ADVANCED DATABASE MANAGEMENT SYSTEMS
(CSEN 5103)

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)   Which of the following is NOT a component of a DDBMS?
         (a) Data communication component   (b) Data Dictionary
         (c) Data security component   (d) None of the above.

   (ii) "Users view each data object as logically unique." Which property of DDBMS supports this given statement?
         (a) Fragmentation Transparency   (b) Replication Transparency
         (c) Location Transparency   (d) Allocation Transparency.

   (iii) Which operation is used to reconstruct the global relation from vertical fragments?
         (a) union   (b) selection
         (c) self join   (d) natural join.

   (iv) Three Phase commit protocol is used for
         (a) concurrency control   (b) recovery
         (c) deadlock prevention   (d) integrity control.

   (v)   The transactions are always ____ if it always locks a data item in shared mode before reading it.
         (a) well formed   (b) well distributed
         (c) well locked   (d) well shared.

   (vi) Serializability of the concurrent transactions are executed by
         (a) locking   (b) time stamping
         (c) both (a) and (b)   (d) neither (a) nor (b).

   (vii) What is inter-operation parallelism?
          (a) Execution of single operation of a query in parallel.
          (b) Execution of different operations of same query in parallel.
          (c) Execution of different operations of same query in pipelined fashion.
          (d) None of these.

   (viii) In a pre-commit state the transaction may be
          (a) committed   (b) aborted
          (c) either (a) or (b)   (d) neither (a) nor (b).

   (ix)   Two phase COMMIT protocol is used for
          (a) concurrency control   (b) integrity control
          (c) recovery   (d) redundancy control.

   (x)   The total ordering of operations across groups ensures _____ of transactions.
          (a) ability to serialize   (b) ability to synchronize
          (c) atomicity   (d) durability.

Group - B

2.   Given the relational schema:
     STUDENT(id, name);
     ENROLLEDIN(id, code);
     SUBJECT(code, lecturer)

   Following are the horizontal fragments created from *STUDENT*, *ENROLLEDIN* and *SUBJECT* relations:

     $e_1 : \sigma_{code = 'cp3020'}(ENROLLEDIN)$ $s_1 : \sigma_{name = 'hector'}(STUDENT)$
     $e_2 : \sigma_{code != 'cp3020'}(ENROLLEDIN)$ $s_2 : \sigma_{lecturer = 'roger'}(SUBJECT)$
     $e_3 : \sigma_{code! = 'cp1500' \wedge code = 'cp1200'}(ENROLLEDIN)$ $s_3 : \sigma_{lecturer ! = 'roger'}(SUBJECT)$
     $e_4 : \sigma_{code IN('cp 1500','cp 3010')}(ENROLLEDIN)$

     Answer the following questions using reduction technique on STUDENT (as a whole relation) and the above fragments.
     In addition, draw reduced tree for each query. Queries should be written in both relational algebra and structured query language. Justify that the disjointness and completeness of the fragmented queries are preserved for the result that you have deduced.
     (i)   What are the names of the students enrolled in CP3020?
     (ii) Which subject student Hector is taking?

(iii) What are the names of the students in both CP1500 and CP1200?
(iv) What are the names of the students that are not enrolled in CP3020?

(4 × 3) = 12

3. (a) Given is the following scenario in a distributed database and some
ass
The
• a
• a
• a
The
• T
n

• The cost of reading or writing a local fragment is 0 unit.
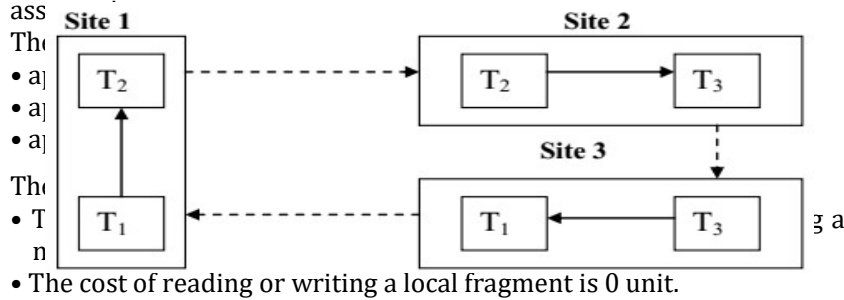
If app1 issues at site 1, app2 issues at site 2, and app3 issues at site 3, then determine which of the following three allocations of fragments minimizes total cost?

Allocation 1: F1 at site 1; F2 at site 2; F3 at site 3
Allocation 2: F1 and F3 at site 1; F2 and F3 at site 3; F1 and F2 at site 2.
Allocation 3: F3 at site 1, F1 at site 2, F2 at site 3.

(b) Given are the relations :
Supplier(supNo, sname, code) where code can be either 'local' or 'non-local'
Parts(partNo, partName, supNo, price)

Fragment the relation Parts into two relations by separating attribute partName. The obtained relation with all the other attributes is to be fragmented into cheap (< = Rs.1000) and expensive (> Rs.1000) parts. The expensive parts shall be once again partitioned into those supplied by 'local' suppliers and those supplied by 'nonlocal' suppliers. Indicate the type of fragmentation used corresponding to each fragment.

Group - C

4. (a) "3PC protocol avoids blocking even if the coordinator site fails" – Justify the statement.

(b) Prove with proper logic that 2-phase locking is a correct method for concurrency control in distributed database.

(c) What is query decomposition? Is it same for centralized and distributed database?

4 + 4 + 4 = 12

5. Consider the following distributed wait-for-graph(DWFG):

(i) Detect the deadlock using distributed deadlock algorithm.
(ii) Describe deadlock detection using ***centralized controller*** with example.
(iii) What is the difference between reliability and availability?

(5 + 5 + 2) = 12

Group - D

6. (a) Give a comparative description of Interquery Parallelism and Intraquery Parallelism.

(b) State the benefits and drawbacks of pipelined parallelism.

(c) How can we parallelize joins where the joining condition is an inequality and partitioning is not applicable? Describe the technique.

4 + 3 + 5 = 12

7. (a) Write the object oriented queries (in OQL) for the given dept_typ object.

Object type **dept_typ**	
Attributes	**Methods**
dno	get_dno
dname	display_data
location	
ph_num	

(i) Create a dept_typ object.
(ii) Define the methods.
(iii) Then create an object table for dept_typ objects.
(iv) Display all the rows of the object table where the department name (dname) is "CSE".

(b) (i) What is an Object table?
(ii) What is the basic difference between OODBMS and ORDBMS?

(4 × 2) + (2 × 2) = 12

Group - E

8. (a) (i) What do you understand by a Statistical database?
(ii) Define, with examples, two type of statistical databases.

(b) (i) What are the various security methods used in Statistical database?
(ii) Explain the methods of Microaggregation and Data Perturbation.

(2 + 2) + (2 + 6) = 12

9. (a) Differentiate between Valid Time and Transaction Time in Temporal Databases?

(b) What is a Bi-temporal Relation?

(c) With the help of an example, describe and differentiate Time Stamp Model v/s Snapshot Model.

(d) Consider the relation **Booking (meeting, room, time),** write temporal queries for
(i) Find all rooms in which the last meeting was 'DB group'
(ii) Find all meetings with a scheduled break.

3 + 3 + 3 + 3 = 12