LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **MATHEMATICS**

FIFTH SEMESTER – **NOVEMBER 2023**

UMT 5602 – FUZZY SETS AND APPLICATIONS

Date: 16-11-2023 Dept. No. Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

	SECTION A - K1 (CO1)
	Answer ALL the Questions **(10 x 1 = 10)**
1.	**Answer the following**
a)	Define a products of fuzzy subsets.
b)	Write a note on transitive closure of a fuzzy binary relations.
c)	Define an anti-symmetry in the context of order relations?
d)	What is the fuzzy matrix model?
e)	Define an expert system.
2.	**Fill in the blanks**
a)	The range of membership values in a fuzzy set typically lies between ____.
b)	A path of a finite graph in fuzzy is a sequence of ____ with associated membership values.
c)	Resemblance relations measure the degree of __ between elements in a set.
d)	In relational mappings, a _____ mapping is a one-to-one correspondence between elements of two sets.
e)	Fuzzification is the process of converting ____ inputs into fuzzy sets.
	SECTION A - K2 (CO1)
	Answer ALL the Questions **(10 x 1 = 10)**
3.	**Choose the correct answer for the following**
a)	What is a fuzzy subset? (i) A subset with elements having uncertain membership (ii) A subset with only crisp elements (iii) A subset with elements having random membership (iv) A subset with all elements having equal membership
b)	The concept of fuzzy graphs is useful in (i) Network analysis (ii) Data clustering (iii) Image processing (iv) Natural language processing
c)	What is a fuzzy preorder? (i) A relation that is reflexive, transitive, and symmetric (ii) A relation that is reflexive, transitive, and anti-symmetric (iii) A relation that is reflexive, transitive, and asymmetric (iv) A relation that is reflexive, transitive, and irreflexive
d)	What does the fuzzy matrix model represent? (i) Uncertain or imprecise information in a matrix form (ii) A matrix with only integer values (iii) A matrix with binary entries (iv) A matrix with non-square dimensions

e)	De-fuzzification in fuzzy control is the process of (i) Converting fuzzy outputs into crisp values (ii) Converting crisp inputs into fuzzy sets (iii) Evaluating the fuzzy rules (iv) Mapping fuzzy inputs to crisp outputs
4.	**State True or False**
a)	The dominance property establishes the order of importance between fuzzy sets.
b)	Fuzzy binary relations are reflexive if every element is related to itself.
c)	Fuzzy perfect order relations are irreflexive, transitive, and possess the strictness property.
d)	Relational mappings are used to establish relationships between two or more sets of data.
e)	Rule evaluation in fuzzy control involves applying a set of predefined rules to fuzzy inputs to determine the appropriate control actions.

SECTION B - K3 (CO2)

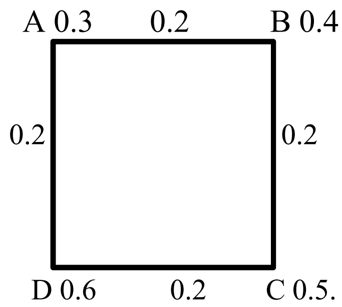
Answer any TWO of the following **(2 x 10 = 20)**

5. Calculate the disjunctive sum for the following two fuzzy subsets

$\underset{\sim}{A} = \{(x_1, 1), (x_2, 0.8), (x_3, 0.3), (x_4, 0.8), (x_5, 0.6), (x_6, 0.3), (x_7, 0.5)\}$

$\underset{\sim}{B} = \{(x_1, 0.8), (x_2, 0.3), (x_3, 0.6), (x_4, 0.5), (x_5, 0.2), (x_6, 0.7)\ (x_7, 0.8)\}$.

6. Examine the order, size, degree and complement for the following graph.



7. If $\underset{\sim}{\mathfrak{R}}$ is a preorder, then show that $\underset{\sim}{\mathfrak{R}}^k = \underset{\sim}{\mathfrak{R}}, k = 1,2,3,\ldots\ldots..$

8. State and prove decomposition theorem for fuzzy relations.

SECTION C – K4 (CO3)

Answer any TWO of the following **(2 x 10 = 20)**

9. Examine projection with an example and explain when it becomes normal projection.

10. Analyze fuzzy equivalence relation and give an example with verification of properties.

11. Define fuzzy graph and explain in detail the different types with examples.

12. Let $\underset{\sim}{R}_1$ and $\underset{\sim}{R}_2$ be two 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

	Then calculate (a). $\underset{\sim}{R}_1 \cup \underset{\sim}{R}_2$ (b). $\underset{\sim}{R}_1 \cap \underset{\sim}{R}_2$ (c). $\underset{\sim}{R}_1 \cdot \underset{\sim}{R}_2$ (d). $\underset{\sim}{R}_1 \hat{+} \underset{\sim}{R}_2$ (e). $\overline{\underset{\sim}{R}_1}, \overline{\underset{\sim}{R}_2}$ (f) $\underset{\sim}{R}_1 \oplus \underset{\sim}{R}_2$.

SECTION D – K5 (CO4)

	Answer any ONE of the following **(1 x 20 = 20)**
13.	Evaluate $\underset{\sim}{R}_2 \circ \underset{\sim}{R}_1$ where $\circ$ is max- min composition.

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

$\underset{\sim}{R}_2$	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	1	0.2	0.3	0.4

14.	Summarize the structure and the process of fuzzy controller.

SECTION E – K6 (CO5)

	Answer any ONE of the following **(1 x 20 = 20)**
15.	Demonstrate in detail the impact of fuzzy cognitive maps (FCM) in the field of medicines.
16.	Determine the characteristics attributes of an expert system and also explain how expert system is applied in strategic planning.

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