

Time: 2½ hrs.**Note:**

1. All questions are compulsory with internal choice.
2. Draw neat diagrams wherever necessary.
3. Figures to the right indicate full marks.

Q.1 Answer the following (any Three)**(15)**

- (a) Explain the characteristics of algorithm with example.
- (b) What is data structure? How are they categorized into different types?
- (c) What are the advantages of using a sparse matrix over a regular matrix and how is it represented using array?
- (d) Write algorithm/code snippet(C/C++) for binary search on an array.
- (e) Write an algorithm/code snippet(C/C++) to insert an element at a specific position within an array.
- (f) Define array. How array is declared in C++? Write algorithm/code snippet(C/C++) for traversing array.

Q.2 Answer the following (any Three)**(15)**

- (a) Define a linked list and discuss its benefits compared to arrays. How is a linked list organized in memory?
- (b) How can linked lists be utilized to represent polynomial expressions and sparse matrices?
- (c) Differentiate between singly linked lists with doubly linked lists.
- (d) Write an algorithm/code snippet(C/C++) to delete a specific node from singly linked list.
- (e) Write an algorithm/code snippet(C/C++) for traversing a doubly linked list in both forward and backward directions.
- (f) Write an algorithm/code snippet(C/C++) to for inserting a node at the end of doubly linked list.

Q.3 Answer the following (any Three)**(15)**

- (a) What is Stack in data structures? Explain its important terminologies using an example.
- (b) What is a Queue in data structures, and what are its different types?
- (c) What are the common applications of a Stack? How does recursion utilize a Stack? Explain with example.
- (d) Write an algorithm/code snippet(C/C++) for evaluation of postfix expression using Stack.
- (e) Write an algorithm/code snippet(C/C++) for dequeue operation on Linear Queue.
- (f) Write an algorithm/code snippet(C/C++) for dequeue operation on Circular Queue.

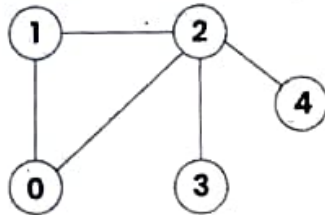
Q.4 Answer the following (any Three)**(15)**

- (a) What are Inorder, Preorder, and Postorder traversals in a Binary Tree? Explain each with an example.
- (b) Discuss following with reference to Trees:
(i) Height of the tree (ii) Complete Binary Tree (iii) Expression tree (iv) Sibling (v) Full Binary Tree
- (c) What is an AVL Tree? Explain the different types of rotations used to maintain its balance.
- (d) Write an algorithm/code snippet(C/C++) for selection sort.
- (e) Write an algorithm/code snippet(C/C++) for bubble sort.
- (f) Write an algorithm/code snippet(C/C++) to create Binary Search Tree.

Q.5 Answer the following (any Three)**(15)**

- (a) Define the shortest path problem and write the Floyd-Warshall algorithm for finding the shortest paths between all pairs of nodes.
- (b) What are the various methods for representing graphs? Describe two of these methods in detail with examples.

- (c) Define hashing in the context of data structures. What is a collision in a hash table, and how is it handled using separate chaining?
- (d) Define a minimum spanning tree and describe its characteristics and applications.
- (e) Explain the concept of linear probing in hash tables. Given a set of values and an array of size 10, demonstrate how to insert the values into the array using the modulo division method with linear probing for collision resolution.
15, 11, 27, 8, 12, 13, 22, 17, 20
- (f) Write the algorithm for Breadth-First Search (BFS). Also, provide both BFS and DFS implementations for the given graph



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