No. of Printed Pages : **6**

MMTE-007

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

Term-End Examination

June, 2013

00322

MMTE-007 : SOFT COMPUTING AND ITS APPLICATIONS

Time : 2 hours | *Maximum Marks : 50*
(Weightage : 50%)

Note : *Question No. 7 is* ***Compulsory****. Attempt* ***any four*** *questions from Q. No.* ***1*** *to* ***6****. Use of calculator is* ***not*** *allowed.*

1. (a) Consider a local area network of inter connected workstations that communicate using Ethernet protocols at a maximum rate of 10 M bit/s. Traffic rates on the network can be expressed as the peak value of the total bandwidth (BW) used, and the two fuzzy variables, "Quiet" and " Congested", can be used to describe the perceived loading of the LAN. If the discrete universal set $X = \{0, 1, 2, 5, 7, 9, 10\}$ represents band width usage, then the membership grades of these elements in the fuzzy sets quiet Q and congested C are given in the table and Fig.1. **10**

x (BW), M bit/s	$\mu_Q(x)$	$\mu_c(x)$
0	1.0	0.0
1	1.0	0.0
2	0.8	0.0
5	0.3	0.4
7	0.1	0.6
9	0.0	0.8
10	0.0	1.0

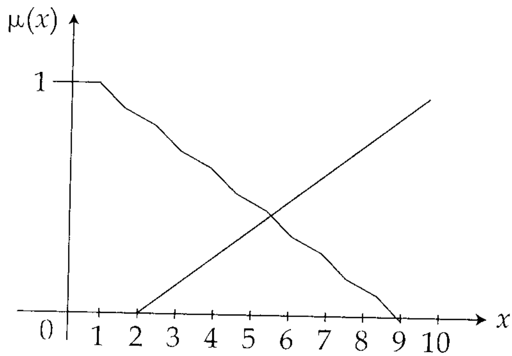

Fig. 1 : Membership functions of quiet and congested.

(b) For these two fuzzy sets find the union, intersection, complement of Q, difference Q - C, and verify any one of Demorgan's law

(i) graphically and

(ii) numerically.

2. (a) Given a fuzzy set A with the membership function given fig 2. **4**

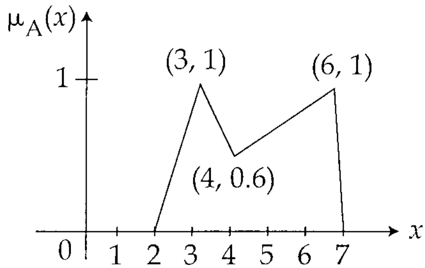

Fig. 2

Derive $\mu_A(x)$ as a mathematical function.

(b) Use a binary-coded Genetic algorithm (GA) to minimize the function **6**

$f(x_1, x_2) = x_1 + x_2 - 2x_1^2 - x_2^2 + x_1 x_2$, in the range of $0 \le x_1, x_2 \le 5$.

Use a random population of size N = 6, a single point crossover with probability $P_c = 1$ and neglect mutation. Assume 3 bits for each variable and thus the GA - string will be 6 - bits long. Show only one iteration by hand calculation.

3. (a) Consider the single layer perception given in Fig 3. **6**

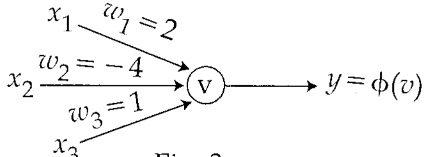

Fig. 3

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

(a) The support of a fuzzy set A is same as the α - cut of a fuzzy set A.

(b) The Manhattan distance and the Mink Owski distance are same for some condition.

(c) The input to a single input neuron is 2, its weight is 2.3 and its bias is -3. The neuron output for Linear transfer function is -1.

(d) The SOM is useful for classification.

(e) The length and order of the schema S = (0**11*0**) are 6 and 3 respectively.

The activation function is given by

$$\phi(v)=\begin{cases}1\ ;\ v \geq 0\\0\ ;\ v < 0\end{cases}$$

Calculate the output y of the unit for each of the following input pattern :

Patterns	p_1	p_2	p_3	p_4
x_1	1	0	1	1
x_2	0	1	0	1
x_3	0	1	1	1

(b) Describe the Binary Hopfield network with the help of an example. 4

4. (a) Define the following operations in Genetic algorithm with one example of each. 4

(i) Crossover

(ii) Mutation

(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. 6

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

What is the filter output ?

5. (a) If the input vectors are $I_1 = [-1, 0]^T$, and $I_2 = [0, 1]^T$, and the initial values of two weight vectors are $[0, 1]^T$ and $[\frac{2}{\sqrt{5}}, \frac{-1}{\sqrt{5}}]$ calculate the resulting weight found after training the competitive layer with the Kohonen's rule and a learning rate α of 0.4 on the input series in order I_1, and I_2. 8

(b) Differentiate between bounded sum and algebric sum of two fuzzy sets. 2

6. (a) What do you mean by a feed - forward neural network ? Using diagram, show how it differs from a recurrent neural network. 4

(b) Consider the two parents which are participating in partially mapped cross over as shown below : 6

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

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

Using partially mapped crossover assuming 2nd and 6th as the crossover sites, find the children solution.