

1 INTRODUCTION TO SOFT COMPUTING TECHNIQUES

- Q What is Soft Computing ?
- Q What is the Concept of computing systems ?
- Q Differentiate "Soft" computing versus "Hard" computing.
- Q What is soft computing? How Soft computing differ from the Hard Computing?
- Q Describe Characteristics of Soft computing.
- Q Describe applications of Soft computing techniques. State the application of SCT in civil engineering.

2 Fuzzy Logic

- Q What is Fuzzy logic ? Explain briefly.
- Q Differentiate between Boolean logic and Fuzzy logic.
- Q Compare the classical relation versus fuzzy relation.
- Q What is Fuzzy sets and membership functions ?
- Q What is membership function? Draw the various membership functions of fuzzy sets with a suitable mathematical formula.
- Q With suitable example, explain how membership function assignment is performed using intuition.
- Q Describe the importance of fuzzy sets and its application in civil engineering sector.
- Q Explain various operations on fuzzy sets. (Such as intersection, union, complement, sum, difference etc. ...)
With suitable example show the operations on fuzzy sets – Union, Intersection and Subtraction.
- Q Describe fuzzy relations.
- Q Define the term Fuzzy rules, propositions, implications and inferences.
- Q Briefly explain various defuzzification techniques.
- Q What is defuzzification? List out various methods of defuzzification. Explain any one method of defuzzification in details.
- Q Describe Some applications of Fuzzy logic.

- Q For the two given fuzzy sets \tilde{A} and \tilde{B} as follows:

$$\tilde{A} = \left\{ \frac{0.2}{x_1} + \frac{0.3}{x_2} + \frac{1}{x_3} + \frac{0.1}{x_4} + \frac{0.5}{x_5} \right\} \text{ and } \tilde{B} = \left\{ \frac{0.1}{x_1} + \frac{0.25}{x_2} + \frac{0.9}{x_3} + \frac{1}{x_4} + \frac{0.5}{x_5} \right\}$$

Find (i) \tilde{A} (ii) $\tilde{A} \cap \tilde{B}$ (iii) $\overline{\tilde{A} \cup \tilde{B}}$ (iv) \tilde{A}/\tilde{B} (v) $\tilde{A} + \tilde{B}$ (vi) $\tilde{A} \cdot \tilde{B}$ (vii) $\tilde{A} \oplus \tilde{B}$

- Q For an aircraft simulator data the determination of certain changes in its operating conditions is made on the basis of hard break points in the match region. Let fuzzy set \tilde{A} and fuzzy set \tilde{B} represent as:

$$\tilde{A} = \text{near match } 0.65 = \left\{ \frac{0}{0.64} + \frac{0.75}{0.645} + \frac{1}{0.65} + \frac{0.5}{0.655} + \frac{0}{0.66} \right\} \text{ and}$$

$$\tilde{B} = \text{in the region of match } 0.65 = \left\{ \frac{0}{0.64} + \frac{0.25}{0.645} + \frac{0.75}{0.65} + \frac{1}{0.655} + \frac{0.5}{0.66} \right\}.$$

Find (i) \tilde{A} (ii) $\tilde{A} \cap \tilde{B}$ (iii) $\overline{\tilde{A} \cup \tilde{B}}$ (iv) \tilde{A}/\tilde{B} (v) $\tilde{A} + \tilde{B}$ (vi) $\tilde{A} \cdot \tilde{B}$ (vii) $\tilde{A} \oplus \tilde{B}$

- Q Consider two fuzzy relations R1 and R2 on $X \times Y$ and $Y \times Z$ respectively, where $X = \{a, b, c\}$, $Y = \{1,2,3,4\}$ and $Z = \{\alpha, \beta\}$. Assume R1 and R2 can be expressed as the following relation

$$\tilde{R}_1 = \begin{bmatrix} 0.2 & 0.6 & 0.8 & 0.9 \\ 0.5 & 0.1 & 0.6 & 0.4 \\ 0.7 & 0.3 & 0.2 & 0.7 \end{bmatrix} \text{ and } \tilde{R}_2 = \begin{bmatrix} 0.6 & 0.2 \\ 0.3 & 0.7 \\ 0.4 & 0.9 \\ 0.8 & 0.5 \end{bmatrix}$$

Calculate the fuzzy max-min, and max- prod composition between two fuzzy relations.

For the logical union of the membership functions shown below Figure (a) and (b),

find the defuzzified value x^* using centroid method.

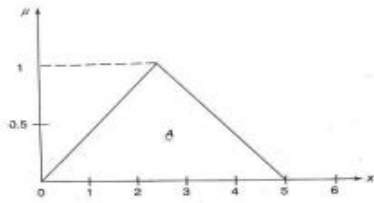


Figure (a)

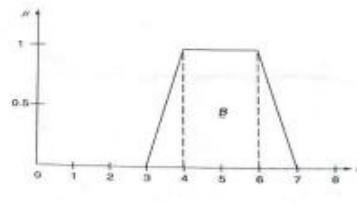


Figure (b)

Q Write a short note on Mamdani FIS for the formation of inference rules.

3 Genetic Algorithms

Q What is Genetic Algorithm. Describe its importance

Q State the importance of Genetic algorithm.

Q Explain Concept of "Genetics" and "Evolution".

Q Briefly explain (1) Encoding (2) Crossover (3) Selection (4) Mutation (5) GA framework (6) GA architectures

Q Define: Crossover and Mutation

Q Describe applications of GA in Civil Engineering

Q How are data represented in genetic programming?

4 ARTIFICIAL NEURAL NETWORK AND ITS APPLICATIONS

Q What is Artificial Neural Network ?

Q Describe Biological neurons and its working.

Q Write short note on biological neuron

Q Differentiate Artificial Neural Network and Biological Neural Network.

Q Classify the biological and the artificial neuron.

Q Describe Different ANNs architectures.

Q What are the advantages and disadvantages of ANN.

Q List out and explain the different types of activation functions used in ANN's.

Q With respect to ANN discuss the various types of learning.

Q With the flow chart explain the training process of Perceptron network.

Q What are the Applications of ANNs to solve some real-life problems.

Q Explain Backpropagation Algorithm

Q Realize the Mc-Culloch-Pitts neuron model for AND gate (take binary data).

Q Realize AND function using perceptron network for bipolar inputs and targets.

Q With the help of block diagram and flow chart, explain the one application of neural network in civil engineering.

5 Hybrid Systems

Q What Do you mean by Hybrid System in Soft Computing Techniques.

Q What is hybrid systems? List the various types of hybrid systems.

Q Write a short note on (1) Fuzzy Neural System (2) Genetic Fuzzy Systems (3) Genetic Neural System.

Q Write a short note on fuzzy neural system.

Q What are the Advantages and Disadvantages of Hybrid Systems.

Q Describe Recycle aggregate pavement (RAP)