

December 2024
B.Tech (CE/IT) - 5th Sem
Database Management Systems (PCC-CS-501)

Duration: 3 Hours

Max. Marks: 75

Instructions:

- 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.

PART A (1.5 marks each)

- Q1** (a) What are the differences between Database system and Data Warehouse system? (1.5)
- (b) What are the responsibilities of DBA? (1.5)
- (c) Define the following: Candidate Key, Primary key, Foreign key. (1.5)
- (d) What is the difference between authentication and authorization? (1.5)
- (e) What is meant by Primary Index and Secondary Index? (1.5)
- (f) Why Armstrong's inference rules are called sound and complete? (1.5)
- (g) Explain how the Nested-Index method is better than the Nested-Loop method for joining two relations? (1.5)
- (h) What do you mean by checkpoints? (1.5)
- (i) What is the difference between domain and tuple calculus? (1.5)
- (j) Differentiate between Wait-Die and Wound-Wait schemes of deadlock prevention. (1.5)

PART B

- Q2** (a) Differentiate between Wait-Die and Wound-Wait schemes of deadlock prevention. (8)
- (b) Elaborate in detail the three-schema architecture of the Database system. Also differentiate between Logical and Physical Data Independence. (7)
- Q3** (a) Consider the following relation BOOK: (7)
- BOOK (book_title, author, type, listprice, author_affil, publisher)
- Here author_affil refers to affiliation of the author. Following FD's exist:

- $\text{book_title} \rightarrow \text{publisher, type}$
- $\text{type} \rightarrow \text{listprice}$
- $\text{author} \rightarrow \text{author_affil}$

- Identify the Primary Key for this relation.
 - Based on the primary key, what normal form (1NF / 2NF / 3NF / BCNF), the relation is in?
 - Apply normalization until you can't decompose the relation further.
- (b) For the following set F of FDs, compute the minimal cover: (4)
 $F = \{ABCD \rightarrow E, E \rightarrow D, A \rightarrow B, AC \rightarrow D\}$
- (c) Differentiate between 4NF and 5NF. (4)

Q4 (a) Consider the following Database Schema of a Company (primary keys are underlined): (10)

employee (name, emplD, bdate, gender, address, salary, dno)
 department (dname, dnumber, managerID)
 project (pname, pnumber, plocation, dnum)
 works_on (emplD, pno, hours)

Write the relational algebra expressions for the following queries:

- List the birth date and address of the employee whose name is 'John Smith'.
 - Retrieve the name and salaries of all employees who work for the 'Research' department.
 - Retrieve the names of employees who work on all the projects that 'John Smith' works on.
 - Generate a report having each department number, the number of employees in the department, and their average salary.
 - For every project located in 'Stafford', list the project number, the controlling department number and the department manager's name, birth date, and address.
- (b) Write the last query given in Q4 (a) i.e. query (v) in SQL, generate its canonical/initial query tree and find optimized query tree using heuristic optimization. (5)

Q5 (a) What are the ways to assign timestamps to transactions? Explain Time-Stamp based Concurrency Control Protocol for the Read/Write operations issued by a transaction. (10)

(b) Define Conflict Serializability. Using Precedence Graph method, check whether the given schedule S (with three transactions T1, T2 & T3) is Conflict Serializable or not: (5)

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

Q6 (a) How data is stored and processed in B-Trees? How are these trees more efficient than Index-Sequential files? (8)

(b) What is SQL injection attack? What are the ways to prevent this attack?
(7)

Q7 Explain in brief the following: (15)

1. Architectures of Distributed Databases
2. KDD Process
3. Entity-Relationship (ER) Model



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