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Mid Term Examination
Paper Code: MC-432
Max Marks: 25

Roll No.: ....
B.Tech.(VIII Semester), March-2019
Fuzzy Sets and Fuzzy Logic
Max Time: 1.5 Hours

- NOTE: **Answer all questions. Assume suitable missing data if any.**

Q 1. (a) State and prove the following properties of crisp set using characteristic function (5)

i. Axiom of excluded middle

ii. Axiom of the contradiction

iii. DeMorgan's Principles

All the aforesaid properties are true in case of fuzzy set. Is this statement true? Justify your answer.

(b) Let $X = \{1, 2, 3, \cdots, 11\}$. $\tilde{A}, \tilde{B}, \& \tilde{C}$ be fuzzy sets on X as given below (5)

$\tilde{A} = \{(1, 0.5), (2, 0.3), (3, 1), (4, 0.2), (5, 0.3), (6, 0.4), (7, 0.6), (8, 0.8), (10, 1), (11, 0.9)\}$

$\tilde{B} = \{(x, \mu_{\tilde{B}}(x) = (1 + (x - 11)^2)^{-1})\}$

$\tilde{C} = \{(x, \mu_{\tilde{C}(x)}) | x \in R\}$

$$where \ \mu_{\tilde{C}}(x) = \begin{cases} 0 & x > 11 \\ [1 + (x - 11)^{-4}]^{-1} & x \leq 11 \end{cases}$$

Determine (1) $\tilde{A} \cup \tilde{B} \cup \tilde{C}$, (2)$\tilde{A} \cap \tilde{B} \cap \tilde{C}$

(c) Let $\tilde{A}$=(-4,-1,2) and $\tilde{B}$=(-2,2,6) be two triangular fuzzy numbers 0 and 4, respectively. Calculate $\tilde{A} \oplus \tilde{B}$, $\tilde{A} \ominus \tilde{B}$, $\tilde{A} \odot \tilde{B}$, $\tilde{A} \oslash \tilde{B}$. The symbols $\oplus$, $\ominus$, $\otimes$, $\oslash$ are addition, substraction, multiplication, and division respectively. Use α-cuts wherever necessary and give reason also. (5)

Q 2. (a) Define fuzzy relation. Compose the following two fuzzy relations $\tilde{R}_1$ on $X \times Y$ and $\tilde{R}_2$ on $Y \times Z$ by using the (5)

i. Max-min composition

ii. Max-product composition

$$\tilde{R}_1 = \begin{bmatrix} 0.5 & 0.4 & 0.7 & 0.3 \\ 0.4 & 0.9 & 0.2 & 0.2 \\ 0.9 & 0.3 & 1 & 0.8 \end{bmatrix}, \quad \tilde{R}_2 = \begin{bmatrix} 1 & 0.7 & 0.1 \\ 0.6 & 0.5 & 0.4 \\ 0.7 & 0.9 & 0.6 \end{bmatrix}$$

Are both compositions are equal? If not, give reason.

(b) Given fuzzy tolerance relation $\tilde{R}$, is reflexive and symmetric. Find the equivalence relation using max-min operation, $\tilde{R}_e$, where $\tilde{R}$ is given as: (5)

$$\tilde{R} = \begin{bmatrix} 1 & 0.8 & 0.6 & 0.2 & 0.1 \\ 0.8 & 1 & 0.9 & 0.7 & 0.4 \\ 0.6 & 0.9 & 1 & 0.1 & 0.3 \\ 0.2 & 0.7 & 0.1 & 1 & 0.5 \\ 0.1 & 0.4 & 0.3 & 0.5 & 1 \end{bmatrix}$$