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Total Pages : 07

003502

Dec. 2025

B.Tech. (Fifth Semester)

Database Management Systems (PCC-CS-501)

Time : 3 Hours] *[Maximum Marks : 75*

Note : It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any *four* questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other. Assume the data and values, wherever required

Part A

1. (a) Define Primary key and Foreign key in a relational database system with example. **1.5**

   (b) Write an algorithm to find closure of a set of attributes. **3**

(c) Explain different types of attributes supported in an ER diagram along with their design notations. 1.5

(d) What are the differences between OLTP and OLAP ? 1.5

(e) What are Wait-Die and Wound-Wait schemes of deadlock prevention ? 1.5

(f) Explain any two join strategies for joining two relations. 1.5

(g) State and explain First Normal Form (1NF). 1.5

(h) How domain calculus and tuple calculus differ ? Explain by an example query. 1.5

(i) How checkpoints are useful in database recovery ? 1.5

Part B

(a) Elaborate in detail the three-schema architecture of Database system. **5**

(b) Explain cardinality constraints and participation constraints applicable in Entity-Relationship (ER) Modeling. **5**

(c) How Network Model and Hierarchical Model differ from each other in terms of data representation and query processing ? **5**

3. (a) Given relation R(A, B, C, D) with the following functional dependencies : **5**

$$F = \{A \rightarrow B, B \rightarrow C, C \rightarrow D\}$$

(i) Find the candidate key(s) of R.

(ii) Decompose R into BCNF (or 3NF, if BCNF not possible) such that the decomposition is lossless.

(iii) Does your decomposition preserve all the functional dependencies ?

(b) What are the Inference Rules of Functional Dependencies ? Why Armstrong's inference rules are called sound and complete ? 5

(c) What are the different types of Database Users ? 5

4. (a) Consider the Sailors-*Boats-Reserves* Database as described below, which models a reservation system where sailors can reserve boats on certain dates : 8

Sailors (sid, sname, rating, age)

boats (bid, bname, color)

reserves (sid, bid, date)

Write each of the following queries in Relational Algebra :

(i) Find the names of sailors who have reserved a boat with Id 103

(ii) Find the colors of boats reserved by the sailor "Alber".

(iii) Find sailor Ids of all sailors who have a rating of at least 8 or reserved a boat with Id 103.

(iv) Find the names of sailors who have made more than 5 reservations.

(b) Describe how a DBMS recovers from a system crash using *undo* and *redo* logging. Why these scheme is preferred over Shadow copy scheme of recovery ? 7

5. (a) Explain the Two-Phase Locking (2PL) protocol for concurrency control. Why Strict 2PL is preferred for ensuring recoverability in DBMS ? 8

(b) Differentiate between Conflict Serializability and View Serializability. Using Precedence Graph method, check whether the given schedule S (with three transactions T1, T2 & T3) is Conflict Serializable or not : 7

S : R1(A), R1(B), W1(A), R2(B), W2(D), R3(C), R3(B), R3(D), W2(B), W1(C), W3(D)

6. (a) Explain how B-tree indexing helps in query processing. What are the advantages of using B-trees for indexing in databases ? 8

(b) Differentiate between MAC, DAC and RBAC access control mechanisms stating their relative advantages and disadvantages. 7

7. (a) What are the different data storage mechanisms in Distributed Databases ? **5**

(b) Describe the complete process of Knowledge Discovery from Databases (KDD). **5**

(c) How query optimization can be performed using heuristic rules ? **5**

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