

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**M.Sc. DEGREE EXAMINATION – MATHEMATICS****SECOND SEMESTER – APRIL 2023****PMT2ME01 – FUZZY LOGIC AND NEURAL NETWORKS**

Date: 08-05-2023

Dept. No.

Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

SECTION A – K1 (CO1)**Answer ALL the questions****(5 x 1 = 5)****1. Answer the following**

- a) State any one limitations of fuzzy systems.
- b) The intersection of $\chi_A(x)$ and $\chi_B(x)$ is defined as
- c) Define binary sigmoid function.
- d) Define Bias in neural networks.
- e) State the transitivity property of fuzzy equivalence relations.

SECTION A – K2 (CO1)**Answer ALL the questions****(5 x 1 = 5)****2. MCQ**

- a) Who introduced fuzzy sets?
i) Klir ii) Yuan iii) Zadeh iv) Max Black
- b) The cardinality of power set $X = \{1,2,3\}$ is
i) 2 ii) 9 iii) 8 iv) 3
- c) For $\underline{A} = \left\{ \frac{1}{2} + \frac{0.5}{3} + \frac{0.3}{4} + \frac{0.2}{5} \right\}$ and $\underline{B} = \left\{ \frac{0.5}{2} + \frac{0.7}{3} + \frac{0.2}{4} + \frac{0.4}{5} \right\}$ then $\underline{B} \setminus \underline{A}$ is
i) $\left\{ \frac{0}{2} + \frac{0.5}{3} + \frac{0.2}{4} + \frac{0.4}{5} \right\}$ ii) $\left\{ \frac{0.5}{2} + \frac{0.3}{3} + \frac{0.3}{4} + \frac{0.2}{5} \right\}$
iii) $\left\{ \frac{0.3}{2} + \frac{0.5}{3} + \frac{0.3}{4} + \frac{0.2}{5} \right\}$ iv) $\left\{ \frac{0.5}{2} + \frac{0.3}{3} + \frac{0.3}{4} + \frac{0.5}{5} \right\}$
- d) Fuzzy Tolerance Relation exhibits the properties of
i) reflexive and transitive ii) reflexive and symmetric
iii) symmetric and transitive iv) All the three
- e) Who designed the first neural networks?
i) Klir ii) Mc Culloch & Pitts iii) Zadeh iv) Donald Hebb

SECTION B – K3 (CO2)**Answer any THREE of the following****(3 x 10 = 30)**

3. Briefly explain the historic perspective of Fuzzy.
4. Create an illustration for explaining Fuzzification process.
5. Where are neural networks being used?
6. Draw and explain Mc Culloch- Pitts net for XOR and AND NOT truth table.
7. How is Hebb net rule used in Artificial Neural Network?

SECTION C – K4 (CO3)**Answer any TWO of the following****(2 x 12.5 = 25)**

8. Explain Adaptive Resonance Theory I training algorithm.
9. How are Natural languages considered in Fuzzy logic? Illustrate with an example.
10. Explain the modeling perception of Hot and Cold with a McCulloch-Pitts Net.
11. State the applications of Hetero associative memory neural network.

SECTION D – K5 (CO4)

Answer any ONE of the following

(1 x 15 = 15)

12. Three separate regions along the San Andreas fault in California have suffered damage from a recent earthquake. For purposes of assessing pay outs from insurance companies to building owners, the five regions must be classified as to their damage levels. Expression of the damage in terms of relations will prove helpful.
- Surveys are conducted of the buildings in each region. All the buildings in each region are described as being in one of three damage states: no damage, medium damage, and serious damage. Each region has each of these three damage states expressed as a percentage (ratio) of the total number of buildings. Hence, for this problem $n = 3$ and $m = 3$. The following table summarizes the findings of the survey team:

Region	x_1	x_2	x_3
x_{i1} – Ratio with no damage	0.3	0.2	0.1
x_{i2} – Ratio with medium damage	0.6	0.4	0.6
x_{i3} – Ratio with serious damage	0.1	0.4	0.3

Use the cosine amplitude method to express these data as a fuzzy relation.

13. A railroad company intends to lay a new rail line in a particular part of a county. The whole area through which the new line is passing must be purchased for right-of-way considerations. It is surveyed in three stretches, and the data are collected for analysis. The surveyed data for the road are given by the sets, B_1 , B_2 , and B_3 , where the sets are defined on the universe of right-of-way widths, in meters. For the railroad to purchase the land, it must have an assessment of the amount of land to be bought. The three surveys on right-of-way width are ambiguous, however, because some of the land along the proposed railway route is already public domain and will not need to be purchased. Additionally, the original surveys are so old (*circa* 1860) that some ambiguity exists on boundaries and public right-of-way for old utility lines and old roads. The three fuzzy sets, B_1 , B_2 , and B_3 , shown in Figures 1 – 3, respectively, represent the uncertainty in each survey as to the membership of right-of-way width, in meters, in privately owned land.

Figure 1:

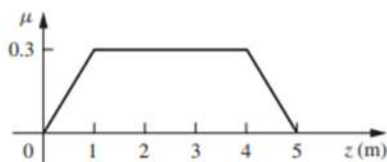


Figure 2:

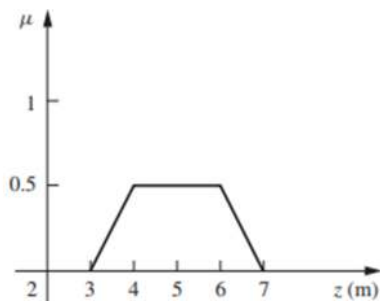
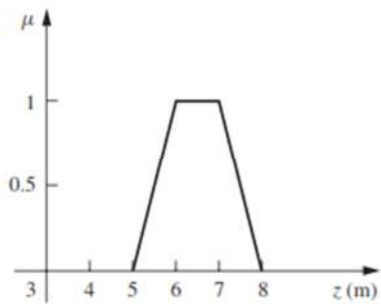


Figure 3:



Defuzzify the following using i) Centroid method ii) Weighted average method iii) Mean Max membership.

SECTION E – K6 (CO5)

Answer any ONE of the following

(1 x 20 = 20)

- 14. Formulate a fuzzy model to study any current social problem.
- 15. Create a simple perceptron for pattern classification.

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