



Daffodil International University
Department of Computer Science and Engineering
Faculty of Science & Information Technology
Semester Final Examination, Fall 2024
Course Code: CSE123, Course Title: Data Structures
Level:1 Term:2 Batch: ALL

Time: 2 Hours

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.]

1.	The Election Commission of Bangladesh is analyzing the connectivity between polling stations in a district to optimize ballot transportation. Each <u>polling station</u> is represented as a <u>node</u>, and each <u>road connecting</u> two polling stations is represented as an <u>edge</u> with a weight (time in minutes). The connectivity is stored using an adjacency matrix. The current connectivity graph is represented as follows: <table><tr><th>Station</th><th>A</th><th>B</th><th>C</th><th>D</th></tr><tr><th>A</th><td>0</td><td>10</td><td>15</td><td>0</td></tr><tr><th>B</th><td>10</td><td>0</td><td>5</td><td>20</td></tr><tr><th>C</th><td>15</td><td>5</td><td>0</td><td>25</td></tr><tr><th>D</th><td>0</td><td>20</td><td>25</td><td>0</td></tr></table> Problem Statement: Question a: Graph Representation (3 Marks): ○ Explain how the above adjacency matrix represents the graph. ○ How would you interpret the value 15 in the matrix at position (A, C)? Question b: Path Analysis (4 Marks): ○ If Station A is selected as the starting point, list all directly connected stations and the respective travel times. ○ Write the pseudocode for finding all directly connected stations for any given station in this adjacency matrix. Question c: Why Graph data structure plays a vital role in computing. (3 marks)	Station	A	B	C	D	A	0	10	15	0	B	10	0	5	20	C	15	5	0	25	D	0	20	25	0	7 3	CO2 CO1
Station	A	B	C	D																								
A	0	10	15	0																								
B	10	0	5	20																								
C	15	5	0	25																								
D	0	20	25	0																								
2.	You are a software engineer working for the Election Commission of Bangladesh to develop digital solutions for efficient election management. With the upcoming elections, the Election Commission needs help managing electoral <u>divisions</u>, organizing candidate data, and optimizing routes between polling stations.	4 12	CO3 CO3																									

	The Election Commission manages a large amount of candidate data organized by unique candidate IDs. To enable fast retrieval and management, you need to store candidate data in a Binary Search Tree (BST). ✓ Question a: Design a Binary Search Tree (BST) in C to store candidate IDs, where each node represents a candidate. ✓ Question b: Implement the following functions: ✓ 1. Insert a new candidate ID into the BST. ✓ 2. Search for a candidate by ID to determine if they are in the system. ✓ 3. Display all candidate IDs in in-order traversal (ascending order of IDs).		
3.	An emergency response team uses a priority queue to handle incoming incidents based on their severity. Incidents with higher priority values are addressed first. The system is implemented using a Max-Heap. Each incident is represented by a priority value. The following two functions handle the core operations of the priority queue: 1. Insert: Adds a new incident to the heap while maintaining the Max-Heap property. 2. Extract Max: Removes and returns the incident with the highest priority from the heap. Here's the initial state of the heap: Heap: [40, 30, 20, 15, 10] Size: 5 ☒ After inserting a new incident with priority 35, the heap is updated. ✓ Question a: Show the step-by-step transformation of the heap after inserting 35. Explain how the Max-Heap property is restored. (3 Marks) ☐ The highest-priority incident is now resolved, and the Extract Max operation is performed. ✓ Question b: Show the heap after removing the highest-priority element. Explain how the heap is adjusted to restore the Max-Heap property. (4 Marks)	7	CO2
4.	Reflecting on your course project experience in Data Structures, describe how you applied a specific data structure (such as a linked list, stack, queue, or binary tree) to solve a problem within your project. In your answer, include: ✓ Question a: Description of the Problem (2 Marks): Briefly explain the problem or requirement that led you to select this particular data structure. ✓ Question b: Data Structure Selection (2 Marks): Explain why you chose this data structure over others. What advantages did it offer for solving the problem? ✓ Question c: Implementation and Challenges (3 Marks): Describe the implementation approach you followed and any challenges you faced. How did you overcome these challenges?	7	CO4

Good Luck