Answer all the questions. Each question carries 20 marks.

I a) 1) Using suitable examples for $\underset{\sim}{A}$ and $\underset{\sim}{B}$ show that $\underset{\sim}{A} - \underset{\sim}{B} \neq \underset{\sim}{B} - \underset{\sim}{A}$

OR

a)2) Using diagrammatic representation, show that $\underset{\sim}{A} - \underset{\sim}{B} = \underset{\sim}{A} \cap \overline{\underset{\sim}{B}}$ **(5)**

b)1) Using suitable examples, explain in detail the different types of hamming distance concepts.

b)2) Define algebraic sum and algebraic product and give examples. For M = {0,1} and

$\mu_A(x) = \{0,1\}$ and $\mu_B(x) = \{0,1\}$, verify whether the following relations are true:

$A \cap B = A \bullet B$ and $A \cup B = A \hat{+} B$. Do these relations hold good even if $M \neq \{0,1\}$

(9+6)

OR

c)1) Explain the different properties that hold good for crisp sets and for fuzzy subsets. Justify the

statement, "We no longer have an algebra in the sense of the theory of ordinary sets; the structure is

that of a vector lattice".

c)2) Give the diagrammatic representation for the power set of the following fuzzy subset with

$$X = \{x_1, x_2, x_3\}, \quad M = \left\{0, \frac{1}{2}, 1\right\}.$$ **(9+6)**

II a) 1) Give the diagrammatic representation for the relations " x and y are very near to one another" and "

x and y are not very near to one another".

OR

a) 2) Define disjunctive sum of two fuzzy relations and give a simple example.   **(5)**

b)1) Using a suitable example, explain that the max-min composition is associative. What can you state

about the associativity for Max-product composition.

b)2) State and prove decomposition theorem for fuzzy relations. Using a suitable example, explain how

the principle of level α could be applied to real life issues.   **(9+6)**

OR

c)1) Check whether transitive property with respect to max-min composition hold good for the following fuzzy relation:

R	A	B	C	D	E	F
A	1	0.1	0.1	0	0	0.5
B	0.1	1	0.6	0	0	0.1
C	0.1	0.6	1	0	0	0.1
D	0	0	0	1	0.3	0
E	0	0	0	0.3	1	0
F	0.5	0.1	0.1	0	0	1

c)2) Define transitive closure of a fuzzy relation and explain how to construct a transitive relation from any relation. **(8+7)**

III a) 1) If R is a fuzzy preorder relation then prove that it equals its transitive closure.

OR

a) 2) To study limit superior and limit inferior, which fuzzy concept will you apply. Explain. **(5)**

b)1) Let $R \subset E \times E$ be a similitude relation. Let x, y, z be three elements of E.

Let $a = \mu_R(x,y) = \mu_R(y,x); b = \mu_R(y,z) = \mu_R(z,y)$ and $c = \mu_R(z,x) = \mu_R(x,z)$.

Show that of these three values a, b and c at least two are equal and the third is greater than the other two.

b)2) Define dissimilitude relation and give an example. **(9+6)**

OR

c)1) For a resemblance relation R, with the usual notations prove that $\forall (x,y) : d(x,y) = \gamma(x,y)$.

c)2) Prove that the max-min transitive closure of a resemblance relation is equal to the min-max transitive closure of a dissemblance relation. **(9+6)**

IV a)1) Describe a few areas where the computer – based pattern recognition system are applied.

OR

a)2) State the fuzzy c – means algorithm. **(5)**

b)1) What are the two major fuzzy pattern recognition methods? Explain their advantages and disadvantages.

b)2) Explain in detail the fuzzy clustering method based on equivalence relation. Give an example.

(8 + 7)

OR

c) Explain in detail with examples, the fuzzy image processing in recognition of handwritten scripts. **(15)**

V a)1) Citing a simple example justify the need for fuzzy concepts to real life issues.

OR

a)2) In short, explain how can one's signature could be verified using fuzzy tools. **(5)**

b) Explain in detail with suitable case studies, fuzzy applications in the field of engineering

OR

c) Explain in detail with suitable example studies on the impact of fuzzy principles in the field of Economics. **(15)**

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