2020

M.Sc. 4th Semester Examination

Applied Mathematics with Oceanology and Computer Programming

Paper-MTM402

Full Marks-40

Time -2 Hours

Candidates are required to give their answers in their own words as far as practicable.

UNIT-I

(FUZZY MATHEMATICS WITH APPLICATIONS)

Answer any one from the following. (20)

1. i) Explain Bellman and Zadeh's optimal principle with example.

   ii) Find $f(\check{A}) = \tilde{B}$, given
   $f(x) = x^2$,
   $\check{A} =$
   $\{(-5,0.1),(-4,0.3),(-3,0.5),(-2,0.7),(-1,0.9),(0,1)(1,0.8),(2,0.6),(3,0.5)(4,0.4)(5,0.2$
   iii) What are random and fuzzy uncertainties?

2. Using Zimmermann method formulate the crisp LPP equivalent to the fuzzy LPP given below

$$\widetilde{Max}\ Z = x_1 + x_2$$
$$\text{Subject to } -x_1 + 3x_2 \lesssim 21$$
$$x_1 + 3x_2 \lesssim 27$$
$$4x_1 + 3x_2 \lesssim 45$$
$$3x_1 + 3x_2 \lesssim 30$$
$$x_1, x_2 \geq 0$$

The aspiration label Z_0 and tolerance p_i are taken as Z_0 =14.5 , p_0=2, p_1=3, p_2=6 and p_3=6.

3. Let $\tilde{A}$ and $\tilde{B}$ two fuzzy numbers with membership functions,

$$\mu_{\tilde{A}}(x) = \begin{cases} 0 & for\ x \leq 1 \\ (x-1)/_2 & for\ 1 < x \leq 3 \\ 1 & for\ 3 < x < 4 \\ (5-x) & for\ 4 \leq x < 5 \\ 0 & fo \geq 5 \end{cases}$$

$$\mu_{\tilde{B}}(x) = \begin{cases} 0 & for\ x \leq 2 \\ (x-2)/_3 & for\ 2 < x < 5 \\ (7-x)/2 & for\ 5 \leq x < 7 \\ 0 & for\ x \geq 7 \end{cases}$$

Using $\alpha - cut$ and addition rule of interval numbers, determine the membership functions of $\tilde{A} + \tilde{B}$.

4. (a) Discuss Verdgay's method to solve a fuzzy linear programming problem.

(b) Evaluate 4[3,4,6]-3[10,15]+17.

5. (a) Define arithmetic operations on interval numbers. For interval X, Y and Z, the distribution property does not hold in general i.e. X(Y+Z)≠ XY+XZ.

(b) Show that the fuzzy set with the following membership function is neither normal nor convex.

$$\mu_{\tilde{A}}(x) = \begin{cases} 0 & for\ x = 1 \\ 3(x-1)/_8 & for\ 1 < x \leq 3 \\ \frac{(6-x)}{4} & for\ 3 < x \leq 4 \\ \frac{(3x-2)}{20} & for\ 4 \leq x \leq 6 \\ \frac{3(7-x)}{5}0 & for\ 6 < x < 7 \\ 0\ for\ x \geq 7 \end{cases}$$

6. *Using Verdegay's method to solve the fuzzy LPP*

$$\text{Maximize } z = 2x_1 + x_2$$

$$\text{Subject to } x_1 + 0x_2 \leq 3 \text{ to } 4$$

$$x_1 + x_2 \leq 4 \text{ to } 6$$

$$0.5x_1 + x_2 \leq 3 \text{ to } 5$$

$$x_1, x_2 \geq 0$$

UNIT-II

(SOFT COMPUTING)

Answer any one from the following. (20)

1. Draw flow chart of Genetic Algorithm. Write a short note on Roulette-Wheel selection process. What do you mean by Fuzzy logic?

2. Compare BNN and ANN.
   Let $X = \{a, b, c, d\}$ and $Y = \{1,2,3,4\}$. The fuzzy sets $\tilde{A}, \tilde{B}$ and $\tilde{C}$ are given by $\tilde{A} = \{(a,0), (b,0.8), (c,0.6), (d,1)\}$, $\tilde{B} = \{(1,0.2), (2,1), (3,0.8), (4,0)\}$, $\tilde{C} = \{(1,0), (2,0.4), (3,1), (4,0.8)\}$, then determine
   If X is $\tilde{A}$ then Y is $\tilde{B}$ else Y is $\tilde{C}$.

3. Write a short note on 'cross over' for binary coded GA.
   Write down the notations and truth values for the following fuzzy propositions:
   i)Negation ii) Disjunction iii) Conjunction iv) Implication

4. i) Write a short note on 'single-layer feed forward network' and 'multi-layers feed forward network'.
   ii) Implement ANDNOT function using MP-Neuron using standard binary data.

5. Apply fuzzy modus ponens rule to deduce 'rotation is quite slow' given:
   i) If the temperature is high then the rotation is slow
   ii) The temperature is very high
   Where $\tilde{H}$ (high), $\widetilde{VH}$ (very high), $\tilde{S}$ (slow) and $\widetilde{QS}$ (quite slow) indicated the associated fuzzy sets as follows:
   for $X = \{30,40,50,60,70,80,90,100\}$, the set of temperatures,
   $Y = \{10,20,30,40,50,60\}$, the set of rotations per minute,
   $\tilde{H} = \{(70,1), (80,1), (90,0.3)\}$, $\widetilde{VH} = \{(90,0.9), (100,1)\}$,
   $\widetilde{QS} = \{(10,1), (20,0.8)\}$, $\tilde{S} = \{(30,0.8), (40,1), (50,0.6)\}$.

6. Using real coded GA, find $\max f(x) = x^3 - 12x^2 + 45x$, given $0 \leq x < 4$ and population size=5.
   Random nos. for selection are 0.46, 0.30, 0.82, 0.90, 0.56,
   probability for cross over p_c =0.4, probability for mutation p_m =0.2,
   random nos. for cross over 0.346, 0.130, 0.982, 0.90, 0.656,
   'a' (for cross over) =0.346,
   random nos. for mutation 0.19, 0.59, 0.65, 0.45, 0.96,
   for mutation r = 0.55, Δ=12, initial population is 1.852, 3.828, 1.380, 1.472, 1.776.