Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

SEVENTH SEMESTER B.Tech. (E & C) DEGREE END SEMESTER EXAMINATION
NOV/DEC 2017
SUBJECT: SOFT COMPUTING TECHNIQUES (ECE - 425)

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

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

1A. Explain with illustration how XOR classification is performed using multilayer perceptron neural network with bipolar discrete neurons

1B. Design a Hopfield auto associative memory to store S_1= [-1 -1 -1]^t. Test the retrieval by applying a test vector S_{test} = [1-11]^t using async update and find the energy after each iteration. Comment on your results.

1C. Design a linear discriminant classifier to perform logical OR classification

(5+3+2)

2A. Perform single step back propagation algorithm to simulate a non-linear function $y = sinz$. The input z = 90. and the augmented input is -1. Assume linear neurons in both layers. The initial weights for the first layer is $V^t = \begin{bmatrix} 1 & 0.5 \\ 0 & -1 \end{bmatrix}$ and for the second layer $W^t = [1 \quad 1 \quad -1]$. Assume $\eta = \lambda = 1$.

2B. Design a bidirectional associative memory to store the following pairs of patterns:
[1 -1 1] → , [-1 -1]^t and [11-1]->[1 1] and test the performance.

2C. Draw McCulloch Pitt neuron model for NAND logic

(5+3+2)

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

$$W^t = \begin{bmatrix} -0.5 & 1 & 0 \\ 1 & 2 & 3 \\ 0 & 1 & 0 \end{bmatrix}$$

Perform single step training for the input [1 0.05 0.4]. Use correlation metric for winner selection. Assume α=1, R=0.

3B. A linear classifier is to be trained to assign x_1=-1 and x_2=1 to class 1 & 2 respectively. Display the movement of weight vector on the weight plane starting from the initial weights of [0 1]^t and perform iteration for 4 steps only. Use c=1 and bias input = -1.

3C. A feed forward network consists of 1 hidden layer and 1 output layer. The input vector is $X = [x1 \quad x2 \quad -1]^t$ and the weight matrices for both the layers are given by $W_1^t = \begin{bmatrix} 1 & -1 & 0 \\ 0 & 2 & 3 \\ 0 & -2 & 1 \end{bmatrix}$ W_2^t= [1 1 1 2.5] respectively. Find the regions of classification for which the network output responds with +1 and its complement with -1.

(5+3+2)

4A. Draw the flowchart for function optimization using Genetic Algorithm. Find the maximum value of the function f(x) = 2x-1, $0 \le x \le 3$, using Genetic algorithm with the initial population as 1101, 1011,1100,0110. Comment on your answer.

4B. Consider the following fuzzy relation defined on U1×U2×U3×U4 where U1={a, b, c} U2={s, t} U3={x, y}& U4={i, j}:

$$Q = {}^{0.7}\!/_{b,t,y,i} + {}^{0.1}\!/_{a,s,x,i} + {}^{0.1}\!/_{b,s,y,i} + {}^{0.9}\!/_{b,s,y,j} + {}^{0.5}\!/_{a,t,y,j} + {}^{0.6}\!/_{c,s,y,i}$$

i) Compute the projections of Q on U1

ii) Compute the cylindrical extensions of the projections in i) to U1×U2×U3×U4

4C. Explain convexity of a fuzzy set with example

(5+3+2)

5A. Draw the network architecture of a Probabilistic Neural Network (PNN) and bring out at least 3 differences between Multilayer perceptron –back propagation and PNN network.

5B. Explain the structure and properties of fuzzy rule base with illustration

5C. Consider the following fuzzy relations:

$$Q1 = \begin{pmatrix} 0.2 & 1 & 1 \\ 0.8 & 0.5 & 0.6 \\ 0.7 & 1 & 0.3 \end{pmatrix} \quad Q2 = \begin{pmatrix} 1 & 1 & 0.8 \\ 0.5 & 0.1 & 0.7 \\ 0.9 & 0.04 & 0.2 \end{pmatrix}$$

Perform Q2 o Q1 by max-product composition

(5+3+2)

6A. Design a simple fuzzy rule based system to simulate a non-linear function Y=cos X, where *X* is defined in the universe [0 180] and *Y* is defined in the universe [-1 1] .Use Mamadani minimum implication with min for t-norm operator and max for s-norm operator. Use weighted average defuzzifier and test by applying the following fuzzy singletons: $X = 0, 90,180$.

6B. Define validation, sensitivity and specificity for a classifier in general.

6C. Given the fuzzy sets $A = \frac{1}{1} + \frac{0.2}{2} + \frac{0.5}{3} + \frac{0.8}{4} + \frac{0.1}{5}$ and $B = \frac{0.3}{1} + \frac{0.6}{2} + \frac{0.7}{3} + \frac{0.8}{4} + \frac{1}{5}$, determine Fuzzy intersection by algebraic product

(5+3+2)

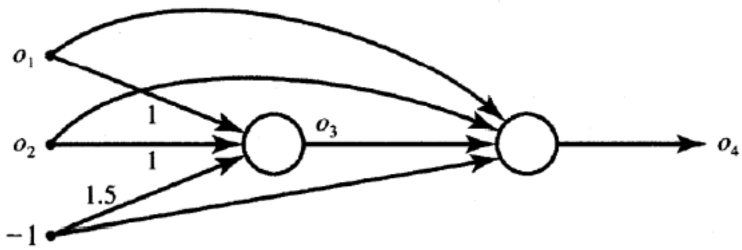

Fig. Q2C