

**DATA STRUCTURE  
(CSEN 2005)**

**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) Degree of a leaf node in a tree is  
(a) 0 (b) 1 (c) 2 (d) 3.
- (ii) In a queue, insertion is done at \_\_\_\_\_.  
(a) Rear (b) Front (c) Back (d) Top.
- (iii) In a hash table, an element with key k is stored at index \_\_\_\_\_.  
(a) k (b) log k (c) h(k) (d) k<sup>2</sup>.
- (iv) Quick sort is faster than \_\_\_\_\_.  
(a) Selection sort (b) Insertion sort  
(c) Bubble sort (d) All of these.
- (v) What would be the Prefix notation for (A\*B)+(C\*D)?  
(a) \*+AB\*CD (b) +\*AB\*CD (c) \*\*AB+CD (d) +\*BA\*CD
- (vi) Which notation provides a strict lower bound for f(n)?  
(a) Omega (b) Big O (c) Small o (d) Theta.
- (vii) Which open addressing technique is free from clustering problems?  
(a) Linear Probing (b) Quadratic Probing  
(c) Double Hashing (d) Rehashing.
- (viii) The number of edges originating at a node u is called its  
(a) In-degree (b) Out-degree  
(c) Source (d) Degree.
- (ix) Which function places an element on the stack?  
(a) Pop() (b) Push() (c) Peek() (d) isEmpty()
- (x) The memory usage of an adjacency matrix is \_\_\_\_\_.  
(a) O(n) (b) O(n<sup>2</sup>) (c) O(n<sup>3</sup>) (d) O(log n).

**Group – B**

2. (a) What do you understand by Time and Space complexity? How is Big-O notation used for complexity analysis of algorithms?
- (b) What is a Sparse matrix? How is a sparse matrix stored to avoid memory wastage? Show with a suitable example.

**(2 + 2 + 3) + (2 + 3) = 12**

3. (a) How is a doubly linked list more useful than a singly linked list? Write a program/pseudo code to add an element after a given element in a doubly linked list.
- (b) Why is a Linked List called a self-referential data type? Represent the polynomial  $6x^5 + 10x^2 + x + 5$  using a Linked List.

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

**Group – C**

4. (a) Draw the queue structure in each case when the following operations are performed on an empty Queue. Show the values of front and rear in each case.
- (a) Add 1, 2, 3, 4, 5, 6      (b) Delete two numbers      (c) Add 7  
(d) Add 8      (e) Delete four numbers      (f) Add 9
- (b) What is Tail recursion? Write a program in C to find the factorial of a given number using Recursion.

**6 + (2 + 4) = 12**

5. (a) Convert the following Infix expression to its Postfix expression using a stack. Show all the intermediate steps clearly.
- (A - 2 \* (B + C) / D \* E) + F**
- (b) What are the advantages of a circular queue over linear queue?

**8 + 4 = 12**

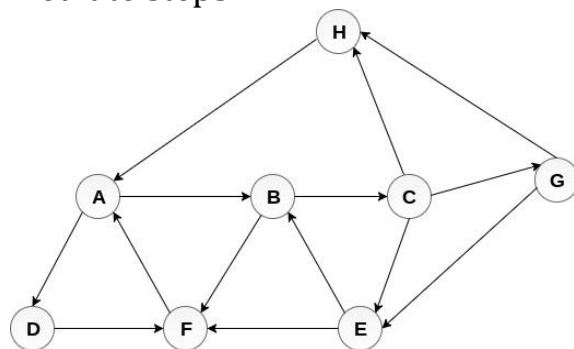
**Group – D**

6. (a) Create a binary search tree with the values given below:
- 98, 2, 48, 12, 56, 32, 4, 67, 23, 87, 46
- (i) Insert 21, 39 and 63 into the tree.
- (ii) Delete 23, 4 and 67 from the tree.
- (b) Define AVL tree. Why is it called a height – balanced tree?

**(3 + 3 + 3) + (1 + 2) = 12**

7. (a) Define the following with suitable examples:
- (i) Complete Graph      (ii) Adjacency Matrix

- (b) Consider the graph G given below with its adjacency list. Find out the order to print all nodes of the graph starting from node H, using DFS algorithm. Show all the intermediate steps.



**Adjacency Lists**

A : B, D  
 B : C, F  
 C : E, G, H  
 G : E, H  
 E : B, F  
 F : A  
 D : F  
 H : A

$$(3 \times 2) + 6 = 12$$

**Group – E**

8. (a) Derive the average case complexity of Binary Search algorithm.  
 (b) Sort the elements 7, 1, 4, 12, 67, 33, 45 using Selection Sort. Show all intermediate steps clearly. What is the complexity of Selection Sort?
9. (a) What is Hashing? Name four commonly used hash functions. Given a hash table of 100 locations, calculate the hash value using Folding method for keys 1298 and 20568.  
 (b) What do you understand by Linear Probing? Briefly discuss its drawbacks, if any.

$$4 + (7 + 1) = 12$$

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

| Department & Section | Submission Link                                                                                                                                                       |
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