



INDIAN INSTITUTE OF INFORMATION  
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School of Electronics


CURRICULUM: HITUGECE22

Cycle Test – I

19, Sep.'22

Degree	B. Tech	Branch	ECE
Semester	V		
Subject Code & Name	ECPE12 / Artificial Neural Networks		
Time: 60 Minutes	Answer All Questions	Maximum: 20 Marks	

S. No.	Question	Marks
1.a	What are the key requirements and assumptions considered while building McCulloch-Pitts neuron model?	1
1.b	Using McCulloch-Pitts neuron model, implement the ANDNOT logic ( $x_1$ AND ( $NOT(x_2)$ )) considering 2 inputs $[x_1, x_2]$ .	2
1.c	Write a short note on the following: i. Why do the neural networks, viz., Hebb Net, Perceptron, and Adaline not provide a definite solution for XOR classification problem? ii. Why is it preferred to use the bipolar data over the Boolean data for training the perceptron network?	2
2.a	Why is it not preferred to use perceptron neural network for multi-output cases?	1
2.b	A single layer neuron with a bias has been trained to recognise the apples. The neuron will recognise an apple if the net input is greater than equal to 1.5 and generate an output of +1 otherwise if the net input is less than 1.5, the neuron will classify the fruit as not apple and generate an output of -1. Based upon the given statement, answer the following: i. What will be the type of the activation function in this neuron? ii. Which learning rules can be used to train this network?	2
2.c	i. What are the possible difficulties while choosing the non-linear activation functions. ii. Briefly discuss the principle of linear separability and how is it applicable in the domain of neural networks.	2
3.a	A two-input perceptron network has been trained to recognise the OR function for bipolar inputs and target values. At the end of the training process, the weights are obtained as $w_1 = 0.25$ , $w_2 = 2.5$ , $b = 0.5$ i. Discuss whether the obtained weights can perfectly classify an OR problem. ii. Also, sketch the decision boundary.	1

3.b	<p>In a food processing plant, a mechanism has been designed to sort the various types of fruits. The mechanism has different sensors to measure the various properties of the fruit, viz., 'Shape', 'Texture', and 'Weight' and the sensors will generate the following outputs:</p> <ul style="list-style-type: none"> <li>• <b>Shape:</b> If the shape is approximately round, sensor will generate an output of +1, otherwise it will generate -1.</li> <li>• <b>Texture:</b> If texture is smooth then sensor will generate an output of +1, otherwise it will generate -1.</li> <li>• <b>Weight:</b> If the weight is more than 200 grams, then sensor will generate an output of +1, otherwise it will generate -1.</li> </ul> <p>Design and train a Hebb net that can distinguish between an apple and a pineapple.</p>	2
3.c	<p>A perceptron network has to be trained to recognise the table and chairs. The network generates an output of +1 if it detects the table, otherwise it generates an output of -1. Assuming the feature vectors <math>x_1 = (1, 0.5)</math> and <math>x_2 = (2, 1)</math> represents the table and chair respectively, answer the following:</p> <ol style="list-style-type: none"> <li>Find and sketch a decision boundary for a perceptron network that will recognize these two vectors.</li> <li>Find weights and bias which will produce the decision boundary as in Qn. No. 3.c.(i), and sketch the network diagram.</li> <li>Determine the output when a test input <math>x_i = (1, 0)</math> is presented to the trained network using 3.c.(i) and (ii). Determine whether the designed perceptron NN is able to produce a response/decision? Explain.</li> </ol>	2
4.a	Discuss the significance of 'principle of minimal disturbance' used in ADALINE and MADALINE networks.	1
4.b	<p>Using LMS learning rule, design a NN that performs the following classification task:</p> <div style="text-align: center;">  <p><math>p_1</math>                      <math>p_2</math></p> </div> <p><b>Fig. 1: Sample dataset for classification.</b></p> <p>Consider dark region as +1 and white region as -1 in Fig. 1. Vectors <math>p_1</math> belongs to Class A (target value +1) and vector <math>p_2</math> does not belong to Class A (target value -1). Assume random initial weights and learning rate = 0.5; perform 1 epoch for training the network.</p>	2
4.c	<p>A Madaline network has been trained to recognise the AND logic using MRH algorithm for training. The network is generating an output of +1 while the target for that particular input vector is -1. Based on this assumption answer the following:</p> <ol style="list-style-type: none"> <li>What could be the possible reasons that the network is not generating a correct response?</li> <li>Discuss how the algorithm will chose a particular hidden Adaline unit for weight update?</li> </ol>	2

\*\*\*\*\* GOOD LUCK \*\*\*\*\*