PC-363-CV-19

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

Examination, Dec.-2020

MATHEMATICS

Paper-IV

FUZZY SETS AND THEIR APPLICATIONS-I

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

[Minimum Pass Marks : 29

नोट : दोनों खण्डों से निर्देशानुसार उत्तर दीजिए। प्रश्नों के अंक उनके दाहिनी ओर अंकित हैं।

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

Section-A

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

(a) **Two fuzzy sets are equal if they have the same number of elements and their....................are equal.**

(b) **For two fuzzy sets A and B on universal set X_ |A|+|B| = ...**

(c) **The law of .... do not holds for fuzzy sets.**

(d) **Define Drastic intersection.**

(e) **Define Decreasing generator**

(f) **Write an example of fuzzy number.**

(g) **Define total projection of fuzzy relation.**

(h) **Define fuzzy pre-order relation.**

(i) **A fuzzy relation R is max-min transitive if ....**

(j) **The only idempotent t – norm is ....**

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

(a) **Computer relative cardinality of following fuzzy Set**

$$A = \frac{.4}{a} + \frac{.2}{b} + \frac{.6}{c} + \frac{.4}{d} + \frac{1}{e}$$

(b) **Find** $.4_A$ **for fuzzy set**

$$A = \{(1,.2),(2,.4),(3,.6),(4,1)\}$$

(c) **Prove that following fuzzy set is fuzzy number**

$$B(x) = \begin{cases} x & 0 \le x \le 1 \\ 0 & \text{other wise} \end{cases}$$

(d) **The matrix of fuzzy relation R (x,y) is**

$$R = \begin{array}{c|cc} & a & b \\ \hline x & 1 & .9 \\ Y & 0 & .7 \\ z & .6 & .3 \end{array}$$

find domain of R

(e) **Prove that following relation is not reflexive.**

$$R = \begin{array}{c|ccc} & x_1 & x_2 & x_3 \\ \hline x_1 & 1 & .4 & .3 \\ x_2 & .2 & 1 & .5 \\ x_3 & .1 & .3 & .9 \end{array}$$

Section-B

12x5=60

Answer any five of the following questions:-

3. **(a) Prove that a fuzzy set A on R is convex if and only if**

   $$A(\lambda x_1 + (1-\lambda)x_2) \geq \text{Min}\,[A(x_1), A(x_2)]$$

   For all $x_1, x_2 \in R$ and all $\lambda \in [0,1]$

   (b) Give example of fuzzy sets in X such that

   $$A \cup A^c = X, \quad A \cap A^c \neq \phi$$

4. **(a) State and prove first decomposition theorem.**

   (b) At $f: x \to y$ be an arbitrary crisp function then for any $A \in f(x)$ and for all $\propto \in [0,1]$ prove that $\propto + [f(A)] = f[\propto + A]$

5. **State and prove first characterization theorem of fuzzy compliments.**

6. **(a) Let $< i, u, c >$ be a dual triple that satisfies the law of excluded middle and the law of contradiction them prove that $< i, u, c >$ does not satisfy the distributive laws.**

   (b) At f be a decreasing generator. Then a function g defined by

   $$g(a) = f(0) - f(a), a \in [0,1]$$

   is an increasing generator with g(1) = f(0) and its Pseudo-inverse is given by

   $$g^{(-1)}(a) = f^{(-1)}[f(0) - a], \quad a \in R$$

7. **At $* \in \{+, -, \cdot, 1\}$ and A , B be continuous fuzzy numbers the prove that $A * B$ is also a continuous fuzzy numbers.**

8. **At R be set of all fuzzy numbers then prove that R is distributive Lattice in which MIN and MAX represent the meet and join respectively.**

9. **Solve PoQ = r where**

   $$Q = \begin{bmatrix} .1 & .4 & .5 & .1 \\ .9 & .7 & .2 & 0 \\ .8 & .1 & .5 & 0 \\ .1 & .3 & .6 & 0 \end{bmatrix}$$

   and

   $$\mathbf{r} = [.8 \; .7 \; .5 \; 0]$$

10. **(a) For any fuzzy relation R on X^2 prove that the fuzzy relation**

    $$R_{T(i)} = \bigcup_{n=1}^{\infty} R^n$$

    is the i – transitive closure of R

    (b) Prove that the properties of symmetry, reflexivity and transitivity are preserved under inversion for both crisp and fuzzy relations.