

Student ID (last 2 digits): _____ Batch _____

Set code: Tree



Daffodil International University
Faculty of Science & Information Technology
Department of Information Technology & Management

Final Examination, Summer 2025

Course Code: ITM 217; Course Title: Data Structure and Algorithm

Sections & Teachers: FM (A)

Marks: 40

Time: 2:00 Hrs

Answer ALL Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

a)	Define the terms Degree, Height, Depth, and Leaf Node in a tree with an appropriate example.	[Marks-3]	CLO-2 Level-1
b)	Explain why a Complete Binary Tree with height h has at least 2^h nodes and at most $2^{(h+1)} - 1$ nodes, using an example.	[Marks-5]	CLO-2 Level-2
	Given student roll numbers: 45, 30, 60, 25, 35, 50, 70, 65		
a)	Construct a Binary Search Tree (BST) using the given values and draw the tree. Then, determine the Preorder, Inorder, and Postorder traversals.	[Marks-4]	CLO-3 Level-3
b)	Analyze the BST to explain how searching for roll number 65 will proceed step by step, and evaluate the efficiency of this search.	[Marks-2]	CLO-3 Level-4
	You are given the following campus map (distances in minutes to walk): Admin—Library (4) Admin—Cafeteria (2) Library—Cafeteria (1) Library—Auditorium (7) Cafeteria—Auditorium (3) Cafeteria—ITM (8) Auditorium—ITM (2)		
a)	Define shortest path algorithm. State one key difference between Dijkstra's Algorithm and Prim's Algorithm.	[Marks-2]	CLO-2 Level-1
b)	Construct the given weighted graph in the form of both adjacency matrix and adjacency list.	[Marks-4]	CLO-3 Level-3
c)	Draw the graph with proper edge weights. Using Prim's Algorithm starting from the Admin node, demonstrate step-by-step selection of edges to construct the Minimum Spanning Tree (MST).	[Marks-5]	CLO-4 Level-4

4.	A company wants to arrange its data in ascending order for efficient searching and retrieval. The dataset is given as: [5, 3, 8, 4, 2, 7, 1, 10] To optimize performance, different sorting algorithms are being considered.		
a)	Explain the concept of Dynamic Programming (DP) with one real-life example.	[Marks-2]	CLO-1 Level-2
b)	Using the given dataset, apply Quick Sort with the first element as the pivot, and illustrate the recursive partitioning steps.	[Marks-4]	CLO-3 Level-3
c)	Determine the total number of comparisons made during the Quick Sort process. Then, evaluate its time complexity in <u>best</u> , <u>worst</u> , and <u>average</u> cases.	[Marks-3]	CLO-1 Level-5
d)	Differentiate between Bubble Sort and Merge Sort in terms of efficiency.	[Marks-3]	CLO-1 Level-2
5.	a) Explain why BFS is suitable for finding the <u>shortest</u> path in an unweighted graph, while Dijkstra's algorithm is more appropriate for a <u>weighted</u> graph. Illustrate with examples.	[Marks-3]	CLO-4 Level-4