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Daffodil International University

Faculty of Science & Information Technology
Department of Computer Science and Engineering
Final Examination, Fall-2024
Course Code: CSE445, Course Title: Natural Language Processing
Level: 4 Term: 1 Batch: 61

Time: 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)	Describe topic modeling method with an example? Is topics modeling and topic distribution are same, Justify your answer?	[5]	CO2
	b)	Explain the components of Recurrent Neural Network (RNN) architecture with a diagram. How does an RNN work?	[5]	
2.	a)	How does speech analysis provide insights into human behavior and communication, and what factors affect its accuracy and effectiveness?	[5]	CO2
	b)	What tools are available for feature extraction from speech data, and which methods are used for noise reduction?	[5]	

3. Consider the following dataset:

Text	Vector Representation	Label
"The movie was fantastic!"	[1, 0, 0, 1, 0, 1, 1, 0, 0, 1]	1
"I didn't enjoy the film."	[0, 1, 1, 0, 1, 0, 0, 1, 1, 0]	0
"Amazing plot and acting!"	[1, 1, 0, 1, 0, 1, 0, 0, 0, 1]	1
"A terrible waste of time."	[0, 0, 1, 0, 1, 0, 1, 1, 1, 0]	0

Input Layer → Hidden Layer Weights (W1):

$$W1 = \begin{bmatrix} 0.3 \\ -0.2 \\ 0.6 \\ 0.1 \\ -0.4 \\ 0.5 \\ 0.2 \\ -0.1 \\ 0.7 \\ -0.3 \end{bmatrix}$$

A scalar bias for the hidden layer neuron $b1 = 0.2$
Hidden Layer → Output Layer Weight (W2):

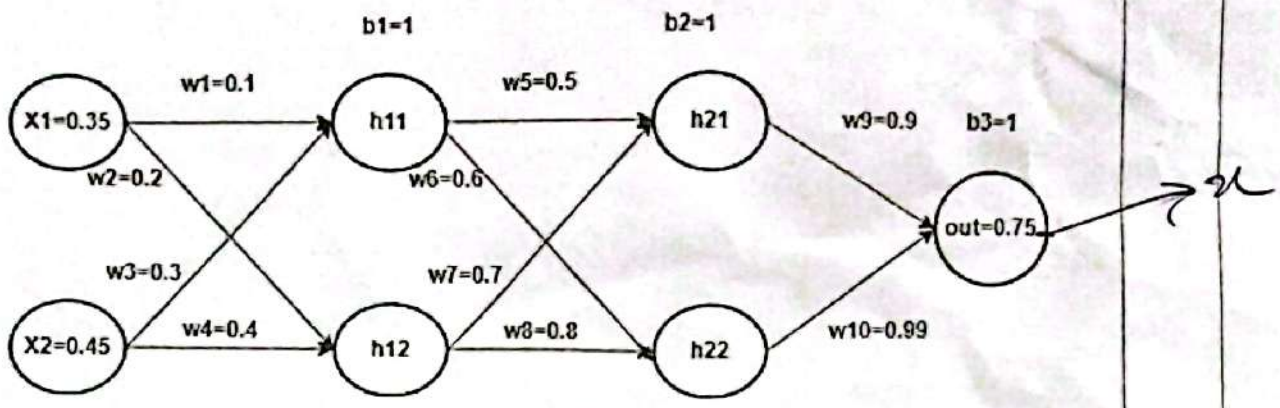
$$W2 = [0.8]$$

A scalar bias for the output layer neuron $b2 = -0.1$

a)	Draw the neural network based on the input vectors and weight matrices.	[2]	CO3
b)	Predict the class for the vector **[0,1,1,0,1,0,0,1,1,0]**. Assume ReLU as the activation function for the hidden layer and SoftMax for the classification function.	[6]	
c)	Calculate the error using mean square error.	[2]	

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বাকীতে : সনি

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4.	Consider the following Neural Network:  		
	When Activation and classification Function = Swish(x) = $\frac{x}{1+e^{-x}}$ If the learning rate is $\eta = 0.01$ calculate adjusted weight for w_9, w_5, w_{10}.	[10]	CO3