Class Test 1; Total Marks 15; Total Time: 30 Mins

1. Compare and contrast Human Intelligence and Artificial Intelligence with suitable examples. [2 Marks]
2. Explain why rational agents are preferred over purely rule-based systems in modern AI. [3 Marks].
3. A delivery robot takes a slightly longer route to avoid traffic congestion. Is its behavior rational? Justify your answer. [3 Marks]
4. A web crawler follows links recursively. Which search strategy (DFS/BFS) does it resemble and why? [4 Marks]
5. What are plateaus, ridges, and local maxima in the context of Hill Climbing? [3 Marks]

Class Test: 2, Course Code: CIS 313; Time: 30 Mins

Q1. Machine Learning Fundamentals (5 marks)

a) Define Machine Learning and explain how it differs from traditional programming. *(2 marks)*

b) Describe one real-life application of ML and identify what type of learning it represents. *(3 marks)*

Q2. Tasks and Linear Regression (5 marks)

a) Write the equation of a simple linear regression model and explain what each term represents. *(3 marks)*

b) If MSE is high, what does that imply about the model's predictions? Give an intuitive explanation. *(2 marks)*

Q3. Logistic Regression Intuition (5 marks)

a) Why can't we directly use linear regression for binary classification problems? *(3 marks)*

b) Why can't we use MSE as a loss function for Logistic Regression? *(2 marks)*

Python Evaluation Task

1. Count Digits and Letters

Write a function analyze_string(s) that returns two counts: number of digits and number of letters in the given string.

- Example: analyze_string("A1B23") → (3, 2)

2. List Average & Filtering

Write a function filter_above_average(numbers) that:

- Calculates the average of a list of numbers.
- Returns a **new list** containing only numbers greater than the average.

Example:
filter_above_average([10, 20, 30, 40]) → [30, 40]

3. Ticket Price Calculator

Rules:

- Base price = 100
- Children (<12): 50% off
- Seniors (≥60): 30% off
- Students get extra 10% off after any other discount

Example:

Input	Output
Age: 65 Is student: False	70.00

Quiz-3

1) Explain the role of an activation function in a perceptron or neural network. Why is a non-linear activation function necessary?

2) Compare a perceptron with a multilayer perceptron.

3) Explain why neural networks with multiple hidden layers are classified as deep neural networks?

4) Consider a deep neural network input layer: 3 nodes, Hidden layer1: 4 nodes, Hidden Layer2: 3 nodes, output layer: 1 node. Sketch the network and explain. Feed forward propagation?

Daffodil International University

Faculty of Science & Information Technology

Department of Computing and Information System

Final Examination, Fall-2025

Course Code: CIS313, Course Title: Artificial Intelligence

Level: 3 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 Artificial Intelligence. briefly explain the difference between "Thinking Humanly" and "Acting Rationally."	[3]	CLO - 2,3,3
	(b)	Why is **Uniform Cost Search (UCS)** guaranteed to find the optimal solution, whereas **Depth-First Search (DFS)** is not? Explain in terms of path costs.	[3]	
	(c)	You are given an evaluation function $f(n) = g(n) + h(n)$. • Explain how **Greedy Best-First Search** utilizes this function (i.e., which part does it ignore?). • Explain how *A* Search* utilizes this function. • Which of the two is complete, and why?	[4]	
2.	(a)	Describe the **Hill Climbing** algorithm. Explain the concepts of a **Plateau** and a **Ridge**. Why are these considered problems for local search algorithms?	[4]	CLO - 2,3,4
	(b)	Briefly define **Linear Regression** and **Logistic Regression**. State the primary difference in the type of **output variable** (target) each model predicts.	[2]	
	(c)	A Data Scientist is building a model to predict the following: 1. The price of a house (in dollars). 2. Whether a loan application will be Approved (1) or Denied (0). 3. The daily temperature (in Celsius). 4. If an email is Spam or Not Spam. Classify which algorithm (Linear or Logistic) should be used for each case and briefly explain why.	[4]	
3.	(a)	What is vector in Machine Learning? Give a proper example. Distinguish between parameter and hyper-parameter.	[2]	CLO - 2,3,4
	(b)	What is the vanishing gradient problem? In which activation functions is it most severe, and why? Give at least two modern solutions to mitigate it.	[3]	

	(c)	Consider a single linear neuron: $y' = wx + b$ and MSE Loss: $L = \frac{1}{N}\sum_{i=1}^{N}(y_i - (wx_i + b))^2$ Compute $\partial L/\partial w$ and $\partial L/\partial b$ and write the final Batch Gradient Descent updates for w and b using learning rate η.	[5]	
4.	(a)	An input image of size 28×28×3 is convolved with a kernel of size 5×5×3. If stride=1 and no padding is used, calculate the exact output feature map size. Write the general formula for output dimension and explain each term.	[4]	CLO L-4,5,3
	(b)	Given the following sentence "The cat that chased the mouse that ate the cheese … was black." Explain why RNN forgets the subject "cat" after 15–20 words. How transformer model solves this problem?	[4]	
	(c)	Prove: AB+AB′C+A′BC=AB+AC+BC	[2]	

$AB + C(AB' + A'B) = AB + (AB) + BC$

$\Rightarrow AB + C(AB) = \text{''}$

$\Rightarrow AB + AC + BC = \text{''}$