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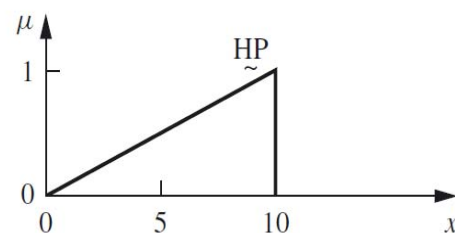
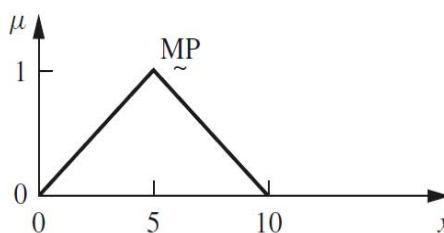
BTECH
(SEM V) THEORY EXAMINATION 2022-23
NEURAL NETWORKS & FUZZY SYSTEM

Time: 3 Hours**Total Marks: 100****Note:** Attempt all Sections. If you require any missing data, then choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 10 = 20**

- (a) Write the applications of artificial neural network.
- (b) Draw 2-4-2 feed forward neural network.
- (c) List various tuning parameters in back propagation.
- (d) If the net input to an output neuron is 0.54, compute its output when the activation function is binary sigmoidal.
- (e) Describe the difference between fuzzy and crisp set.
- (f) Explain linguistic variables in brief.
- (g) Define universal set in fuzzy set theory with example.
- (h) Describe fuzzy inference system.
- (i) Describe strong α -cut fuzzy set.
- (j) Define the L-R type Fuzzy numbers.

SECTION B**2. Attempt any three of the following:****10 x 3 = 30**

- (a) Compare and contrast Biological Neuron and Artificial Neuron with suitable diagram.
- (b) Explain the importance of sigmoidal function in Backpropagation algorithm. Drive the equation for output layer weight adjustment for Back-Propagation Neural Network: $\Delta W = \eta \{OH\}$.
- (c) What are the components of fuzzy logic control and explain them in detail with block diagram?
- (d) Suppose an engineer is addressing a problem in the power control of a mobile cellular telephone transmitting to its base station. Let MP be the medium-power fuzzy set and HP be the high-power set. Let the universe of discourse be composed of discrete units of $dB \times m$, that is, $X = \{0, 1, 2, \dots, 10\}$. The membership functions for these two fuzzy sets are shown in figure. For these two fuzzy sets demonstrate union, intersection, complement and the difference.



- (e) Explain the structure of a neural expert system in details.

SECTION C

3. Attempt any one part of the following: 10 x 1 = 10

- (a) Analyze the necessity of Activation function in ANN. Characterize different types of activation functions used in ANN.
- (b) Train a hetero-associative memory network using Hebb rule to store input row vector $s = (s_1, s_2, s_3, s_4)$ to the output row vector $t = (t_1, t_2)$. The vector pairs are given in table below:

<i>Input Targets</i>	s_1	s_2	s_3	s_4	t_1	t_2
1^{st}	1	0	0	0	1	0
2^{nd}	1	1	0	0	1	0
3^{rd}	0	0	0	1	0	1
4^{th}	0	0	1	1	0	1

4. Attempt any one part of the following: 10 x 1 = 10

- (a) Explain step by step procedure of back propagation learning algorithm in detail.
- (b) The input to a single input neuron is 2, weight is 2.3 and its bias is -3. Examine the neuron output for different transfer functions:
 - (i) Unit step with threshold value = 1
 - (ii) Linear with slope $m = 2$
 - (iii) Bipolar Sigmoidal with $\lambda = 0.5$

5. Attempt any one part of the following: 10 x 1 = 10

- (a) Explain the meaning of defuzzification in fuzzy logic controller. Describe different methods of defuzzification process.
- (b) A Rocket was launched carrying a satellite which will be reaching a distance of 22,300 miles at a speed of 4.9 m/s from Earth. During its path, the average speed (A) for every 20-minute intervals and fuel consumed (B) for every 2000 miles traveled is monitored. Given the fuzzy sets that follow.

$$\tilde{A} = \left\{ \frac{0.6}{20} + \frac{0.7}{40} + \frac{0.9}{60} + \frac{0.8}{80} + \frac{0.8}{100} + \frac{0.7}{120} \right\}$$

$$\tilde{B} = \left\{ \frac{0.9}{2000} + \frac{0.8}{4000} + \frac{0.7}{6000} + \frac{0.6}{8000} + \frac{0.3}{10000} + \frac{0.2}{12000} \right\}$$

Determine a relation \tilde{R} that relates the average speed and fuel consumed.

6. Attempt any one part of the following: 10 x 1 = 10

- (a) For an air conditioner, what will be the input and output in a Fuzzy controller? Explain in details of Fuzzy Logic Controller for Classroom Air Conditioner.
- (b) Explain with example, the importance of fuzzy logic system in your own healthcare.

7. Attempt any one part of the following: 10 x 1 = 10

- (a) Explain synergy between neural-fuzzy system. Summarize different characteristics of it.
- (b) Analyze the different steps of the Fuzzy-backpropagation training.