

DATA STRUCTURE AND DATABASE CONCEPTS  
(CSEN 2201)

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 alternatives for the following: **10 x 1=10**
- (i) Course(course\_id,sec\_id,semester) Here the course\_id, sec\_id and semester are \_\_\_\_\_ and course is a \_\_\_\_\_ .  
(a) relations, attribute (b) attributes, relation  
(c) tuple, relation (d) tuple, attributes.
- (ii) To remove a relation from an SQL database, we use the \_\_\_\_\_ command.  
(a) delete (b) purge  
(c) remove (d) drop table.
- (iii) Which of the following algorithm follows “divide and conquer” approach?  
(a) Bubble Sort (b) Quick Sort  
(c) Selection Sort (d) Insertion Sort.
- (iv) In linked list each node contain minimum of two fields. One field is data field to store the data second field is  
(a) pointer to character (b) pointer to integer  
(c) pointer to node (d) node.
- (v) For which of the following situations, Binary Search can be used?  
(a) Sorted Array (b) Unsorted Array  
(c) Sorted Linked List (d) Unsorted Linked List.

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- (vi) A relational database consists of a collection of  
(a) tables (b) fields  
(c) records (d) keys.
- (vii) Database \_\_\_\_\_, which is the logical design of the database, and the database \_\_\_\_\_, which is a snapshot of the data in the database at a given instant.  
(a) instance, schema (b) relation, schema  
(c) relation, domain (d) schema, instance
- (viii) Which is not an ACID property?  
(a) Atomicity (b) Durability  
(c) Consistency (d) Integrity
- (ix) A transaction that completes its execution is said to be  
(a) committed (b) aborted  
(c) rolled back (d) failed
- (x) Linked lists are best suited  
(a) for relatively permanent collections of data  
(b) for the size of the structure and the data in the structure are constantly changing  
(c) for both of above situation  
(d) for none of above situation.

### Group - B

2. (a) Write the pseudo code to reverse the contents of a queue using stack.
- (b) Write the pseudo-code using recursion to find and display  
(i) the factorial of a number n taken as input from the user.  
(ii) the GCD of two numbers taken as input.

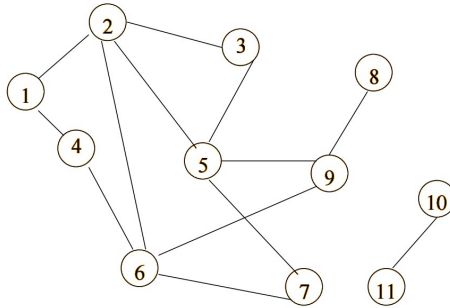
**6 + (3+3) = 12**

3. (a) Write the pseudo-code to implement Quick Sort over n elements.
- (b) State the advantages of Binary Search over Linear Search. Which method of searching is more suitable for Linked List and why?

**(6) + (3+3) = 12**

**Group - C**

- 4. (a) Write down the DFS algorithm to traverse a graph.
- (b) Using the aforementioned algorithm, traverse the graph given below while considering 1 as the starting node.



- (c) Insert the following nodes in the given order to form a binary search tree  
25, 50, 15, 22, 35, 10, 12, 70, 24, 4, 31, 18, 90, 66, 60, 44.  
Traverse the tree in post-order and pre-order and show the traversal.

$$4 + 4 + (2+2) = 12$$

- 5. (a) Write a function ***AlternatingSplit()*** that takes a single linked list and divides up its nodes to make two smaller linked lists. The sublists should be made from alternating elements in the original list. So if the original list is {a, b, a, b, a}, then one sublist should be {a, a, a} and the other should be {b, b}.
- (b) Write the pseudo-code to remove all duplicate nodes of a single linked list sorted in ascending order while travelling just once.

$$6 + 6 = 12$$

**Group - D**

- 6. (a) What are the entity integrity constraints?
- (b) Discuss the differences between the candidate keys and the primary key of a table.
- (c) Explain what is meant by a foreign key.
- (d) What is weak entity type?

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- (e) What will be the schema for representing such entity type in a database table?

$$2 + 3 + 2 + 2 + 3 = 12$$

7. Given relational schema:

Sailors (sid, sname, rating, age)

Reserves (sid, bid, date)

Boats (bid, bname, color)

Write expressions and SQL queries for the following statements using Relational Algebra and SQL respectively.

- i) Find names of sailors who have reserved **boat #103**
- ii) Find names of sailors who have reserved a red boat
- iii) Find sailors who have reserved a red or a **green boat**
- iv) Find sailors who have reserved a **red and** a **green boat**
- v) Find the names of sailors who have reserved **all boats**.

$$2 + 2.5 + 2.5 + 2.5 + 2.5 = 12$$

**Group - E**

8. (a) What is functional dependency?  
(b) Why is normalization done? Describe the anomalies.  
(c) Define 1NF, 2NF, 3NF with example(s).

$$2 + 2 + 4 + 4 = 12$$

9. (a) Explain serial, non-serial, conflict-serializable and equivalent schedules.  
(b) Consider two transactions  $T_1$  and  $T_2$  and four schedules  $S_1, S_2, S_3, S_4$  of  $T_1$  and  $T_2$  as given below:

$T_1: r_1[x] w_1[x] w_1[y]$

$T_2: r_2[x] r_2[y] w_2[y]$

$S_1: r_1[x] r_2[x] r_2[y] w_1[x] w_1[y] w_2[y]$

$S_2: r_1[x] r_2[x] r_2[y] w_1[x] w_2[y] w_1[y]$

$S_3: r_1[x] w_1[x] r_2[x] w_1[y] r_2[y] w_2[y]$

$S_4: r_2[x] r_2[y] r_1[x] w_1[x] w_1[y] w_2[y]$

Justify the statement: "schedules  $S_2$  and  $S_3$  are conflict-serializable".

$$2 + 2 + 2 + 2 + 4 = 12$$