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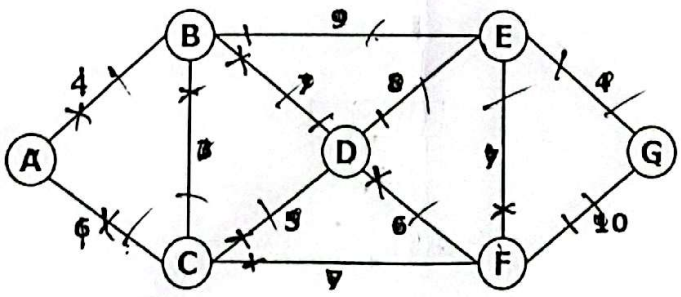
Daffodil International University
Faculty of Science & Information Technology
Department of Computing and Information System
Final Examination, Fall-2024
Course Code: CIS122, Course Title: Data Structure
Level: 1 Term: 2

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)	As a student of CIS, why do you study Data Structure? Mention the common operations on various data structures.	[4]	CO1 L-1, 2,4
	(b)	Given an array, A[1.....12][1.....15] with base value 150 and the size of each element is 2 Byte in memory. Find the address of A[9][6] with the help of column-major order. 296	[3]	
	(c)	Draw a flowchart to split an array into two separate arrays: one for positive numbers and the other for negative numbers.	[3]	

2.	(a)	Write a Pseudocode which performs a merge operation for two linked lists.	[4]	CO4 L-2, 3,5
	(b)	Draw K_5. Construct the minimum spanning tree (MST) for the given graph (Figure 01) using Prim's algorithm.  **Figure 01: Undirected graph**	[6]	

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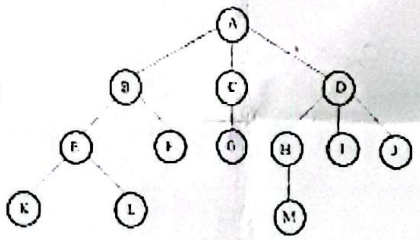
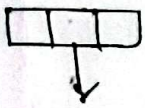
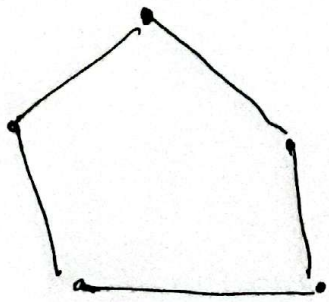
3.	(a)	What do you mean by Successful and Unsuccessful search? Suppose you have an array called DATA as follows: 11, 22, 30, 33, 40, 44, 55, 60, 66, 70, 77. Now find the ITEM = 56 using binary search.	[5]	CO3 L-2, 4
	(b)	A circular queue has a size of 4 and has 2 elements 10 and 40 where F=2 and R=3. After inserting 50 and 60, what is the value of F and R. Trying to insert 30 at this stage what happens? Delete 2 elements from the queue and insert 70, 80 & 90. Show the sequence of steps with necessary diagrams with the value of F & R.	[5]	

4.	(a)	Construct the Max-Heap for the following set of data: 10, 2, 6, 7, 18, 1, 8.	[4]	CO4 L-2, 4,5
	(b)	From Figure 01, prove that the sum of all the vertex degrees is equal to twice the number of edges.	[3]	
	(c)	For a given tree (Figure 02) explain the following terms: I. Degree II. Sibling III. Depth of a tree  **Figure 02: Tree**	[3]	





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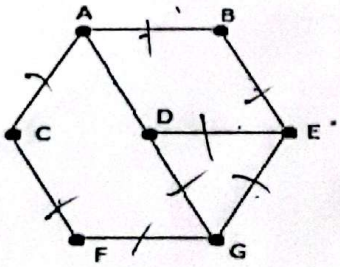
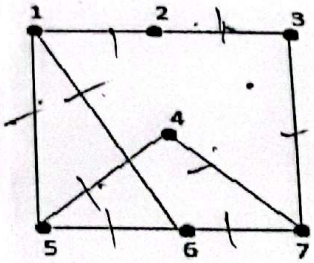
Daffodil International University

Department of Computing and Information System
Faculty of Science and Information Technology (FSIT)
Final Examination: Fall Semester-2024
Program: B.Sc. in CIS **Section:** 19_A
Course Code: CIS123; **Level:** 1 **Term:** 2 **Course Title:** Discrete Mathematics

Time: 2 Hours **Total Marks: 40**

(Answer all the followings questions)

Q. sl		Questions	Mark	CLO
1		Apply your knowledge of mathematical induction to prove that, $1 \cdot 2 + 2 \cdot 3 + \cdots + n(n+1) = n(n+1)(n+2)/3$ whenever n is a nonnegative integer	5	CLO1 Level : 1,2
2	a	Demonstrate your knowledge about: proposition, quantifier, universal quantifier, existential quantifier, counter example, uniqueness quantifier, declarative sentence.	7	
	b	Show that, $\neg(p \vee (\neg p \wedge q))$ and $\neg p \wedge \neg q$ are logically equivalent by developing a series of logical equivalences.	4	
3		For each of these relations on the set {1, 2, 3, 4}: • R1 = {(1, 2), (1, 3), (2, 1), (2, 3), (3, 1), (4, 4)} • R2 = {(1, 1), (1, 4), (2, 2), (3, 3), (4, 1)} • R3 = {(2, 3), (3, 4), (4, 2)} • R4 = {(1, 1), (2, 1), (1, 2), (2, 2), (3, 3), (4, 4)} • R5 = {(1, 2), (1, 3), (3, 4)} • R6 = {(1, 4), (2, 3), (3, 1), (4, 2), (4, 4)} **Demonstrate which relation is reflexive, symmetric, anti-symmetric, and transitive.**	6	CLO-1 Level -2
4	a	Determine those graphs are **isomorphic** or not.  **Graph: G**  **Graph : H**	3	CLO-2 Level -3

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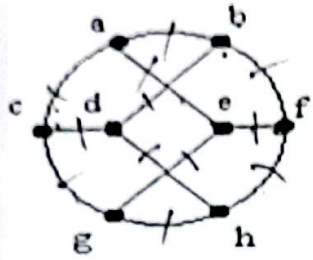
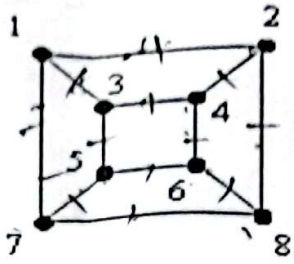
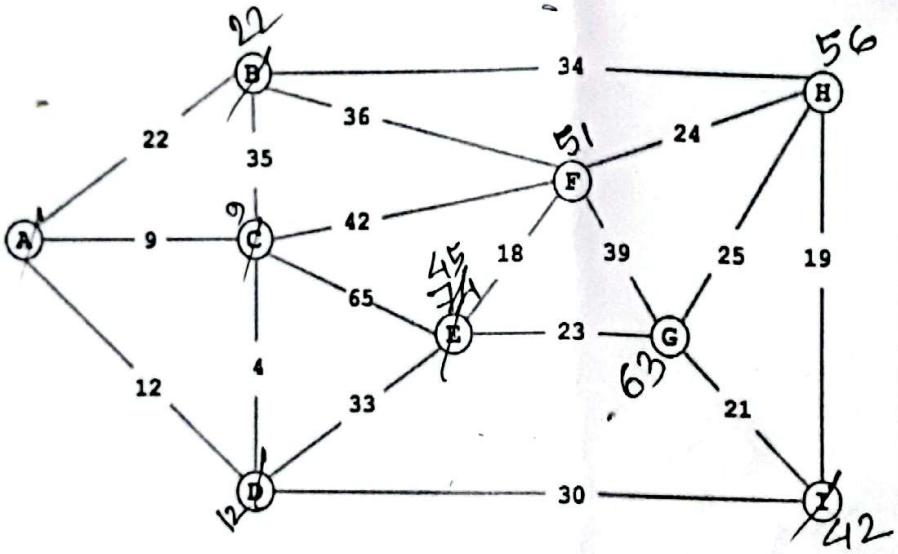
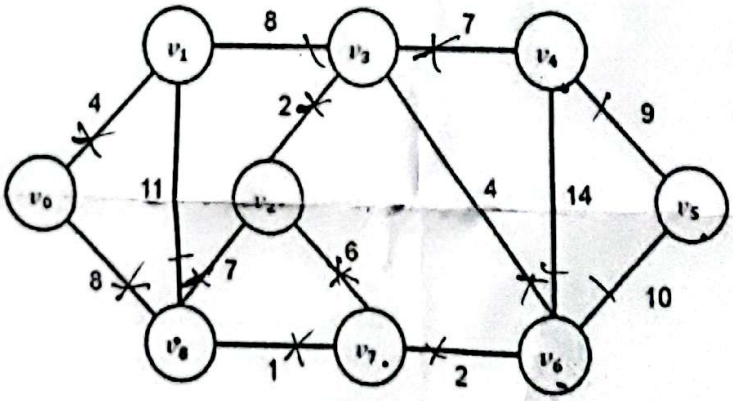
4	b	Determine those graphs are **isomorphic** or not  **Graph: P**  **Graph: Q**	3	CLO-2 *Level -3*
5	a	Construct the shortest path from **A to H**  	6	CLO-2 *Level -3*
5	b	Implement Prim's algorithm to find out Minimum spanning tree of the following graph.  	6	CLO-2 *Level -3*

.....Allah Hafez.....

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Daffodil International University

Faculty of Science & Information Technology
Department of Computing and Information System (CIS)
Final Exam, Fall-2024
Section A
Course Code: CIS 131
Course Title: Computer Architecture & Organization

Time: 2 Hours **Total Marks: 40**

(The figure of the right margin indicates the marks)

(You need to answer all of the following questions)

1.	a) Discussed the key changes from 1st generation computers to 5th generation computers. b) Describe the basic organization of the computer system with a proper diagram.	4 4	CLO1
2.	a) Assume a 20 cm diameter wafer has a cost of 15, contains 100 dies, and has 0.030 defects/cm^2 & also a 25 cm diameter wafer has a cost of 18, contains 116 dies, and has 0.041 defects/cm^2. a. Find the yield of both wafers. b. Find the cost per die for both wafers. c. If the number of dies increased by 15% and the defects per area unit increased by 20% find the die area and yield. b) A program runs in 10s on computer A, which has a 2.5 GHz clock. We are trying to help a computer designer build a computer B, which will run this program in 8s. The designer wants to increase the clock rate but this increase will affect the rest of the CPU design causing computer B to require 1.3 times as many clock cycles as computer A for this program. i. What clock rate should we tell the designer to target?	6 4	CLO2
3.	a) If the decimal value of 'b' is 98, find out both the decimal and binary values of 'x' and 'y'. b) Subtract 100011 from 010010 using the complementary method. c) Convert (-5XX.80)$_{10}$ in IEEE-754 32-bit floating point number representation. Where **XX** represents the last two digits of your Student ID.	2 2 6	CLO3
4.	a) Implement a Full Adder circuit using Two Half Adders and an OR Gate. b) Simplify the given 4 variables Boolean using the K-Map and draw the circuit. F (A, B, C, D) = Σ (0, 1, 2, 5, 7, 8, 9, 10, 13, 15) c) Implement an Encoder of 8 inputs and draw the circuit.	4 4 4	CLO4

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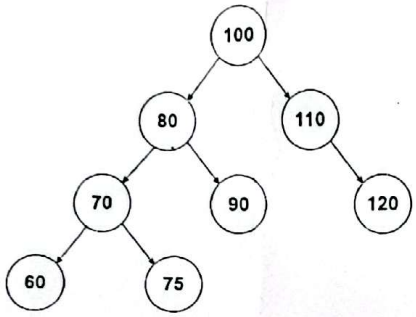
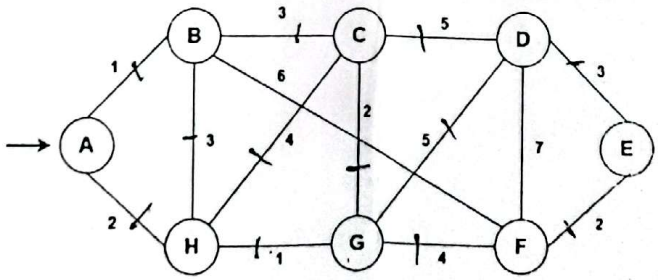
Daffodil International University

Faculty of Science & Information Technology
Department of Computing and Information System
Final Examination, Fall-2024
Course Code: CIS 132, Course Title: Algorithms
Level: 1 Term: 2

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.	 **Figure-1: A Binary Search Tree**			
	a)	Analyze the given BST to determine and print its 'In-order' traversal series by implementing the relevant algorithm.	[3]	CO3
	b)	Analyze the given BST Tree to execute the process for deleting nodes 70 and 90, explaining the steps involved in the procedure.	[3]	
	c)	Construct the updated BST following the specified deletions. Design and apply a method to verify if the updated tree meets AVL tree Properties, and if it does not, implement the required modifications to balance it as a valid AVL tree.	[4]	
2.	 **Figure-2: Pictorial representation of a graph.** 262144			
	a)	Define MST. How many MSTs can be generated from the given graph?	[2]	CO3
	b)	Implement Breadth-First Search (BFS) on the given graph. Identify the different techniques for graph representation and demonstrate the representation of the given graph using one of these techniques.	[4]	
	c)	Apply Kruskal's algorithm, demonstrating each step of the process to construct the Minimum Spanning Tree (MST) of the given graph.	[4]	

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3.	Given three arrays, A = [345, 123, 567, 789, 234, 890, 456], B = [170, 45, 75, 90, 802, 24, 2].			CO
	a)	Explain why Merge Sort is preferred over Bubble Sort and Insertion Sort for large datasets. Include a comparison of their worst-case time complexities.	[3]	CO4
	b)	Demonstrate the steps of the Quick Sort algorithm implementing on array B. What will the array look like after sorting?	[4]	
	c)	Analyze the process of Radix Sort (base 10) by breaking down the steps involved in sorting the array A. Identify how the array changes after each pass and explain the effect of each pass on the array.	[3]	

4.

Scenario-1:

(a)

```
int left = 0, right = n - 1;
int found = -1;

while (left <= right) {
  int mid = left + (right - left) / 2;

  if (arr[mid] == target) {
    found = mid;
    break;
  } else if (arr[mid] < target) {
    left = mid + 1;
  } else {
    right = mid - 1;
  }
}
```

(b)

```
for (int i = 0; i < rows; ++i) {
    for (int j = 0; j < cols; ++j) {
        cout << "Element at position (" << i + 1 << "," << j + 1 << "): ";
        cin >> matrix[i][j];
    }
}
cout << "The matrix is:" << endl;
    for (int i = 0; i < rows; ++i) {
        for (int j = 0; j < cols; ++j) {
            cout << matrix[i][j] << " ";
        }
    cout << endl;
    }
```

Scenario-2:

A teacher needs to determine the highest score among three students who recently took an exam. Each student's score is entered into a system. The system must identify the largest score among the three using a custom algorithm. The teacher plans to use this system to highlight the top performer for each subject.

a)	Compare the concepts of Best, Worst, and Average case time complexity in algorithm analysis with examples.	[3]	CO1
b)	Apply the principles of algorithm analysis to determine the time complexity of the given code snippets.	[3]	
c)	Identify the attributes of the given scenario and analyze the process of comparing three scores in a grading system. Construct an algorithm to determine the highest score and explain the logical steps involved in making the comparisons.	[4]	

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Daffodil International University

Department of Computing and Information System(CIS)
Faculty of Science & Information Technology
Final Examination, Fall 2024
Course Code: STA 101, Course Title: Statistics I
Sections & Teachers: All

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) **Compare** between simple correlation and partial correlation? **Illustrate** with example. **[Marks-3]** **CLO-2 *Level-2***

b) **Show** the differences between experiment and trail? **Illustrate** with a hypothetical example. **[Marks-2]**

2. a) A CIS department wants to analyze whether there is a relationship between the number of hours students spend studying programming and their scores in the final programming exam.
The following data represents a sample of 5 students: **[Marks-6]**

Hours Studied	2	4	6	8	10
Exam Score	50	60	70	80	90

i) **Determine** the coefficient of correlation
ii) **Interpret** the result.

b) You are analyzing a dataset of online courses to determine the relationship between the number of hours students spend watching course videos and their final test scores. Based on the data below, **[Marks-9]** **CLO-3 *Level-5***

Hours Watched	2	4	6	8	10	12
Final Test Score	50	55	60	65	70	75

i) Draw scatter plot.
ii) **Determine** the estimated regression model.
iii) **Interpret** the value β_0 and β_1.
iv) **Conclude** the test score for a student who watches course videos for 7 hours.

3. a) The CIS department at Daffodil university claims that the average score of students on a programming proficiency test is 75. To verify this claim, a sample of 50 students is taken, and their average score is found to be 72, with a variance of 100.
At a significance level of 5%, **Test** whether the average score is different from 75? **[Marks-7]** **CLO-4 *Level-6***

b) A CIS department is monitoring the number of cybersecurity incidents detected by an intrusion detection system (IDS) per hour. The system monitors 20 network events in an hour, and the probability of detecting a cybersecurity incident in a single event is 15%. **Choose** Poisson distribution to find the probability that, **[Marks-8]**

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		i) No cybersecurity incidents are detected in an hour? 0.0497 ii) Exactly 2 cybersecurity incidents are detected in an hour? 0.224 iii) More than 4 cybersecurity incidents are detected in an hour? 0.1849 iv) What is the expected number of cybersecurity incidents detected in a 12-hour monitoring period?		
	c)	A survey was conducted among city residents to determine their preferences for two online streaming platforms: Platform A and Platform B. The survey revealed the following: 55% of the residents use Platform A, 45% of the residents use Platform B and 35% of the residents use both platforms. If a resident is selected at random: **Examine,** i) What is the probability that, the resident uses only one platform? ii) If the residents are mutually exclusive, then find the probability that they uses only one platform? 0.65	**[Marks-5]**	

Formulas

❖ Correlation Coefficient

$$r = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^{n}(X_i - \bar{X})^2}\sqrt{\sum_{i=1}^{n}(Y_i - \bar{Y})^2}}$$

❖ Regression Coefficient

$$\hat{\beta}_1 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

$$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1\bar{x}$$

❖ Basic Concepts of Probability

General Rule of Addition

P(A or B)= P(A U B)= P(A) + P(B) – P(A∩B)

Conditional Probability

$$P(A|B) = P(A \text{ and } B) / P(B) = \frac{P(A \cap B)}{P(B)}$$

❖ Binomial Distribution

$$f(x;n,p) = \begin{cases} \binom{n}{x} p^x q^{n-x} & \text{for } x = 0,1,2,\ldots,n \\ 0; & \text{otherwise} \end{cases}$$

❖ Poison Distribution

$$f(x;\lambda) = \begin{cases} \frac{e^{-\lambda}\lambda^x}{x!} & \text{for } x = 0,1,2,\ldots,\infty. \\ 0; & \text{otherwise} \end{cases}$$

❖ Hypothesis testing

$$|Z| = \left|\frac{\bar{X} - \mu_0}{\frac{\sigma}{\sqrt{n}}}\right|$$

$$|t| = \left|\frac{\bar{X} - \mu_0}{\frac{s}{\sqrt{n}}}\right|$$