No. of Printed Pages : 5

MMTE-007

M.Sc. (MATHEMATICS WITH APPLICATIONS IN COMPUTER SCIENCE)

M.Sc. (MACS)

00801

Term-End Examination

December, 2017

MMTE-007 : SOFT COMPUTING AND ITS APPLICATIONS

Time : 2 hours *Maximum Marks : 50*

(Weightage : 50%)

Note :

(i) *Question no. 7 is* ***compulsory.***

(ii) *Attempt any* ***four*** *questions from questions no. 1 to 6.*

(iii) *Use of non-programmable scientific calculator is allowed.*

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1. (a) How do classical sets differ from fuzzy sets ? Consider the two given fuzzy sets A and B.

$$A = \left\{\frac{1}{2} + \frac{0{\cdot}3}{4} + \frac{0{\cdot}5}{6} + \frac{0{\cdot}2}{8}\right\} \text{ and}$$

$$B = \left\{\frac{0{\cdot}5}{2} + \frac{0{\cdot}4}{4} + \frac{0{\cdot}1}{6} + \frac{1}{8}\right\}$$

Perform Union, Intersection, Complement and Difference operations over fuzzy sets A and B. *6*

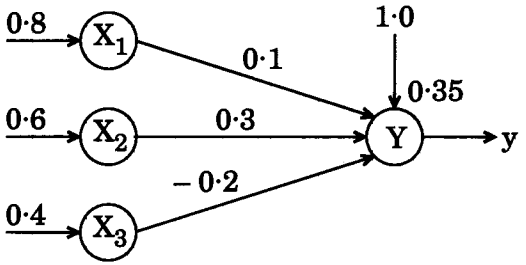
(b) Compare and contrast the following with suitable examples : 4

(i) Crisp K-NN classification technique and Fuzzy K-NN classification technique

(ii) Supervised pattern recognition and Unsupervised pattern recognition

2. (a) Implement AND function using McCulloch-Pitts neuron. 5

(b) Obtain the output of the neuron Y for the network given below using activation function as (i) binary sigmoidal, and (ii) bipolar sigmoidal : 5



3. (a) Find the weights required to perform the following classification using perceptron network :

The vectors (1, 1, 1, 1) and (– 1, 1, – 1, – 1) are belonging to the class (so have target value 1), vectors (1, 1, 1, – 1) and (1, – 1, – 1, 1) are not belonging to the class (so have target value – 1).

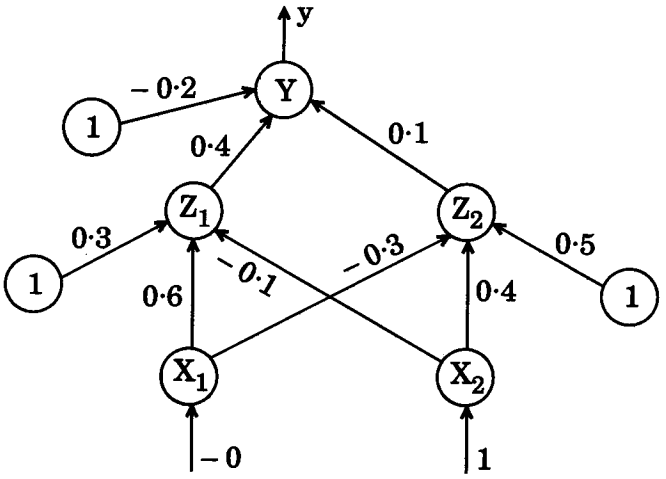
Assume learning rate as 1 and initial weights as 0. 6

(b) Two fuzzy relations are given by

$$R = \begin{array}{c} \\ x_1 \\ x_2 \end{array}\begin{array}{c} \begin{array}{cc} y_1 & y_2 \end{array} \\ \begin{bmatrix} 0{\cdot}6 & 0{\cdot}3 \\ 0{\cdot}2 & 0{\cdot}9 \end{bmatrix} \end{array} \text{ and } S = \begin{array}{c} \\ y_1 \\ y_2 \end{array}\begin{array}{c} \begin{array}{ccc} z_1 & z_2 & z_3 \end{array} \\ \begin{bmatrix} 1 & 0{\cdot}5 & 0{\cdot}3 \\ 0{\cdot}8 & 0{\cdot}4 & 0{\cdot}7 \end{bmatrix} \end{array}.$$

Obtain fuzzy relation T as a composition between these fuzzy relations. *4*

4. Using back-propagation algorithm, find the new weights for the following network [perform one iteration] :



Given that :

(a) Input pattern is [0, 1].

(b) Target output is 1.

(c) Learning rate $\alpha = 0{\cdot}25$.

(d) Activation function is binary sigmoidal. *10*

5. (a) Generate the population in the next iteration using Roulette-Wheel criterion. *6*

k	1	2	3	4	5
F_k	3·5	4·6	5	2·8	1·8

(b) Write a formula describing the function defined by one-hidden-layer (already trained) MLP with a single output. Also, write a formula describing the function by a RBFN with a single output. How do they differ ? *4*

6. (a) Use a binary-coded Genetic Algorithm (GA) to minimize the function

$$f(x_1, x_2) = x_1 + x_2 - 2x_1^2 - x_2^2 + x_1 x_2$$
$$0 \le x_1, x_2 \le 5.$$

Use a random population of size N = 6, a single point crossover with probability $P_c = 1$ and neglect mutation. Assume 3 bits for each variable. Perform one iteration. *6*

(b) Take any two fuzzy sets and verify any one of De Morgan's laws graphically and numerically. *4*

7. State, giving reasons, whether the following statements are *True* or *False* : *5×2=10*

(a) A multilayer network with linear transfer function is equivalent to a single-layer network.

(b) If a Genetic Algorithm is to be used to evolve a binary string of length n containing only 1's, and the initial population is a randomly generated set of binary strings of length n, then the suitable fitness function would be the sum of 1's in the string.

(c) In the Hopfield network, the neurons belonging to the same layer receive inputs from the neurons of the previous layer and send their values only to neurons of the next layer.

(d) Radial Basis Function (RBF) network is a local network.

(e) The length of chromosomes to determine the maximum value of the set

$S = \{x \mid 0 \leq x \leq 4096\}$ is 12.