H/G/TX

Reg. No: 21BDS0100

VIT®
Vellore Institute of Technology

Summer Term Final Assessment Test – July 2024

Course: BCSE302L - Database Systems
Class NBR(s): 0278 Slot: A1+TA1+A2+TA2
Time: Three Hours Max. Marks: 100

- KEEPING MOBILE PHONE/ELECTRONIC DEVICES EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

Answer ALL Questions
(10 X 10 = 100 Marks)

1. Design a 3-tier architecture for a university's online examination system that handles user authentication, question banks, and exam scheduling.
   a. Describe the roles of the Presentation Layer, Application Layer, and Data Layer.
   b. Outline a database schema with at least four tables and their primary keys.
   c. Explain how a student's request to take an exam flows through the three tiers.
2. Design an Entity-Relationship (ER) model for a cricket club's management system. The system should handle player profiles, team compositions, and match results.
   a) Draw an ER diagram that includes entities for Players, Teams, Matches, and Coaches, along with their attributes and relationships.
   b) Specify primary keys for each entity and any necessary foreign keys.
   c) Describe two key relationships between these entities and their cardinalities.
3. a) Explain the Boyce-Codd Normal Form (BCNF) with respect to database normalization. Provide an example scenario where BCNF would be beneficial for a retail store database handling products, suppliers, and orders. **[5]**
   b) Differentiate between trivial and non-trivial functional dependencies in database management systems. Provide examples for each. **[5]**
4. a) Compare Sparse Indexing and Dense Indexing techniques in database systems. Provide examples and discuss their impact on storage and query performance. **[5]**
   b) Describe the key operations of Selection, Projection, Cartesian Product, and Rename in relational algebra. Provide examples highlighting their roles and differences in database queries. **[5]**

5. Consider a B+ tree with an order m=4 in a database system. Initially, the tree is empty. Insert the keys 10, 20, 5, 15, 25, 3, 8, 12, 18, 22, 30 into the B-tree in the given order. Visualize the resulting B+tree.

6. Compare and contrast static hashing and dynamic hashing in database management systems (DBMS). Discuss their respective advantages and disadvantages, and provide scenarios where each would be most appropriately used.

7. Explain the concept of concurrent executions in a Database Management System (DBMS) and discuss the potential problems that can arise due to concurrent executions. Provide a brief example for each problem.

8. Define a transaction in the context of an ATM system. Discuss the importance of ACID properties in ensuring data integrity during ATM transactions.

9. Explain the concept of deadlocks in Database Management Systems (DBMS).
   a. Define what a deadlock is and how it occurs in the context of DBMS.
   b. Describe the conditions necessary for a deadlock to happen.
   c. Discuss techniques used to prevent or resolve deadlocks in DBMS.
   d. Provide an example scenario illustrating the occurrence and resolution of a deadlock in a database system.

10. Explain the growing and shrinking phases of the 2-Phase Locking (2PL) protocol in DBMS. How do these phases contribute to ensuring serializability and preventing concurrency issues? Provide an example to illustrate the functioning of these phases.

⇔⇔⇔ H/G/TX ⇔⇔⇔