



Daffodil International University
Faculty of Science & Information Technology
Department of Software Engineering
Midterm 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: 1 Hour 30 Mins

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.	a)	While developing a solution for a computational problem, a software engineer must ensure that the chosen algorithm is both correct and efficient. Explain the concept of an algorithm and analyze the essential characteristics that define a good algorithm.	[Marks-2]	CLO-1 Level-4
	b)	Break down the execution of the following code snippet and identify its time complexity. <table><tr><td><pre>#include <stdio.h> int main() { int n; scanf("%d", &n); for (int i = 1; i < n; i++) { for (int j = 0; j < i; j += 4) { printf("Done\n"); } } return 0; }</pre></td><td><pre>#include <stdio.h> int main() { int n; scanf("%d", &n); int count = 0; for (int i = 1; i < n; i *= 2) { count++; } for (int j = 0; j < n; j++) { count++; } printf("%d\n", count); return 0; }</pre></td></tr></table>	<pre>#include <stdio.h> int main() { int n; scanf("%d", &n); for (int i = 1; i < n; i++) { for (int j = 0; j < i; j += 4) { printf("Done\n"); } } return 0; }</pre>	
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2.	a)	A weather station at Daffodil International University recorded the following temperature readings (in °C) during a winter day: [15, -8, 22, -12, 4, 0, -5] To make the data easier to analyze, the meteorological team wants to arrange the temperature readings from the lowest value to the highest value. The sorting process begins by considering the first reading as already arranged, and then each subsequent reading is inserted into its correct position among the previously arranged readings. Explain the step-by-step process used to arrange the temperature readings. Finally, provide the sorted sequence and briefly explain the best-case and worst-case time complexities of this sorting approach with proper justification.	[Marks-4]	CLO-2 Level-2

	b) During the annual admission process at Daffodil International University, the registration system received the following student application IDs in a random order: [38, 12, 45, 7, 29, 18, 50, 3, 41, 24] Due to the large number of records, the system organizes the data by handling smaller portions of the list independently before combining the results into a final ordered sequence. The goal is to arrange the application IDs from the <u>largest value</u> to the smallest value. Visualize each step involved in organizing the application IDs and show how the final sequence is obtained.	[Marks-4]																						
	c) A university is organizing a technology festival and has allocated 700 square meters of space for corporate exhibition stalls. Several companies have applied for stalls, each requiring a certain area and offering a sponsorship amount in return <table><tr><th>Company</th><th>Area Required (sq. m)</th><th>Sponsorship (Tk.)</th></tr><tr><td>A</td><td>120</td><td>84,000</td></tr><tr><td>B</td><td>180</td><td>144,000</td></tr><tr><td>C</td><td>150</td><td>90,000</td></tr><tr><td>D</td><td>200</td><td>180,000</td></tr><tr><td>E</td><td>250</td><td>250,000</td></tr><tr><td>F</td><td>100</td><td>50,000</td></tr></table> The organizing committee aims to maximize the total sponsorship without exceeding the available stall space. Two greedy strategies are considered: (i) selecting companies with the minimum area requirement first and (ii) selecting companies with the highest sponsorship-to-area ratio first Compare both strategies and distinguish which strategy provides a better allocation. Briefly explain the greedy-choice principle and discuss why that strategy performs better in this scenario.	Company	Area Required (sq. m)	Sponsorship (Tk.)	A	120	84,000	B	180	144,000	C	150	90,000	D	200	180,000	E	250	250,000	F	100	50,000	[Marks-7]	
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3.	a) During an inter-university programming competition, participants were required to exchange short text messages with their teammates while minimizing network bandwidth usage. One team decided to use Huffman Coding, a greedy algorithm, to compress their messages before transmission. To test their implementation, they encoded the text message "SUCCESSWINNER" Illustrate the Huffman Tree for the given message and determine the Huffman code for each character.	[Marks-5]	CLO-3 Level-4																					