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iii) A, B, C is a set of attributes. The functional dependency is as follows :

$$AB \twoheadrightarrow B, AC \twoheadrightarrow C, C \twoheadrightarrow B$$

- a) is in 1 NF
 - b) is in 2 NF
 - c) is in 3 NF
 - d) is in BCNF.
- iv) Which of the following is not a benefit of site autonomy ?
- a) Global catalog is not necessary to access local data
 - b) Node can upgrade software independently
 - c) Administrators can recover from isolated system failures independently
 - d) No need for backup and recovery.
- v) Replication of attributes violates which of the following conditions of fragmentation ?
- a) Completeness
 - b) Reconstruction
 - c) Disjointness
 - d) Both (b) and (c).
- vi) Idempotence of unary operation implies ($U = >$ unary operation, $B = >$ binary operation)
- a) $U_1 U_2 R \parallel U_2 U_1 R$
 - b) $U (RBS) \times U (R) B U (S)$
 - c) $UR \times U_j U_2 R$
 - d) $U (R) B U (S) \times U (RBS)$.

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- vii) Two-phase commitment protocol is used for
- a) concurrency control
 - b) integrity control
 - c) recovery
 - d) redundancy.
- viii) Atomicity of transaction demands
- a) all the transaction's operations will be performed
 - b) none of the transaction's operations will be performed
 - c) no stable state
 - d) none of these.
- ix) Clustering means
- a) keeping a common data in one place
 - b) keeping different types of data in one place
 - c) keeping different types of data in different places
 - d) keeping a common data in different places.
- x) Semi-join is required to
- a) reduced network traffic
 - b) reduced memory usage
 - c) increased speed
 - d) none of these.

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GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. What is distribution transparency ? Explain different levels of distributed transparency. 1 + 4

3. a) What is serializability in a distributed database ? 1
b) Draw the reference architecture of distributed database. 4

4. What is locking ? What are the shared and exclusive locks ? Briefly discuss Timestamp protocol in relation to distributed database systems. 1 + 1 + 1 + 2

5. What are the differences between semi-join and natural join ? Explain with example. Show that semi-join is not commutative. 2 + 2 + 1

6. a) What are the advantage and disadvantage of replication ? 3
b) What is auxiliary program ? 2

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Why are distributed deadlocks occurred ? 2
b) What are distributed wait-for graph and local wait-for graph ? How wait-for graph helps in deadlock detection ? 5

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c) Consider the following wait-for graph :

Site 1

Site 2

r_2

— ~ T2 \emptyset T3i

r_J

T1 — 1 T1 < T31

where T_j s are the transactions and ~ waiting for the case of different transactions \emptyset waiting in the case of same transaction.

Detect the deadlock occurred here. 6

d) What is false deadlock ? 2

8. Optimize the following query. List the flats that are for rent along with the corresponding branch details :

Relations : BRANCH (BranchNo, Street, City, PostCode)

PROPFORRENT (PropNo, Addr, Type, RentAmount, OwnerNo, BranchNo)

Partitions :

P1 : "BranchNo = 'B003' # Type = 'House' (PROPFORRENT)

P2 : "BranchNo = 'B003' # = 'FLAT' (PROPFORRENT)

!

P3 : "BranchNo != 'B003' (PROPFORRENT) !

B1 : "BranchNo = 'B003' (BRANCH) !

B2 : "BranchNo != 'B003' (BRANCH) !

Write the SQL. Write the corresponding relational algebraic expression. Then optimize the query. 2 + 3 + 10

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9. a) What is serializability in a distributed database?
- b) Give a brief introduction to 2PL as a distributed concurrency control method.
- c) Let two objects x, y be stored at site S1, z, w be stored at site S2.

Determine for each of the following executions, whether the execution is serializable or not.

If yes, determine all possible total orders of transactions.

If no, then prove that there is no total order possible.

Execution 1 :

S1 : $R_i(x) R_j(x) W_j(x) W_i(x)$

S2 : $R_i(w) R_j(z) W_j(w) W_i(w)$

Execution 2 :

S1 : $R_i(x) R_j(w) W_j(y) W_i(y)$

S2 : $W_i(z)$

Execution 3 :

S1 : $R_i(x) R_j(x) W_i(x) W_j(y) !$

S2 : $R_i(z) R_j(z) W_j(z) W_i(w)$

Execution 4 :

S1 : $R_i(y) R_j(x) W_j(x)$

S2 : $W_i(z) R_i(w) R_j(w) W_j(w) .$

3 + 5 + 7

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10. a) What is query optimization ? 3
- b) Explain distributed cost model with an example. 5
- c) What do you mean by the cardinality of selection ? 2
- d) Explain centralized query optimization. 5
11. Write short notes on any *three* of the following : 3 × 5
- i) Open database connectivity
 - ii) Distributed 2-phase locking protocol
 - iii) Network partitioning
 - iv) Fragmentation
 - v) Peer-to-Peer Architecture
 - vi) Check point and Cold start.

