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Subject Code:- BCSBS0404

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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - THEORY EXAMINATION (20..... - 20.....)

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. The database administrator is, in effect, the coordinator between the _____ and _____ . (CO1, K1) 1
- (a) DBMS, database
- (b) Application program, database
- (c) Database, user
- (d) Application programs, users
- 1-b. In which one of the following, the multiple lower entities are grouped (or combined) together to form a single higher-level entity? (CO1, K1) 1
- (a) Specialization
- (b) Generalization
- (c) Aggregation
- (d) None of the above
- 1-c. Determine which of the following normal forms deals with atomicity, ensuring that each attribute contains only atomic values? (CO2, K2) 1
- (a) 1NF
- (b) 2NF
- (c) 3NF
- (d) BCNF
- 1-d. Consider the schema R(S,T,U,V) and the dependencies $S \rightarrow T$, $T \rightarrow U$, $U \rightarrow V$, $V \rightarrow S$. 1

Let $R = \{R1, R2\}$ such that $R1 \cap R2 = \Phi$. Then the decomposition is : (CO2, K4)

- (a) not in 2NF
- (b) in 2NF but not in 3NF
- (c) in 3NF but not in 2NF
- (d) in both 2NF and 3NF

1-e. Identify the SQL function utilized for determining the count of rows in a SQL query. (CO3, K2) 1

- (a) COUNT()
- (b) NUMBER()
- (c) SUM()
- (d) COUNT(*)

1-f. A query in the tuple relational calculus is expressed as: (CO3, K1) 1

- (a) $\{t \mid P(t) \mid t\}$
- (b) $\{P(t) \mid t\}$
- (c) $\{t \mid P(t)\}$
- (d) All of the mentioned

1-g. Identify the most critical ACID feature for transaction reliability. (CO4, K1) 1

- (a) Atomicity
- (b) Adaptability
- (c) Abstraction
- (d) Accessibility

1-h. Determine which transaction accesses multiple nodes. (CO4, K2) 1

- (a) A Remote Transaction
- (b) A Distributed transaction
- (c) Both remote and distributed
- (d) None of the mentioned

1-i. Identify which part of data warehouse architecture collects organization-wide data. (CO5, K1) 1

- (a) Data Mart
- (b) Enterprise Warehouse
- (c) Virtual Warehouse
- (d) data warehouse view

1-j. Identify which data structure is an unordered collection with possible duplicates. (CO5, K1) 1

- (a) Set
- (b) Bag
- (c) List

(d) Dictionary

2. Attempt all parts:-

- | | | |
|------|---|---|
| 2.a. | List out two major responsibilities of a database administrator. (CO1, K2) | 2 |
| 2.b. | Describe the difference between functional dependency and multi-valued dependency in the context of database normalization. (CO2, K3) | 2 |
| 2.c. | Analyze how the GROUP BY clause impacts data aggregation in SQL. (CO3, K4) | 2 |
| 2.d. | Justify the role of “Atomicity” in maintaining database consistency during failures. (CO4, K3) | 2 |
| 2.e. | Examine the role of network monitoring systems in detecting suspicious activities. (CO5, K3) | 2 |

SECTION-B

30

3. Answer any five of the following:-

- | | | |
|------|---|---|
| 3-a. | Explore the concept of mapping cardinality in ER Diagrams, elucidating how it defines relationships between entity sets. (CO1, K3) | 6 |
| 3-b. | Explain the differences between a file system and a database system, highlighting their respective features and advantages. Provide examples to illustrate the distinctions between the two systems. (CO1, K3) | 6 |
| 3-c. | Explain the Boyce-Codd Normal Form (BCNF) in the context of relational databases. Provide an example to illustrate how a relation schema can be decomposed into BCNF and discuss the criteria for determining whether a relation schema satisfies BCNF. (CO2, K3) | 6 |
| 3-d. | Let a relation R (A,B,C,D,E,F) and functional dependency { $AB \rightarrow C$, $C \rightarrow D$, $D \rightarrow EF$, $F \rightarrow A$, $D \rightarrow B$ }. Relation R is decomposed into R1(A,B,C) , R2(C,D,E),R3(E,F). Check whether decomposition is lossless or lossy decomposition. (CO2, K4) | 6 |
| 3.e. | Explain the selection operator in relational algebra and its role in filtering rows from a relation based on specified conditions. Discuss the syntax of the selection operation and provide examples to illustrate its usage in SQL queries. (CO3, K3) | 6 |
| 3.f. | Show how lack of 2PL can result in a non-serializable schedule. Evaluate with an example. (CO4, K5) | 6 |
| 3.g. | Examine the features of a data warehouse and analyze how they support data analysis. (CO5, K4) | 6 |

SECTION-C

50

4. Answer any one of the following:-

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|------|--|----|
| 4-a. | Construct an E-R diagram for a hospital with a set of patients and a set of medical doctors. Associated with each patient, a log of the various tests and examinations conducted. Also Reduce ER Diagram of Hospital to Relational Tabular Form. (CO1, K6) | 10 |
| 4-b. | Discuss relational database? Explain procedural and non procedural languages in | 10 |

context with database system. (CO1, K3)

5. Answer any one of the following:-

- 5-a. Given a relation R(P, Q, R, S, T, U, V, W, X, Y) and Functional Dependency set $FD = \{ PQ \rightarrow R, P \rightarrow ST, Q \rightarrow U, U \rightarrow VW, \text{ and } S \rightarrow XY \}$, determine whether the given R is in 3NF? If not convert it into 3 NF. (CO2, K4) 10
- 5-b. Consider a relation schema R(X Y Z W P) is decomposed into R1(X Y Z W) and R2(X Z W P). determine whether the above R1 and R2 are Lossless or Lossy. (CO2, K5) 10

6. Answer any one of the following:-

- 6-a. Using the following schema represent the following queries using DRC: customer(customername, street, city) Loan (loanno, branchname, amount) Borrower(customername, loan no) (i) Find the loan number, branch, amount of loans of greater than or equal to 100 amount. (ii) Find the loan number for each loan of an amount greater or equal to 150. (iii) Find the names of all customers having a loan at the “Main” branch and find the loan amount . (CO3, K5) 10
- 6-b. Evaluate the concepts of tables, records, and domains in SQL. Demonstrate and justify how table joins are implemented in MySQL with examples. (CO3, K5) 10

7. Answer any one of the following:-

- 7-a. Critically analyze the following transactions T1, T2, T3, and T4, along with their respective read and write sets: (CO4, K5) 10
- T1: Read(A), Write(B)
T2: Read(B), Write(C)
T3: Read(C), Write(A)
T4: Read(A), Write(B)
- Determine if the given set of transactions is conflict serializable. If conflict serializable, provide a serial order in which these transactions can be executed to maintain the equivalent result. If not, explain why.
- 7-b. Explain the method of testing the serializability. Consider the schedule S1 and S2 given below S1: R1(A),R2(B),W1(A),W2(B) S2: R2(B),R1(A),W2(B), W1(A) Check whether the given schedules are conflict equivalent or not? (CO4, K3) 10

8. Answer any one of the following:-

- 8-a. Analyze the principles of database security by comparing authentication, authorization, and access control. Evaluate the differences between MAC and RBAC models. (CO5, K5) 10
- 8-b. Evaluate the advantages of distributed databases over centralized DBMS. Discuss additional functionalities provided by DDBMS. (CO5, K5) 10