LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FOURTH SEMESTER – APRIL 2017

MT 4817- FUZZY SETS AND ITS APPLICATIONS

Date: 27-04-2017 Dept. No. Max. : 100 Marks
09:00-12:00

Answer all the questions. Each question carries 20 marks.

I. a)1) Define ordinary subset nearest to a fuzzy subset.

OR

a)2) State and prove Decomposition theorem for fuzzy subsets. **(3)**

b)1) Give the power set of a fuzzy subset for E = $\{x_1, x_2\}$ and M= $\{0, \frac{1}{3}, \frac{2}{3}, 1\}$

b)2) *Prove : Let $P_i, m_i, n_i \in R^+$, $i=1,2,3,\ldots,k$ then*

$$(p_i \le m_i + n_i, i = 1,2,\ldots,k) \Rightarrow \sqrt{\sum_{i=1}^{k} p_i^2} \le \sqrt{\sum_{i=1}^{k} m_i^2} + \sqrt{\sum_{i=1}^{k} n_i^2}$$ **(7+10)**

OR

c)1) If $a = \mu_{\tilde{A}}(x); b = \mu_{\tilde{B}}(x);\ c = \mu_{\tilde{C}}(x)$; verify whether associativity is true for algebraic sum and distributivity is true for product and algebraic sum.

c)2) Given find $\tilde{A} \hat{+} \tilde{B} \hat{+} \tilde{C}$.

	x_1	x_2	x_3	x_4	x_5	x_6	x_7
$\tilde{A}$	0	0.3	0.7	1	0	0.2	0.6
$\tilde{B}$	0.3	1	0.5	0.8	1	0.5	0.6
$\tilde{C}$	1	0.5	0.5	0.2	0	0.2	0.9

(7+10)

II a)1) Explain the difference between anti-symmetric and perfect anti-symmetric fuzzy relation.

OR

a)2) Explain normal projection with an example. **(3)**

b)1) Using a suitable example explain the concept of conditioned fuzzy subsets.

b)2) Define preorder of a fuzzy relation and verify whether the given relation $\tilde{R}$ is transitive or not? Justify your reason.

$\tilde{R}$	A	B	C	D	E
A	1	0.8	0.7	1	0.9
B	0.8	1	0.7	0.8	0.8
C	0.7	0.7	1	0.7	0.7
D	1	0.8	0.7	1	0.9
E	0.9	0.8	0.7	0.9	1

(7+10)

OR

c)1) Explain in detail fuzzy subset induced by a mapping.

c)2) For the given fuzzy relations $\underset{\sim}{R}_1$ *and* $\underset{\sim}{R}_2$ find $\underset{\sim}{R}_1 \circ \underset{\sim}{R}_2$ where o represents 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

. **(9+8)**

III.a)1) Prove that the transitive closure of any fuzzy binary relation is a transitive binary relation

OR

a)2) Define fuzzy ordinal relation and give an example. **(3)**

b)1) *Let* $\underset{\sim}{R} \subset E \times E$ *be a similitude relation. Let x, y, z be the elements of E. Put*

$$a = \mu_{\underset{\sim}{R}}(x, y) = \mu_{\underset{\sim}{R}}(y, x);\quad b = \mu_{\underset{\sim}{R}}(y, z) = \mu_{\underset{\sim}{R}}(z, y);\quad c = \mu_{\underset{\sim}{R}}(z, x) = \mu_{\underset{\sim}{R}}(x, z);$$

then prove that $c \geq a = b \;\; or \;\; a \geq b = c \;\; or \;\; b \geq c = a.$

b)2) If $\underset{\sim}{R}$ is a preorder relation then prove that $\underset{\sim}{R}^k = \underset{\sim}{R}$ for k =1,2,3,… **(10+7)**

OR

c)1) Define fuzzy equivalence relation and give an example with verification of properties**.** **(17)**

IV) a)1) In a set there are n mutually disjoint (in all aspects) elements. Using the clustering techniques you have known, how many clusters will you be able to make. Give your reasons.

OR

a)2) What is fuzzy grammar? **(3)**

b)1) Explain in detail fuzzy c-means clustering method with an example. **(17)**

OR

c)1) Give a detailed description of fuzzy syntactic method.

c)2) Explain with an example fuzzy membership-roster method. **(8+9)**

V) Choosing any one of the following fields, explain in detail the fuzzy application in that field.

Medicine/ Economic / Engineering / Robotics

Your answer should have the following points:

1. Introduction - covering the main aspect of fuzzy part and application issues
2. Historical developments - covering the way the fuzzy principle/model/method got evolved and contributors. Also, the special features that got into the developments during the years
3. Fuzzy principles - covering the different fuzzy definitions, principles required in your application aspect.
4. Explain your case study or application area/case/ issues
5. Apply the fuzzy principle to the case study - covering what are the requirements/assumptions/attributes required for your case study and how it is being applied. You have to justify why fuzzy principles have to be utilized or explain the need for fuzzy applications in this case
6. Findings of your case study- what are the conclusions you derive using fuzzy principles.
7. Interpretation of your findings for common man's understanding
8. Conclusion- Explaining the advantages of your application of fuzzy principles.

(20)

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