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)

Time: 2:00 Hrs **Marks: 40**

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*
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 best, worst, and average 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 shortest path in an unweighted graph, while Dijkstra's algorithm is more appropriate for a weighted graph. Illustrate with examples.	[Marks-3]	CLO-4 *Level-4*