M.Sc. (MATHEMATICS WITH APPLICATIONS IN COMPUTER SCIENCE)
M.Sc. (MACS)

00339

Term-End Examination

December, 2010

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 and Q. No. 7 is **compulsory**. Calculator are **not** allowed.*

1. (a) Write the output function, of a neuron for   5
        the following functions.

    (i)   Linear transfer function.

    (ii)   Log - sigmoid transfer function.

    (iii) Tan - sigmoid transfer function.

    Also draw the graph of the output functions
    of these transfer functions.

    (b) Let the universe of discourse U be given by   5

    U = { 20, 21, 22, ..., 25 }

    Let A be the fuzzy set defined on U by

    $$A = \left\{ \frac{.5}{20}, \frac{.6}{21}, \frac{.7}{22}, \frac{.7}{23}, \frac{.9}{24}, \frac{1}{25} \right\}$$

    (i)   Find A^c.

    (ii)   Draw the graph of A^c.

2. (a) What do you mean by a feed - forward **6**
neural network ? Using diagrams, show
how it differs from a recurrent neural
network.

(b) Consider a travelling sales man problem **4**
(TSP) involving eight cities A, B, C, D, E, F,
G, H. A scheduling GA with various types
of cross over operator is to be used to solve
this TSP. Determine children solution of the
following two parents using order cross over
#1, assuming 2 - nd and 6 - th sites as the
cross over sites.

Parent 1 : A B C D E F G H

Parent 2 : C A D B F H E G

3. (a) Draw the graph of the decision boundaries **4**
of MADALINE to solve XOR problems.

(b) Let R and S be defined on **4**

$\{1, 3, 5\} \times \{1, 3, 5\}$ by

$R = \{(x, y) \mid y = x + 2\}$ and

$S = \{(x, y) \mid x < y\}$.

(i) Write the fuzzy relation matrices
R and S.

(ii) Compute R o S and S o R using max -
min composition.

(c) For the fuzzy set   **2**

$$A = \{(1, 0.2), (2, 0.5), (3, 0.8), (4, 1), (5, 0.7)\}$$

Find the α-cut of A for $\alpha = 0.5$.

4. Consider a data set of three points given in the   **10**
    following table, each of which has two features
    f_1 and f_2.

	f_1	f_2
x_1	2	10
x_2	4	9
x_3	7	12

Assuming the values of the parameters c and m
as 2 and the initial cluster centers V_1 = (2, 2) and
V_2 = (5, 5), apply the FCM algorithm to find the
new cluster center after one iteration.

5. (a) Consider the following population of binary   **8**
        strings for a maximization problem.

String	000101	010101	110000	101010	011011	100001
Fittness	2	5	1	10	8	20

Reproduce it using :

(i) Tournament selection using
    tournament of size 2.

(ii) Elitism.

(b) Differentiate between supervised and   **2**
    unsupervised learning with the help of an
    example.

6. (a) If $\alpha_1 < \alpha_2$, then show that $A_{\alpha_1} \supseteq A_{\alpha_2}$, where $\supseteq$ denotes the crisp superset relation. Illustrate this with an example.   3

   (b) Consider the ADALINE filter with three neurons in the input layer having weights $W_{11} = 3$, $W_{12} = 1$ and $W_{13} = -2$ and the input sequence   5

   $$\{-, \_\_\_\_, 0, 0, 0, -4, 5, 0, 0, 0, \_\_\_\}.$$

   What is the filter output ?

   (c) Describe the following operators with suitable example for a GA.   2

   (i)   Cross over.   (ii)   Mutation

7. Which of the following statement are true and which are false. Justify your answer.   2x5=10

   (a) If a single layer neural network has six inputs and two outputs, then six neurons are required.

   (b) The Hopfield network is a multi-layer neural network.

   (c) If A and B are two fuzzy sets where $\mu_A(x) = 0.3$, $\mu_B(x) = 0.9$ then $\mu_{C_{A \cup B}}(x_c) = 0.6$.

   (d) A set partition of a fuzzy set is a constrained soft partition only if $\sum_j \mu_{cj}(xi) < 1 \; \forall \; xi \in X$.

   (e) The order of the schema ** 10 ** is 6.