LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FOURTH SEMESTER – **APRIL 2015**

MT 4817 - FUZZY SETS AND ITS APPLICATIONS

Date : 22/04/2015 Dept. No. Max. : 100 Marks

Time : 09:00-12:00

Answer **all** the questions. Each question carries 20 marks.

I. a)1) If the fuzzy subsets $\underset{\sim}{A}$ and $\underset{\sim}{B}$ represents real numbers very near to 5 and 10 respectively, find the fuzzy subset of real numbers very near to 5 and 10. **(5)**

	x_1	x_2	x_3	x_4	x_5
$\underset{\sim}{A}$	0.2	0.7	1	0	0.5
$\underset{\sim}{B}$	0.5	0.3	1	0.1	0.5

OR

a)2) Choosing suitable fuzzy subsets $\underset{\sim}{A}$ and $\underset{\sim}{B}$, prove that the relative hamming distance lies between 0 and 1. **(5)**

b)1) Define algebraic product and algebraic sum between two fuzzy subsets. Justify the statement that distributivity between algebraic product and algebraic sum does not hold good where as separately with Union and Intersection holds good. **(10)**

b)2) Let $p_i, m_i, n_i \in R^+, i = 1, 2, 3..., k$ then prove that $(p_i \leq m_i + n_i, i = 1, 2, 3..., k)$ **(5)**

$$\Rightarrow \sqrt{\sum_{i=1}^{k} p_i^2} \leq \sqrt{\sum_{i=1}^{k} m_i^2} + \sqrt{\sum_{i=1}^{k} n_i^2}$$

OR

c)1) Define ordinary set of level α. Also, state and prove the Decomposition theorem for fuzzy subsets. Explain how the notion of α-level plays an important role in proving the theorem. **(9)**

c)2) Using suitable example, explain briefly index of fuzziness. **(6)**

II. a)1) Define support of a fuzzy relation and give an example. Under what condition, union of two fuzzy relations form a support of either of the given fuzzy relations. **(5)**

OR

a)2) The fuzzy relation in $\underset{\sim}{R}^2$ is defined by $\mu_{\underset{\sim}{R}}(x, y) = 1 - \frac{1}{1 + x^2 + y^2}$. Draw the subset of level 0.3. **(5)**

b)1) Prove that for some k, $\underset{\sim}{R} = \underset{\sim}{R} \cup \underset{\sim}{R}^2 \cup .... \cup \underset{\sim}{R}^k$ where $\underset{\sim}{R}^{k+1} = \underset{\sim}{R}^k$ and $\underset{\sim}{R}$ is a fuzzy binary relation. Find the transitive closure for the given fuzzy relation $\underset{\sim}{R}$ where $\underset{\sim}{R}$ is given as **(9)**

$\underset{\sim}{R}$	$\underset{\sim}{A}$	$\underset{\sim}{B}$	$\underset{\sim}{C}$
$\underset{\sim}{A}$	0.8	1	0.1
$\underset{\sim}{B}$	0	0.4	0
$\underset{\sim}{C}$	0.3	0	0.2

b)2) Prove: Let $R \subset ExE$ then prove that $\forall (x,y) \in ExE$; $\mu_{R^k}(x,y) = l_k * (x,y)$

where $l_k * (x,y)$ is the strongest path existing from x to y of length k. Also prove that if the cardinality of E = n, then $\underset{\sim}{R} = \underset{\sim}{R} \cup \underset{\sim}{R}^2 \cup .... \cup \underset{\sim}{R}^n$. **(6)**

OR

c)1) When fuzzy relations are converted to crisp relations, what do you do with the boundary values. Give an example. **(5)**

c)2) Using suitable example, show that Max-Min composition is associative. **(10)**

III. a)1) Consider the relation $\underset{\sim}{R}$ given with the membership function

$\mu_{\underset{\sim}{R}}(x,y) = \dfrac{1}{1+|x-y|}$, *for all* $x, y \in N$. Is this relation a resemblance relation? **(5)**

OR

a)2) Define Min-Max distance in a resemblance relation. **(5)**

b) Explain the following with examples: fuzzy relation of (i) preorder (ii) semi preorder (iii) anti reflexive preorder (iv) perfect anti-symmetric (v) similitude (vi) dissimilitude and (vii) Resemblance. **(15)**

OR

c)1) Prove that $\overline{\hat{\underset{\sim}{R}}} \subset \overset{\overline{\square}}{\hat{\underset{\sim}{R}}}$ where $\underset{\sim}{R}$ is an resemblance relation. **(6)**

c)2) Prove: Let $\hat{\underset{\sim}{R}}$ be the max-min transitive closure of any fuzzy relation $\underset{\sim}{R}$ contained in E x E, and let $\overset{\vee}{\overline{\underset{\sim}{R}}}$ be the max-min transitive closure of $\overline{\underset{\sim}{R}}$. Then prove that $\overline{\hat{\underset{\sim}{R}}} = \overset{\vee}{\overline{\underset{\sim}{R}}}$ **(9)**

IV. a)1) . Explain sensing problem in pattern recognition.

OR

a)2). Explain the process of fuzzy c- means algorithm. **(5)**

b). Explain in detail the procedures involved in pattern recognition by fuzzy syntactic method with an example. **(15)**

OR

c)1). Give a detailed description of fuzzy image processing.

c)2). Explain with an example fuzzy membership- roaster method. **(8+7)**

V a)1) In the field of medicine, how is the fuzzy principle of clustering used in the detection cancerous cells? **(5)**

OR

a)2) In any field of application, give an example where the concept of fuzzy degree of measure applied. **(5)**

b) Write in detail the application of fuzzy concepts in the field of civil engineering. **(15)**

OR

c) Write in detail the application of fuzzy principles in the field of Economics. **(15)**

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