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# Daffodil International University

**Faculty of Science & Information Technology**
**Department of Computing and Information System**
**Final Examination, Spring-2026**
**Course Code: CIS132, Course Title: Algorithms**
**Level: 1 Term: 3**

**Exam Duration: 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. | a) | Define the concept of an algorithm and classify the various types of algorithms with relevant examples. | [3] | CO1 |
| | b) | Analyze the given code to find out the time complexity.<br>*int cube(int n)*<br>*int count = 0;*<br>*for (int i = 0; i < n; i++)*<br>*for (int j = 0; j < n; j++)*<br>*for (int k = 0; k < n; k++)*<br>*count += 1;*<br>*return count;* | [3] | |
| | c) | Given the recurrence relation,<br>$T(n) = 2T(n/2) + n$<br>Solve it using an appropriate method and determine its asymptotic time complexity. | [4] | |
| 2. | | During a flood, a relief camp receives 9 trucks carrying different types of items and people. Each item is assigned a **priority weight (1 = highest priority, 9 = lowest priority)** based on urgency. | | CO2 |

| Item | Priority (Weight) |
|---|---|
| Medicine boxes | 1 |
| Bottled water | 2 |
| Food packets | 3 |
| Life jackets | 4 |
| Rescue Team | 5 |
| Reconstruction Members | 6 |
| Fund Team | 7 |
| Journalists | 8 |
| Member of Parliament | 9 |

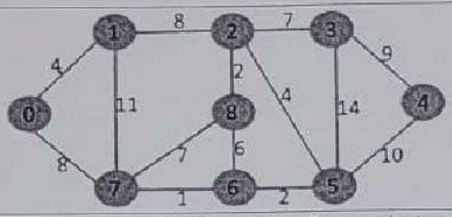
However, the trucks arrive in a **random (unsorted) order**:
**Bottled water → Member of Parliament → Food packets → Journalists → Life jackets → Rescue Team → Medicine boxes → Fund Team → Reconstruction Members**



Insertion-

① 2 9 3 8 4 5 1 7 6 i=1, Key=9, j=0
② 2 3 9 8 4 5 1 7 6 i=2 K=3, j=0
③ 2 3 8 9 4 5 1 7 6 i=3, K=8, j=1
④ 2 3 4 8 9 5 1 7 6 i=4 K=4 j=1
⑤ 2 3 4 5 8 9 1 7 6 i=5 K=5, j=2
⑥ 1 2 3 4 5 8 9 7 6 i=6, K=1, j=-1
⑦ 1 2 3 4 5 7 8 9 6 i=7, K=7, j=5
⑧ 1 2 3 4 5 6 7 8 9 i=8, K=6 j=4

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| | | | | |
|---|---|---|---|---|
| | a) | Apply Insertion Sort and Quick Sort to organize the given relief items according to priority. Show major steps of execution. | [8] | |
| | b) | Analyze the number of comparisons and swaps required in Quick Sort and Insertion Sort for this dataset. | [2] | |
| 3. | |   | | CO3 |
| | a) | Perform Depth-First Search (DFS) starting from node 0 and write the traversal order. | [3] | |
| | b) | Apply Prim's Algorithm (starting from node 0) to construct the Minimum Spanning Tree (MST). Show the selected edges step by step. | [3] | |
| | c) | Apply Kruskal's Algorithm to construct the MST. Show edge sorting and selection process. | [3] | |
| | d) | Compare the results of Prim's and Kruskal's algorithms. Are the MSTs the same? Justify your answer briefly. | [1] | |
| 4. | a) | You have an unlimited supply of 2-taka, 3-taka, 4-taka, and 6-taka notes. Using the dynamic programming approach, determine the minimum number of notes required to make a total of 15 taka. Show the necessary steps of your solution. | [5] | |
| | b) | A gym worker is organizing weights by stacking them on shelves. The weights (in kilograms) are given below:<br>**12, 16, 18, 8, 16, 12, 10, 4, 6, 10, 12, 16, 20, 10, 24**<br>Each shelf has a load capacity of **40 kg**.<br>Using the Bin Packing algorithm concepts, solve the following:<br>i. Determine the Lower Bound (LB) for the minimum number of shelves required.<br>ii. Apply the First-Fit (FF) algorithm to pack the weights and show the arrangement of items in each shelf.<br>iii. Apply the First-Fit Decreasing (FFD) algorithm and show the final arrangement after sorting.<br>iv. Find the optimal bin packing solution (minimum possible number of shelves) and compare it with FF and FFD results. | [5] | CO4 |