



# LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

## B.Sc. DEGREE EXAMINATION – MATHEMATICS

FOURTH SEMESTER – APRIL 2018

### 16UMT4ES02- FUZZY SETS AND APPLICATIONS

Date: 23-04-2018  
Time: 09:00-12:00

Dept. No.

Max. : 100 Marks

#### Part A: Answer all the questions and each question carries 2 marks.

10 x 2 = 20

1. Define fuzzy set and give an example.
2. Define anti-symmetry and perfect anti symmetry for a fuzzy relation.
3. For the given two sets, find the generalized relative hamming distance:

$$A = \{(x_1/1), (x_2/0.8), (x_3/0.2), (x_4/.8), (x_5/0.6), (x_6/0.3), (x_7/0.5)\}$$

$$B = \{(x_1/0.8), (x_2/0.3), (x_3/0.6), (x_4/0.5), (x_5/0.4), (x_6/0.7), (x_7/0.8)\}$$

4. Explain ordinary subset of level  $\alpha$  for the following set

$$A = \{(x_1/0), (x_2/0.3), (x_3/0.7), (x_4/1), (x_5/0), (x_6/0.2), (x_7/0.6)\}$$

5. Explain the formula or method to assign values for causal relation between two attributes.
6. Find the disjunctive sum for the following two fuzzy relations:

$R_1$	$y_1$	$y_2$
$x_1$	0,2	0,3
$x_2$	0,3	0,8

$R_2$	$z_1$	$z_2$
$y_1$	1	0,2
$y_2$	0,4	1

7. Define ordinary relation closest to a fuzzy relation and give an example.
8. What is a limit cycle and a fixed point.
9. Explain the similarities between a neuron and synoptic matrix.
10. What is difference between FCM model and FRM model.

#### Part B: Answer any FIVE questions and each question carries 8 marks.

5 x 8 = 40

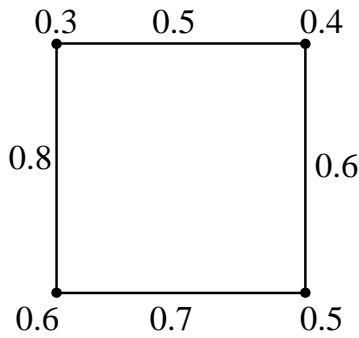
11. Explain projection with an example and when does it become a normal projection.
12. Find the disjunctive sum of the following two fuzzy subsets.

$$A = \{(x_1/1), (x_2/0.8), (x_3/0.2), (x_4/.8), (x_5/0.6), (x_6/0.3), (x_7/0.5)\}$$

$$B = \{(x_1/0.8), (x_2/0.3), (x_3/0.6), (x_4/0.5), (x_5/0.4), (x_6/0.7), (x_7/0.8)\}$$

13. Explain strongest path in a fuzzy graph with an example.

14. Find the order, size, degree and complement for the following graph.



15. Considering fuzzy similitude relation  $R$ , and choosing three quantities a, b and c as the following

$$a = \mu_R(x, y) = \mu_R(y, x); \quad b = \mu_R(y, z) = \mu_R(z, y); \quad c = \mu_R(z, x) = \mu_R(x, z);$$

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

16. Explain various types of fuzzy numbers with an example.

17. Explain pentagonal fuzzy number with an example. Give a detailed account of operation on pentagonal fuzzy numbers.

18. The result at the end of a fuzzy model analysis is absolutely unsuitable as a solution for the problem analyzed. What would have gone wrong? Explain in detail.

**Part C: Answer any TWO questions and each question carries 20 marks.**

**2 x 20 = 40**

19. (i) Draw the vector lattice of fuzzy subsets for  $E = \{x_1, x_2, x_3\}$  and  $M = \{0, 1/2, 1\}$

Let  $p_i, m_i, n_i \in R^+, i = 1, 2, 3, \dots, k$  then prove that

$$(ii) \quad (p_i \leq m_i + n_i, i = 1, 2, 3, \dots, k) \Rightarrow \sqrt{\sum_{i=1}^k p_i^2} \leq \sqrt{\sum_{i=1}^k m_i^2} + \sqrt{\sum_{i=1}^k n_i^2}$$

20. Let  $\underline{A} = \{(x_1/1), (x_2/0.8), (x_3/0.2), (x_4/.8), (x_5/0.6), (x_6/0.3), (x_7/0.5)\}$

$\underline{B} = \{(x_1/0.8), (x_2/0.3), (x_3/0.6), (x_4/0.5), (x_5/0.4), (x_6/0.7), (x_7/0.8)\}$  and

$\underline{C} = \{(x_1/0), (x_2/0.5), (x_3/0.2), (x_4/0.7), (x_5/0.6), (x_6/0.9), (x_7/0.1)\}$ . Calculate

i)  $(\underline{A} \cup \underline{B}) \cap \underline{C}$     ii)  $(\underline{A} \cap \underline{B}) \cup \underline{C}$     iii)  $\overline{(\underline{A} \cap \underline{B})} \cup \underline{C}$     iv)  $\underline{A} \bullet \underline{B} \bullet \underline{C}$     v)  $\hat{\underline{A}} + \hat{\underline{B}} + \hat{\underline{C}}$

21. Find  $\underline{R}_3 \circ \underline{R}_2 \circ \underline{R}_1$ , where  $\circ$  is the max-min composition.

$\underline{R}_1$	$y_1$	$y_2$	$y_3$	$y_4$	$y_5$
$x_1$	0,2	0,3	0,8	0,6	0,1
$x_2$	0,3	0,8	0,6	0,6	1
$x_3$	0,2	1	0,4	0,1	0

$\underline{R}_2$	$z_1$	$z_2$	$z_3$	$z_4$
$y_1$	1	0,2	0,3	0,4
$y_2$	0,4	1	0,1	0,2
$y_3$	0,3	0,4	1	0,1
$y_4$	0,2	0,3	0,4	1
$y_5$	0,1	0,2	0,3	0,4

$\underline{R}_3$	$t_1$	$t_2$	$t_3$	$t_4$	$t_5$
$z_1$	0,9	0	0,3	0,4	0,5
$z_2$	0,9	0,6	0,4	0,7	0,6
$z_3$	0	0,8	0,9	0,3	0,7
$z_4$	0,3	1	0,1	0,4	1

21. Using any fuzzy model, analyze any social/medical/environmental/educational/ economic issue in detail and interpret your findings.

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