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Daffodil International University

Faculty of Science & Information Technology

Department of Computer Science & Engineering

Midterm Examination, Summer 2026

Course Code: CSE123, Course Title: Data Structure

Level: 1 Term: 3 Batch: 70

Time: 01:30 Hrs **Marks: 25**

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		Daffodil International University (DIU) has introduced a new bus service for the Mirpur area. From 1:00 PM to 4:00 PM, there will be one bus every hour traveling from DIU to Mirpur. Each bus has: • a unique ID number (integer), • a capacity (integer), • and a pointer (*next) that stores the address of the next bus in the service schedule. This arrangement can be represented using a linked list, where each bus is a node, and the pointer connects it to the next bus. *1 | 25 | 23221* ID capacity *next **Address: 12431, Time of Leaving for Mirpur: 1pm, position: 1** *23 | 28 | 32165* ID capacity *next **Address: 23221, Time of Leaving for Mirpur: 2pm, position: 2** *31 | 28 | 45678* ID capacity *next **Address: 32165, Time of Leaving for Mirpur: 3pm, position: 3** *17 | 28 | NULL* ID capacity *next **Address: 45678, Time of Leaving for Mirpur: 4pm, position: 4**		CO2
	a)	Write a C program to create a linked list of buses for the given schedule (1 PM to 4 PM) as the figure in the question portrayed and display all the information.	[4]	
	b)	It is seen that at 3pm, usually there are more students than 28 capacity so the authority introducing new bus having ID 13 which has capacity 40. Write a C program to create a new bus node (Bus ID = 13, Capacity = 40) and insert it at position 3 (after the node having ID: 23) in the linked list of DIU–Mirpur bus schedule.	[4]	
	c)	Write a function to delete the nodes containing Bus IDs 23 and 31 from the linked list of the DIU–Mirpur bus schedule, considering that in the first week after the Eid vacation student attendance is low, and reconnect the remaining nodes so that the linked list structure is preserved.	[4]	

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2		A logic circuit simulator converts arithmetic expressions representing signal computations into a form that can be executed sequentially. A stack is used to handle operators while transforming the expression. Expression: *(2+3)^2 / 5 + 3 – 2 * (1+2)* Convert the expression into postfix and then evaluate the expression using stack.	[3+2]	CO1
3		Daffodil International University (DIU) uses a queue to manage bus seat reservations. The following sequence of operations occurs: i. Enqueue passengers: P1, P2, P3, P4, P5 ii. Dequeue two passengers iii. Enqueue passengers: P6, P7 iv. Dequeue one passenger v. Enqueue passenger: P8		CO1
	a)	Draw the state of the queue after each operation to visualize how the queue changes. Ensure that the nature of the queue is clearly represented.	[5]	
	b)	Explain why a queue is an appropriate data structure for managing bus seat reservations at DIU and what would happen if a stack were used instead of a queue for this reservation system.	[3]	