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May-25-0339

CS-401 (Database Management System) [CSE, IT]

B.Tech. 4th (CBCS)

Time : 3 Hours

Max. Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C and D. Section E is compulsory.

SECTION - A

1. Discuss, in detail, the concept and overview of a Database Management System (DBMS). How does a DBMS improve data management over traditional file systems? Include an explanation of the key features and advantages of using a DBMS. (10)
2. Given a database schema for a university system, calculate the number of potential users categorized into different roles (students, faculty, administrators). Assume you have 10,000 students, 500 faculty members, and 50 administrators. What is the total number of database users, and how would a DBMS handle access control for these different roles? (10)

SECTION - B

3. Discuss the main operations of relational algebra. Provide detailed examples of selection, projection, union, set difference, Cartesian product, and join operations. How do these operations facilitate querying relational databases? (10)
4. Discuss the use of set operations in SQL. Explain the UNION, INTERSECT, and EXCEPT operations with examples. How do these operations facilitate data manipulation and retrieval in SQL? (10)

SECTION - C

5. Discuss Boyce-Codd Normal Form (BCNF) and how it differs from 3NF. Provide an example to demonstrate a situation where a relation is in 3NF but not in BCNF. (10)
6. Consider a database with a table **Orders(order_id, customer_id, order_date, total_amount)**. If there are 1,000,000 rows in the table and each row is 100 bytes in size, calculate the total storage required for the table. How would an index on **customer_id** affect the storage requirements? (10)

SECTION - D

7. Define serializability and recoverability in the context of transaction management. How do these concepts ensure the correctness and integrity of transactions? Provide examples to illustrate the differences between serializability and recoverability. (10)
8. Explain the concept of logging in database systems. What types of information are typically recorded in a transaction log? How does logging facilitate the recovery process? Provide examples to demonstrate how logging works. (10)

SECTION - E (Compulsory)

9. Answer all the questions below:
 - (a) What are the main steps involved in the two-phase commit protocol for distributed databases?
 - (b) What is the purpose of validation in concurrency control mechanisms?
 - (c) What is a functional dependency in the context of relational database design?