PC-483-CV-19-S

M.A./M.Sc.- MATHEMATICS (IV-SEMESTER)

Term End Examination, 2019-20

FUZZY SETS AND THEIR APPLICATIONS-II

PAPER-IV

Time : Three Hours] **[Maximum Marks : 080**

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

SECTION-A

1. **Answer the following questions:-** **2*5=10**
   (a) How do you calculate Bel measure from basic probability assignment.
   (b) How do you calculate plausible measure from basic probability assignment.
   (c) What are the various types of fuzzy quantifiers.
   (d) Write the four modules of a general fuzzy controller.
   (e) What do you mean by fuzzy decision making?
2. **Answer the following questions:-** **2*5=10**
   (a) Prove that
   (i) Nec $(A) > 0 \Rightarrow$ Pos $(A) = 1$
   (ii) Pos $(A) < 0 \Rightarrow$ Nec$(A) = 0$ for every $A \in p(x)$
   (b) How are the following primitives defined by Lukasiewicz $\overline{a}$, $a \wedge b$, $a \vee b \Rightarrow b$ and $a \Leftrightarrow b$
   (c) Write the reasonable axioms of fuzzy implications.
   (d) Explain multicriteria decision making.
   (e) For fuzzy measure of prove that of $(A \cup B) \leq min\,[g(A),\ g(B)]$ for any two set A&B

SECTION-B

Answer any five of the following questions:- **12*5=60**

3. (a) Let a given finite body of evidence (F, m) be nested. Then prove that
   $Nec(A \cap B) = min\,[Nec(A), Nec(B)]$
   $Pos(A \cup B) = max\,[Pos(A), Pos(B)]$
   (b) Let basic probability assignments m_1 and m_2 on $X = \{a, b, c, d,\}$ which are obtained from two independent sources be defined as follow:
   $m_1(\{a, b\}) = .2,\ m_1(\{a, c\}) = .3,$
   $m_1(\{b, d\}) = .5,\ m_2(\{a, d\}) = .2,$
   $m_2(\{b, c\}) = .5,\ m_2(\{a, b, c\}) = .3,$
   Calculate the combined basic probability assignment $m_{1,}\ 2$ by using the Dunpster rule of combination.
4. (a) Prove that $pl(A) \geq Bel(A)$ for all $A \in p(x)$
   (b) Prove that every possibility measure Pos on a finite power set p(x) is uniquely determined by a possibility distribution function $r\colon X \to [0, 1]$ via the formula
   $Pos(A) = max\, r(x)\ \ x \in A\ \ for\ each\ A \in p(x)$
5. (a) Write short notes on:-
   (i) Fuzzy proposition
   (ii) Linguistic Hedges
   (b) Let sets of values of variables x and y be $X = \{x_1, x_2, x_3\}$ and $Y = \{y_1, y_2,\}$, respectively. Assume that a proposition "if x is A, then y is B" is given, where $A = \frac{.5}{x_1} + \frac{1}{x_2} + \frac{.6}{x_3}$ and $B = \frac{1}{y_1} + \frac{.4}{y_2}$ Then given a fact expressed by the proposition "x is A'," where is $A' = \frac{.6}{x_1} + \frac{.9}{x_2} + \frac{.7}{x_3}$, use the generalized modus ponens to derive a conclusion in form "y is B'."
6. Let a fuzzy proposition of the from p: if x is A, then y is B is S be given, where S is the identity function (i.e. S stands for true), and let a fact be given in the form "x is A'", where sup $A'(x) = A'(x_0)$ $x\colon A(x) = a$ for all $a \in [0, 1]$ and some x_0 s.t. $A(x_0) = a$ Then prove that the method of truth value restrictions is equal to the one obtained by the generalized modus ponens provided that are use the same fuzzy implication in both inference methods.

7. (a) Let i_1, i_2 be t-norms s.t. $i_1(a,b) \leq i_2(a,b)$ for all $a, b \in [0,1]$, and let i_1, i_2 be R-implications based on i_1, i_2 respectively. Then prove that $i_1(a,b) \geq i_2(a,b) \forall a, b \in [0,1]$

   (b) Let A be a normal fuzzy set for any continuous t-norm i and the associated w_i operator, let $i = w_i$, that is $i(A,(x), B(y)) = w_i(A(x), B(y))$ for all $x \in X, y \in Y$ Then prove that $B(y) = sup\ i[A(x), i(A(x), B\ (y)]\ x \in X$ holds.

8. (a) Write short notes on fuzzy expert systems.

   (b) Let $i(a,b) = max\ (0, a+b, -1)$ for all $a, b \in [0,1]$ and let i_a be the Lukasiewicz implication that is $w_i(a,b) = i_a(a,b) = min(1, 1-a+b)$ for all $a, b \in [0,1]$ Then prove that $Ao^{wi}B = [c(B)0^{wi}c(A)]^{-1}$ holds for any fuzzy sets A, B.

9. Discuss in detail the various basic components of a general fuzzy controller.

10. Explain any two defuzzification methods.