



Date: 23-11-2022

Dept. No.

Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

Answer ALL Questions

1. a) Using diagrammatic representation, show that  $A - B = A \cap \overline{B}$ . (5)

OR

b) Explain in detail the Quadratic distance and generalized relative hamming distance with suitable examples. (5)

c) Let  $R \subset E \times E$  then prove that  $\forall (x, y) \in E \times E; \mu_{R^k}(x, y) = l_k^*(x, y)$   
where  $l_k^*(x, y)$  is the strongest path existing from  $x$  to  $y$  of length  $k$ . (7)

d) Let  $p_i, m_i, n_i \in R^+, i = 1, 2 \dots k$ , then prove that  $\sqrt{\sum_{i=1}^k p_i^2} \leq \sqrt{\sum_{i=1}^k m_i^2} + \sqrt{\sum_{i=1}^k n_i^2}$ , where  $p_i \leq m_i + n_i, i = 1, 2 \dots k$ . (8)

OR

e) Completely verify whether the given fuzzy relation  $R$  is transitive or not ?. (8)

$R$	A	B	C	D
A	0.2	1	0.4	0.4
B	0	0.6	0.3	0
C	0	1	0.3	0
D	0.1	1	1	0.1

f) Consider the reference set  $E = \{A, B, C, D, E, F, G\}$  and the fuzzy subsets. (7)

$$\underline{A} = \{(A, 0), (B, 0.3), (C, 0.7), (D, 1), (E, 0), (F, 0.2), (G, 0.6)\}$$

$$\underline{B} = \{(A, 0.3), (B, 1), (C, 0.5), (D, 0.8), (E, 1), (F, 0.5), (G, 0.6)\}$$

$$\underline{C} = \{(A, 1), (B, 0.5), (C, 0.5), (D, 0.2), (E, 0), (F, 0.2), (G, 0.9)\}$$

Then calculate

(i)  $\delta(\underline{A}, \underline{B}), \delta(\underline{A}, \underline{C}), \delta(\underline{B}, \underline{C})$

(ii)  $\in(\underline{A}, \underline{B}), \in(\underline{A}, \underline{C}), \in(\underline{B}, \underline{C})$

(iii)  $\gamma(\underline{A}, \underline{B}), \gamma(\underline{A}, \underline{C}), \gamma(\underline{B}, \underline{C})$

2. a) Explain in detail the concept of conditioned fuzzy subsets with an example. (5)

OR

b) State and prove the decomposition theorem for fuzzy relations. (5)

c) Explain in detail fuzzy subset induced by a mapping. (5)

d) Check whether transitive property with respect to max-min composition hold good for the following fuzzy relation (10)

$\underline{R}$	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

**OR**

e) When fuzzy relations are converted to crisp relations, what do you do with the boundary values? Give an example. (8)

f) Define algebraic product and algebraic sum of two fuzzy relations with an example. (7)

3. a) Explain min-max distance in resemblance relation with an example. (5)

**OR**

b) Define fuzzy ordinal relation and give an example. (5)

c) If  $\underline{R}$  is transitive and reflexive, then show that  $\underline{R}^k = \underline{R}, k = 1, 2, \dots$  (7)

d) Define fuzzy equivalence relation and give an example with verification of properties. (8)

**OR**

e) Explain the following fuzzy relation of (i) preorder (ii) anti-symmetric (iii) dissimilitude and (iv) resemblance, each with an example. (8)

f) Let  $R$  be a fuzzy relation. If for some  $k, \underline{R}^{k+1} = \underline{R}^k$  then prove that  $\hat{\underline{R}} = \underline{R} \cup \underline{R}^2 \cup \underline{R}^3 \cup \dots \cup \underline{R}^k$ . (7)

4. a) Explain the two basic methods of fuzzy clustering. (5)

**OR**

b) Give a detailed description of fuzzy image processing. (5)

c) Explain fuzzy membership roster method with an example. (7)

d) Explain in detail fuzzy c-mean algorithm. (8)

**OR**

e) Explain sensing problem in pattern recognition. (7)

f) Explain with an example fuzzy syntactic method. (8)

5. a) Justify the need for fuzzy concepts to real life issues with simple example. (5)

**OR**

b) Write a short note to explain how the application of fuzzy concepts improves activities in the field of engineering. (5)

c) Explain in detail the impact of fuzzy principles in the field of Economics. (15)

**OR**

d) Explain in detail fuzzy application in the field of technology. (15)