

**SOFT COMPUTING
(MCAP 3171)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.*

Candidates are required to give answer in their own words as far as practicable.

**Group – A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**

- (i) The probability of performing mutation in genetic algorithm is considered to be very low because
 - (a) mutation helps to maintain the diversity in the population
 - (b) high mutation rate affects the convergence of the algorithm
 - (c) mutation does not generate new solution
 - (d) none of these.
- (ii) In order to apply GA, an optimization problem should be formulated as
 - (a) maximization problem
 - (b) minimization problem
 - (c) decision problem
 - (d) none of these.
- (iii) Multi Layer Perceptron can be used as
 - (a) a classifier
 - (b) an estimator
 - (c) both classifier and estimator
 - (d) none of these.
- (iv) An auto-associative network is
 - (a) a neural network that contains no loops
 - (b) a neural network that contains feedback
 - (c) a neural network that has only one loop
 - (d) a single layer feed-forward neural network with pre-processing.
- (v) For the same size of training data as input, the fastest learning techniques is
 - (a) supervised training with error correction
 - (b) supervised training without error calculation
 - (c) supervised training with stochastic method
 - (d) supervised training with Hebbian method.
- (vi) Which of the following cannot be stated using fuzzy logic?
 - (a) Color of an apple
 - (b) Height of a person
 - (c) Date of birth of a student
 - (d) Speed of a car.

- (vii) For standard fuzzy intersection, which of the following holds good?
 - (a) $\mu_{\tilde{A} \cap \tilde{B}}(x) = \min(\mu_{\tilde{A}}(x), \mu_{\tilde{B}}(x))$
 - (b) $\mu_{\tilde{A} \cap \tilde{B}}(x) = \max(\mu_{\tilde{A}}(x), \mu_{\tilde{B}}(x))$
 - (c) $\mu_{\tilde{A} \cap \tilde{B}}(x) = \mu_{\tilde{A}}(x) - \mu_{\tilde{B}}(x)$
 - (d) none of these.
- (viii) Consider a fuzzy set $\tilde{A}(x) = \{(a, 0.4), (b, 0.6), (c, 1), (d, 1), (e, 0.8)\}$. The core of $\tilde{A}(x)$ i.e. $\text{Core}(\tilde{A})$ is
 - (a) {c, d}
 - (b) {a, b, e}
 - (c) {(a, 0), (b, 0), (e, 0)}
 - (d) {(a, 0.4), (b, 0.6), (e, 0.8)}.
- (ix) Which of the following transformations on membership functions of fuzzy sets enhances the membership values?
 - (a) Dilation
 - (b) Concentration
 - (c) Contrast intensification
 - (d) Fuzzification.
- (x) Let $I = (U, A)$ be an information system and $B \subset A$ and $X \subset U$. Then which of the following relations is not valid?
 - (a) $\overline{B}(X \cup Y) = \overline{B}(X) \cup \overline{B}(Y)$
 - (b) $\overline{B}(X \cap Y) \subseteq \overline{B}(X) \cap \overline{B}(Y)$
 - (c) both (a) and (b)
 - (d) none of these.

Group – B

2. (a) Define the premises of soft computing. Compare between soft and hard computing.
- (b) Explain with example the Roulette-wheel selection algorithm. What is the limitation of Roulette-wheel selection algorithm? How is this limitation overcome in Rank-based selection algorithm?
(2 + 3) + (4 + 1 + 2) = 12
3. (a) What is Hamming cliff problem? Give an example.
- (b) Two parent chromosomes in order GA are given as under:

P ₁ :	8	4	7	3	6	2	5	1	9	0
P ₂ :	0	1	2	3	4	5	6	7	8	9

 Obtain the two offsprings that can be obtained following the “partially mapped crossover (PMX)” technique.
- (c) Assume that the following is a chromosome in order GA encoding scheme.

Offspring:	B	H	F	G	C	E	A	D
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 Explain how such a chromosome can be mutated. Consider the least change in chromosomes between the offspring and the mutated offspring.
4 + 4 + 4 = 12

4. (a) Generate the truth table of NAND logic by McCulloch-Pitts neural network.

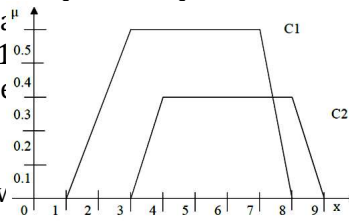
$$\mu = \begin{cases} 0 & \text{if } x \leq a \\ (x-a)/(b-a) & \text{if } a \leq x \leq b \\ (c-x)/(c-b) & \text{if } b \leq x \leq c \\ 0 & \text{if } c \leq x \end{cases}$$

Group - C

(b) Differentiate between linear associative memory and hetero associative memory.

(b) The results of two implication processes are shown below.

(c) Consider linear free input A1 = [1, 1, 1, 1], A2 = [-1, 1, -1, 1] construct weight vector W and identify the noise



4 + 2 + 6 = 12

5. (a) Differentiate between fuzzy networks with suitable diagram. Find the defuzzified output using the following methods:

(b) (i) center of gravity (COG) method
(ii) weighted average method.

[x1, x2, x3] = [0.3, 0.7, 0.9], [w1, w2, w3] = [0.2, 0.1, -0.3] and b1 = 0.45

(c) Define bias and activation function in context of artificial neural network (ANN).

Group - E

8. Consider the information system presented below to represent data related to the shopping habits of a number of customers for a shopping mall. Find the reducts of the information system as well as the minimal reducts from the set of reducts obtained. Also, extract the rules on the basis of one of the minimal reducts and assuming modes of payment (P) to be the decision attribute.

6. (a) Consider A(x) and B(x) are two fuzzy sets define below:

A(x) = {(x1, 0.1), (x2, 0.2), (x3, 0.3), (x4, 0.4)}

#	Customer Name	Gender (GD)	Food (F)	Garment (GM)	Cosmetics (C)	Toys (D)	Amount (A)	Payment Mode (P)
1	Mili	F	Yes	Yes	Yes	Yes	High	CC
2	Bill	M	Yes	No	No	No	Low	Cash
3	Rita	F	Yes	Yes	Yes	Yes	High	CC
4	Pam	F	Yes	Yes	Yes	Yes	High	CC
5	Maya	F	No	No	Yes	No	Medium	Cash
6	Bob	M	Yes	No	No	No	Medium	CC
7	Tony	M	Yes	No	No	No	Low	Cash
8	Gaga	F	Yes	Yes	Yes	Yes	High	CC
9	Sam	M	Yes	No	No	No	Low	Cash
10	Abu	M	Yes	No	No	No	Low	Cash

max-min

$$\begin{pmatrix} x_2 & 0.9 & 0.8 & 0.5 & 0.6 \\ x_3 & 0.9 & 1.0 & 0.7 & 0.8 \end{pmatrix} \begin{pmatrix} y_3 & 0.9 & 0.5 & 0.8 \\ y_4 & 0.6 & 0.7 & 0.5 \end{pmatrix} = 12$$

9. (a) What do you mean by rough membership?

(b) Describe the operation of particle swarm optimization.

7. (a) Plot the following membership function for fuzzy set and find Singleton, core, cross over points and support for the same. Why is this fuzzy set said to be normal?

2 + 5 + 5 = 12