No. of Printed Pages : 5

MMTE-007

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

M.Sc. (MACS)

00621 **Term-End Examination**

June, 2019

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 non-programmable and non-scientific calculator is allowed.*

(iv) *All symbols have their usual meanings.*

1. (a) In a neural network, if input, weight and bias to a single-input neuron are 2·0, 2·3 and – 3 respectively, then,

(i) Determine the net input to the transfer function.

(ii) Determine the neuron output for the following transfer functions : *4*

I. Hard Limit

II. Linear

III. Log-sigmoid

(b) What is Sigma-Pi Network ? How is it different from Multilayer Perceptron (MLP) ? What are the limitations of Sigma-Pi Network ? 6

2. (a) What are two major limitations of Hopfield networks ? Under what conditions, a Hopfield model of 'N' nodes can achieve 100% correct retrieval on 'P' patterns ? 5

(b) Maximize $f(x) = \frac{-x^2}{10} + 3x$, where $0 \leq x \leq 31$ using genetic algorithm. 5

3. (a) Let P and Q be the fuzzy sets with their membership functions $\mu_P(x) = 0{\cdot}8$ and $\mu_Q(x) = 0{\cdot}65$, respectively. Write the membership function of $\bar{P}$, $P \cap Q$, $P \cup Q$ and $\bar{P} \cup Q$. 4

(b) Consider a single layer perceptron having 2 inputs and 1 output. Let threshold be 0·5, learning rate be 0·6, bias be – 2 and weight values $w_1 = 0{\cdot}3$ and $w_2 = 0{\cdot}7$. If the input patterns are given in the following table,

then find the value of output and training using perceptron learning rule for one epoch. 6

Input Pattern

x_1	x_2	D
1	1	1
1	0	1
0	1	−1
0	0	1

4. (a) A Hopfield network has the following standard binary pattern :

S = [111; 101; 100]

Find the weight matrix. 8

(b) Write the expression for triangular membership function. 2

5. (a) Consider the following travelling salesman problem involving 9 cities :

Parent 1	G	J	H	E	F	D	B	I	C	A
Parent 2	A	B	C	D	E	F	G	H	I	J

Determine the children solution using

(i) order crossover #1, and

(ii) order crossover #2. 4

(b) Find max – average composition for R(x, y) and S(x, y) defined by the following relational matrices : *6*

$$R = \begin{bmatrix} 0{\cdot}1 & 0{\cdot}2 & 0 & 1 & 0{\cdot}7 \\ 0{\cdot}3 & 0{\cdot}5 & 0 & 0{\cdot}2 & 1 \\ 0{\cdot}8 & 0 & 1 & 0{\cdot}4 & 0{\cdot}3 \end{bmatrix},$$

$$S = \begin{bmatrix} 0{\cdot}9 & 0 & 0{\cdot}3 & 0{\cdot}4 \\ 0{\cdot}2 & 1 & 0{\cdot}8 & 0 \\ 0{\cdot}8 & 0 & 0{\cdot}7 & 1 \\ 0{\cdot}4 & 0{\cdot}2 & 0{\cdot}3 & 0 \\ 0 & 1 & 0 & 0{\cdot}8 \end{bmatrix}$$

6. (a) Write the schema for the gene sequence (1000111) and (0001100). Also, write six chromosome sets identified by the schemas written by you. *4*

(b) Consider the data :

	x_1	x_2	x_3	x_4
f_1	1	2	3	4
f_2	10	8	6	5

Apply fuzzy c-mean algorithm to find the new cluster centre after one iteration. *6*

[Use $c = m = 1$ and $v_1 = (4, 4)$, $v_2 = (8, 8)$].

7. State whether the following statements are *True* or *False*. Give reasons for your answers. *10*

(a) Self-organizing system is a special class of artificial neural network based on competitive learning.

(b) The length of chromosomes to determine the maximum value of the set (S)

$$S = \{X \mid 0 \leq x \leq 4096\} \text{ is } 12.$$

(c) If $\alpha_1 > \alpha_2$, then the subset relation is $A\alpha_1 \supseteq A\alpha_2$.

(d) Only linearly separable data can be classified by multilayer perceptron.

(e) If $w(k_0) = w(k_0 + 1) = w(k_0 + 2)$, then perceptron is non-linearly separable.