



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.	<p>The Election Commission of Bangladesh is analyzing the connectivity between polling stations in a district to optimize ballot transportation. Each polling station is represented as a node, and each road connecting two polling stations is represented as an edge with a weight (time in minutes). The connectivity is stored using an <b>adjacency matrix</b>.</p> <p>The current connectivity graph is represented as follows:</p> <table><tr><td>Station</td><td>A</td><td>B</td><td>C</td><td>D</td></tr><tr><td>A</td><td>0</td><td>10</td><td>15</td><td>0</td></tr><tr><td>B</td><td>10</td><td>0</td><td>5</td><td>20</td></tr><tr><td>C</td><td>15</td><td>5</td><td>0</td><td>25</td></tr><tr><td>D</td><td>0</td><td>20</td><td>25</td><td>0</td></tr></table> <hr/> <p><b>Problem Statement:</b></p> <p><b>Question a: Graph Representation (3 Marks):</b></p> <ul style="list-style-type: none"><li>○ Explain how the above adjacency matrix represents the graph.</li><li>○ How would you interpret the value 15 in the matrix at position (A, C)?</li></ul> <p><b>Question b: Path Analysis (4 Marks):</b></p> <ul style="list-style-type: none"><li>○ If Station A is selected as the starting point, list all directly connected stations and the respective travel times.</li><li>○ Write the pseudocode for finding all directly connected stations for any given station in this adjacency matrix.</li></ul> <p><b>Question c: Why Graph data structure plays a vital role in computing. (3 marks)</b></p>	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.	<p>You are a software engineer working for the <b>Election Commission of Bangladesh</b> to develop digital solutions for efficient election management. With the upcoming elections, the Election Commission needs help managing electoral divisions, organizing candidate data, and optimizing routes between polling stations.</p>	4 12	CO3 CO3																									

	<p>The Election Commission manages a large amount of <b>candidate data</b> organized by unique candidate IDs. To enable fast retrieval and management, you need to store candidate data in a Binary Search Tree (BST).</p> <p><b>Question a: Design a Binary Search Tree (BST)</b> in C to store candidate IDs, where each node represents a candidate.</p> <p><b>Question b:</b> Implement the following functions:</p> <ol style="list-style-type: none"> <li>1. Insert a new candidate ID into the BST.</li> <li>2. Search for a candidate by ID to determine if they are in the system.</li> <li>3. Display all candidate IDs in <b>in-order traversal</b> (ascending order of IDs).</li> </ol>		
3.	<p>An emergency response team uses a <b>priority queue</b> to handle incoming incidents based on their severity. Incidents with higher priority values are addressed first. The system is implemented using a <b>Max-Heap</b>. Each incident is represented by a priority value.</p> <p>The following two functions handle the core operations of the priority queue:</p> <ol style="list-style-type: none"> <li>1. <b>Insert:</b> Adds a new incident to the heap while maintaining the Max-Heap property.</li> <li>2. <b>Extract Max:</b> Removes and returns the incident with the highest priority from the heap.</li> </ol> <p>Here's the initial state of the heap:  Heap: [40, 30, 20, 15, 10]  Size: 5</p> <p><input type="checkbox"/> After inserting a new incident with priority 35, the heap is updated. <b>Question a:</b> Show the step-by-step transformation of the heap after inserting 35. Explain how the Max-Heap property is restored. (3 Marks)</p> <p><input type="checkbox"/> The highest-priority incident is now resolved, and the <b>Extract Max</b> operation is performed. <b>Question b:</b> Show the heap after removing the highest-priority element. Explain how the heap is adjusted to restore the Max-Heap property. (4 Marks)</p>	7	CO2
4	<p>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:</p> <p><b>Question a: Description of the Problem (2 Marks):</b> Briefly explain the problem or requirement that led you to select this particular data structure.</p> <p><b>Question b: Data Structure Selection (2 Marks):</b> Explain why you chose this data structure over others. What advantages did it offer for solving the problem?</p> <p><b>Question c: Implementation and Challenges (3 Marks):</b> Describe the implementation approach you followed and any challenges you faced. How did you overcome these challenges?</p>	7	CO4

*Good Luck*