Daffodil International University

Faculty of Science & Information Technology

Department of Software Engineering

Final Examination, Summer 2026

Course Code: SE214; Course Title: Algorithm Design and Analysis

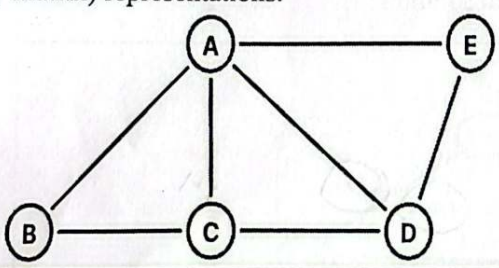
Sections & Teachers: AS (A, B, C), MMSI (D, E), AAS (F, G), AF (H, I), SA (J)

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.]

1. a) **Analyze** the given graph and **illustrate** its linked (adjacency list) and sequential (adjacency matrix) representations.



[Marks: 1.5+1.5]

b) An emergency relief drone can carry a maximum of **9 kg** of supplies. The available items are:

Item	Emergency Supply	Weight (kg)	Priority Value
A	Medicine Kit	2	30
B	Food Pack	3	40
C	Water Pack	4	45
D	Rescue Equipment	5	80

The relief coordinator plans to load items **A, B, and C**, claiming that their combined priority value of **115** makes this the best possible selection.

(i) Optimize the selection of emergency supplies using the **0/1 Knapsack** approach and **identify** the combination that provides the maximum priority value.

(ii) Compare the optimal solution obtained in part **(i)** with the coordinator's proposed selection of A, B, and C, and **explain** whether the coordinator's decision is optimal based on the total weight and priority value.

[Marks: 5+2] **CLO 3** ***Level 4***

c) A digital publishing company is comparing two product names after a branding update to determine the longest sequence of unchanged characters. Since the names have been partially modified, the system uses the Longest Common Subsequence (LCS) algorithm to identify the shared pattern. The two names are

X = PLATFORM

Y = PLASTRON

(i) Identify the common subsequence with the maximum possible length, showing the approach and traceback path.

(ii) Analyze how the dynamic programming table helps avoid redundant computations compared to a recursive solution.

[Marks: 4+1]

	d)	A vending machine is programmed to dispense change using the minimum number of coins to reduce dispensing time and improve efficiency. The machine has an unlimited supply of coins with the following denominations: **[1, 2, 5, 8]** A customer needs to receive **10 units** of change. **Analyze** how dynamic programming can be used to determine the minimum number of coins required to dispense the change, assuming each coin denomination can be used multiple times.	[Marks: 5]	
2.	*a)*	A warehouse needs to pack the following items into bins of capacity **10 units**: **Evaluate** the **First-Fit** and **First-Fit Decreasing** approaches for the given items and **determine** which provides the more optimized solution.	[Marks: 5]	
	b)	Consider the weighted graph shown below. A student applies Kruskal's algorithm and selects the following edges to construct a minimum spanning tree (MST): (n02, n03), (n04, n01), (s, n04), (n00, t), (n03, t), (n00, n04) The student claims that the resulting tree is the minimum spanning tree. **Evaluate** whether the selected edges form a valid minimum spanning tree (MST). If any selected edge is incorrect, identify the error(s), construct the correct MST, and calculate its total weight. **Justify** your answer with appropriate reasoning.	[Marks: 2+5]	CLO 4 *Level 5*
	c)	**Determine** the shortest paths from the given source vertex (S) to all other vertices using the **Bellman-Ford algorithm.**	[Marks: 8]	

Item	Size
A	8
B	3
C	6
D	4
E	7
F	2