No. of Printed Pages : 6

MMTE-007

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

M.Sc. (MACS)

Term-End Examination

00292

December, 2018

MMTE-007 : SOFT COMPUTING AND ITS APPLICATIONS

Time : 2 hours *Maximum Marks : 50*

(Weightage : 50%)

Note :

(i) *Question no. **7** is **compulsory**.*

(ii) *Attempt any **four** questions from questions no. 1 to 6.*

(iii) *Use of scientific and non-programmable calculator is allowed.*

1. (a) What are fuzzy relations ? Compute the Cartesian product of two fuzzy sets A and B given below : 4

$$A = \left\{\frac{0.3}{x_1} + \frac{0.7}{x_2} + \frac{1}{x_3}\right\} \text{ and } B = \left\{\frac{0.4}{y_1} + \frac{0.9}{y_2}\right\}$$

(b) Implement NAND function using McCulloch-Pitts neuron, for binary data representation given below : 6

Input	x_1	0	0	1	1
	x_2	0	1	0	1

2. (a) Write short notes on the following with examples : 6

(i) Perceptron Learning Rule

(ii) Widrow-Hoff (LMS) Learning Rule

(b) Determine the following :

(i) Net input to the transfer function

(ii) Output of neuron for the following transfer functions :

I. Hard limit

II. Linear

III. Log-sigmoid

for a Neutral network, where input to a single-input neuron is 2·0, weight is 2·3 and bias is –3. 4

3. (a) Consider three-layer perceptron with three inputs, three hidden and one output units. Given the initial weight matrix for hidden and output nodes as,

$$W_H = \begin{bmatrix} 3 & 2 & 1 \\ 2 & 3 & 3 \\ 1 & 4 & 2 \end{bmatrix} \text{ and } W_0 = \begin{bmatrix} 0 \\ 2 \\ 3 \end{bmatrix}$$

If input vector is $I = [4 \quad 5 \quad 1]$, calculate the output using hard limiting function as activation function. 6

(b) Consider a 5-bit chromosome '10011'. List all the schemas. Find the length and order of each of the schemas. *4*

4. (a) Improve the solution of the following problem :

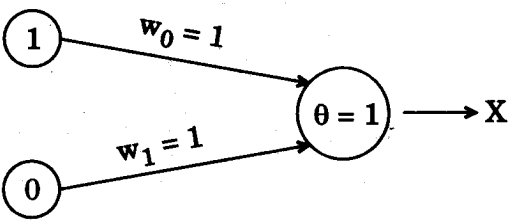
Maximize $f(x) = \sqrt{x}$, subject to

$1 \leq x \leq 15$ by considering the length of the string as 4. Show only one iteration. *5*

(b) A small perceptron with two inputs and one output unit is trained using the following training set :

Pattern No.	Input	Output
1	1	1
2	0	0

At some instant, current weights of connections and inputs to the network are as shown below :



(i) What training pattern has been used at that instant ?

(ii) What output will the network produce ?

(iii) If the network learning rate is 0·25, then find the change in weights w_0 and w_1. *5*

5. (a) How does ADALINE differ from MADALINE ? Discuss the MADALINE architecture with a suitable diagram. *4*

(b) Consider a data set of five 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 centre after one iteration. The initial cluster centres are given by $v_1 = (4, 5)$ and $v_2 = (11, 10)$.

	f_1	f_2
x_1	7	12
x_2	12	3
x_3	13	8
x_4	4	4
x_5	5	5

Assume the constants $c = m = 2$. *6*

6. (a) State the Travelling Salesman Problem (TSP) and give an example. Consider the following TSP 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

(i) Order Crossover #1, assuming 4^{th} and 7^{th} sites as the Crossover sites.

(ii) Order Crossover #2, assuming 3^{rd}, 5^{th} and 7^{th} as the key positions. *6*

(b) Determine the connectivity matrix for the pattern P (four patterns) given below : *4*

$$P = \begin{bmatrix} 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \end{bmatrix}$$

7. State whether the following statements are *True* or *False*. Justify your answer. *5×2=10*

(a) Back propagation reduces to the LMS algorithm for a Single Layer Linear Network (ADALINE).

(b) The offsprings of parents with a high fitness value, have a high fitness value, for any fitness function.

(c) In Radial Basis Function (RBF) network, the neurons belonging to the same layer send their output to the neurons of the next and previous layers.

(d) Hopfield network is a particular case of Kohonen network.

(e) For any two fuzzy sets A and B and $x \in U$, if $\mu_A(x) = 0{\cdot}4$ and $\mu_B(x) = 0{\cdot}8$, then the value of $\mu_{\overline{A} \cup \overline{B}} = 0{\cdot}4$.
