## 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 Time: 09:00 AM - 12:00 NOON

Dept. No.

Max. : 100 Marks

	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)	<ul> <li>What is a fuzzy preorder?</li> <li>(i) A relation that is reflexive, transitive, and symmetric</li> <li>(ii) A relation that is reflexive, transitive, and anti-symmetric</li> <li>(iii) A relation that is reflexive, transitive, and asymmetric</li> <li>(iv) A relation that is reflexive, transitive, and irreflexive</li> </ul>								
d)	<ul> <li>What does the fuzzy matrix model represent?</li> <li>(i) Uncertain or imprecise information in a matrix form</li> <li>(ii) A matrix with only integer values</li> <li>(iii) A matrix with binary entries</li> <li>(iv) A matrix with non-square dimensions</li> </ul>								

e	De-fuz	zificati	ion in f		ontrol i	s the pro	DCESS O	f																		
e)	De-fuzzification in fuzzy control is the process of (i) Converting fuzzy outputs into crisp values																									
	(i) Converting ruzzy 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 The dominance property establishes the order of importance between fuzzy sets																									
a)																										
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. Rule evaluation in fuzzy control involves applying a set of predefined rules to fuzzy inputs to																									
e)								ng a set	of pre	defined	l rules	to fuzz	zy inpu	ts to												
	determ	ine the	approp	priate c		actions.		<b></b>																		
	1.					SECTIO	)N B -	K3 (C)	02)																	
	Answe	er any '	TWO	of the f	iollowi	ng							(2	x 10	=											
	20)																									
5.						he follo	•																			
	$A = \{(x_1, 1), (x_2, 0.8), (x_3, 0.3), (x_4, 0.8), (x_5, 0.6), (x_6, 0.3), (x_7, 0.5)\}$																									
	$B_{\sim} = \{(x_1, 0.8), (x_2, 0.3), (x_3, 0.6), (x_4, 0.5), (x_5, 0.2), (x_6, 0.7), (x_7, 0.8)\}.$																									
									<u> </u>	<u> </u>																
6.	Exami	ne the o	order, s	ize, de	•	-				ing gra	aph.				Examine the order, size, degree and complement for the following graph.											
						A 11 2	$(\Lambda')$	D 1	) 4																	
					-	A 0.3	0.2	B (	0.1																	
					-	H 0.5	0.2																			
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7.	If R is	a preor	rder, th	en shov	0.	2	0.2	0. C 0	2 0.5.																	
7.	If $\mathfrak{R}$ is	a preor	rder, th	en shov	0.	2 D 0.6	0.2	0. C 0	2 0.5.																	
7.	~				$0.$ w that $\frac{1}{2}$	$2$ $D 0.6$ $\overline{\mathfrak{R}^{k}_{\sim}} = \mathfrak{R}$	0.2 , <i>k</i> = 1	0.1 C 0	2 0.5.																	
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	~				0. w that s tion the	$2$ $D 0.6$ $\overline{\mathfrak{R}^{k}_{\sim}} = \mathfrak{R}$	0.2 $k = 1$ or fuzzy	0 C 0 ,2,3,	2 0.5. 																	
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8. 9. 10. 11.	<ul> <li>State as</li> <li>Answe</li> <li>Examin</li> <li>Analyz</li> <li>Define</li> </ul>	nd prov er any ' ne proj ze fuzzy	ve deco TWO of ection y equiv graph a	omposit of the f with an valence and exp	0. w that s tion the <b>Sollowi</b> n examp relatio plain in	$2$ $D \ 0.6$ $\Re^{k} = \Re$ $\mathbb{C}$ \mathbb{C} $\mathbb{C}$ $C$	0.2 $k = 1$ or fuzzy $N C -$ explain ve an e	0. C 0 ,2,3, y relation <b>K4 (C</b> when the second	2 0.5. ons. O3) it become e with y	verifica	ation of	•	on.	10 = 2												
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8. 9. 10. 11.	$\sim$ State as Answe Examin Analyz Define Let $\underline{R}_1$ $\underline{R}_1$ $X_1$	nd prover any $r$ any $r$ any $r$ and $r$ and $r$ and $r$	ve deco <b>TWO</b> ection y equiv graph a $_2$ be tw $Y_2$ 0.2	omposite of the f with and valence and exp to relation $Y_3$ 1	$w \text{ that } S$ tion the S followi relatio blain in ions $Y_4$ 0	$2$ $D \ 0.6$ $\Re^{k} = \Re$ $\mathbb{C}$ \mathbb{C} $\mathbb{C}$ $C$	$0.2$ $k = 1$ or fuzzy $N C -$ explain ve an e he diffe $R_2$	0.1 C = 0 7,2,3, y relation <b>K4 (C</b> <b>when</b> example erent ty $Y_1$	2 0.5. 0	verificath example $Y_3$	ation of nples. $Y_4$	•	on.	<u>10 = 2</u>												

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

					5	SECTI	N D -	– K5 (C	<b>CO4</b> )				
	Answe	er any	ONE o	of the f				(-					$(1 \times 20 = 20)$
13.	Evaluate $R_2^\circ R_1$ where $\circ$ is max-min composition.												
	$R_1$	<i>Y</i> <sub>1</sub>	<i>Y</i> <sub>2</sub>	<i>Y</i> <sub>3</sub>	<i>Y</i> <sub>4</sub>	<i>Y</i> <sub>5</sub>		$\underline{R}_2$	$Z_1$	$Z_2$	$Z_3$	$Z_4$	
	$X_1$	0.2	0.3	0.8	0.6	0.1		<i>Y</i> <sub>1</sub>	1	0.2	0.3	0.4	
	<i>X</i> <sub>2</sub>	0.3	0.8	0.6	0.6	1		<i>Y</i> <sub>2</sub>	0.4	1	0.1	0.2	
	<i>X</i> <sub>3</sub>	0.2	1	0.4	0.1	0		<i>Y</i> <sub>3</sub>	0.3	0.4	1	0.1	
								<i>Y</i> <sub>4</sub>	0.2	0.3	0.4	1	
								<i>Y</i> <sub>5</sub>	1	0.2	0.3	0.4	
14.	Summ	arize th	ne struc	ture an	d the p	rocess	fuzz	y contr	oller.				
					S	SECTI	N E -	- K6 (C	CO5)				
	Answe	er any	ONE o	of the f	ollowir	ıg							$(1 \times 20 = 20)$
15.	Answer any ONE of the following       (1)         Demonstrate in detail the impact of fuzzy cognitive maps (FCM) in the field of medicin											dicines.	
16.	Detern	nine the	e chara	cteristi	cs attri	butes o	n ex	pert sys	stem an	d also	explain	how e	xpert system is
	applied	d in stra	ategic p	olannin	g.								