

**SOFT COMPUTING APPLICATION
(INFO 4282)**

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) Which of the following algorithms can be used to train a single-layer feed forward network?
 - (a) Hard competitive learning
 - (b) Soft competitive learning
 - (c) A genetic algorithm
 - (d) All of the above.
 - (ii) Ranking is a technique used for
 - (a) deleting undesirable members of the population
 - (b) obtaining the selection probabilities for reproduction
 - (c) copying the fittest member of each population into the mating pool.
 - (d) copying the fittest member of each population into the mating pool.
 - (iii) Perceptron can learn
 - (a) AND
 - (b) XOR
 - (c) Both (a) and (b)
 - (d) None of these
 - (iv) What is true regarding back propagation rule?
 - (a) It is also called generalized delta rule
 - (b) Error in output is propagated backwards only to determine weight updates
 - (c) There is no feedback of signal at any stage
 - (d) All of the mentioned
 - (v) The crossover points of a membership function are defined as the elements in the universe for which a particular fuzzy set has values equal to
 - (a) Infinity
 - (b) 0
 - (c) 1
 - (d) 0.5
 - (vi) _____ is an ability to learn how to do tasks based on the data given for training or initial experience.
 - (a) Self Organization
 - (b) Adaptive Learning
 - (c) Fault tolerance
 - (d) Robustness

- (vii) _____ is/are the way/s to represent uncertainty.
 (a) Fuzzy Logic (b) Probability
 (c) Entropy (d) All of the mentioned
- (viii) The room temperature is hot. Here the hot (use of linguistic variable is used) can be represented by _____
 (a) Fuzzy Set (b) Crisp Set
 (c) Fuzzy & Crisp Set (d) None of these
- (ix) Which is not a fuzzy connective?
 (a) Conjunction (b) Disjunction
 (c) Implication (d) AND
- (x) Neural Networks are complex _____ with many parameters.
 (a) Linear Functions (b) Nonlinear Functions
 (c) Discrete Functions (d) Exponential Functions

Group – B

2. (a) Draw the flow chart of the basic Genetic Algorithm (GA).
 (b) Differentiate between order crossover and position-based crossover with proper example.

6 + 6 = 12

3. (a) How is GA different from evolutionary programming? Explain schema theorem in Genetic Algorithm.
 (b) Explain why do we prefer Rank selection over the method of Roulette-Wheel selection in Genetic Algorithm?

(3 + 3) + 6 = 12**Group – C**

4. (a) Perform the following fuzzy arithmetic operation $C = A + B$ through extension principle by fuzzifying the function $z(x+y) = x+y$ for the given fuzzy set:
 $A = 0.3/1 + 0.7/2 + 1/3 + 0.7/4 + 0.3/5 + 0/6$.
 $B = 0.2/4 + 0.6/5 + 1/6 + 0.6/7 + 0.2/8 + 0/9$.
 (b) Explain fuzzy inference procedure by generalized Modus Tollens.

9 + 3 = 12

5. (a) Let x be a linguistic variable that measures a company's employee performance, which takes values from the universe of discourse $U = \{1,2,3,4,5,6,7,8,9,10\}$. Suppose the term set of x includes Excellent, Good, Fair and Bad. The membership functions of these linguistic labels are listed as follows:
 $\mu_{\text{Excellent}} = \{(8,0.3), (9,0.5), (10,1)\}$
 $\mu_{\text{Good}} = \{(6,0.2), (7,0.6), (8,0.8), (9,1), (10,1)\}$
 $\mu_{\text{Fair}} = \{(3,0.4), (4,0.6), (5,0.9), (6,0.9), (7,0.5), (8,0.1)\}$
 $\mu_{\text{Bad}} = \{(1,1), (2,0.8), (3,0.7), (4,0.4)\}$.

(b) Construct the membership functions of the following compound sets:

(i) Not Bad but not very Good

(ii) Good but not Excellent

Let R and S be two fuzzy relations defined here:

$$R = \begin{matrix} & \begin{matrix} y_1 & y_2 & y_3 & y_4 \end{matrix} \\ \begin{matrix} x_1 \\ x_2 \\ x_3 \end{matrix} & \begin{pmatrix} 0.9 & 0.7 & 0.5 & 0.5 \\ 0.7 & 0.4 & 1.0 & 0.2 \\ 0.8 & 0.9 & 0.4 & 0.1 \end{pmatrix} \end{matrix} \quad S = \begin{matrix} & \begin{matrix} z_1 & z_2 & z_3 & z_4 \end{matrix} \\ \begin{matrix} y_1 \\ y_2 \\ y_3 \\ y_4 \end{matrix} & \begin{pmatrix} 0.9 & 0.7 & 0.6 & 0.5 \\ 0.8 & 0.3 & 0.2 & 0.7 \\ 0.9 & 0.3 & 1.0 & 0.9 \\ 0.8 & 0.9 & 0.7 & 0.8 \end{pmatrix} \end{matrix}$$

Compute the result $R \circ S$ using max-min composition and $R+S$ using max-average composition.

6 + 6 = 12

Group – D

6. (a) Solve the following fuzzy relation equations by Zadeh Max Min composition:
If rainfall is 'High', drought is 'Low'. Deduce the drought level when the rainfall is very high. Take High (rainfall) = $\{0.5/2 + 0.8/3 + 1/4\}$ and Low (drought) = $\{1/1 + 0.6/2 + 0.2/3\}$. The universe discourse for the rainfall rate is X and drought level is Y as

$$X = \{1, 2, 3, 4\}, \quad Y = \{1, 2, 3\}.$$

- (b) What do you mean by fuzzification? Explain with suitable example. Write any three fuzzy implication operators.

6 + (3 + 3) = 12

7. (a) Consider a single layer perceptron having 2 inputs and 1 output. Let threshold be 0, learning rate be 1, bias be 0 and weight values are $w_1=0$ and $w_2 = 0$. Given the input patterns in the Source/Target Pattern table, compute the value of the output and train using perceptron learning rule for one epoch.

X_1	X_2	t
1	1	1
-1	1	-1
1	-1	-1
-1	-1	-1

- (b) Write a flowchart of an Adaline algorithm.

8 + 4 = 12

Group – E

8. Explain the weight updating process in a BPNN network in both hidden and output layer.

12

9. (a) Explain any three-activation function used in Back-propagation Neural Network.
- (b) What are the features of 2nd generation Neural Network? Write the advantages and disadvantages of BPNN algorithm.

6 + (3 + 3) = 12

Department & Section	Submission Link
ECE	https://classroom.google.com/c/Mjk4ODM4ODE3MjA2/a/MzU1NzYyOTcwNjQ4/details
BACKLOG	https://classroom.google.com/c/MzY0ODgzOTg2MDk4/a/MzY1MDMzODM0NzEw/details