

(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
- What is data structure? Explain the categories in which data structure can be divided.
  - What is an algorithm? What are the characteristics of an algorithm?
  - What is meant by complexity of an algorithm? Explain different types of complexities.
  - Write an algorithm to insert an element into the array and to delete an element from the array.
  - What is bubble sort? Sort the following data items using bubble sort method.  
14, 33, 27, 35, 10
  - What are the advantages and limitations of an array?
2. **Attempt any three of the following:** 15
- What is linked list? Write and explain an algorithm to insert an element at the beginning of the singly linked list.
  - Write and explain an algorithm to split a link list into two linked lists.
  - What is circular linked list? How to traverse a circular linked list?
  - What is the need of two way linked lists? Explain the structure of a node in a two way linked list.
  - Write a short note on header linked list.
  - 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
- Define stack. Discuss the basic operations performed on the stack. Also explain overflow and underflow conditions of the stack.
  - Write an algorithm to implement the stack operations using an array.
  - Convert the following expressions in postfix and prefix notations.
    - $I_{in} = (x - y) \times ((z + v) / f)$
    - $I_{in} = (x * y) + (z + ((a + b - c) * d)) - l * (j / k)$
  - Define queue. How queue is represented in memory using linked list?
  - Write a short note on double ended priority queue.
  - Write an algorithm to insert and delete a node from a circular queue.
4. **Attempt any three of the following:** 15
- 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
  - 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]

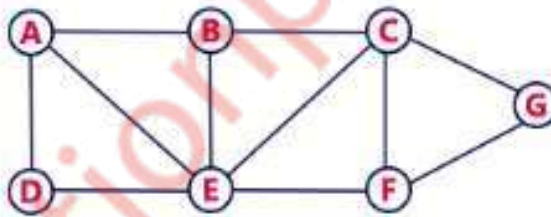
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- c. Sort the following data elements using heap sort algorithm.  
22, 35, 17, 8, 13, 44, 5, 28
- d. What is AVL tree? How balancing is done in AVL tree? Explain with example.
- e. What are 2-3 trees? How to delete a key value from 2-3 trees?
- f.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

