Roll No. .....

M.C.A. SEMESTER I EXAMINATION 2025-26

CS – 108 : Data Structures and Algorithms

Time : Three hours **Max. Marks : 70**

(WRITE YOUR ROLL NO. AT THE TOP IMMEDIATELY ON THE RECEIPT OF THIS QUESTION PAPER)

Note: Question No. 1 is compulsory. Answer any four from the rest of the questions. Terms and abbreviations have their standard meanings.

1 (a) What is an analysis of the algorithm? Explain the Asymptotic Notations used while analyzing an algorithm. (7)

(b) What do you mean by collision and how can you handle it by using linear probing. (3)

(c) Using modulo-division and linear probing method, store the keys given below in an array of 13 elements. How many collisions occurred and what is the density of the list after the following keys are inserted: 28, 7, 846, 786, 431, 870, 612, 675, 876, 546, 34, 1. (4)

2 (a) Explain how a stack and a queue can be implemented using a linked list. Also, mention the advantages of using a linked list over an array for these implementations, if any. (7)

(b) You have n identical-looking coins, and exactly one of them is counterfeit. The counterfeit coin is lighter than the genuine coins. Using just a two-pan balance, write an algorithm to find the counterfeit coin. What is the time complexity of your algorithm? (7)

3 (a) What is a binary tree and define the following binary trees with an example (i). Full binary tree (ii). Complete binary tree (iii) left & right skewed binary tree. (5)

(b) What is a binary search tree (BST) and construct a BST for the following data 10, 08, 15, 12, 13, 07, 09, 17, 20, 18, 04, 05. (4)

(c) Using a suitable example, illustrate how to delete nodes with (i) no children, (ii) one child, and (iii) two children in a binary search tree. (5)

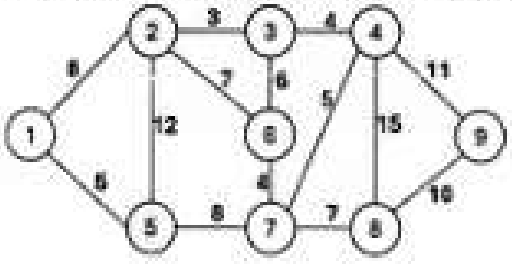
4 (a) Write algorithm of selection sort. Discuss the time and space complexity of the algorithm. Illustrate its operation by sorting the elements 64, 25, 12, 22, and 11. Also, prove that the algorithm is not stable. (7)

(b) Write the algorithm for depth first search and explain its working with an example. (7)

5 (a) Construct a binary tree from the Post-order and In-order sequence given below: In-order: GDHBAEICF and Post-order: GHDBIEFCA. (7)

(b) What is the minimum cost spanning tree? Discuss kruskal's algorithm with an example. (4)

(c) Draw all possible minimum spanning trees for the following graph: (3)



6 (a) Explain the two fundamental properties that make a problem suitable for dynamic programming. Show how the 0–1 Knapsack problem satisfies these characteristics. (7)

(b) Solve the following 0-1 Knapsack Problem using all possible greedy approaches. Number of items = 5, knapsack capacity W = 100, weight vector = {50, 40, 30, 20, 10} and profit vector = {1, 2, 3, 4, 5}. (7)