL query created by the attacker. (CO5) 1

(a) SQL injection

(b) SQL

(c) Direct

(d) Application

1-j. _____ access controls rely upon the use of labels. (CO5) 1

(a) Discretionary

(b) Role-based

(c) Mandatory

(d) Nondiscretionary

2. Attempt all parts:-

2.a. Assess the significance of normalization in database management, considering its impact on reducing data redundancy, enhancing data consistency, and enabling efficient querying. (CO1) 2

2.b. Explain Relational Algebra with their operator. (CO2) 2

2.c. Explain aggregate functions . Also list the aggregate functions supported by SQL. (CO3) 2

2.d. Describe the importance of the "Atomicity" property in ACID. Discuss how atomic transactions help maintain database consistency in the event of failures. (CO4) 2

2.e. Discuss the role of Intrusion Detection Systems (IDS) in database security. (CO5) 2

SECTION B **30**

3. Answer any <u>five</u> of the following:-

3-a. Explain the degree of a relationship in E-R Model with their types. (CO1) 6

3-b. Explain the concepts of Primary Key, Candidate Key, and Foreign Key, detailing their roles in database integrity and relationship management. (CO1) 6

3-c. Let a relation R (A, B, C, D ,E) and functional dependency {A –> BC, CD –> E, B –> D, E> A}. Relation R is decomposed into R1(A, B, C) and R2(A, D,E). Check whether decomposition is lossless or lossy decomposition. (CO2) 6

3-d. Explain Armstrong's axioms in the context of functional dependencies in relational databases. Provide examples to illustrate how each axiom can be applied to derive additional functional dependencies from a given set. (CO2) 6

3.e. Discuss the projection operator in relational algebra and its significance in retrieving specific columns from a relation. Explore how projection eliminates redundant data and simplifies query results. Provide examples to demonstrate the usage of projection in SQL queries. (CO3) 6

3.f. Define dirty read is in the context of database transactions. Discuss how a dirty read could occur in the banking application and its potential impact on data consistency. (CO4) 6

3.g. Discuss common data mining techniques, such as classification, clustering, and association rule mining. Provide examples of real-world applications of data mining in business intelligence and analytics. (CO5) 6

SECTION C **50**

4. Answer any <u>one</u> of the following:-

4-a. Explore the concepts of Aggregation, Specialization, and Generalization within database modeling, evaluating their applications and implications. (CO1) 10

4-b. Construct an Entity-Relationship (ER) diagram for a university registration system. The system should manage information about students, courses, instructors, and registrations. Each student can enroll in multiple courses, and each course can have multiple students enrolled. An instructor can teach multiple courses, and each course is taught by a single instructor. Additionally, each student's registration in a course should capture the semester and year of registration. Include appropriate entity types, relationships, and attributes in your diagram. (CO1) 10

5. Answer any <u>one</u> of the following:-

5-a. Consider a relation schema R(A, B, C, D, E) with functional dependencies: 10

$A \rightarrow B, C$

$B \rightarrow D$

$D \rightarrow E$

a) Identify the candidate keys for the relation schema R.

b) Determine the highest normal form satisfied by the relation schema R. Provide a rationale for your answer. (CO2)

5-b. Consider a relation schema R(A, B, C, D, E, F, G) with the following set of functional dependencies: 10

$A \rightarrow B, C$

$B \rightarrow D, E$

$C, D \rightarrow F$

$F \rightarrow G$

Determine the highest normal form satisfied by the relation schema R. Justify your answer.

If the relation schema R is not in the highest normal form, specify the

normalization form it violates and provide steps to decompose it into smaller relations to achieve the highest normal form. (CO2)

6. Answer any <u>one</u> of the following:-

6-a. Consider the following schema: EmployeeDetails(EmpId, FullName, ManagerId, DateOfJoining, City), EmployeeSalary(EmpId, Project, Salary, Variable) Answer the following questions using SQL queries; (i) Write an SQL query to fetch the EmpId and FullName of all the employees working under Manager with id – '986'. (ii) Write an SQL query to fetch the different projects available from the EmployeeSalary table. (iii) Write an SQL query to find the maximum, minimum, and average salary of the employees. (iv) Write an SQL query to fetch the employees whose name begins with any two characters, followed by a text "hn" and ending with any sequence of characters. (CO3) 10

6-b. Consider a scenario where you are tasked with implementing a hash table using the modulo 10 hashing technique. You are provided with a set of keys: {15, 23, 7, 35, 11, 26, 18, 42, 9, 31}. 10

Design a hash table with 10 buckets, numbered from 0 to 9.
Implement a hash function using modulo 10 to map keys to bucket locations.
Insert the provided keys into the hash table using the hash function.
Ensure proper handling of collisions, if any, using suitable collision resolution technique.
Provide a step-by-step explanation of the insertion process, including how keys are hashed and placed into the hash table. (CO3)

7. Answer any <u>one</u> of the following:-

7-a. Check whether the given schedule S is conflict serializable or not. S: R4(A), R2(A), R3(A), W1(B), W2(A), R3(B), W2(B). (CO4) 10

7-b. Explain the concept of serializability in scheduling and discuss how it ensures database consistency in concurrent transaction processing. Provide examples of conflict and view serializable schedules to illustrate the concept. (CO4) 10

8. Answer any <u>one</u> of the following:-

8-a. Describe the challenges and benefits of managing distributed databases. Discuss techniques for ensuring data consistency, availability, and fault tolerance in distributed database environments. (CO5) 10

8-b. Compare and contrast object-oriented databases (OODB) and object-relational databases (ORDB) in terms of their structure, data modeling capabilities, and suitability for different application domains. (CO5) 10