# M.Sc. 4th Semester Examination, 2012

## APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

(*Fuzzy Sets and Their Applications, Soft Computing*)

PAPER—MTM-403

*Full Marks* : 50

*Time* : 2 hours

*The figures in the right-hand margin indicate marks*

GROUP – A

(*Fuzzy Sets and Their Applications*)

[ *Marks* : 25 ]

Answer **Q. No. 1** and any *three* from the rest

**1.** Answer any *two* questions : 1 × 2

(*a*) What is a support of a fuzzy set ?

(*b*) Define the union operation of two fuzzy sets.

(*c*) Give an example of a trapezoidal fuzzy number.

2. What are causes of uncertainty ? Explain the traditional and modern view of uncertainty ? What are random and non-random uncertainty ? Explain it. 2 + 2 + 2

3. (*a*) What is meant by fuzzy optimization ? Explain it.

   (*b*) Prove that D' Morgan's law is true for fuzzy sets. 3 + 3

4. Discuss Verdegay's method to solve a fuzzy LPP. 6

5. (*a*) Simplify the following :

   $$3\,[1, 2, 4, 6] - 2\,[-3, 4, 5] + 5\,[-2, 2] + 10$$ 2

   (*b*) If $\widetilde{A} = [2, 4, 5, 7]$ and $\widetilde{B} = [1, 3, 5, 8]$ be two trapezoidal fuzzy numbers, then using $\alpha$-cut, find $\widetilde{A} + \widetilde{B}$. 4

6. Using Zimmerman's method, determine the crisp LPP equivalent to the following fuzzy LPP :

   Find $x$
   Such that

   $$13x_1 + 12x_2 \geq \widetilde{b}_0$$
   $$4x_1 + 3x_2 \leq \widetilde{b}_1$$
   $$2x_1 + 5x_2 \leq \widetilde{b}_2$$
   $$3x_1 + 4x_2 \leq \widetilde{b}_3$$

where the goal $b_0$ of the fuzzy objective is 25 and its corresponding tolerance $p_0$ is 2 and the fuzzy resource $b_i$ and their tolerance $p_i$ are as follows :

$$b_1 = 12,\ b_2 = 10,\ b_3 = 12$$
$$p_1 = 1,\ \ p_2 = 1,\ \ p_3 = 2.$$ 6

[ *Internal Assessment* : 5 Marks ]

## GROUP – B

## (*Soft Computing*)

[ *Marks* : 25 ]

**1.** Answer any *two* of the following :

(*a*) Maximize $f(x) = x^3 - 12x^2 + 45x$ in $0 \leq x \leq 4$ using real coded GA(one iteration only) given that
Population size = $N = 5$
Initial population, $x(t) \equiv \{1{\cdot}852, 3{\cdot}828, 1{\cdot}380, 1{\cdot}472, 1{\cdot}776\}$
Random Nos. to be used for selection :
0·46, 0·30, 0·82, 0·90, 0·56, $p_c = 0{\cdot}4$
Random Nos. to be used for crossover
0·346, 0·130, 0·982, 0·090, 0·656, $p_m = 0{\cdot}2$

Random Nos. to be used for mutation
0·19, 0·59, 0·65, 0·45, 0·96

Permutation Value = $\Delta = 1{\cdot}20$ } for random
random No. = $r = 0{\cdot}55$ } mutation 8

(*b*) Let $X = \{a, b, c, d\}$, $Y = \{1, 2, 3, 4\}$
$\widetilde{A} = \{(a, 0)\ (b, 0{\cdot}8)\ (c, 0{\cdot}6)\ (d, 1)\}$
$\widetilde{B} = \{(1, 0{\cdot}2)\ (2, 1)\ (3, 0{\cdot}8)\ (4, 0)\}$
$\widetilde{C} = \{(1, 0)\ (2, 0{\cdot}4)\ (3, 1)\ (4, 0{\cdot}8)\}$

Determine the implication relations

(*i*) IF $x$ is $\widetilde{A}$ THEN $y$ is $\widetilde{B}$

(*ii*) IF $x$ is $\widetilde{A}$ THEN $y$ is $\widetilde{B}$
ELSE $y$ is $\widetilde{C}$ 3 + 5

(*c*) (*i*) Present the model of an artificial neuron with hard limit function as threshold function.

(*ii*) Verify the output of logical AND function by a single perceptron using initial weights

$$W = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

and bias, $b = -2$. 5 + 3

2. Answer any *one* of the following : 4 × 1

(*a*) Outline the Roulette-Wheel selection process along with the algorithm. 4

(*b*) Explain the one point and two point crossover for binary cross-over process with examples.

Outline the advantages and disadvantages, if any, of GA. 2 + 2

[ *Internal Assessment* : 5 Marks ]