



Date: 30-11-2022

Dept. No.

Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

Part - A

Answer ALL Questions

(10 x 2 = 20)

1. Write down the difference between fuzzy set and crisp set.
2. Define relative hamming distance.
3. Find the complement for
 $A = \{(x_1, 0.2), (x_2, 0.5), (x_3, 1), (x_4, 0.9), (x_5, 0.01)\}$
4. Define the union of two fuzzy relations R and Q .
5. Define path in a relation R .
6. Define similitude relation.
7. Define hidden pattern in fuzzy cognitive mapping.
8. What is a limit cycle and a fixed point.
9. Define expert system.
10. Write any two applications of fuzzy control

Part-B

Answer any FIVE Questions

(5 x 8 = 40)

11. Let R_1 and R_2 be two fuzzy relations.

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

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

Find (i) algebraic product (ii) algebraic sum and (iii) distinctive sum for R_1 and R_2

12. 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 $P_i, m_i, n_i \in R^+, i = 1, 2, 3, \dots, k$ and $P_i \leq m_i + n_i, i = 1, 2, 3, \dots, k$.

13. Verify the transitivity relation for the following relation

R \sim	A	B	C	D
A	1	0	0.2	0.3
B	0	1	0.1	1
C	0.2	0.7	1	0.4
D	0	1	0.4	1

14. Define fuzzy equivalence relation with an example.

15. State and prove decomposition theorem for fuzzy relations.

16. Let $\mathfrak{R} \subset E \times E$ be a similitude relation. Let x, y, z be three elements E . Let $c = \mu_{\mathfrak{R}}(x, z) = \mu_{\mathfrak{R}}(z, x)$, $a = \mu_{\mathfrak{R}}(x, y) = \mu_{\mathfrak{R}}(y, x)$ and $b = \mu_{\mathfrak{R}}(y, z) = \mu_{\mathfrak{R}}(z, y)$. Then $c \geq a = b$ or $a \geq b = c$ or $b \geq c = a$

17. Let $X = \begin{bmatrix} 0.3 & 0.7 & 0.8 & 1 & 0.5 & 0.4 \\ 0.4 & 0.5 & 1 & 0.3 & 0.8 & 0.5 \\ 0.6 & 0.1 & 0.4 & 0.8 & 0 & 0.2 \\ 0.9 & 0.4 & 0.6 & 1 & 0.3 & 0 \end{bmatrix}$ and $Y = \begin{bmatrix} 1 & 0.2 & 0.3 & 0.4 & 0.5 & 0 \\ 0.8 & 0.5 & 0.2 & 0.1 & 0.1 & 1 \\ 0.5 & 1 & 0.8 & 1 & 0 & 0.3 \\ 0.2 & 0.7 & 1 & 0.5 & 0.6 & 0.2 \end{bmatrix}$

Find $\text{Max}\{X, Y\}$ and $\text{Min}\{X, Y\}$

18. Explain the various attributes of an expert system.

Part - C

Answer any TWO Questions

(2 x 20 = 40)

19. (a) Find $R_2 \circ R_1$ using max-min composition.

R_1	y_1	y_2	y_3	y_4	y_5
x_1	0.1	0.2	0	1	0.7
x_2	0.3	0.5	0	0.2	1
x_3	0.8	0	1	0.4	0.3

R_2	z_1	z_2	z_3	z_4
y_1	0.9	0	0.3	0.4
y_2	0.2	1	0.8	0
y_3	0.8	0	0.7	1
y_4	0.4	0.2	0.3	0
y_5	0	1	0	0.8

(b) Explain the following fuzzy relation of (i) symmetric (ii) dissimilitude and (iii) anti-symmetric, each with an example. (14+6)

20. (a) Define fuzzy graph and explain different types with examples.

(b) If \mathfrak{R} is a preorder, then show that $\mathfrak{R}^k = \mathfrak{R}, k = 1, 2, 3, \dots$ (10+10)

21. (a) Let $\underline{A} = \{(x_1, 0.2), (x_2, 0), (x_3, 0), (x_4, 0.6), (x_5, 0.8), (x_6, 0.4), (x_7, 1)\}$

$\underline{B} = \{(x_1, 0.7), (x_2, 0.2), (x_3, 0), (x_4, 0.6), (x_5, 0.5), (x_6, 1), (x_7, 0)\}$

Find (i) $d(\underline{A}, \underline{B})$ (ii) $\delta(\underline{A}, \underline{B})$ (iii) $e^2(\underline{A}, \underline{B})$ (iv) $\in(\underline{A}, \underline{B})$

(b) Explain the structure and the process of fuzzy controller. (8+12)

22. Explain in detail the impact of fuzzy cognitive maps (FCM) in the field of social issues. (20)

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