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

Term-End Examination

December, 2012

00601

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) Select an implementation technology for a numerical processor. Computation throughout is directly related to clock speed. Assume that all implementations will be in the same family (e.g., CMOS). Considering whether the design should be implemented using medium - scale integration (MSI) with discrete parts, field - programmable array parts (FPGA), or multichip modules (MCM). Define the universe of potential clock speeds as $x = \{1, 10, 20, 40, 80, 100\}$ MHz, and define MSI, FPGA, and MCM as fuzzy sets of clock frequencies that should be implemented in each of these technologies. The following 7 table defines the membership values for each of the three fuzzy sets. It may be noted that the assignments made in this table reflect only the operational speed capabilities, per cost ratio and do not include other factors.

Clock frequency (MHz)	MSI (M)	FPGA (F)	MCM (c)
1	1	0.3	0
10	0.7	1	0
20	0.4	1	0.5
40	0	0.5	0.7
80	0	0.2	1
100	0	0	1

Find $M \cup F$, $M \cap F$, $\overline{M}$, $\overline{F}$, $\overline{M \cup C}$, $F \cup \overline{F}$, $\overline{C} \cup \overline{F}$.

(b) Distinguish between gradient based local optimization method and stochastic hill climbing method with the help of an example. **3**

2. (a) Given a fuzzy set A with a triangular membership function as given in fig. 1. 7

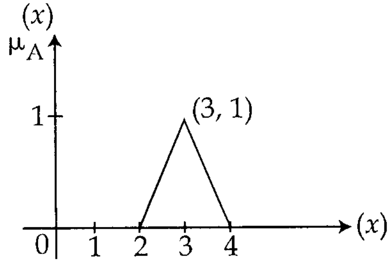

Fig. 1 : Triangular membership function

(i) Derive $\mu_A(x)$ as a mathematical equation.

(ii) Draw the graphs for $\mu_{A \cup \bar{A}}$ and $\mu_{A \cap \bar{A}}$.

(iii) Verify whether or not the following are true.

$$A \cup \bar{A} = U$$
$$A \cap \bar{A} = \phi$$

(b) Write fuzzy C - means algorithm for clustering. 3

3. (a) Differentiate between back propagation network and radial basis networks. Explain with one example of each. 4

(b) The perception may be used to perform numerous logic function. Demonstrate the implementation of the binary logic function AND, OR and COMPLEMENT. Assume that the input to AND and OR is two numbers drawn from $\{-1, 1\}$ representing false and true respectively and the input to COMPLEMENT is one number drawn from $\{-1, 1\}$. 6

4. Find the weights required to perform the following classification using perception network. The vector (1, 1, 1, 1) and (−1, 1, −1, −1) are belonging to the class (so have target value '1'), vector (1, 1, 1, −1) and (1, −1, −1, 1) are not belonging to the class (so have target value '−1'). Assume learning rate as 1 and initial weights wi = 0 for i = 0, 1, 2, 3 and 4. Also, draw the architecture of the network. **10**

5. (a) Obtain the output of the memory for the network given in fig. 2 using activation function (i) binary sigmoidal and (ii) bipolar sigmoidal. **4**

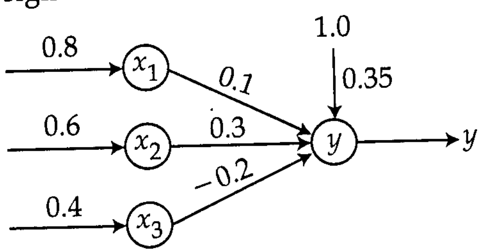

fig. 2

(b) Consider the following travelling salesman problem involving 7 cities. **6**

Parent 1	A	B	C	D	E	F	G
Parent 2	D	F	E	G	A	C	B

Determine the children solution using.

(i) Order crossover (# 1), assuming 3rd and 6th cities as crossover sites.

(ii) Order crossover (# 2), assuming 3rd, 5th and 7th cities as the key positions.

6. (a) Consider the multilayer perception given in fig. 3. Use back propagation to find the first updated values for weights w_3 and w_4 given the input and output shown in fig. 3. **7**

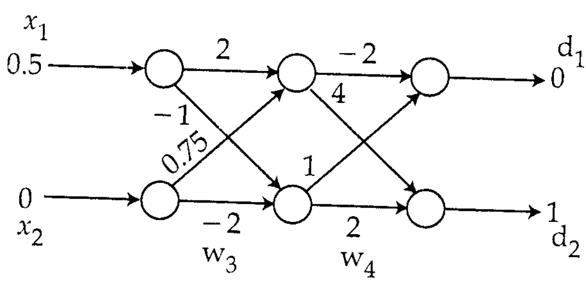

fig. 3

(b) Find the length and order of the following schema. **3**

(i) (1 * * 0 0 * 0 * *)

(ii) (* 0 1 * 1 * *)

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

(a) The length of chromosome to determine minimum of function $f(x) = x^2$ on the integer interval [0, 1024] is 10.

(b) The schema for the gene sequence

{ 1 0 0 0 1 1 1 } and { 0 0 0 1 1 0 0 } is (* 0 0 * 1 1 *).

(c) If $\alpha_1 < \alpha_2$ then $A_{\alpha_1} \subseteq A_{\alpha_2}$ where $\subseteq$ denotes a crisp subset relation.

(d) XOR problem can be implemented using a single perception.

(e) The number of weights in a three layer perception with four nodes, three nodes and two nodes at input layer, hidden layer and output layer respectively is 18.