



Daffodil International University
Faculty of Science & Information Technology
Department of Computer Science & Engineering
Final Examination, Summer 2025

Course Code: CSE445, Course Title: Natural Language Processing

Level: 3 Term:3 Batch: 62

Time: 02:00 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.	Explain the architecture and working principle of a Recurrent Neural Network (RNN). In your answer: - Describe how the hidden state is updated over time using the input vector, previous hidden state, and weight matrices (include the mathematical equations). - Explain the concept of vanishing and exploding gradients in RNNs and how they affect training. - Compare RNNs with LSTMs in terms of their ability to capture long-term dependencies.	10	CO3
2.	Define Large Language Models (LLMs) and explain their key characteristics. In your answer: - Describe what a <i>prompt</i> is and how it is used to interact with an LLM. - Discuss how prompt design can affect the quality and reliability of the model's output.	5	CO5
3.	Consider a simple feedforward neural network with: - Input layer: 2 neurons (x_1, x_2) - Hidden layer: 2 neurons with sigmoid activation - Output layer: 1 neuron with sigmoid activation - Loss function: Mean Squared Error (MSE) Given: - Inputs: $x_1=0.05, x_2=0.10$ - Target output: $y=0.01$ - Initial weights: - From input to hidden: $w_{1,1}=0.15, w_{2,1}=0.20$(to hidden neuron h1) $w_{1,2}=0.25, w_{2,2}=0.30$(to hidden neuron h2) - From hidden to output: $w_{h1,o}=0.40, w_{h2,o}=0.45$ - Biases: $b_{h1}=b_{h2}=0.35, b_o=0.60$ - Learning rate: $\eta=0.5$ After calculating MSE, you need to apply back propagation and adjust $w_{1,1} \rightarrow w_{1,2}$.	15	CO3
4.	A small dataset of short reviews about phones. We want to discover hidden topics such as Hardware (battery, camera, screen) and Service/Price (price, warranty, support).	10	CO2

