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MAIN EXAMINATION

MAY – JULY 2019 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER AND LIBRARY SCIENCE

SPECIAL / SUPPLEMENTARY EXAMINATION

CMT 439:NEUTRAL NETWORK

Date: JULY 2019	**Duration: 2 Hours**
INSTRUCTIONS: Answer Question ONE and any other TWO Questions	

QUESTION ONE (30MARKS)

a) With the help of a suitable diagram, explain the structure of biological neurons. Also show how information flows in the neural system. **(10marks)**

b) Provide a brief history of artificial neural networks. **(5marks)**

c) Compare brains and traditional computers in five respects. **(5marks)**

d) Outline any four areas where artificial neural networks are used. **(4marks)**

e) A 4-input neuron has weights 1,2,3 and 4. The transfer function is linear with the constant of proportionality being equal to 2. The inputs are 4,10,5 and 20 respectively. Determine the output. **(6marks)**

QUESTION TWO (20 MARKS)

a) Describe the following learning methods. **(12marks)**

i. Perceptron

ii. Least mean square

iii. Back propagation

b) Use a diagram to explain why an exclusive OR function is not linearly separable. **(4marks)**

c) Explain the LMS Gradient Descent method. **(4marks)**

QUESTION THREE (20 MARKS)

a)With a supervised learning algorithm, we can specify target output values, but we may never get close to those targets at the end of learning. Give two reasons why this might happen.

(4marks)

b) Distinguish between feed forward network and a recurrent network. **(4marks)**

c) Describe the competitive process of the self-organizing map algorithm. **(6marks)**

d) In a 2-D self-organizing map with input vectors of dimension m, and k neurons in the map, how many weights will these have? **(2marks)**

e) Explain how we can use a layer of Adalines to perform classification for more than two classes. **(4marks)**

QUESTION FOUR (20 MARKS)

a) What are the main stages in the pattern recognition process? Describe with examples, the concepts of feature vectors and discriminant functions in this context. **(10 marks)**

b) i. Write down the energy function of a discrete Hopfield net. **(4marks)**

ii. Compute the weight matrix for a 4-neuron Hopfield net with the single fundamental memory $\xi_1 = [1,–1, –1, 1]$ stored in it. **(6marks)**

QUESTION FIVE (20 MARKS)

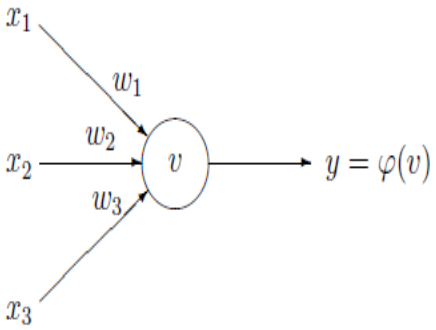
a) Explain how the hidden layer of a RBF network is different from the hidden layer in a MLP. Explain this difference in terms of:

i. What the hidden nodes compute when feeding data to the network **(4marks)**

ii. How this affects the shape of the discriminant when using the networks for classification **(4marks)**

ii. How the hidden nodes are trained in MLPs and RBF **(4marks)**

b) Consider the unit shown below.



Suppose that the weights corresponding to the three inputs have the following values:

$w_1 = 2$
$w_2 = -4$
$w_3 = 1$

and the activation of the unit is given by the step-function:

$$\varphi(v) = \begin{cases} 1 \text{ if } v \geq 0 \\ 0 \text{ otherwise} \end{cases}$$

Calculate what will be the output value y of the unit for each of the following input patterns. **(8marks)**

Pattern	**P_1**	**P_2**	**P_3**	**P_4**
X_1	**1**	**0**	**1**	**1**
X_2	**0**	**1**	**0**	**1**
X_3	**0**	**1**	**1**	**1**

END