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

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

MAKE-UP EXAMINATIONS, MAY 2018

SUBJECT: SOFT COMPUTING [ELE 4026]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 05, May 2018** **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 **(02)**

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:

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

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. **(04)**

2A. A neural network has one layer of two neurons. The available information of the network are $W = \begin{bmatrix} 2 & -1 \\ 0.5 & 0.75 \end{bmatrix}$, $\text{Bias} = \begin{bmatrix} 1 & -0.5 \end{bmatrix}^t$ and $O = \begin{bmatrix} 0.28 & -0.73 \end{bmatrix}^t$.

Biasing input = -1. The activation function is bipolar continuous with λ = 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]

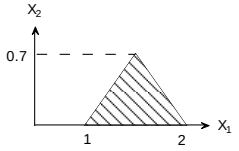
$$\mu(y) = \begin{cases} 0.25 * y^2 & 0 \le y \le 2 \\ 1 & 2 \le y \le 3 \\ 4 - y & 3 \le y \le 4 \end{cases}$$

Sketch the membership function and determine the crisp value Y* using centroid defuzzification method. **(04)**

2C. Consider the fuzzy sets

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

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



(03)

3B. Explain the following terms with relevant illustrations: **(03)**

(i) Auto-association (ii) Hetero-association (iii) Supervised learning

3C. The initial weight matrix of a neural network is $W^{(0)}=[1 \quad -1 \quad 0 \quad 0.5]^t$. The set of input training vectors and desired responses are given below:

$$X_1 = [1 \quad -2 \quad 0 \quad -1]^t; \quad X_2 = [0 \quad 1.5 \quad -0.5 \quad -1]^t; \; d_1 = -1; \quad d_2 = -1;$$

Assuming learning constant c = 0.4 and λ = 1 for bipolar sigmoidal activation function, determine the modified weights at the end of one cycle using delta learning rule. **(04)**

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 $O = [6 \; 7 \; 8 \; 9 \; 10]^t$ for an input X = 4, determine the output error matrix. **(06)**

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 $[2, 1.5]^t$. **(05)**

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)**