QPC: RN23PHD406 AY 23 Reg. No

GIET UNIVERSITY, GUNUPUR – 765022

Ph.D. (First Semester) Examinations, January – 2024

23SPPEEE1012 - Artificial Neural Networks and Fuzzy Logic System

(EEE)

Time: 3 hrs Maximum: 70 Marks

The figures in the right hand margin indicate marks.

Answer ANY FIVE Questions (14 x 5 = 70 Marks)

Marks

1.a. Design a AND gate using perceptron network. 8

b. Explain why XOR-problem cannot be solved by a Single-Layer Perceptron and how it is solved by a Multi-Layer Perceptron. 6

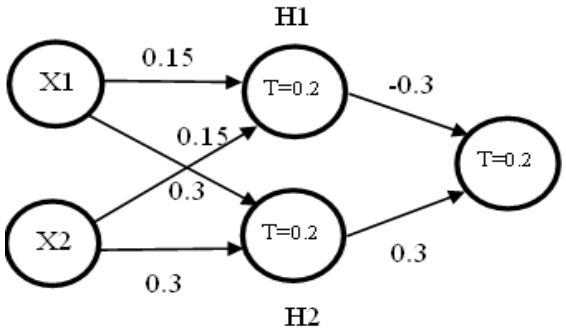
2.a. Using Madaline neural network, implement XOR function with bi-polar input and targets. Assume the required parameters for training of the network.

The training pattern for XOR- function is given in the Table-1.

x_1	x_2	1	t
1	1	1	-1
1	-1	1	1
-1	1	1	1
-1	-1	1	-1

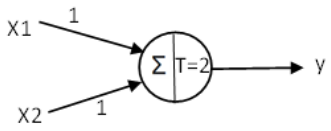
14

3.a. Draw a table of input and output for the network and identify the logic gate.



10

b. Identify the logic function realized by



4

4.a. What is feedback neural network architecture? Draw the single-layer recurrent network and multi-layer recurrent network. 8

b. Define membership function and state its importance in fuzzy logic. 6

5.a. State and prove D'Morgan's Laws for the following fuzzy set 6

$$A = \{(x_1, 0.2), (x_2, 0.3), (x_3, 0.7)\}$$

$$B = \{(x_1, 0.3), (x_2, 0.9), (x_3, 0.5)\}$$

b. Consider two fuzzy sets A=$\left\{\frac{0.3}{1} + \frac{0.3}{2} + \frac{0.4}{3} + \frac{0.5}{4}\right\}$ and B=$\left\{\frac{0.1}{1} + \frac{0.2}{2} + \frac{0.2}{3} + \frac{1}{4}\right\}$ 8

Find the bounded sum and bounded difference of the given fuzzy sets.

6.a. Consider the following two fuzzy sets

A=$\left\{\frac{0.3}{x1} + \frac{0.7}{x2} + \frac{1}{x3}\right\}$ and B=$\left\{\frac{0.4}{y1} + \frac{0.9}{y2}\right\}$ Perform the cartesian product over these given sets. 8

b. Two fuzzy sets are given as 6

	x_1	x_2	x_3	x_4	x_4
A	0.1	0.2	0.3	0.6	0
B	0.3	0.4	0.5	0.7	0.8

Find (i) $(A \cap B)_{0.6}$ (ii) $(B \cup \bar{A})_{0.6}$

7.a. What do you mean by defuzzification in fuzzy logic control system? Mention different methods of defuzzification process. A fuzzy set C is described by the equation. 10

$$\mu_c(z) = \begin{cases} \frac{z}{3}, 0 < z \leq 2 \\ \frac{2}{3}, 2 < z \leq 4 \\ \frac{6-z}{3}, 4 < z \leq 5 \\ \frac{1}{3}, 5 < z \leq 7 \\ \frac{8-z}{3}, 7 < z \leq 8 \end{cases}$$

Determine the de-fuzzified value by using COG method.

b. Distinguish between Mamdani FIS and Sugeno FIS. 4

8.a. Two fuzzy relations are given by- 8

R =

	y_1	y_2
x_1	0.6	0.3
x_2	0.2	0.9

and $S =$

	z_1	z_2	z_3
x_1	1	0.5	0.3
x_2	0.8	0.4	0.7

Obtain the fuzzy relation T as a composition between fuzzy relations

b. How is a fuzzy relation converted into a crisp relation using Lamda-cut process. 6

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