

Question Paper consists of FIVE units, each carrying 12 marks  
 Each unit has TWO questions; either of them should be answered  
 All parts of a question must be answered at one place.

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### UNIT-I

- |    |    |  | Marks |
|----|----|--|-------|
| 1. | a) | Describe the major steps in database design and explain its importance in system development.  | 6M    |
|    | b) | How to maintain class hierarchies in ER-Diagrams? And How various constraints can be modelled in ER-Diagram? Explain with employee database. | 6M    |

(OR)

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| 2. | a) | Discuss the advantages and challenges of database systems in large-scale applications. | 6M |
|    | b) | Discuss the different types of database users and administrators.                      | 6M |

### UNIT-II

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|----|----|--|----|
| 3. | a) | Explain different types of integrity constraints in the relational model.  | 5M |
|    | b) | Consider the following relational schemas. Write the following queries in relational algebra, and tuple relational calculus.<br>Suppliers( <u>sid</u> : integer, sname: string, address: string)<br>Parts( <u>pid</u> : integer, pname: string, color: string)<br>Catalog( <u>sid</u> : integer, <u>pid</u> : integer, cost: real) | 7M |
|    |    | i) Find the sids of suppliers who supply some red part or are at 221 Packer Street.  |    |
|    |    | ii) Find the sids of suppliers who supply every red or green part.   |    |
|    |    | iii) Find the pids of the most expensive parts supplied by suppliers named Yosemite Sham.  |    |

(OR)

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|----|----|--|----|
| 4. | a) | Compare Relational Algebra and Relational Calculus in terms of expressiveness and usage.   | 5M |
|    | b) | Consider the following schemas:<br>Sailors ( <u>sid</u> , sname, rating, age)<br>Reserves ( <u>sid</u> , <u>bid</u> , <u>day</u> )<br>Boats ( <u>bid</u> , bname, color) | 7M |
|    |    | Write the following queries in relational algebra, and Domain relational calculus:   |    |
|    |    | i) Find the names of sailors who have reserved a red boat.   |    |
|    |    | ii) Find the sname, bid, and day for each reservation.   |    |
|    |    | iii) Find the name of sailors who have reserved at least one boat  |    |

### UNIT-III

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|----|----|--|----|
| 5. | a) | Explain aggregate operators and GROUP BY and HAVING clauses in SQL. And discuss how null values are handled in SQL operations. | 6M |
|    | b) | Discuss the importance of schema refinement and its role in normalization.   | 6M |

(OR)

6. a) Consider the following tables:  
 Emp(empid, ename, city)  
 Company(cid, cname, city, turnover)  
 Emp\_Company(empid, cid, salary, jdate)  
 Emp\_shift(eid, shift) 6M  
 Constraints: employee salary can be from 12000/- to 200000/- and shift can be either A or B or C.  
 Write a stored procedure that takes company name and returns the employees name who joined first and last in that company.
- b) Explain the concept of functional dependencies (FDs) with examples. 6M

#### UNIT-IV

7. a) Define multivalued dependencies (MVDs) and explain their impact on schema design. 6M  
 Explain the concept of Fourth Normal Form (4NF) and provide examples.
- b) Consider the following two transactions: 6M
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|---|--|
| T1 : read(A);<br>read(B);<br>if A = 0 then B := B + 1;<br>write(B). | T2: read(B);<br>read(A);<br>if B = 0 then A := A + 1;<br>write(A). |
|---|--|
- Let the consistency requirement be  $A = 0 \vee B = 0$ , with  $A = B = 0$  the initial values.
- i) Show a concurrent execution of T1 and T2 that produces a non-serializable schedule.
- ii) Is there a concurrent execution of T1 and T2 that produces a serializable schedule?

**(OR)**

8. a) Discuss the lossless join and dependency preservation properties in decomposition. 6M  
 b) Explain in detail about timestamp based concurrency control techniques. 6M

#### UNIT-V

9. a) Discuss insertion and deletion operations in B+ Trees with examples. 6M  
 b) Explain clustered, primary, and secondary indexes with suitable examples. 6M

**(OR)**

10. a) Compare hash-based indexing and tree-based indexing methods. 6M  
 b) Write a short note on comparison of file organizations and their suitable use cases. 6M