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MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

SIXTH SEMESTER B.Tech. (I & C E) DEGREE END SEMESTER EXAMINATION
May/June 2016
SUBJECT: NEURAL NETWORKS AND FUZZY LOGIC (ICE - 328)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates
- Answer **ANY FIVE** full questions.
- Missing data may be suitably assumed.

1A. Implement the perceptron rule for the set of input training vectors $x_1= [0\ -2\ 0\ \ -1]^t$; $x_2=[0\ 1.5\ -0.5\ -1]^t$; $x_3=[-1\ 1\ 0.5\ -1]^t$ and the initial weight vector w^1 is assumed as $[1\ -1\ 0\ 0.5]^t$. The learning constant is assumed to be c=0.1. The desired response for x_1, x_2 and x_3 are $d_1= -1$, $d_2= -1$and d3= 1. Find the final weights using perceptron learning rule.

1B. Illustrate any three activation functions with their mathematical expression.

1C. Explain the need for line of separability.

(5+3+2)

2A. Using perceptron algorithm solve for the AND gate using binary input and bipolar output. Assume learning rate as 1 and threshold as 0.2.

2B. Write a short note on Adaptive Resonance Theory (ART-1).

2C. Find the final weights for the AND function using HEBB net algorithm. Use binary inputs and targets.

(5+3+2)

3A. Apply the Mexican Hat algorithm for the simple net having seven units with the following specifications. $f(x)=\begin{cases}0 & if\ x<0\\ x & if\ 0\le x\le 2\\ 2 & if\ 2<x\end{cases}$. The initial parameters are given by R_1=1, R_2=2, C_1=1, C_2= -1. Find the unit which is having higher activation function.

3B. Write the stepwise algorithm for the back propagation algorithm. Also write its advantages and disadvantages.

3C. List the advantages of BAM algorithm compared to other neural network algorithms.

(5+3+2)

4A. Let X be the universe of military aircraft of interest as defined here

$$X=\{a10, b52, b117, c5, c130,\ fu,\ flu,\ f14,\ f15,\ f16,\ f111, Kc130\}.$$

Also let A be the fuzzy set of bomber aircraft

$$A=\left\{\frac{0.2}{f16}+\frac{0.4}{f4}+\frac{0.5}{a10}+\frac{0.5}{f14}+\frac{0.6}{f15}+\frac{0.8}{f111}+\frac{1.0}{b117}+\frac{1.0}{b52}\right\}$$ and B is the fuzzy set of fighter

aircraft given by $B=\left\{\frac{0.1}{b117}+\frac{0.3}{f111}+\frac{0.5}{f4}+\frac{0.8}{f15}+\frac{0.9}{f14}+\frac{1.0}{f16}\right\}$. Find (i) A/B (ii) $\overline{A}\,U\,\overline{B}$ (iii) $\overline{AUB}$ (iv) $\overline{A\cap B}$ (v) B/A (vi) $\overline{A}$ UA.

4B List any three properties of Fuzzy sets giving expression for each.

4C Define Fuzzy and Crisp sets.

(5+3+2)

5A. Many products such as tar, petroleum jelly and petroleum are extracted from the crude oil. In a newly drilled oil well, three sets of oil samples are taken and tested from their viscosity. The results are given in the form of the three fuzzy sets A1,A2 and A3. All defined on a universe of normalized viscosity, as shown in Fig.5A. By using standard formulas, find the most nearly representative viscosity value for all three oil samples, and hence find Z* for the three fuzzy viscosity sets.

5B. Brief the following membership value assignments.

(i) Intuition (ii) Rank ordering (iii) Inference.

5C. Explain the de-fuzzification process and its need.

(5+3+2)

6A. Consider the fuzzy sets A and B defined on the interval X=[0,5] of real numbers by the membership grade functions

$\mu_A(x)=\frac{x}{x+1}, \mu_B(x)=2^{-x}$. Determine the mathematical formula and graphs of the membership grade functions of each of the following sets.

(i) $\mu_{A\cap B}(x)$ (ii) $\mu_{\bar{A}\cup\bar{B}}(x)$

6B. It is required to maintain the outlet temperature of the shell and tube heat exchanger at 45^0 C. Assume the inlet temperature is around 60^0 C and the manipulated variable is the cold water flow rate. The flow rate can be adjusted in four different rates with the control valve opening namely "Fully Closed", "Partially Open", "Half valve open" and "Fully Open". Considering the output temperature in four different stages, frame the fuzzy rules and tabulate the same.

(5+5)

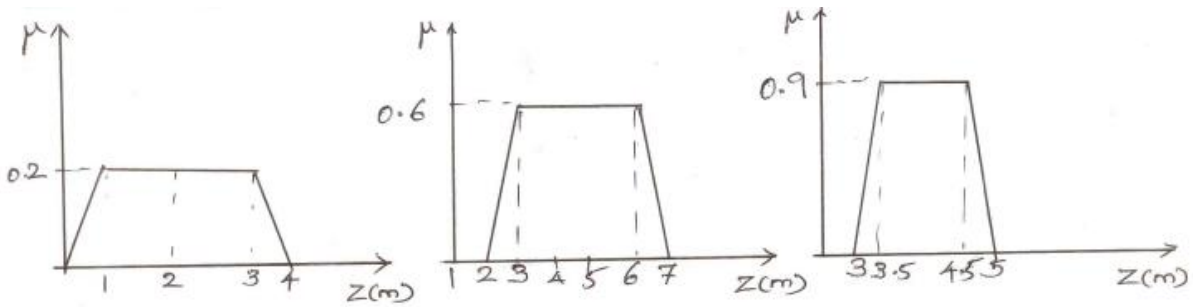

Fig.5A.

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