

M00745

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

M.Sc. (MACS)

Term-End Examination,

December 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 Question No. 1 to 6.

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

(iv) All the symbols have their usual meaning.

1. a) What is α -cut of a Fuzzy set? Establish the relation between the set generated by α -cutting and the value of α . Why do we need to determine the α - cut of a fuzzy set? 5
- b) Differentiate between the following: 5
 - i) Clustering and classification techniques
 - ii) Mays Learning Rule and Widrow-Hoff (LMS) Learning rule.
2. a) Write Fuzzy C-Means algorithm? How it is related to K-means algorithm? What is the practical application of Fuzzy C-mean algorithm? Discuss with suitable example. 6

(2)

- b) Find the Length and Order of the following schemas: 4

i) $S_1 = 1 * * 0 0 * 1 * *$

ii) $S_2 = * 0 0 * 1 * *$

iii) $S_3 = * * * 0 * * * *$

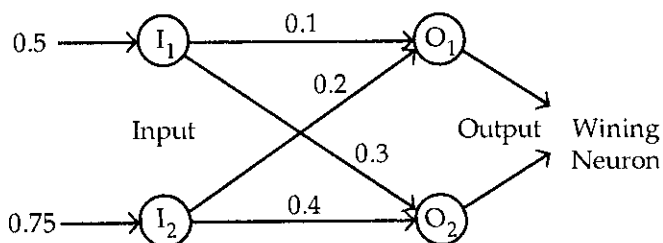
iv) $S_4 = * 1 * 0 1 *$

3. a) Define the McCulloch-Pitts model. What are the rules for evaluating the input to a McCulloch-Pitts unit? Implement AND function using McCulloch-Pitts neuron (Take binary data) 7
- b) Check whether the Fuzzy relation

$$R = \begin{bmatrix} 1 & 0.6 & 0 & 0.2 \\ 0.6 & 1 & 0.4 & 0 \\ 0 & 0.4 & 1 & 0 \\ 0.2 & 0 & 0 & 1 \end{bmatrix} \text{ is an equivalence relation.}$$

3

4. a) Write the algorithm for training a Kohonen network. Calculate the output of each neuron, for the Kohonen network shown below. 4



(3)

- b) Illustrate the steps involved in genetic algorithm to minimize $f(x) = x \sin x + 1$, such that x takes the values between $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ for one generation. The value of crossover probability and mutation probability are 0.4 and 0.2 respectively, and the population size is 6. 6

5. a) Show that single layer linear network is equivalent to multilayer network with Linear transfer function. 5
- b) What are Radial Basis Function Networks (RBFN)? How RBFN is used for polynomial fitting? Give suitable example. 5

6. a) Find the children solution of the following travelling salesman problem using order crossover #2 and position crossover: 4

Parent 1: 1 2 3 4 5 6 7 8 9

Parent 2: 2 3 6 8 5 1 4 7 9

- b) Consider the Fuzzy sets A and B defined on the interval $X = [0, 5]$ by the membership grade functions

$$\mu_A(x) = \frac{x}{x+1} \text{ and } \mu_B(x) = 2^{-x}$$

Determine the mathematical formulae and graphs of the membership function of each of the following sets: A^c , B^c , $A \cup B$, $A \cap B$, $(A \cup B)^c$. 6

(4)

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

- i) Kohonen network is trained in an unsupervised mode.
- ii) Hop field network is a form of Artificial Neural Network that serves as content, addressable memory system with binary threshold units.
- iii) The K-Nearest Neighbour algorithm is used for both classification and clustering.
- iv) The length and order of the schema
 $S = (** * 0 1 * * 1)$ are 0 and 1 respectively.

- v) If two Fuzzy sets A and B are $\left\{ \frac{0.2}{x_1}, \frac{0.8}{x_2} \right\}$ and $\left\{ \frac{0.6}{x_1}, \frac{0.8}{x_2} \right\}$ respectively, then $A \neq B$.

