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

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)
END SEMESTER EXAMINATIONS, NOVEMBER 2018
SUBJECT: SOFT COMPUTING [ELE 4026]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 24, November 2018** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Graph sheet shall be supplied, if required.
- Missing data may be suitably assumed.

1A. Define the following terms used in fuzzy system:
(i) support (ii) alpha-cut (iii) convex (iv) height ***(04)***

1B. Given two relations R_1 and R_2 as shown below,

R_1 = SPEED

	TORQUE T_1	T_2	T_3
50	0.2	0.7	0.5
75	0.6	0.8	1.0
90	0.5	0.8	0.6
100	0.1	0.4	1.0

R_2 = TORQUE

	POWER 100	500
T_1	0.6	0.1
T_2	0.4	0.8
T_3	0.5	1.0

Obtain
(i) composition Q = R_1 o R_2
(ii) projection of Q on speed and
(iii) projection of Q on power ***(03)***

1C. Let 'a' = $\mu_A(x) = 0.52$ and 'b' $= \mu_B(x) = 0.79$. Calculate the following:
(i) S-norm DOMBI class with $\lambda = 0.2$
(ii) T-norm DUBOI-PRADE class with $\alpha = 0.5$
(iii) Compliments of 'a' and 'b' by YAGER class with $w = 3$ ***(03)***

2A. Two linguistic variables A and B are defined as given below:

$$A = \left\{\frac{0.5}{X_1} + \frac{1.0}{X_2} + \frac{0.6}{X_3}\right\} \quad B = \left\{\frac{1.0}{Y_1} + \frac{0.4}{Y_2}\right\} \quad \text{and } B' = \left\{\frac{0.8}{Y_1} + \frac{0.5}{Y_2}\right\}$$

Given fuzzy inference,

Y is B′
IF X is A THEN Y is B
X is A′

Find A′ using (i) Lukasiewicz implication (ii) Zadeh implication. ***(03)***

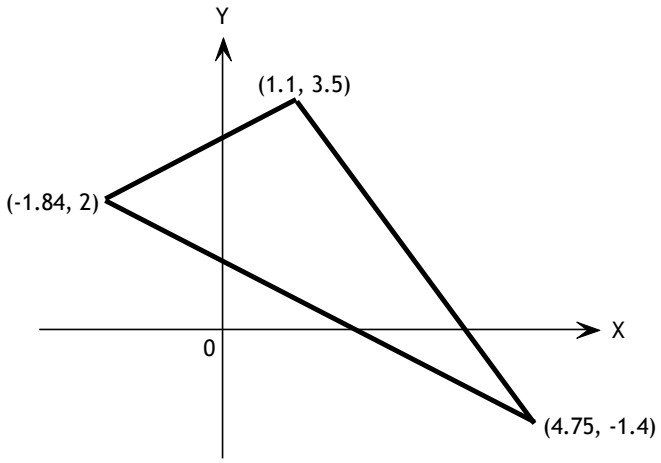
2B. A fuzzy controller is to be designed to estimate change in voltage required for a voltage regulator to maintain constant voltage across its terminals. The two inputs to Fuzzy controller are error and change in error, the output being change in voltage. All parameters are defined in universe of discourse [-1 to +1]. The design shall include

(i) Linguistic values and respective equations for triangular membership functions for all linguistic variables considered

(ii) List of IF-THEN rules required

For sample input of error = - 0.8 and change in error = 0.5, calculate crisp value of change in voltage using weighted average method of defuzzification. ***(07)***

3A. Design and sketch a discrete neural network such that any point inside the triangle shown in figure is the solution.



(04)

3B. A neural network has one layer consisting of two neurons. The available information of the network are $W = \begin{bmatrix} 2 & -1 \\ 0.5 & 0.75 \end{bmatrix}$ Bias = $\begin{bmatrix} 1 \\ -0.5 \end{bmatrix}$ and O = $\begin{bmatrix} 0.28 \\ -0.73 \end{bmatrix}$

Biasing input = -1. The activation function is bipolar continuous with λ = 1.25. Sketch the neural network and determine the input matrix X. ***(03)***

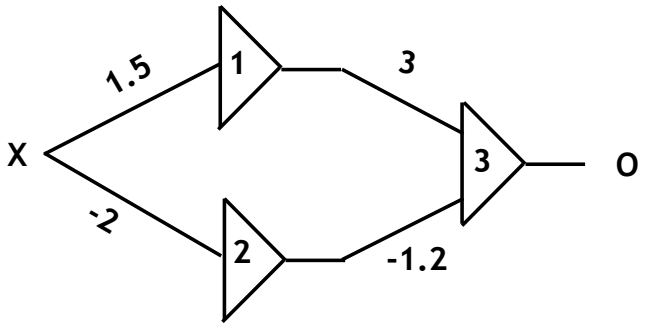
3C. Design a neural network for the following classification:

P_1 (0.8, 0.9), P_2 (2.1, 3.5) and P_3 (-2, -1.3) belongs to Class A (output = -1)

P_4 (2.1, 0.9) and P_5 (-2, 0.5) belongs to Class B (output = +1)

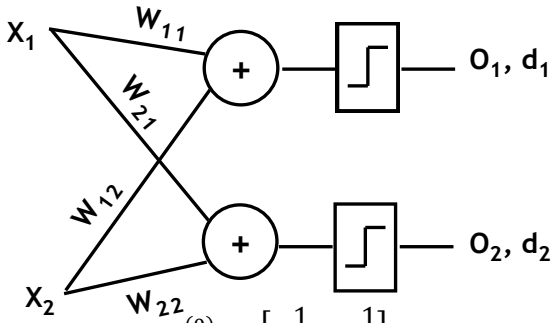
Sketch the designed network and indicate respective synaptic weights and biasing weights. ***(03)***

4A. In the network shown in figure below, Neurons 1 and 2 are bipolar sigmoidal with λ = 1.25 and neuron 3 has an activation function O= f(net) = net. For a given input X = 0.7, the desired output is 3. Modify all weights using back propagation algorithm for one iteration assuming learning constant as 0.8.



(05)

4B. A two input - two output neural network is as shown in figure.



The initial weight matrix is given as $W^{(0)} = \begin{bmatrix} 1 & 1 \\ -0.5 & 1 \end{bmatrix}$.

The input patterns at two instances are $X^{(1)} = \begin{bmatrix} 2.5 \\ -3.1 \end{bmatrix}$ and $X^{(2)} = \begin{bmatrix} -1.2 \\ -2 \end{bmatrix}$ and respective desired outputs are $d^{(1)} = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$ and $d^{(2)} = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$.

Determine the modified weight matrix at the end of one iteration using Perceptron learning rule. Assume learning constant c = 1 ***(05)***

5A. A single layer Hopfield feedback network is required to store the following bit patterns:

$$S_1 = \begin{bmatrix} 1 \\ -1 \\ -1 \\ 1 \end{bmatrix} \quad S_2 = \begin{bmatrix} -1 \\ 1 \\ -1 \\ -1 \end{bmatrix} \text{ and } \quad S_3 = \begin{bmatrix} 1 \\ 1 \\ -1 \\ 1 \end{bmatrix}$$

Calculate the weight matrix required and draw the neural network indicating all weights on the diagram. Obtain energy level for each pattern. ***(04)***

5B. Genetic algorithm is employed to determine minimum value of given the function $y = e^{-(x-3)^2}$ where 1 < x < 4 using 5 bit binary string.

The initial population given are [1 0 1 0 1], [0 0 1 1 0], [1 1 1 0 0], [0 1 0 1 1].

For one iteration, obtain

(i) ranking of chromosomes (ii) crossover (iii) mutation and (iv) replacement. ***(06)***