LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **MATHEMATICS**

THIRD SEMESTER – **APRIL 2023**

PMT 3502 – FUZZY SETS AND APPLICATIONS

Date: 04-05-2023 Dept. No. Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

Answer ALL Questions

1. a) Define Generalized hamming distance and relative Euclidean with an example.

OR

b) If the fuzzy subsets A and B represents real numbers very near to 5 and 10 respectively, find the fuzzy subset of real numbers very near to 5 and 10. (5)

c) Find $\underset{\sim}{R}_2 \circ \underset{\sim}{R}_1$ using max-min composition.

$\underset{\sim}{R}_1$	y_1	y_2	y_3	y_4	y_5
x_1	0.1	0.2	0	1	0.7
x_2	0.3	0.5	0	0.2	1
x_3	0.8	0	1	0.4	0.3

$\underset{\sim}{R}_2$	z_1	z_2	z_3	z_4
y_1	0.9	0	0.3	0.4
y_2	0.2	1	0.8	0
y_3	0.8	0	0.7	1
y_4	0.4	0.2	0.3	0
y_5	0	1	0	0.8

OR (15)

d) Let $\underset{\sim}{R}_1$ and $\underset{\sim}{R}_2$ be two fuzzy relations.

$\underset{\sim}{R}_1$	Y_1	Y_2	Y_3	Y_4
X_1	0.3	0.2	1	0
X_2	0.8	1	0	0.2
X_3	0.5	0	0.4	0

$\underset{\sim}{R}_2$	Y_1	Y_2	Y_3	Y_4
X_1	0.3	0	0.7	0
X_2	0.1	0.8	1	1
X_3	0.6	0.9	0.3	0.2

Find (i) union (ii) intersection (iii) algebraic product (iv) distinctive sum for $\underset{\sim}{R}_1$ and $\underset{\sim}{R}_2$

(8)

e) Let $p_i, m_i, n_i \in R^+, i = 1,2 \ldots k$, then prove that $\sqrt{\sum_{i=1}^{k} p_i^2} \leq \sqrt{\sum_{i=1}^{k} m_i^2} + \sqrt{\sum_{i=1}^{k} n_i^2}$, where $p_i \leq m_i + n_i, i = 1,2 \ldots k$. (7)

2. a) Explain in detail fuzzy subset induced by a mapping.

OR

b) Explain global projection with an example. (5)

c) Find $A \oplus B$ for

	x_1	x_2	x_3	x_4	x_5	x_6	x_7
A	0.7	0.2	0	0.6	0.5	1	0
B	0.2	0	0	0.6	0.8	0.4	1

(8)

d) State and prove the decomposition theorem for fuzzy subsets. (7)

OR

e) Using suitable example, show that Max-Min composition is associative. (7)

f) Define algebraic product and algebraic sum of two fuzzy relations with an example. (8)

3. a) Consider the relation $\underset{\sim}{R}$ given with the resemblance function $\mu_{\underset{\sim}{R}}(x, y) = \frac{1}{1+|x-y|}$, for all $x, y \in N$. Is this relation a resemblance relation?.

OR

b) Let $\underset{\sim}{R} \subset E \times E$ be a similitude relation. Let x, y, z be three elements E. Let $c = \mu_{\underset{\sim}{R}}(x,z) = \mu_{\underset{\sim}{R}}(z,x)$, $a = \mu_{\underset{\sim}{R}}(x,y) = \mu_{\underset{\sim}{R}}(y,x)$ and $b = \mu_{\underset{\sim}{R}}(y,z) = \mu_{\underset{\sim}{R}}(z,y)$. Then $c \geq a = b \;\; or \;\; a \geq b = c \;\; or \;\; b \geq c = a.$ (5)

c) Explain the following fuzzy relation of (i) preorder (ii) semi-preorder (iii) perfect anti- symmetric and (iv) similitude, each with an example. (8)

d) Prove that $\bar{\bar{\underset{\sim}{R}}} \subset \dot{\hat{\underset{\sim}{R}}}$, where $\underset{\sim}{R}$ is an resemblance relation. (7)

OR

e) If $\underset{\sim}{R}$ is a preorder relation then show that $\underset{\sim}{R} = \underset{\sim}{R}^2 = \underset{\sim}{R}^3 = \cdots = \underset{\sim}{R}^k = \cdots = \hat{\underset{\sim}{R}}$ (8)

f) Define fuzzy equivalence relation and verify the properties with an example. (7)

4. a) Explain the process of fuzzy c- mean algorithm.

OR

b) Explain sensing problem in pattern recognition. (5)

c) Describe a few areas where computer-based pattern recognition system are applied. (7)

d) Give a detailed description of fuzzy image processing. (8)

OR

e) Explain fuzzy membership roaster method with an example. (7)

f) Explain how fuzzy clustering methods are based on fuzzy equivalence with an example. (8)

5. a) Explain how one's face can be verified using fuzzy tools.

OR

b) In any field of application, explain the concept of fuzzy degree of measure applied with an example. (5)

c) Explain in detail fuzzy application in the field of medicine. (15)

OR

d) Explain in detail with suitable case studies, fuzzy applications in the field of Robotic. (15)

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