CLASS: IMSc   SEMESTER : V
BRANCH: MATHEMATICS   SESSION : MO/2024

SUBJECT: MA303 FUZZY LOGIC

TIME: 3 Hours   FULL MARKS: 50

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL

Q.1(a) Order the fuzzy sets defined by the following membership function grades(assuming   [5]   1   1,2,3
x≥0) by the inclusion(subset) relation
   $A(x)=1/(1+10x)$, $B(x)=(1/(1+10x)^{0.5})$, $C(x)=(1/(1+10x)^2)$.

Q.1(b) Find the following for the two given sets: [5]   1   1,2,3
(i) Height of A_1 and A_2.   (ii) Is A_1 or A_2 normal? iii.Sketch graph of A_1 and A_2.

$$\widetilde{A_1} = \begin{cases} x-5, if\ 5 \leq x \leq 6 \\ -x+7. if\ 6 < x \leq 7 \\ 0, otherwise \end{cases} \qquad \widetilde{A_2} = \begin{cases} 0.5\left(\frac{x}{3}-\frac{5}{3}\right), if\ 5 \leq x \leq 8 \\ -0.5(\frac{x}{3}+\frac{11}{3}). if\ 8 < x \leq 10 \\ 0, otherwise \end{cases}$$

Q.2(a) Let $\tilde{A}$ ={$(x_1,0.3),(x_2,0.4),(x_3,0.5)$} and $\tilde{B}$ ={$(y_1,0.5),(y_2,0.6)$} be two fuzzy sets defined on   [5]   2   1,2,3
the universes of discourse X={x_1,x_2,x_3} and Y={y_1 ,y_2} respectively. Then the fuzzy
relation $\tilde{R}$ resulting out of the fuzzy Cartesian product $\tilde{A}X\tilde{B}$.Also find α-cut of the fuzzy
relation $\tilde{R}$.

Q.2(b) Compute the complements, intersection and union of the following   [5]   2   1,2,3
fuzzy relations R and S.

R	a	b	c	d
a	1.0	0.2	0.4	0.0
b	0.0	0.1	0.0	0.9
c	0.1	0.0	1.0	0.0
d	0.0	0.4	0.0	0.1

S	a	b	c	d
a	1.0	0.0	0.0	0.4
b	0.0	0.0	0.4	0.9
c	0.4	0.0	0.1	0.0
d	0.5	1.0	0.0	0.0

Q.3(a) Define α-cut of a triangular fuzzy number. Find α-cut of a triangular fuzzy number   [5]   3   1,2,3
(6,7,8).Is multiplication operation of a triangular fuzzy number a fuzzy number?

Q.3(b) Calculate the following operations of triangular fuzzy sets by using α-cut operation A =   [5]   3   1,2,3
(1, 3, 8) & B= (2, 4, 5).
i. A(v)B   ii. A(Λ)B. iii. A (/) B.

Q.4(a) State whether the following argument is valid or not.If valid,give proof.If not valid,give counter example. [5] 4 1,2,3

If a baby is hungry,the baby cries.
If the baby is not mad,then he does not cry.
If a baby is mad,then he has a red face.
Therefore,if a baby is hungry,then he has a red face.

Q.4(b) Let us define the input on the universe of discourse X= [0,50,100,150,200] and Y= [0,50,100,150,200]. Define two fuzzy sets w and M as follows [5] 4 1,2,3

$w = [1/0+0.9/50+0.3/100+0/150+0/200] \subset X$ and $M= [0/0+0.4/50+1/100+0.4/150+0/200] \subset X$ and $S=[0/0+0/50+0.5/100+0.9/150+1/200] \subset Y$.
Then construct the proposition "If w, then not S".

Q.5(a) Write a note on fuzzy decision with appropriate examples. [5] 5 1,2,3

Q.5(b) Formulate the fuzzy linear programming problem by Zimmermanns method and show graphs and membership functions for the formulations. [5] 5 1,2,3

Max $Z=6x_1+4x_2+3x_3$
Subject to:
$8x_1+6x_2+5x_3 \leq 500$
$10x_1+8x_2+3x_3 \leq 360$
$x_1,x_2,x_3 \geq 0$
Take $b_0=21.25$ and $p_0=1.25$ .Also $p_1=75,p_2=54$.

::::::22/11/2024::::::M