M.Sc. (MATHEMATICS WITH APPLICATIONS IN COMPUTER SCIENCE)
M.Sc. (MACS)
Term-End Examination   00659

December, 2011

MMTE-007 : SOFT COMPUTING AND ITS APPLICATIONS

Time : 2 hours   *Maximum Marks : 50*

Note : *Attempt **any four** questions from Q. No. **1** to Q. No. **6**.*
*Q. No. **7** is **compulsory**.*

1. (a) Consider two fuzzy sets   6

$$A = \left\{ \frac{1}{2} + \frac{0.5}{3} + \frac{0.6}{4} + \frac{0.2}{5} + \frac{0.6}{6} \right\} \quad \text{and}$$

$$B = \left\{ \frac{0.5}{2} + \frac{0.8}{3} + \frac{0.4}{4} + \frac{0.7}{5} + \frac{0.3}{6} \right\}$$

Find complement, union, intersection and difference of the above two fuzzy sets.

    (b) Define the following giving an example of   4
    each

    (i)   Learning Rate

    (ii) Momentum

    (iii) Stability

    (iv) Convergence

2. (a) Consider fuzzy relation 4

$$R = \begin{array}{c} \\ x_1 \\ x_2 \end{array} \begin{array}{cc} y_1 & y_2 \\ \begin{bmatrix} 0.7 & 0.6 \\ 0.8 & 0.3 \end{bmatrix} \end{array} \text{ and}$$

$$S = \begin{array}{c} \\ y_1 \\ y_2 \end{array} \begin{array}{ccc} z_1 & z_2 & z_3 \\ \begin{bmatrix} 0.8 & 0.5 & 0.4 \\ 0.1 & 0.6 & 0.7 \end{bmatrix} \end{array}$$

Find the relation $T = RoS$ using max-min and max-product composition.

(b) Improve the solution of the following 6 problem

$$f(x) = \sqrt{x}$$

subject to $1 \le x \le 32$. Show working solution for only two iterations using genetic algorithm.

3. (a) For the given fuzzy sets 6

$$A = \left\{ \frac{1}{1.0} + \frac{0.65}{1.5} + \frac{0.4}{2.0} + \frac{0.35}{2.5} + \frac{0}{3.0} \right\}$$

$$B = \left\{ \frac{0}{1.0} + \frac{0.25}{1.5} + \frac{0.6}{2.0} + \frac{0.25}{2.5} + \frac{1}{3.0} \right\}$$

$$C = \left\{ \frac{0.5}{1.0} + \frac{0.25}{1.5} + \frac{0}{2.0} + \frac{0.25}{2.5} + \frac{0.5}{3.0} \right\}$$

Prove the associativity and the distributivity properties for A, B and C.

(b) Consider the following travelling sales man 4
problem involving 9 cities.

Parent 1 : F I G E D C A H B

Parent 2 : C B G I H F D E A

Determine the children solution using order crossover (# 1), assuming 2nd and 8th sites as crossovers.

4. (a) Consider the following training data set : 6

I_1	I_2	Output
0.6	0.1	0.3

Assume two nodes at a given multilayer perceptron ,with weights between input layer and hidden layer given by

$\begin{bmatrix} 0.2 & -0.3 \\ 0.1 & 0.5 \end{bmatrix}$ and

weights between hidden layer and output

node given by $\begin{bmatrix} -0.3 \\ 0.2 \end{bmatrix}$

Show the output at each node of MLP and updated weights after one iteration.

(b) Input to a single - input neuron is 2, its 4
weight is 2.3 and its bias (β) is -3. What is the net input to the transfer function ? Also, find the output of the neuron, if it has the following transfer functions (i) hard limiting (ii) linear (iii) log-sigmoid function.

5. (a) Consider a data set of six points given in the following table, each of which has two features f_1 and f_2. Apply FCM algorithm to determine the new cluster center after one iteration. The initial cluster centers are given by $v_1 = (4, 5)$ and $v_2 = (11, 10)$. **6**

	f_1	f_2
x_1	2	12
x_2	4	19
x_3	7	13
x_4	11	5
x_5	12	7
x_6	14	4

(b) Consider the ADALINE filter with two neurons in the input layer having the weights $w_{11} = 3$, $w_{12} = 2$. The input sequence is $\{- - -, 0, 0, 5, -4, 0, 0, - - -\}$. Find the filter output from 0 to 5. **4**

6. (a) Consider a Hopfield network whose weight matrix is given by **6**

$$W = \frac{1}{3} \begin{bmatrix} 0 & -2 & 2 \\ -2 & 0 & -2 \\ 2 & -2 & 0 \end{bmatrix}$$

Consider two test input vectors
$PT_1 = (1 \quad -1 \quad 1)$ and $PT_2 = (-1 \quad 1 \quad -1)$.
Check if the output state vectors satisfy alignment conditions.

(b) Write the schema for the Gene sequence 2
(1 0 0 0 1 1 1), and (0 0 0 1 1 0 0).

(c) Write at least four chromosomes sets, which 2
are identified by schema $S = (1\ 0\ *\ 0\ *)$.

7. Which of the following statements are true or 10
false. Give reasons for your answers.

(a) If a 3 - input neuron is trained to output a
zero when the input is 110 and output one
when the input is 111, then after
generalization, the output will be zero when
the input is 000 or 010 or 110 or 100.

(b) The following figure represents a single layer
feed forward neural network.
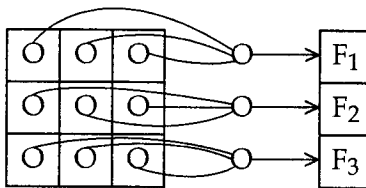
(c) If the inputs of 4 - input neurons having
weights 1, 2, 3 and 4 are 4, 10, 5 and 20
respectively, then the output will be 119 for
the linear transfer function with the constant
of proportionality being equal to 2.

(d) IF $\alpha_1 < \alpha_2$, then the subset relation is
$A_{\alpha_1} \subseteq A_{\alpha_2}$.

(e) The length of chromosomes to determine
maximum value of the set
$S = \{x/0 \le x < 4096\}$ is 12.