

(Time: 2½ hours)

Total Marks: 75

- N. B.: (1) All questions are compulsory.
 (2) Make suitable assumptions wherever necessary and state the assumptions made.
 (3) Answers to the same question must be written together.
 (4) Numbers to the right indicate marks.
 (5) Draw neat labeled diagrams wherever necessary.

1. **Attempt any three of the following:** 15
 - a. What is data structure? Explain the categories in which data structure can be divided.
 - b. What is an algorithm? What are the characteristics of an algorithm?
 - c. What is meant by complexity of an algorithm? Explain different types of complexities.
 - d. Write an algorithm to insert an element into the array and to delete an element from the array.
 - e. What is bubble sort? Sort the following data items using bubble sort method.
14, 33, 27, 35, 10
 - f. What are the advantages and limitations of an array?
2. **Attempt any three of the following:** 15
 - a. What is linked list? Write and explain an algorithm to insert an element at the beginning of the singly linked list.
 - b. Write and explain an algorithm to split a link list into two linked lists.
 - c. What is circular linked list? How to traverse a circular linked list?
 - d. What is the need of two way linked lists? Explain the structure of a node in a two way linked list.
 - e. Write a short note on header linked list.
 - f. Explain how to represent a sparse array using an array and a linked list with an example.
3. **Attempt any three of the following:** 15
 - a. Define stack. Discuss the basic operations performed on the stack. Also explain overflow and underflow conditions of the stack.
 - b. Write an algorithm to implement the stack operations using an array.
 - c. Convert the following expressions in postfix and prefix notations.
 - (i) $I_{in} = (x - y) \times ((z + v) / f)$
 - (ii) $I_{in} = (x * y) + (z + ((a + b - c) * d)) - l * (j / k)$
 - d. Define queue. How queue is represented in memory using linked list?
 - e. Write a short note on double ended priority queue.
 - f. Write an algorithm to insert and delete a node from a circular queue.
4. **Attempt any three of the following:** 15
 - a. Reconstruct the binary tree whose in-order and pre-order traversals are:
 In-order Traversal : g d b h e i a f c
 Pre-order Traversal: a b d g e h i c f
 - b. What is binary search tree? Write an algorithm to find the position of a given element 'Item' and its parent in a binary search tree.

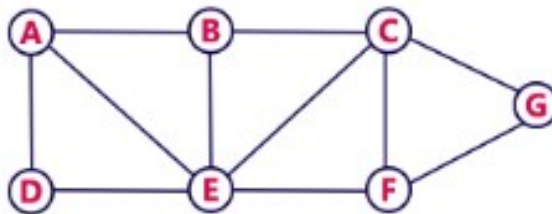
[TURN OVER]

- c. Sort the following data elements using heap sort algorithm.
22, 35, 17, 8, 13, 44, 5, 28
- d. What is AVL tree? How balancing is done in AVL tree? Explain with example.
- e. What are 2-3 trees? How to delete a key value from 2-3 trees?
- f. What are the algorithmic steps of insertion sort method? Sort the following data elements using insertion sort method.
7, 8, 5, 2, 4, 6, 3

5. **Attempt any three of the following:**

15

- a. What is hashing? Explain mid square method and division remainder method of calculating address.
- b. Describe the following collision resolution techniques.
(I) Linear probing
(II) Chaining
- c. Define the following terms.
1. Graph
2. Outdegree and Indegree
3. Source and sink
4. Path
5. Strongly connected graph
- d. Traverse the following graph using Depth First Search traversal technique. Start traversing from the source vertex 'A'.



- e. Explain Warshall's algorithm of finding path matrix of a graph.
- f. Find the minimum spanning tree for the following graph using Prim's algorithm and the source vertex 'S'.

