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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]	

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	(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 ∂L/∂w and ∂L/∂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]	

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