LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION - **MATHEMATICS**

FOURTH SEMESTER – **APRIL 2013**

MT 4961 - THEORY OF FUZZY SUBSETS

Date : 06/05/2013 Dept. No. Max. : 100 Marks
Time : 1:00 - 4:00

Answer all the questions. All the questions carry equal marks.

I. **a)1)** If M = {0,1} show that $A \cap B = A \bullet B$ and $A \cup B = A \hat{+} B$ where $\cap$ represents MINIMUM, $\bullet$ represents algebraic product and $\hat{+}$ algebraic sum.

OR

a)2) Prove the following properties: $\underset{\sim}{A} \cap (\underset{\sim}{A} \cup \underset{\sim}{B}) = \underset{\sim}{A}$ *and* $\underset{\sim}{A} \cup (\underset{\sim}{A} \cap \underset{\sim}{B}) = \underset{\sim}{A}$

(3)

b)1) Draw for E= $\{x_1,x_2,x_3\}$ and M= $\{0, \frac{1}{2}, 1\}$, the Boolean lattice of ordinary sets and the vector lattice for fuzzy subsets.

b)2) Define ordinary subset of level α for a fuzzy subset $\underset{\sim}{A}$ and choosing suitable values and elements verify $\alpha_2 \geq \alpha_1 \Rightarrow A\alpha_2 \subset A\alpha_1$.

(10+7)

OR

c)1) Define ordinary subset nearest to a fuzzy subset. Using suitable examples verify the principal properties concerning the nearest ordinary subset.

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

$$(P_i \leq m_i + n_i, i = 1, 2, ..., k) \Rightarrow \sqrt{\sum_{i=1}^{k} P_i^2} \leq \sqrt{\sum_{i=1}^{k} m_i^2} + \sqrt{\sum_{i=1}^{k} n_i^2}$$

(7+10)

II. **a)1)** Explain normal projection with an example.

OR

a)2) How does ordinary relation closest to a fuzzy relation differ from ordinary subset of level α in a fuzzy relation.

(3)

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

b)2) Consider $\underset{\sim}{R}_1$ *and* $\underset{\sim}{R}_2$ as given below. Verify with the given example that

$\underset{\sim}{R}_2 \circ \underset{\sim}{R}_1 = \underset{\sim}{R} \Rightarrow \cong R_2 \circ R_1 = R$ where o represents max-min composition.

(10+7)

$\underset{\sim}{R}_1$	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

c)1) Using a suitable example explain the concept of conditional fuzzy subsets.

c)2) Prove: Let $\underset{\sim}{R} \subset E \times E$; then one has $\forall (x,y) \in E \times E : \mu_{\underset{\sim}{R}}(x,y) = l^*_k(x,y)$ where $l^*_k(x,y)$ is the strongest path existing from x to y of length k.

(10+7)

III.a)1) Define fuzzy order relation and give an example.

OR

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

(3)

b)1) Explain (i) MIN-MAX distance between two elements in a similitude relation

(ii) MIN-MAX distance in a resemblance relation

(iii) MIN-SUM distance in a resemblance relation.

b)2) Let $\underset{\sim}{R}$ be a resemblance relation. Then with the usual notations prove that $\overline{\hat{\underset{\sim}{R}}} \subset \bar{\dot{\hat{\underset{\sim}{R}}}}$.

(8+9)

OR

c)1) Define the following and give examples.

(i) Similitude (ii) dissimilitude (iii) resemblance and (iv) dissemblance relations .

c)2) 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 $c \geq a = b \;\; or \;\; a \geq b = c \;\; or \;\; b \geq c = a.$

(8+9)

IV)a)1) What are the fundamental problems in pattern recognition.

OR

a)2) Briefly describe the two basic methods of fuzzy clustering.

(3)

b)1) Give a detailed demonstration of fuzzy c-means clustering method.

b)2) Imagine a serial theft is taking place in your locality. As an expert, you are called to analyze the evidences available and give a detailed analytical report. Which of the fuzzy tools or methods will you apply and why?

(10+7)

OR

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

c)2) Write a detailed description of fuzzy image processing.

(8+9)

V.a)1) Write a short note on the possibilities for application of fuzzy concepts in the field of civil engineering.

OR

a)2) How the natural treatments like acupressure and siddha differ from the allopathic treatment.

(3)

b) Explain in detail the possibilities for fuzzy logic applications in the field of Industry where more and more of automated machines replace human skills.

(17)

OR

c) What are the compulsions in ‘Economics’ that requires analysis based on fuzzy concepts? Explain in detail using suitable case studies and analysis.
(17)

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