Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
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SEVENTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION - NOV/DEC 2016
SUBJECT: SOFT COMPUTING TECHNIQUES (ECE - 425)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates
- Answer **ANY FIVE** full questions.
- Missing data may be suitably assumed.

1A. Design a single layer perceptron classifier to perform the following classification using Linear Discriminant Classifier:

$\left(P1=\begin{bmatrix}-1\\1\end{bmatrix},t1=-1\right),\left(P2=\begin{bmatrix}-1\\-1\end{bmatrix},t2=-1\right),\left(P3=\begin{bmatrix}0\\0\end{bmatrix},t3=1\right),\left(P4=\begin{bmatrix}1\\0\end{bmatrix},t4=1\right)$

Test the classifier for the following test vectors:

$\left(P5=\begin{bmatrix}2\\0\end{bmatrix},P6=\begin{bmatrix}-0.5\\1\end{bmatrix},P7=\begin{bmatrix}0\\1\end{bmatrix},P8=\begin{bmatrix}-1\\-2\end{bmatrix}\right)$.Draw the network architecture. Plot the patterns on a 2-D Euclidian space and illustrate the discriminant analysis principle

1B. Perform two training steps of Widrow Hoff learning rule for the following training data:

$\left(X1=\begin{bmatrix}2\\0\\-1\end{bmatrix},d1=-1\right),\left(X2=\begin{bmatrix}1\\-2\\-1\end{bmatrix},d2=1\right)$.Assume η=1. The initial weights are $w^1=\begin{bmatrix}1 & 0 & 1\end{bmatrix}^t$

1C. Explain different ways in which bitmap images of alphabets C, I, T can be presented to the input of a neural network. Assume a 3×3 pixels in all cases.

(5+3+2)

2A. Analyze a single feed forward and back propagation step for a two layered feed forward network with the following data: The transposed weight matrices for both the layers are:

1st layer

$V=\begin{bmatrix}-0.5 & -1\\1 & -1\end{bmatrix}$

2nd layer

$W=\begin{bmatrix}-0.5 & -1 & -1\end{bmatrix}$

The input to the network p = 0.25 and the bias input is -1.The desired output is d= cosπp. Use unipolar continuous neurons in the first layer and f (net) =net in the 2nd layer .Assume η=1.

2B. Explain the architecture of a Probabilistic Neural Network with the help of its architecture.

2C. Mention any one advantage and disadvantage of a Support Vector Machine Classifier

(5+3+2)

3A. Design a recurrent auto associative memory to store the following patterns:
$s1 = [1\ 1\ 1\ -1]^t, s2 = [1\ 1\ -1\ 1]^t, s3 = [-1\ -1\ 1\ 1]^t$, Perform asynchronous update by considering the test pattern as $s0 = [1\ -1\ -1\ 1]^t$.Assume sgn (0) =1. Also determine the energy function in each step.

3B. The initial transposed weight matrix of a Kohenen's feature map is given by:

$$W = \begin{bmatrix} 0.1 & 0.5 & 1 \\ 0.01 & 0.5 & 0.03 \\ 0.9 & 0.6 & 0.1 \end{bmatrix}$$.Perform single step training for the input vector, X1 = $[0.2\ 0.5\ 0.14]^t$. Assume α=0.8, R=1. Use correlation metric to find the winner.

3C. In evaluating a certain classifier performance, if there are a total of N=1000 patterns and the accuracy obtained is 80%, find the cost of classification for the following cost matrix:

Cost matrix	Predicted class		
Actual class	C(i/j)	+	-
	+	-2	10
	-	10	-2

(5+3+2)

4A. A temporal associative memory needs to be designed for recall of the following sequence:
$s^{(1)} = [1\ \ -1\ \ 1\ 1\ \ -1]^t$, $s^{(2)} = [-1\ \ -1\ \ 1\ -1\ \ 1]^t$,$s^{(3)} = [-1\ \ 1\ \ 1\ -1\ \ -1]^t$
Compute the weight matrix W and check the recall of patterns in the forward directions. Assume bipolar binary activation function.

4B. What is Mexican hat and hexagonal neighbourhood competitive learning? Explain with illustration

4C. Illustrate the difference between:

i) Auto & hetero associative memories
ii) Pattern classification & recognition

(5+3+2)

5A. Explain fuzzy rule base and fuzzy inference engines with appropriate illustration

5B. Perform 2 steps of winner take all learning steps for the following data using linear neurons:
$W^t = \begin{bmatrix} 0.1 & -0.5 \\ -0.8 & 1 \end{bmatrix}$ $X_1 = [0.5\ \ -0.5]^t$ $X_2 = [-0.8\ \ 0.1]^t$ & α = 0.8.

5C. Explain briefly how the hamming distance between stored and test patterns affect the retrieval capacity of associative memories with illustration

(5+3+2)

6A. Find the crisp output for the membership shown in **Fig Q6A**, using centre of gravity defuzzification.

6B. Design and test a bidirectional hetero associative memory to store the following pairs of patterns:
$A^1 = [1\ \ 1]^t; B^1 = [-1\ \ -1\ \ -1]^t$; $A^2 = [-1\ \ -1]^t; B^1 = [1\ \ 1\ \ 1]^t$. Draw the memory architecture.

6C. Using Genetic algorithm, optimize the nonlinear function $f(x) = x^2$, for $0 \leq x \leq 3$, where x is an integer. Illustrate the basic concept with one iteration only.

(5+3+2)

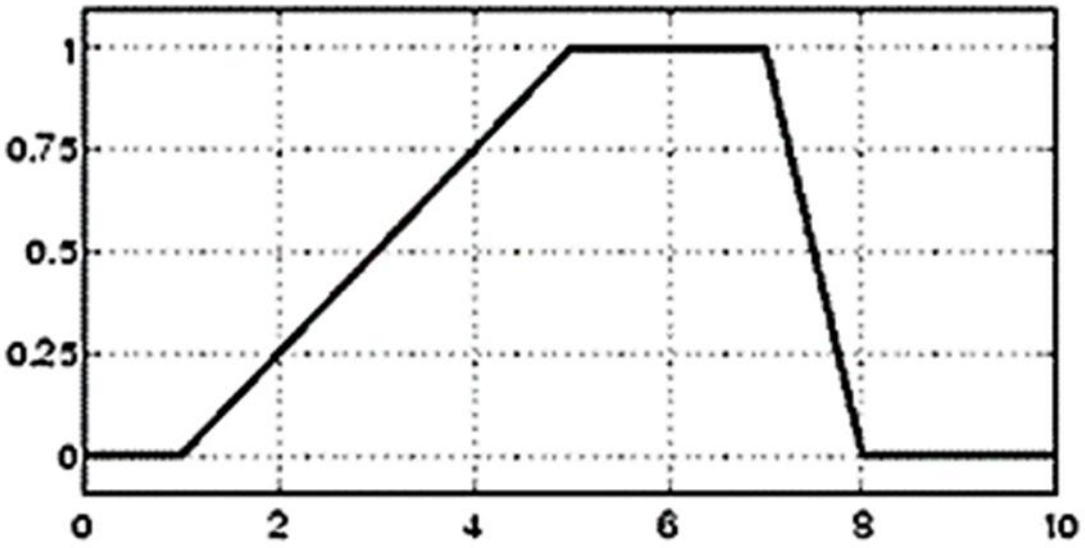

Fig. Q6A