Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER III (OLD) – EXAMINATION – WINTER-2016

Subject Code: 730205 **Date:27/10/2016**

Subject Name: Fuzzy Logic and Neural Networks

Time:02:30 pm to 05:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Explain the difference between fuzzy C-Mean algorithm and traditional C-Mean with example. **07**

(b) Consider a Self Organizing Map (SOM) network of linear topology having 3 nodes A, B, and C. node B is connected to node A and node C both. **07**

Consider the training set T1=(0.9, 0, 0.5), T2=(1.5, 1.2, 0.5), T3=(0.7, 1.5, 0.4), and initial weight vector is given as,

WA: 0.7, 0.1, 1.0

W0 = WB: 1.0, 0.6, 0.4

WC: 0.5, 1.0, 0.8

Show the calculations for training this SOM network for first two iterations. Consider the initial topological distance D(t)=1 for first iteration and D(t)=0 thereafter. Also consider (t)=0.5 for first iteration, and (t)=0.25 thereafter.

Q.2 **(a)** Given patterns **07**

A1=(000111001) B1=(010000111)

A2=(110110101) B2=(101001010)

A3=(111001110) B3=(100000001)

Use bidirectional associative memory proposed by kosko to check whether

(i) B2 is recalled from A2?

(ii) B3 is recalled from A3?

If yes then how?

(b) (1) What is the effect of following parameters on the working of backpropagation network? **04**

(i) No. of hidden nodes (ii) Momentum coefficient (α)

(iii) Sigmoidal gain (λ) (iv) Learning coefficient (η)

(2) Given two fuzzy sets *tall* and *medium* with universal set X as follows. **03**

X = {Kinjal, Jigar, Sanjay, Dax}

tall = {(Kinjal,0.1), (Jigar,0.4), (Sanjay,0.8)}

medium = {(Kinjal,0.7), (Jigar,0.8), (Dax,0.9)}

Find difference and disjunctive sum of *tall* and *medium.*

OR

(b) Specify different techniques for membership value assignments and correlate the techniques with fuzzy system. **07**

Q.3 **(a)** Enlist the characteristics of Hopfield network? What is the role of energy function? Explain the working of Continuous Hopfield networks in brief. **07**

(b) Suppose an ANN has two inputs with values 0.4 and -0.7, one output with value 0.1, two nodes in a hidden layer. Show all the steps to train the network for given sample using back propagation algorithm. (Assume any random values for weights) **07**

OR

Q.3 **(a)** Explain the working of Radial Basis Function (RBF) neural network with suitable example. **07**

(b) Explain the λ-cut procedure in detail. Explain its importance for fuzzy logic. **07**

Q.4 **(a)** Let the two universal sets are **07**

attendance = {30, 40, 50, 60, 70, 80, 90, 100}
marks = {0, 5, 10, 14, 18, 20}

fuzzy sets corresponding to attendance are
average= {(50,0.7), (60,1), (70,1), (80,0.6), (90,0.3)}
high= {(70,0.7), (80, 0.9), (90,1), (100,1)}
and fuzzy sets corresponding to marks are
less = {(5,0.9), (10,0.8), (14,0.2)}
good = {(14,1), (18,0.6), (20,0.1)}

Find fuzzy relation for given two implications.
(i) If attendance is *average* then marks are *less*.
(ii) If attendance is *average* then marks are *less* else marks are *good*.

(b) What is working principle of Swarm Intelligence (SI). Briefly explain at least two algorithms based on the concepts of SI. **07**

OR

Q.4 **(a)** Explain the importance of Fuzzy approach in Pattern Recognition with suitable example. **07**

(b) Three fuzzy sets *X*, *Y*, *Z* are as follows. **07**

X = {(1,0),(2,0.45),(3,0.45),(4,0)}
Y = {(3,0),(4,0.8),(5,0.8),(6,0)}
Z= {((5,0),(6,1),(7,1),(8,0)}
Find defuzzified output of aggregated fuzzy sets *X*, *Y*, *Z* using centroid method.

Q.5 **(a)** Explain feature analysis and partitions of the feature space using fuzzy logic. **07**

(b) Apply Hebbian learning rule for the netwok having one node with four inputs. **07**
The initial weight vector connecting all the inputs is W=[0 4 –5 -2]. Consider input patterns to be X1=[3 5 -2 0], X2=[2 -4 0.3 -3], X3=[0.4 2 1 –1]. Display the updated weight vector after applying input training patterns. Consider bipolar activation function f(net)=sgn(net) for the calculation.

OR

Q.5 **(a)** Differentiate supervised learning, unsupervised learning and reinforced learning. List various types of neural networks and their purpose in brief. Which type of learning is followed in each of these networks? **07**

(b) There is a 2-2-1 fuzzy neural network. **07**
Fuzzy inputs are: I1 = (1,0.2,0.3), I2 = (0,0.1,0.4)
Fuzzy weights are: W11 = (0.894,0.634,0.101), W21 = (0.66,0.567,0.64),
(From inputs to first hidden node)
W12 = (-0.723,0.71,0.855), W22 = (0.134,0.719,0.153),
(From inputs to second hidden node)
Wh11=(0.092,0.277,0.223), Wh21=(0.972,0.137,0.72).
(From hidden nodes to output node)
Compute the crisp output corresponding to the given input.

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