

**Third Semester B. Tech. (Computer Science and Engineering /
Data Science) Examination**

DATA STRUCTURES AND ALGORITHMS

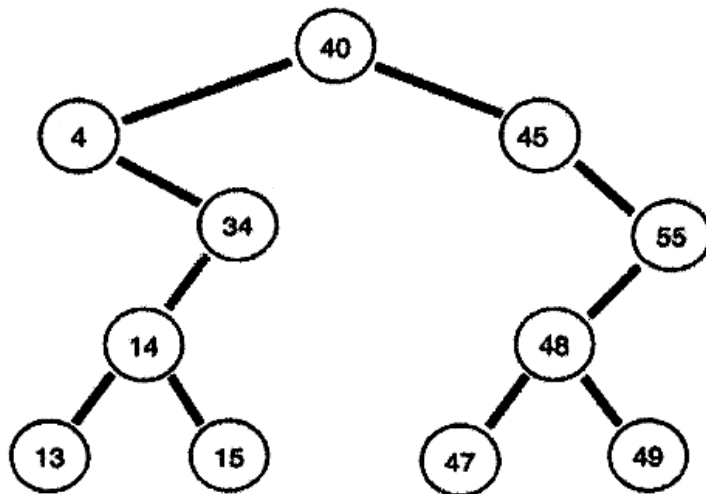
Time : 3 Hours]

[Max. Marks : 60

Instructions to Candidates :—

- (1) Attempt all questions.
 - (2) All questions carry marks as indicated against them.
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1.
 - (a) Consider a two dimensional array Marks [10] [5] having its base address of as 1350 and number of bytes per element of the array is 4. Compute the address of the element, Marks [8] [3] in row major order as well as column major order. 6(CO1)
 - (b) Write a program that computes the product of the elements that are stored on the main diagonal of a matrix using pointers. 2(CO1)
 - (c) Using frequency count method, find the time complexity of an algorithm that calculates the sum of the squares of n numbers. 2(CO1)
 2.
 - (a) Convert the following infix expression to postfix expression. Show the stackframe at each step :
$$(A - 2 * (B + C) / D * E) + F$$
 4(CO2,4)
 - (b) Explain how multiple stacks in an array is useful. Describe STACKFULL and STACKEMPTY condition for the same. 3(CO2,4)
 - (c) Write a Program to calculate the number of items in a queue. 3(CO2)
 3.
 - (a) Define the structure for Doubly linked list. Write a function to perform the following operations :—
 - (1) Inserting the node at the end in a Doubly linked list.
 - (2) Display whether the Count the number of nodes in the doubly linked list is Even or Odd. 5(CO2)

- (b) Give an comparative analysis between a linked list and a linear array. Which one you will prefer and when explain with a suitable example ?
2(CO2)
- (c) Write a function to implement linked list to demonstrate STACK operations.
3(CO2)
4. (a) Compare the complexity of Linear search Vs. Binary search algorithm.
2(CO3)
- (b) Consider the following list of unsorted numbers which are to be sort using Heap Sort :
82, 90, 10, 12, 15, 77, 55, 23
Show the stepwise execution of the algorithm with appropriate diagrams.
Discuss the complexity of Heap sort algorithm. 5(CO3)
- (c) Construct a Binary Search Tree (BST) for the following sequence of numbers—
50, 15, 62, 5, 20, 58, 91, 3, 8, 37, 60, 24 3(CO3)
5. (a) Write an algorithm to traverse a given binary tree in Inorder, Preorder and Postorder traversal sequence.
Apply the algorithm on the given binary tree to show all three traversal sequences.



5(CO3)

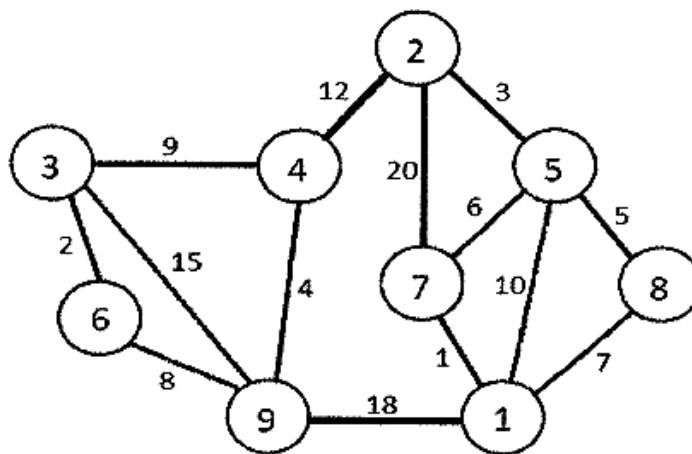
- (b) Justify the statement "AVL trees are balanced search trees".

Explain the following type of imbalances possible in a AVL tree with the help of an example :

- LL Imbalance.
- RR Imbalance.
- LR Imbalance.
- RL Imbalance.

5(CO3)

6. (a) Apply Prim's algorithm on the following graph to find Minimum cost spanning tree cost. Show stepwise execution of the algorithm.



5(CO3)

- (b) Given keys {329, 410, 333, 970, 280, 159, 865, 593, 621, 564} and the mid-square hash function, show the contents of the hash table of size 10 which resolves collision using :

- (a) Linear Probing.
- (b) Quadratic Probing.
- (c) Double hashing with second hash function $h(x) = x \pmod{10}$.
- (d) Chaining.

5(CO3,4)

