PD-363-S.E.-CV-19

M.A./M.Sc. MATHEMATICS (3rd Semester)

Examination, Dec.-2020

Paper-IV

FUZZY SETS AND THEIR APPLICATIONS-I

Time : Three Hours] **[Maximum Marks : 80**

[Minimum Pass Marks :29

Note : Answer from both the Sections as directed. The figures in the right-hand margin indicate marks.

Section-A

1. Answer following questions:- **1x10=10**

(a) **If A is a fuzzy set given by**

$$f(x) = \begin{cases} 1, & when\ \ x \le 20 \\ \frac{(35-x)}{15}, & when\ \ 20 < x < 35 \\ 0, & when\ \ x \ge 20 \end{cases}$$

Then for $\alpha \in [0,1], \alpha +\ \ A =$ ——————

(b) **If for** $x, y \in R$ **and** $\lambda \in [0,1]$, A **is a fuzzy set such that** $A(x) = .5$ **and** $A(y) = .7$, **then the value of** $A(\lambda x + (1-\lambda)y)$ **is**——————

(c) **If** A **is a fuzzy set on** $X = \{1,3,5,7,9\}$ **given by** $A(1) = 0.1,\ A(3) = 0.5,$ $A(5) = 0.3,\ A(7) = 0.7$ **and** $A(9) = 0.9$, **then the standard complement** $\overline{A}$ **of fuzzy set** A **is**——————

(d) **If** $i = [0,1] \times [0,1] \to [0,1]$ **is a t-norm, then the algebraic product** $i(0.5, 0.4) =$ ——————

(e) **If** $u = [0,1] \times [0,1] \to [0,1]$ **is a t-co.norm then the bounded sum** $u(0.5, 0.5) =$ ——————

(f) **If** A **is a fuzzy number defined by**

$$f(x) = \begin{cases} 0, & for\ \ x \le -1\ \ and\, x > 3 \\ \frac{(x+1)}{2}, & for -1 < x \le 1 \\ \frac{(3-x)}{2}, & for\, 1 < x \le 3 \end{cases}$$

Then $0.5_A =$ ——————

(g) **For any two fuzzy numbers** A **and B define** $MIN(A,B)$ **and** $MAX(A,B)$.

(h) **If** $R(X,Y)$ **is a fuzzy relation, then dom**$R(x) =$ —————— **for all**$x \in X$

(i) **Define sup-I composition of two fuzzy relations** $P(X,Y)$ **and** $Q(Y,Z)$.

(j) **Define INF-**w_i **compositions of fuzzy relations.**

2. Answer all questions:- **2x5=10**

(a) **If** $A = \frac{0.2}{2} + \frac{0.3}{3} + \frac{0.4}{4} + \frac{0.4}{5} + \frac{0.7}{6}$ **is a fuzzy set on** $X = \{2,3,4,5,6\}$, **then find value of** $\wedge(A)$?

(b) **State third decomposition theorem.**

(c) **Define drastic intersection.**

(d) **Define a fuzzy number.**

(e) **Define compatibility relation.**

Section-B **12x5=60**

Answer any five of the following questions.

3. Let A, B **be fuzzy sets defined on a universal set** X. **Prove that** $|A| + |B| = |A \cup B| + |A \cap B|$ **where** $\cap, \cup$ **are standard fuzzy intersection and union respectively.**

4. Let A and B be fuzzy sets defined on the universal set $X = Z$ whose membership functions are given by

$$A(x) = \frac{.5}{(-1)} + \frac{1}{0} + \frac{.5}{1} + \frac{.3}{2} \quad \text{and} \quad B(x) = \frac{.5}{2} + \frac{1}{3} + \frac{.5}{4} + \frac{.3}{5}$$

Let $f: X \times X \to X$ be defined by $f(x_1, x_2) = x_1 + x_2$

For all $x_1, x_2 \in X$. Calculate $f(A, B)$.

5. Let f be a decreasing generator. Then prove that a function g defined by $g(a) = f(0) - f(a)$ for any $a \in [0,1]$ is an increasing generator with $g(1) = f(0)$, and its pseudo-inverse $g^{(-1)}$ given by $g^{(-1)}(a) = f^{(-1)}(f(0) - a)$ for any $a \in R$.
6. Let $* \in \{+, -, \cdot, /\}$ and let A, B denote continuous fuzzy numbers. Then prove that the fuzzy set $A * B$ defined by $(A * B)(z) = sup\ min[A(x), B(y)]$ for all $z \in R$, $z = x * y$
7. Explain fuzzy morphisms with suitable example.
8. Explain problem partitioning with suitable example.
9. Prove that $\breve{P} = \left(Q \overset{wi}{\underset{0}{}} R^{-1}\right)$ is the greatest approximate solution of $P \overset{i}{\underset{0}{}} Q = R$.
10. For any fuzzy relation $R on X^2$, prove that fuzzy relation $R_{T(i)} = \bigcup_{n=1}^{\infty} R^{(n)}$ is the i-transitive closure of R.