Roll No. .....

DD–766

M. A./M. Sc. (Fourth Semester)

EXAMINATION, 2020

MATHEMATICS

Paper Third (C)

[(Fuzzy Set Theory and Its Applications (II)]

Time : Three Hours

Maximum Marks : 80

Note : Attempt any *two* parts from each question. All questions carry equal marks.

Unit—I

1. (a) Define logic, propositional logic. Write canonical form of modus ponens, modus tollens, hypothetical syllogism, unconditional and qualified proposition, conditional and unqualified proposition, conditional and qualified propositions.

   (b) Give the steps of truth value restriction.

(c) Let :

$$X = x_1, x_2, x_3$$

$$Y = y_1, y_2$$

$$Z = z_1, z_2$$

and $$A = \left(\frac{.5}{x_1}, \frac{1}{x_2}, \frac{6}{x_3} \right)$$

$$B = \left\{ \frac{1}{y_1} . \frac{.4}{y_2} \right\}, C = \left\{ \frac{.2}{z_1}, \frac{1}{z_2} \right\}$$

for $J(a,b) = \begin{cases} 1 & \text{if } a \le b \\ b & \text{if } a > b \end{cases}$

then find :

$$R_3(x,z) = \sup_{y \in Y} \min \left[R_1(x,y), R_2(y,z) \right]$$

Unit—II

2. (a) Draw architecture of expert system.

(b) Show that :

$$J(a,b) = f^{-1}$$

$$f(1 - f(a) + f(b)),$$

where $f : [0,1] \to [0,\infty)$, $f(0) = 0$

is an increasing function, is a fuzzy implication.

(c) If :

$$A_1 = \left(\frac{1}{x_1}, \frac{.9}{x_2}, \frac{.1}{x_3} \right)$$

$$A_2 = \left(\frac{.9}{x_1}, \frac{1}{x_2}, \frac{.2}{x_3} \right)$$

$$B_1 = \left(\frac{1}{y_1}, \frac{.2}{y_2} \right)$$

$$B_2 = \left(\frac{.2}{y_1}, \frac{.9}{y_2} \right)$$

$$A_3 = \frac{.8}{x_1}, \frac{.9}{x_2}, \frac{.1}{x_3}$$

Find B_3 by method of interpolation.

Unit—III

3. (a) Discuss the main issues involved in the design of a fuzzy controller for stabilizing an inverted pendulum.

(b) Write a short note on fuzzification of classical dynamic systems.

(c) Write assumptions in a fuzzy control system design.

Unit—IV

4. (a) What do you mean by defuzzification ? Write a brief account of centre of sums method.

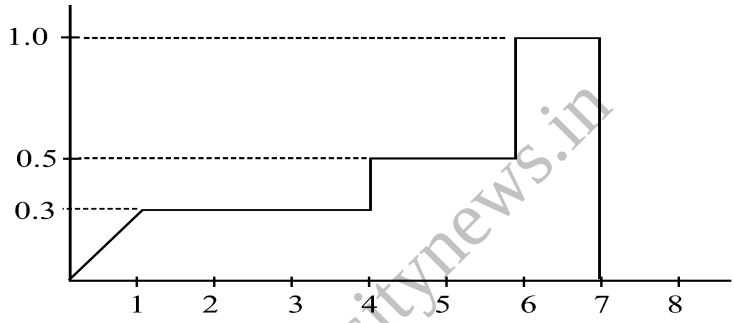
(b) Aggregate graphically the fuzzy sets :

$$A_1 = \frac{0}{0}, \frac{.3}{1}, \frac{.3}{2}, \frac{.3}{3}, \frac{.3}{4}, \frac{0}{5}$$

$$A_2 = \frac{0}{3}, \frac{.5}{4}, \frac{.5}{5}, \frac{.5}{6}, \frac{0}{7}$$

$$A_3 = \frac{0}{5}, \frac{1}{6}, \frac{1}{7}, \frac{0}{8}$$

(c) Find x^* by method of centroid method for the figure :



Unit–V

5. (a) If $^{0+}A = 0,4$, $^{1}A = 1,3$ and B, C are symmetric triangular fuzzy numbers with centres $C_B = 4$, $C_C = 5$ and spreads $S_B = S_C = 2$. Rank these fuzzy numbers with Hamming distance method.

(b) Explain the method of symmetric fuzzy linear programming method.

(c) Explain the method of proposed by Shimura to construct an odering of all given alternatives.