AH-1553-CV-19-S

M.Sc. (Final) MATHEMATICS

Term End Examination, 2019-20

FUZZY SETS AND THEIR APPLICATIONS

PAPER-

Time : Three Hours] **[Maximum Marks : 100**

Note : Attempt any five questions. All questions carry equal marks.

1. **(a) State and prove second Decomposition theorem on Fuzzy set.**
   (b) A fuzzy set A on R is convex iff
   $$A[\lambda x_1 + (1-\lambda)x_2] \geq \min[A(x_1), A(x_2)]$$
2. **State and prove characterization theorem of t-conorm.**
3. **(a) Prove that a continuous fuzzy complement has a unique equilibrium.**
   (b) Prove that the standard fuzzy intersection is the only idempotent t-norm.
4. **Let $A \in F(R)$ then A is a fuzzy number if and only if there exists a closed interval $[a,b] \neq 0$ such that**
   $$A(x) = \begin{cases} 1, & for\ x \in [a,b] \\ l(x), & for\ x \in (-\infty, a) \\ r(x), & for\ x \in (b, \infty) \end{cases}$$
   Where l is a function from $(-\infty, a)$ to $(0,1)$ that is monotonic increasing continuous from right, and such that $l(x) = 0\ \forall\ x \in (-\infty, w_1)$; r is a function from (b, ∞) to $[0,1]$ that is monotonic decreasing, continuous from the left, and such that $r(x) = 0\ \forall x \in (w_2, \infty)$
5. **Solve the following fuzzy relation equation for the max. min composition**
   $$P0 \begin{bmatrix} .5 & .7 & 0 & .2 \\ .4 & .6 & 1 & 0 \\ .2 & .4 & .5 & .6 \\ 0 & .2 & 0 & .8 \end{bmatrix} = [.5 \quad .5 \quad .4 \quad .2]$$
6. **Let a given finite body of evidence $[f, m]$ be nested. Then prove that**
   (i) $nec(A \cap B) = min[nec(A), nec(B)]$
   (ii) $pos(A \cup B) = max[pos(A), pos(B)]$
7. **Explain Methods of defuzzification.**
8. **Solve the following fuzzy linear programming problems.**
   $MaxZ = 6x_1 + 5x_2$
   s.t.
   $$(5,3,2)x_1 + (6,4,2)x_2 \leq (25,6,9)$$
   $$(5,2,3)x_1 + (2,1.5,1)x_2 \leq (13,7,4)$$
   $$x_1, x_2 \geq 0$$
9. **Explain with example**
   (i) Multistage decision making
   (ii) Multiperson decision making
10. **(a) Prove that**
    $$B_2' \subseteq B_4' \subseteq B_1' = B_3'$$
    (b) Let sets of of values of variable x and ψ be $X = \{x_1, x_2, x_3\}$ and $Y = \{y_1, y_2, y_3\}$ respectively let us take proposition
    $$P: "if\ X\ is\ A\ then\ \psi\ is\ B" \text{ where}$$
    $$A = \frac{.5}{x_1} + \frac{1}{x_2} + \frac{.6}{x_3} \quad and \quad B = \frac{1}{y_1} + \frac{.4}{y_2}$$
    Then given a fact expressed by the proposition "X is A' " where
    $$A' = \frac{.6}{x_1} + \frac{.9}{x_2} + \frac{.7}{x_3}$$

By the use of generalized modus ponens derive a conclusion in the form " ψ is B' "
Explain with example