

B.E. Instrumentation Engineering (Model Curriculum) Semester-VII
IN703M - Artificial Intelligence in Instrumentation

P. Pages : 3



Time : Three Hours

GUG/S/25/14258

Max. Marks : 80

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- Notes :
1. All questions carry marks as indicated.
 2. Due credit will be given to neatness and adequate dimensions.
 3. Assume suitable data wherever necessary.
 4. Diagrams and Chemical equation should be given wherever necessary.

1. A) List out the different industrial applications of fuzzy logic based system. Discuss any one application in detail. 8
- B) Define the following term:
1) Equality of fuzzy sets
2) Containment of a fuzzy set 8

OR

2. A) Define the following nomenclatures used in fuzzy set theory: 8
- 1) Support
 - 2) Core
 - 3) Cross-over points
 - 4) Height
 - 5) Normality
 - 6) Fuzzy singleton
 - 7) Cardinality
 - 8) Fuzzy Number
- B) Define Membership function. Discuss following MFs in detail 8
- 1) Triangular MF
 - 2) Gaussian MF
 - 3) Generalized bell-shaped MF
 - 4) Sigmoidal MF
3. A) Find the intersection of fuzzy sets A and B for the universe of discourse $X = \{1, 2, 3, 4\}$ using T-norm operators. 8
- $A = 0.7/1 + 0.5/2 + 0.1/3 + 0.6/4$
- $B = 0.8/2 + 0.3/3$
- B) Write a short note on : 8
- 1) Fuzzy IF Then Rules
 - 2) Fuzzy Inference System

OR

4. A) Two fuzzy sets A and B with universe of discourse X and Y, respectively defined as 8
 $A = 0.2/x_1 + 0.4/x_2 + 0.5/x_3$

$$B = 0.5/y_1 + 0.1/y_2 + 0.7/y_3$$

Find the following:

- i) Fuzzy relation R between A & B
- ii) Cylindrical extension of R_A in the direction of fuzzy set B i.e. $C(R_A)$.
- iii) Cylindrical extension of R_B in the direction of fuzzy set A i.e. $C(R_B)$

- B) Find Yager's class of complement of fuzzy set A given below for the values of 8
 $w = \{0.5, 1, 2, 3\}$

$$A = 0.7/1 + 0.5/2 + 0.1/3 + 0.6/4$$

5. A) Illustrate the functions of biological neuron. Discuss how artificial neuron models are 8
inspired from biological neurons.

- B) Difference between: 8

- 1) Hebbian Vs Perceptron learning rule
- 2) Hard-limiting neuron Vs Soft-limiting neuron

OR

6. A) Draw and discuss the architecture of feed forward neural network. 6

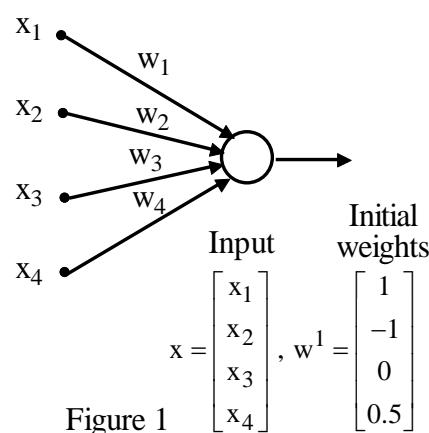
- B) Compute the new updated weights for the network shown in figure 1 using Perceptron 10
learning rule with the initial weight vector

$$W^1 = \begin{bmatrix} 1 \\ -1 \\ 0 \\ 0.5 \end{bmatrix}$$

The network needs to be trained using the set of three input vectors as below:

$$x_1 = \begin{bmatrix} 1 \\ -2 \\ 0 \\ -1 \end{bmatrix}, x_2 = \begin{bmatrix} 0 \\ 1.5 \\ -0.5 \\ -1 \end{bmatrix}, x_3 = \begin{bmatrix} -1 \\ 1 \\ 0.5 \\ -1 \end{bmatrix}, \text{ with learning constant } c = 0.1. \text{ The teachers desired}$$

responses for x_1, x_2, x_3 are $d_1 = -1, d_2 = -1, \text{ and } d_3 = 1$, respectively.



7. A) Design and demonstrate a perceptron for performing "OR" function. Also state the limitations single layer perceptron. 10
- B) State the perceptron convergence theorem and discuss the limitations of single layer perceptron as a pattern classifier with an example. 6

OR

8. Discuss the feed forward neural network with two continuous perceptron layers with respect to following points: 16
- i) Architecture of two layer feed forward neural network.
 - ii) Illustrate error back propagation training algorithm using flowchart.
9. A) Discuss with an example the principle of unsupervised learning with respect to machine learning. 8
- B) Discuss the types of machine learning with suitable example. 8

OR

10. A) Discuss with an example the principle of reinforcement learning with respect to machine learning. 8
- B) Discuss the concepts of Deep learning with suitable example. 8
