

(3 Hours)

Total Marks: 80

- N.B:** (1) Question No. 1 is compulsory  
(2) Attempt any three questions out of the remaining five questions  
(3) Figures to the right indicate full marks  
(4) Make suitable assumptions wherever necessary with proper justifications

- Q1 A Explain the concept of Abstract Data Type with an example. [05]  
B What are the disadvantages of representing a linear queue using an array? [05]  
How are they overcome?  
C Given an array based stack implemented with a maximum size of 4, [05]  
perform the following operations in sequence: Push(12), Push(25),  
Push(33), Pop(), Push(47), Push(51), Push(66). Now, based on the  
sequence of operations, apply your knowledge to:  
i. Determine the state of the stack after each operation.  
ii. Identify if any overflow or underflow conditions occur during  
these operations. If so, at which step do they occur?  
iii. Write conditions to check for stack overflow and underflow.  
D Write an algorithm to perform binary search on a given set of 'n' numbers. [05]
- Q2 A Consider two different orders of inserting the elements 40, 20, 60, 10, 30, [10]  
50, 70 into an empty Binary Search Tree (BST):  
i. Insert the elements in the given order.  
ii. Insert the elements in reverse order.  
Construct both BSTs and compare their heights.  
B Write a program in C to create a Singly linked list. Include functions to [10]  
insert element at the second last position and display every alternate  
element of the list.
- Q3 A Explain Depth First search and Breadth First search graph traversal [10]  
techniques with example.  
B Given the values {11, 9, 62, 51, 6, 99, 16, 9, 58, 47}, a hash table of size [10]  
10 and a hash function  $h(k) = k \bmod 10$ , show the resulting table after  
inserting the values in the given order using Linear probing technique.

- Q4 A Given the set of characters and frequencies: [10]  
M: 4, N: 8, O: 16, T: 32, E: 64.  
Construct the Huffman tree and write the binary code for each symbol and  
encode the string "MOMENT".
- B Write a program in C to implement Circular queue using an array. [10]
- Q5 A Explain the key differences between a singly linked list, a doubly linked [10]  
list, and a circular linked list. Use diagrams to show the structure of each  
type and discuss the advantages and disadvantages of each.
- B Write a program in C to evaluate a postfix expression. [10]
- Q6 A Write a program in C to remove all occurrences of a specific value from a [10]  
given doubly linked list.
- B Perform a series of insertions with the elements 9, 15, 19, 8, 7, 13, 10, 25, [10]  
30, 14. Show all the rebalancing steps required to keep the AVL tree  
balanced.