

B.E. / B.Tech. Computer Science & Engineering (Model Curriculum) Semester-III  
**SE102CS - Data Structure & Algorithms**

P. Pages : 3

Time : Three Hours



**GUG/S/25/13802**

Max. Marks : 80

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- Notes : 1. All questions are compulsory.  
2. All questions carry equal marks.  
3. Assume suitable data wherever necessary.  
4. Illustrate your answers wherever necessary with the help of neat sketches.

- 1.** a) Derive the time complexity of following code segments: 8

i)    `for(i = n; i >= 1; i = i/2)`  
      {  
         Statement;  
      }

ii)    `for(i = 0; i < n; i++)`  
      {  
         for(j = 0; j < i ; j++)  
         {  
            statement;  
         }  
      }

- b) Imagine you are designing a library management system. The system needs to keep track of various books, including their titles, authors, publication years, and availability status. Which data structure(s) would you choose to efficiently organize and search for books? Discuss the trade-offs between using an array, linked list, or hash table for this purpose. 8

**OR**

- 2.** a) Write a program to merge two sorted arrays into a third array in a sorted form. 8

- b) Write a program to search a number in the array using non-recursive binary search method, also discuss its time and space complexity. 8

- 3.** a) What is a linked list? State its advantages in terms of memory usage. Suppose list is a singly linked list in memory consisting of numerical values. Write a program to find maximum value in the list. 8

- b) What is a Doubly linked list? List the applications of it. Write a program to delete the first node from the doubly linked list. 8

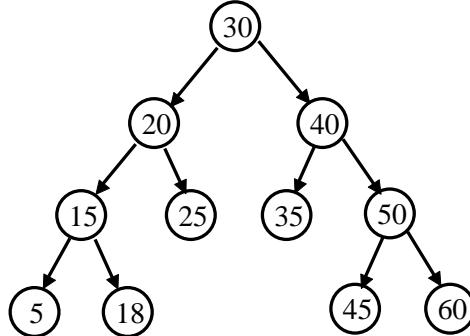
**OR**

- 4.** a) Write a program to implement a stack using singly linked list. 8

- b) Write a program to implement a singly linked list and perform insertion and deletion in following way: 8
- Insert element at the beginning of a list
  - Delete last element from the list
- 5.** a) Write an algorithm to evaluate the postfix expression. 8
- Evaluate the following postfix expression and show the status of stack for each iteration of evaluation.  
 $A\ B\ C+ * D/$  : with  $A = 3$ ,  $B = 4$ ,  $C = 5$  and  $D = 9$
- b) A stack is to be implemented using an array. The associated declarations are: 8
- ```
int stack [100];
int top = -1;
```
- Give the statement to perform PUSH and POP operation.

### OR

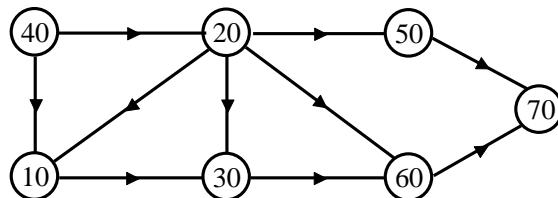
- 6.** a) Differentiate between linear and circular queue. Write a program to implement a Circular queue, using an Enqueue (), Dequeue () and Display () functions. 8
- b) Convert the following Infix to postfix and prefix expression. 8
- $(A + B * C) - P + D * (E / F \wedge G)$
  - $(A / B + C) / (E * F) / G$
- 7.** a) Write a program to print the degree of all the nodes in a binary tree. 8
- b) Write a recursive function for pre-order, in-order and post-order tree traversal. Also write the pre-order, in-order and post-order expression for the following given binary tree. 8



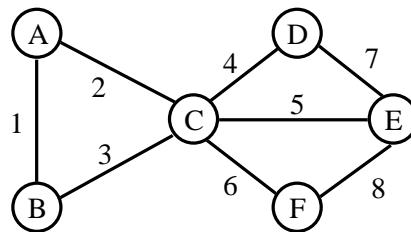
### OR

- 8.** a) Construct a binary tree having the following traversal sequences 8  
 Preorder : I N O F M A I N O T R  
 Inorder : I N F O R M A T I O N  
 Also write its post-order traversal.
- b) Construct a binary search tree from the following sequence of values: 8  
 $50, 90, 30, 10, 70, 20, 15, 55, 77, 33, 25$   
 Write a program using recursive function to search an element in a binary search tree.

9. a) Write an algorithm for BFS traversal of a graph. 8  
 Also write the BFS and DFS traversal order for the following given graph.



- b) What is the difference between Prims algorithm and Kruskal's algorithm for finding the minimum-spanning tree (MST) of a graph? Using Kruskal's algorithms on the following graph construct corresponding MST and find the cost. 8



**OR**

10. a) Show all the passes to sort the following array using selection sort and insertion sort. 8  
 $\{3, 10, 2, 7, 11, 13, 12, 4, 21\}$
- b) Using Linear probing and Quadratic probing, insert the following values in the hash table of size 10. Show how many collisions occur in each iterations 8  
 28, 55, 71, 67, 11, 10, 90, 44.

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