APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING [P.G.]

M.Sc. Fourth Semester End Examination-2024

[Regular & Supplementary Paper]

PAPER-MTM-402

Full Marks: 50 ***Time: 02 Hrs***

The figures in the right-hand margin indicate marks

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

Illustrate the answers wherever necessary.

[Use separate answer script for each unit]

Unit I

[Fuzzy Mathematics with Application]

F.M. – 25

Answer question No. 1 and two from the rest $2 \times 2 = 4$

1. (a) What is the difference between random uncertainty and non-random uncertainty?

   (b) Suppose (10, 14, 19) is a triangular fuzzy number. Write its membership function and draw its diagram.

   (c) Show that law of contradiction and law of excluded middle are not true in fuzzy set theory.

2. (a) For the following three interval numbers

   [1, 4], [2, 5] and [3, 8]

   Show that the distributive law does not hold.

(b) State Bellman and Zadeh's principle for fuzzy LPP. 4+4

3. (a) What does mean by "Symmetric and Non-symmetric" fuzzy linear programming problems?

(b) Determine the crisp LPP equivalent to the fuzzy LPP using Werner's method

$$Max\ Z = 4x_1 + 5x_2 + 9x_3 + 11x_4$$

$$\text{Sub. To } x_1 + x_2 + x_3 + x_4 \leq 15\ to\ 5$$

$$7x_1 + 5x_2 + 3x_3 + 2x_4 \leq 80\ to\ 120$$

$$3x_1 + 5x_2 + 10x_3 + 15x_4 \leq 100\ to\ 130$$

Where $x_1, x_2, x_3, x_4 \geq 0$. It is given that the optimum value of the LPP with lower and upper resources are $z_0 = 99.29$ and $z_1 = 130$.

2+6

4. Using Zadeh's extension principle, prove that $[1, 3]+ [5, 8]=[6,11]$

8

[Internal Assessment – 5]

Unit II

[Soft Computing]

F.M. - 25

1. **Answer any two questions of the following:** **2x2= 4**

a) What do you mean by fuzzy reasoning?

b) Write the expression and membership function of the fuzzy relation $\tilde{R}$. If x is $\tilde{A}$, then y is $\tilde{B}$.

c) Give the difference between the 'Artificial Neural Network' and 'Biological Neural Network'

2. **Answer any two questions of the following:** **2x4= 8**

a) Find the population after 'Binary Cross over' for the following

Present population: 100101, 011010, 111010, 111010, 101100, 101100

Probability of Crossover, Pc=0.7

Pos (position) of crossover is 2

Random Nos for crossover.

0.62, 0.80, 0.50, 0.47, 0.75, 0.45

b) Generate the output of the logical OR function single paraptron where weight $W = \begin{bmatrix} 1 \\ 1 \end{bmatrix} bias\ b = -1$.

c) Explain different activation functions of ANN.

3. **Answer any one questions of the following:** **8x1= 8**

a) Let $A = B\{1,5,9,10\}$ be some typical job performance indexes in an application, with the following discrete membership function for the fuzzy description "poor performance".

$$\mu_A(a) = \begin{cases} 1.0\ if\ a=1 \\ 0.5\ if\ a=5 \\ 0.1\ if\ a=9 \\ 0.0\ if\ a=10 \end{cases}$$

Let R be a fuzzy relation between two numbers in A, meaning" very close to each other" and be defined as

R:

	1	5	9	10
1	1.0	0.5	0.0	0.0
5	0.5	1.0	0.5	0.1
9	0.0	0.5	1.0	0.5
10	0.0	0.1	0.5	1.0

Suppose that one wants to perform the following fuzzy logic inference:

Premise	a has poor performance
Implication	a and b are very close to each other
conclusion	b has some what poor performance

Compute the membership value at b=5 i.e. $\mu_B(5)$.

b) Let the classification is as like as

$$\left\{x_1^T=[2,2], d_1=0\right\}\cdot\left\{x_2^T=[1,-2], d_2=1\right\}$$

$$\left\{x_3^T=[-2,2], d_3=0\right\}\cdot\left\{x_4^T=[-1,1], d_4=1\right\}$$

Solve it upto one iteration only) with two element perception network having hard limit activation function, the symbols have the usual meanings.

c) Maximize $f(x)=4+10x-x^2, 1\le x\le 9$ using binary coded GA.

Given that population size N=5, initial population $x_1=10111$,

$x_2=10101, x_3=11100, x_4=11101, x_5=10100.$

Random numbers for selection: 0.19, 0.63, 0.97, 0.11, 0.70.

Cross-over probability, $P_c=0.8$ and random numbers for cross-over: 0.60,0.85,0.57, 0.37, 0.70.

Mutation probability, $P_m=0.04$ and random numbers for mutation 0.21,0.37, 0.02, 0.52, 0.07, 0.97, 0.14, 0.61, 0.17, 0.09, 0.03, 0.82, 0.08, 0.21, 0.37, 0.20, 0.25, 0.72, 0.24, 0.16, 0.47, 0.58, 0.49, 0.01, 0.18. (one iteration only)

[Internal Assessment – 5]