

## ENDSEM

1. There are 10 questions. Each question provides 4 options. Choose correct option A/B/C/D.

1 The complexity of push operation in Stack structure is

- (A)  $O(1)$  (B)  $O(\log n)$  (C)  $O(n)$  (D) None of these

2 A sorting algorithm is stable if

- (A) its time complexity is constant irrespective of the nature of input.  
(B) its space complexity is constant irrespective of the nature of input.  
(C) preserves the original order of records with equal keys.  
(D) it sorts any volume of data in a constant time.

3 The running time complexity for creating a heap of size  $n$  is

- (A)  $O(n)$  (B)  $O(\log n)$  (C)  $O(n \log n)$  (D)  $O(n^2)$

4 Consider a (singly) linked list of  $n$  elements. What is the running time complexity to insert an element after an element pointed by some pointer?

- (A)  $O(1)$  (B)  $O(\log n)$  (C)  $O(n)$  (D) None of these

5 A full binary tree with  $2n+1$  nodes contains

- (A)  $n$  leaf nodes (B)  $n$  non-leaf nodes  
(C)  $n-1$  leaf nodes (D)  $n-1$  non-leaf nodes

6 A  $(2,4)$ -tree is a

- (A) Balanced Binary tree (B) Skewed Binary tree  
(C) Unordered tree (D) Multi-way Search tree

7 A technique for direct search is

- (A) Binary Search (B) Linear Search (C) Tree Search (D) Hashing

8 The balance factor of any node of an AVL tree could be

- (A) 1, -1 or 2                      (B) 1, 0 or -1                      (C) 0, 2 or 4                      (D) None of these

9 A graph can be implemented by

- (A) adjacency matrix                      (B) incidence matrix  
(C) adjacency list                      (D) all of these

10 Minimum Spanning Tree of a graph is a tree that

- (A) covers all the edges of the graph                      (B) covers all the vertices of the graph  
(C) covers all the edges and vertices of the graph (D) None of these

2. A stack is to be implemented using an array. The associated declared are:

```
int stack[50];
```

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int top = 0;
```

Write the statement to perform push operation.

Explain how stack is used in function call. How do you implement three stacks in single array?

3. What is heap? How to build a heap? Write the algorithm for Heap sort. Comment on running time complexity of the heapsort?

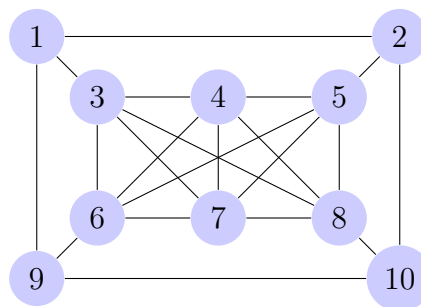
4. Write an algorithm for postorder traversal of a tree.

Let T be a tree with more than one node. Is it possible that the preorder traversal of T visits the nodes in the same order as the postorder traversal of T? If so, give an example; otherwise, argue why this cannot occur. Likewise, is it possible that the preorder traversal of T visits the nodes in the reverse order of the postorder of the postorder traversal of T? If so, give an example; otherwise, argue why this cannot occur.

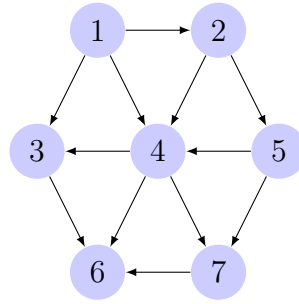
5. What is an AVL tree? Explain how a node can be inserted into an AVL tree. You must consider different cases as appropriate. Calculate the complexity of the node insertion operation?

6. Why hashing is important? Explain the method of Separate Chaining(Open Hashing). How this method avoids collision? What is the exact complexity of the search operation in separate chaining?

7. How is Breadth-First search different from Depth-First search? Write an algorithm to implement Breadth-First search? Illustrate the algorithm with following graph.



8. What is Topological ordering? What is the application of topological ordering? Write an algorithm to find a Topological ordering. Using the algorithm find a topological ordering of the following graph. Comment on running time complexity of the algorithm that you use to find a topological ordering.



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All human things are subject to decay, and  
when fate summons, Monarchs must obey

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*Mac Flecknoe*

## Answers