

**SOFT COMPUTING
(CSEN 4263)**

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) Consider two given fuzzy sets X and Y are:
 $X = \{ 0.8/a + 0.3/b + 0.5/c \}$
 $Y = \{ 0.6/a + 0.7/b + 0.8/c \}$
Then $X \cup Y =$
(a) $\{ 1/a + 0.8/b + 0.6/c \}$ (b) $\{ 0.8/a + 0.3/b + 0.8/c \}$
(c) $\{ 0.6/a + 0.8/b + 0.5/c \}$ (d) $\{ 0.8/a + 0.7/b + 0.8/c \}$
- (ii) Let A and B are two fuzzy sets with membership function $m_x(A)$, $m_x(B)$. Then $m_x(A \cap B)$ is equal to
(a) $m_x(A) + m_x(B)$ (b) $m_x(A) - m_x(B)$
(c) $\max(m_x(A), m_x(B))$ (d) $\min(m_x(A), m_x(B))$
- (iii) In Artificial Neural Network model, a very small learning rate implies
(a) Lesser chance of convergence to any local optima.
(b) Higher chance of convergence to any local optima
(c) More computing time to converge
(d) None of these.
- (iv) Which one of the following function can be only be captured only by a multi layered perceptron model but not by a single perceptron model:
(a) AND (b) OR (c) XOR (d) None of these.
- (v) The full form of “ACO” Optimization Technique is _____.
(a) Ant Colony Optimization (b) Associative Control Optimization
(c) Ant Crossover Optimization (d) Alien Control Optimization.
- (vi) The size of each chromosome for the problem maximizing a function $f(x) = x^2$ in the interval $0 \leq x \leq 31$ is
(a) 8 (b) 5 (c) 4 (d) none of these.

- (vii) Oneself-organizing feature map (SOFM) has 20 input units, and 40 output units arranged in a two-dimensional grid. How many weights does this network have?
 (a) 400 (b) 800 (c) 900 (d) 1000.
- (viii) Which of the following concept is related with genetic algorithm?
 (a) MOGA (b) Gradient descent
 (c) Synaptic weights (d) Back propagation.
- (ix) Let's assume that a fuzzy set A is defined as follows :
 $A = 0.5/50 + 1/60 + 0.5/70 + 0/80 + 1/90 + 0.3/100$?
 Which one of the following is the Complement of fuzzy set A :
 (a) $0.5/50 + 1/60 + 0.5/70 + 0/80 + 1/90 + 0.7/100$
 (b) $0.5/50 + 0/60 + 0.5/70 + 0/80 + 1/90 + 0.7/100$
 (c) $0/50 + 0/60 + 0.5/70 + 1/80 + 0/90 + 0.3/100$
 (d) $0.5/50 + 0/60 + 0.5/70 + 1/80 + 0/90 + 0.7/100$
- (x) Consider two strings A = 11011 and B = 00110. After one of the steps of Genetic Algorithm, the string has the values A = 11010 and B = 00111 then the step is
 (a) Mutation (b) Reproduction
 (c) Crossover (d) none of these.

Group – B

2. (a) What are the differences between hard computing and soft computing?
- (b) Let A and B be two fuzzy relations defined here:

$$A = \begin{bmatrix} 0.4 & 0.8 & 0.3 \\ 0.4 & 0.6 & 1.0 \\ 0.9 & 0.5 & 0.0 \end{bmatrix} \quad B = \begin{bmatrix} 0.7 & 0.7 \\ 0.4 & 0.8 \\ 1.0 & 0.2 \end{bmatrix}$$

 Each element inside the matrix depicts the membership value.
 Compute the result of $A \circ B$ using max-min composition.
4 + 8 = 12
3. (a) The fuzzy set for 'Fair' is given as
 $\text{Fair} = \{0/1 + 0.2/2 + 0.4/3 + 0.7/4 + 0.9/5\}$
 Determine the membership values for 'Very Fair' and 'Not very Fair'. Explain your answer.
- (b) How do you determine the cardinality of this Fuzzy set? Explain various options.
6 + 6 = 12

Group – C

4. (a) Explain Hebbian learning rule.
- (b) Use Hebbian learning rule to train ANN that implements OR gate. Show the steps for weight update after each iteration.
- (c) Which activation function will you use in this case and why?

2 + 8 + 2 = 12

5. Briefly explain self-organizing map along with an appropriate example.

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Group – D

6. Consider a Complete Graph $G(V,E)$, where $|V|=10$.
Consider edges between two vertices to represent *traffic*.
Now you are asked to identify any optimal Hamiltonian cycle where traffic is minimum.
Define **Chromosomes**, **fitness functions**, **cross over** and **mutation**.

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7. (a) What is mutation? Describe different types of crossover methods used in Genetic algorithm, along with suitable examples.
- (b) Describe various encoding schemes in genetic algorithm with suitable examples.

6 + 6 = 12

Group – E

8. Briefly explain using a suitable example that how Ant Colony optimization solves a problem.

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9. Write short notes on any two of the following topics:

(2 × 6) = 12

- (i) Multi objective optimization.
(ii) Particle Swarm Optimization.
(iii) Fuzzy Logic.

Department & Section	Submission Link
CSE A + B + C	https://classroom.google.com/c/Mjk5MzYzNTAwMjE2/a/MzYwNjUyNDY5MDEy/details