

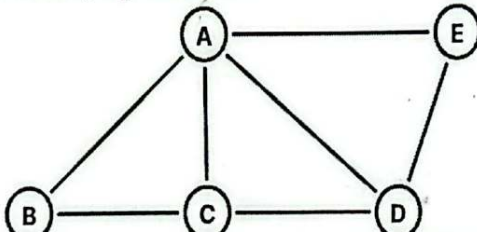


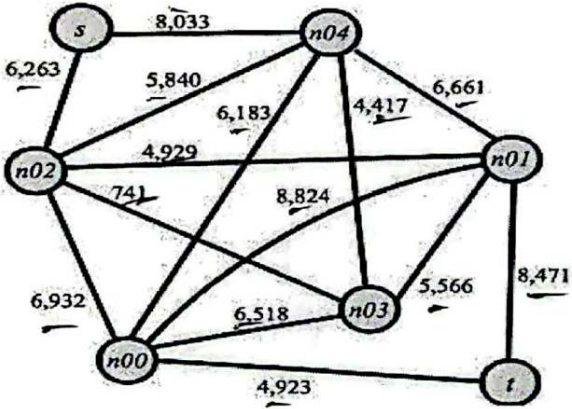
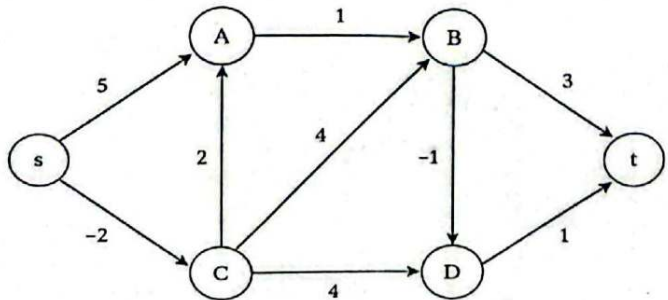
Daffodil International University  
Faculty of Science & Information Technology  
Department of Software Engineering  
Final Examination, Summer 2026

**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) | <p>Analyze the given graph and illustrate its linked (adjacency list) and sequential (adjacency matrix) representations.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | [Marks: 1.5+1.5] |                  |             |                |   |              |   |    |   |           |   |    |   |            |   |    |   |                  |   |    |              |                  |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------|-------------|----------------|---|--------------|---|----|---|-----------|---|----|---|------------|---|----|---|------------------|---|----|--------------|------------------|
| b)    | <p>An emergency relief drone can carry a maximum of 9 kg of supplies. The available items are:</p> <table border="1"> <thead> <tr> <th>Item</th><th>Emergency Supply</th><th>Weight (kg)</th><th>Priority Value</th></tr> </thead> <tbody> <tr> <td>A</td><td>Medicine Kit</td><td>2</td><td>30</td></tr> <tr> <td>B</td><td>Food Pack</td><td>3</td><td>40</td></tr> <tr> <td>C</td><td>Water Pack</td><td>4</td><td>45</td></tr> <tr> <td>D</td><td>Rescue Equipment</td><td>5</td><td>80</td></tr> </tbody> </table> <p>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.</p> <p>(i) Optimize the selection of emergency supplies using the 0/1 Knapsack approach and identify the combination that provides the maximum priority value.</p> <p>(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.</p> | 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 | [Marks: 5+2] | CLO 3<br>Level 4 |
| 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               |             |                |   |              |   |    |   |           |   |    |   |            |   |    |   |                  |   |    |              |                  |
| c)    | <p>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<br/>X = PLATFORM<br/>Y = PLASTRON</p> <p>(i) Identify the common subsequence with the maximum possible length, showing the approach and traceback path.</p> <p>(ii) Analyze how the dynamic programming table helps avoid redundant computations compared to a recursive solution.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | [Marks: 4+1]     |                  |             |                |   |              |   |    |   |           |   |    |   |            |   |    |   |                  |   |    |              |                  |

|      | <p>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]<br/>A customer needs to receive <b>10 units</b> of change.<br/><b>Analyze</b> how dynamic programming can be used to determine the <u>minimum</u> number of <u>coins</u> required to dispense the change, assuming each coin denomination can be used multiple times.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | [Marks: 5] |      |   |   |   |   |   |   |   |   |   |   |   |   |            |                  |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------|---|---|---|---|---|---|---|---|---|---|---|---|------------|------------------|
| 2.   | <p>a) A warehouse needs to pack the following items into bins of capacity <b>10 units</b>:</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Size</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>8</td> </tr> <tr> <td>B</td> <td>3</td> </tr> <tr> <td>C</td> <td>6</td> </tr> <tr> <td>D</td> <td>4</td> </tr> <tr> <td>E</td> <td>7</td> </tr> <tr> <td>F</td> <td>2</td> </tr> </tbody> </table> <p><b>Evaluate</b> the <b>First-Fit</b> and <b>First-Fit Decreasing</b> approaches for the given items and <b>determine</b> which provides the more optimized solution.</p> <p>b) Consider the weighted graph shown below.</p>  <p>A student applies Kruskal's algorithm and selects the following edges to construct a minimum spanning tree (MST):<br/>(n02, n03), (n04, n01), (s, n04), (n00, t), (n03, t), (n00, n04)</p> <p>The student claims that the resulting tree is the minimum spanning tree.<br/><b>Evaluate</b> 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. <b>Justify</b> your answer with appropriate reasoning.</p> <p>c) <b>Determine</b> the shortest paths from the given source vertex (S) to all other vertices using the <b>Bellman-Ford</b> algorithm.</p>  | Item       | Size | A | 8 | B | 3 | C | 6 | D | 4 | E | 7 | F | 2 | [Marks: 5] | CLO 4<br>Level 5 |
| Item | Size                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |      |   |   |   |   |   |   |   |   |   |   |   |   |            |                  |
| A    | 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |      |   |   |   |   |   |   |   |   |   |   |   |   |            |                  |
| B    | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |      |   |   |   |   |   |   |   |   |   |   |   |   |            |                  |
| C    | 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |      |   |   |   |   |   |   |   |   |   |   |   |   |            |                  |
| D    | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |      |   |   |   |   |   |   |   |   |   |   |   |   |            |                  |
| E    | 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |      |   |   |   |   |   |   |   |   |   |   |   |   |            |                  |
| F    | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |      |   |   |   |   |   |   |   |   |   |   |   |   |            |                  |
|      | <p>c) <b>Determine</b> the shortest paths from the given source vertex (S) to all other vertices using the <b>Bellman-Ford</b> algorithm.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | [Marks: 8] |      |   |   |   |   |   |   |   |   |   |   |   |   |            |                  |