Daffodil International University

Faculty of Science & Information Technology

Department of Software Engineering

Midterm Examination, Spring 2026

Course Code: SE 131 Course Title: Data Structure

Level: 1 Term: 3 Sections: 45 (A, B, C, D, E, F, G, H, I, J, K, L)

Instructors: AB (A, B), DMA (C, D, E), MAK (F), HBM (G), SD (H, I), MAB (J, K), NML (L)

Time: 1 hour 30 minutes **Marks: 25**

Directions:

- Answer questions serially.

1. A.	Describe linear data structures and non-linear data structures with one example of each.	[CLO-1, Level-1] [Marks-2+2]
B.	Define time complexity and space complexity, and briefly explain their importance in algorithm design.	
2.	**Scenario 1:** A university system stores thousands of student records in a database. Administrators for academic and administrative purposes regularly access these records. **Case 01:** To find a particular student ID, the system checks records starting from the first entry and continues one record at a time until the required ID is found or the list ends. **Case 02:** In another system, the student records are arranged in increasing order of ID, and the system repeatedly compares the target ID with the middle record and discards half of the remaining records after each comparison.	[CLO-2, Level-2] [Marks-2+2]
A.	Considering the above scenario, for each case, **explain** the appropriate searching technique and **compute** its time complexity.	
B.	**Show** which searching technique is more efficient and why.	
3. A.	**Scenario 2:** A software system stores some character elements in an array in descending alphabetical order as shown below: ['Z', 'Y', 'X', 'V', 'U', 'T', 'S', 'R', 'Q', 'P', 'O', 'N', 'M', 'L', 'K', 'J', 'I', 'E', 'D','C','A'] The system attempts to search for the character 'W' using binary search. **Show** the steps of Binary Search.	[CLO-3, Level-3] [Marks-2+4]
B.	A group of students is managing player scores for a mini gaming competition. The scores of 7 players are initially stored in an array as follows: [58, 42, 91, 33, 76, 25, 64] i) Apply **Bubble Sort** to arrange the scores in **ascending order** (**show** only the required passes). ii) After sorting, **delete the score 33** from the array (**show** the main part of the code only).	
4. A.	Suppose a network router maintains a singly linked list to track active data packets waiting for transmission. Assume each node occupies 24 bytes, and the available memory locations for nodes are: 2000, 2024, 2048, 2072, 2096, 2120, 2144 The packet IDs arrive at the router in the following order: P101, P102, P103, P104, P105, P106, P107 Perform the following operations: a) **Sketch** the linked list after inserting all packets in arrival order. b) After transmission, the first two packets leave the buffer. **Sketch** the updated linked list. c) Later, three new packets P108, P109, and P110 arrive and are added in the last of the buffer. **Sketch** the linked list again. d) **Write** the basic code to define a node structure and insert a node at the end of a singly linked list.	[CLO-3,Level-3] [Marks-8]
B.	A media player keeps track of the most recent audio tracks accessed by a user. The system always records the latest track on top, and when a track is removed, the most recently added track is removed first, i.e. works in LIFO format. The system size of this player is 4. Initially, the system contains the following tracks in memory: A1,A2,A3 **Draw** the following operations step by step: a) Draw the initial arrangement, clearly indicating the most recent track and array index positions. b) Two new tracks A4 and A5 are accessed and added to the system. c) One track is removed from the system. d) Three more tracks B1, B2, and B3 are accessed and added. e) One track is removed, followed by adding two tracks C1 and C2. f) Nine tracks are removed consecutively. Draw the final state of the system.	[CLO-3, Level-3] [Marks-3]