

**DISTRIBUTED DATABASE MANAGEMENT SYSTEMS
(INFO 3132)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.*

Candidates are required to give answer in their own words as far as practicable.

**Group – A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) In horizontal fragmentation all fragments are
 - (a) Parsed
 - (b) Disjoint
 - (c) Have duplicate tuples
 - (d) have only 2 records
 - (ii) Minterm predicate is a _____ of simple predicates.
 - (a) Conjunction
 - (b) Disjunction
 - (c) Subtraction
 - (d) Disjoint
 - (iii) In Nested Loop Join algorithm the smaller relation is used as the
 - (a) Inner loop
 - (b) Outer Loop
 - (c) Block loop
 - (d) None
 - (iv) In a relation R(A, B, C, D), If A is the candidate key, and set of functional dependencies are $F = \{ A \rightarrow BC \text{ and } A \rightarrow D \}$. Then in which normal form the relation is in.
 - (a) BCNF
 - (b) 3NF
 - (c) 2NF
 - (d) 1NF
 - (v) A relation R(X, Y, Z), holds $F = \{ XY \rightarrow Z, Z \rightarrow Y \}$. The candidate keys will be
 - (a) {XY} only
 - (b) {XY} and {XZ}
 - (c) {XY}, {XZ} and {YZ}
 - (d) X only
 - (vi) The fragmentation where a base table is required to divide tuples is
 - (a) Derived Horizontal Fragmentation
 - (b) Derived Vertical Fragmentation
 - (c) Dedicated Horizontal Fragmentation
 - (d) Dedicated Vertical Fragmentation.
 - (vii) Properties of fragment design are
 - (a) Disjointness
 - (b) Completeness
 - (c) Reconstruction
 - (d) All

- (viii) In 2PC protocol of distributed transaction preparing for commit and waiting for AAM or READY message happens in
(a) Phase I (b) Phase II
(c) Phase III (d) Phase IV
- (ix) A trivial join dependency is when
(a) R JD (R1, R2, R3) (b) R JD (R1, R)
(c) R JD (R1,R2,R,R4) (d) both (b) and (c)
- (x) Selection of the most efficient query evaluation plan is known as
(a) Query Execution (b) Query Optimization
(c) Query Knowledge (d) Query Translation

Group – B

2. (a) A relation R (X, P , C , T , G) with attributes is given.
The given set of FD's are

$X \rightarrow P$
 $C \rightarrow T$
 $(X, P) \rightarrow G$

- (i) Find out the candidate keys from the set of given FD's.
(ii) Find the canonical cover of F.
(iii) Find out in which normal form the relation is? Explain.
(iv) Convert the relation into its higher normal form such that dependency is preserved and lossless decomposition occurs. Explain.

- (b) Explain 4NF with example.

8 + 4 = 12

3. (a) Considering an online shopping website, write a PL/SQL code to create a login page where user-id and password is taken as input from the user. After successful validity checking, display "Welcome" otherwise display "Wrong userid or password".

- (b) Draw and explain the architecture of distributed DBMS along with the distribution transparency at each level.

7 + 5 = 12

Group – C

4. (a) Consider a relation Land containing all details of land in Bankura District. The table has the following attributes: (plot-id,block-name,land-cost,mauja-location). There are mauja locations where the plots are present: Basudevpur, Borjora, and Chowshal.
There exists only one application that accesses the tuples of the Land table using its mauja-location.

- (i) Design the set of simple predicates.
- (ii) Also design the minterm predicates from those.
- (iii) Find out the valid minterm predicates.
- (iv) A new application arrives which accesses the tuples with respect to land-cost. All tuples with land-cost less than 100000 per katha are accessed. Find out the new set of simple predicates, if required.

- (b) Explain the difference between horizontal and derived horizontal fragmentation with example.

8 + 4 = 12

5. (a) Explain the difference between horizontal and vertical fragmentation Schema. What are the correctness rules of fragmentation.

- (b) $P_2 = \text{Set of Simple Predicates} = \{ \text{Branch_name} = \text{'Lucknow'}, \text{Branch_name} = \text{'Durgapur'}, \text{Balance} < 20000, \text{Balance} \geq 400000 \}$
How many total Minterm predicates we will have ?? What are the valid Minterm Predicates??

(3 + 3) + (3 + 3) = 12

Group – D

6. (a) A distributed database system, having 3 sites is designed, where 3 fragments R1, R2, and R3 exists. Now, consider the following two allocations of fragments:

- 1. R1 at site 1 R2 at site2 and R3 at site 3
- 2. R1 and R2 at site 1 and R2 and R3 at site 3

The following applications are issued with same frequency.

A1 issued at site 1, reads 5 records of R1 and 5 records of R2

A2 issued at site 3 reads 5 records of R3 and 5 records of R2

A3 issued at site 2 reads 10 records of R2

If we take locality of references as objective, then which solution is the best.

- (b) What is a network failure with respect to distributed transaction.

9 + 3 = 12

7. (a) With respect to distributed transaction, explain the coordinator state transition diagram. Also explain the participants state transition diagram.

- (b) Explain the algorithm for 3PC protocol in distributed environment for both Coordinator and Participants.

(3 + 3) + 6 = 12

Group – E

8. (a) Consider the following Employee database.

Employee (employee name, street, city) **Works** (employee name, company name, salary) **Company** (company name, city) **Manages** (employee name, manager name)

Write relational algebra for the following queries.

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1. Find the city and company name of the employees, who earn salary greater than Rs. 20000.
2. Find the names and cities of residence of all employees who work for First Bank Corporation.
3. Find all employees in the database who do not work for First Bank Corporation.

(b) With the help of a diagram state the steps of query processing

6 + 6 = 12

9. (a) State 6 equivalence rules with respect to query optimization.

(b) Explain the hash join algorithm

6 + 6 = 12

Department & Section	Submission Link
IT	https://classroom.google.com/c/MTQ4OTIzOTM5MTI5/a/Mjc0NTQ4Mzk3Njg3/details