Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL (A constituent Institution of MAHE, Manipal)

## VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING) MAKE-UP EXAMINATIONS, DECEMBER 2017

## SUBJECT: SOFT COMPUTING [ELE 4026]

REVISED CREDIT SYSTEM

Time: 3 Hours	Date: 26, December 2017	Max. Marks: 50

## **Instructions to Candidates:**

- ✤ Answer ALL the questions.
- Missing data may be suitably assumed.
- 1A. Write the expressions for the following:(i) Yager compliment (ii) Dubois-Prade S-norm
- 1B. A linguistic variable AGE described in a universe of discourse [5:100] has linguistic values "child", "young" and "old". Obtain suitable triangular membership function for each linguistic value. (04)
- 1C. Two linguistic variables "large" and "low" are defined as given below:

$$\operatorname{large} = \left\{ \frac{0.5}{x_1} + \frac{1}{x_2} + \frac{0.6}{x_3} \right\}; \quad \operatorname{low} = \left\{ \frac{1}{y_1} + \frac{0.4}{y_2} \right\}; \quad \operatorname{NOT} \operatorname{large} = \left\{ \frac{0.6}{x_1} + \frac{0.9}{x_2} + \frac{0.7}{x_3} \right\};$$

Given fuzzy inference,

Flux is NOT large

If Flux is Large Then Speed is low

Speed is NOT low

Determine the fuzzy set "NOT low" using

- (i) Zadeh implication and
- (ii) Dienes-Rescher implication.
- 2A. A neural network has one layer of two neurons. The available information of the

network are W = 
$$\begin{bmatrix} 2 & -1 \\ 0.5 & 0.75 \end{bmatrix}$$
, Bias =  $\begin{bmatrix} 1 & -0.5 \end{bmatrix}^t$  and O =  $\begin{bmatrix} 0.28 & -0.73 \end{bmatrix}^t$ .

Biasing input = -1. The activation function is bipolar continuous with  $\lambda$  = 1.25. Determine the input matrix X and sketch the neural network. (04)

2B. The membership function of a fuzzy set Y is defined as follows in a universe of discourse U:[0:4]

 $\mu(y) = \begin{cases} 0.25 * y^2 & 0 \le y \le 2\\ 1 & 2 \le y \le 3\\ 4-y & 3 \le y \le 4 \end{cases}$ 

Sketch the membership function and determine the crisp value Y\* using centroid defuzzification method.

(04)

(02)

(04)

2C. Consider the fuzzy sets

$$A = \left\{ \frac{0.4}{1} + \frac{0.7}{2} + \frac{1}{3} + \frac{0.8}{4} \right\} \text{ and } B = \left\{ \frac{0.2}{1} + \frac{0.6}{2} + \frac{0.9}{3} + \frac{0.7}{4} \right\}, \text{ prove that } \overline{A \cup B} = \overline{A} \cap \overline{B}$$
 (02)

3A. Design a bipolar discrete neural model such that the input pattern lies in the shaded region shown in below.



- 3B. Explain the following terms with relevant illustrations:
  (i) Auto-association
  (ii) Hetero-association
  (iii) Supervised learning
  (03)
- <sup>3C.</sup> The initial weight matrix of a neural network is  $\mathbf{W}^{(0)} = \begin{bmatrix} 1 & -1 & 0 & 0.5 \end{bmatrix}^t$ . The set of input training vectors and desired responses are given below:

$$X_1 = \begin{bmatrix} 1 & -2 & 0 & -1 \end{bmatrix}^t; \quad X_2 = \begin{bmatrix} 0 & 1.5 & -0.5 & -1 \end{bmatrix}^t; \ d_1 = -1; \quad d_2 = -1;$$

Assuming learning constant c = 0.4 and  $\lambda = 1$  for bipolar sigmoidal activation function, determine the modified weights at the end of one cycle using delta learning rule.

4A. A neural network has two neurons in its hidden layer with biasing synaptic weight of -0.5 for each neuron connected to a single input X. The output layer has five neurons with biasing synaptic weight of -1 for each neuron. The biasing signal for all neurons is -1. The activation function for hidden layer is unipolar sigmoidal while the output neurons have their activation function defined by f(net)=net. Hidden layer weights

are Y = 
$$[0.5 \ 0.8]^{t}$$
. Output layer weights are W =  $\begin{bmatrix} 1 & 0.7 & 0.5 & 0.6 & 0.91 \\ 0.5 & 1 & 1 & 0.9 & 1 \end{bmatrix}$ 

Sketch the network described as above.

If the desired output  $0 = [6 \ 7 \ 8 \ 9 \ 10]^t$  for an input X = 4, determine the output error matrix.

- 4B. Using genetic algorithm, find the maximum value of the given function  $y = e^{-(x-3)^2}$  where 1 < x < 5 using 5 bit binary string. The initial population given are  $[1\ 0\ 0\ 0\ 1]$ ,  $[0\ 0\ 1\ 1\ 0]$ ,  $[1\ 0\ 1\ 0\ 0]$ ,  $[0\ 1\ 0\ 1\ 1]$ . (04)
- 5A. Design a neural network to perform the following classification:

Class A :  $x_1 = (0.5, 1)$ ,  $x_2 = (2, 1)$  and  $d_1 = -1$ 

Class B :  $x_3 = (-1, 1)$ ,  $x_4 = (-2, 1)$  and  $d_2 = 1$ 

Assume that there is no biasing signal, the learning constant as 0.5 and initial weight vector as  $[2, 1.5]^t$ .

5B. It is required to store two patterns  $S_1 = [1 - 1 1 - 1]^t$  and  $S_2 = [-1 1 - 1 1]^t$  in an associative memory using Hopfield network. Obtain the suitable weight matrix. For asynchronous mode of bit transfer, draw the state transition diagram when the input for the network is  $[1 1 1 1]^t$ . Calculate the energy level for the initial and final state in the transition diagram. (05)

(06)

(05)

(04)