GUJARAT TECHNOLOGICAL UNIVERSITY
BE SEM-VII Examination-Nov/Dec.-2011

Subject code: 173101   **Date: 26/11/2011**
Subject Name: Soft Computing
Time: 10.30 am-01.00 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)** Describe back propagation learning techniques. Discuss learning rule for the hyperbolic tangent activation function with necessary derivations.   **07**

  (b)   i.   What is linear separability? Give example of linearly separable and inseparable problem?   **03**
       ii.   Why single layer perceptron is not capable of solving linearly inseparable problem?   **02**
       iii. Compare: Supervised Vs. Unsupervised Learning   **02**

Q.2 **(a)**   i.   What is artificial neural network? Define characteristics and applications of artificial neural network.   **05**
       ii.   Difference between hard computing and soft computing.   **02**

  (b)   List feature of fuzzy NN. Justify the use of fuzzy logic in soft computing. What are the criticisms for fuzzy logic?   **07**

<div align="center">OR</div>

  (b)   The results of three implication processes are shown in the Fig. 1.   **07**
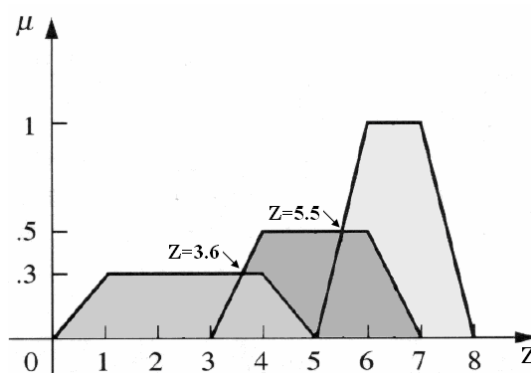

Fig. 1

  Find the aggregated output and the defuzzyfied output using the following methods:
       i.   Center of Gravity or Centroid method
       ii. Weighted average method
       iii. Means-max method

Q.3 **(a)**   Write a short notes on: **07**
       i.   Radial Basis Function
       ii. LVQ
  (b)   i.   Explain extension principle in fuzzy Logic   **03**
       ii. Consider the two fuzzy sets A and B and given α=2:   **04**
           A ={ 0.33/6 + 0.67/7 +1/8 + 0.67/9+0.33/10}
           B= {0.2/6 + 0.6 /7 +1/8 + 0.8 /9 + 0.52/10}
           Find (i) AUB (ii) A^{α} (iii) A-B

Q.3 **(a)** Compare:
     i.   Feed forward Vs. Feedback network   **02**
     ii.   Human brain Vs. Artificial Neuron   **03**
     iii. Single Layer Vs. Multilayer Perceptron   **02**
  (b) i.   Define rough set. Consider the following information table 1:   **05**

U	a_1	a_2	a_3
X_1	2	1	3
X_2	3	2	1
X_3	2	1	3
X_4	2	2	3
X_5	1	1	4
X_6	1	1	2
X_7	3	2	1
X_8	1	1	4
X_9	2	1	3
X_{10}	3	2	1

Table 1

If attribute B= $\{a_1, a_2, a_3\}$ is selected, find out the equivalence classes. Consider the target set X= $\{X_1, X_3, X_4, X_5, X_9\}$. Can we distinguish this set from whole data set in the space of three attributes B= $\{a_1, a_2, a_3\}$? Calculate the lower approximation, upper approximation, and Boundary region of this rough set.
     ii.   Discuss fuzzy membership interpretation using Rough set theory.   **02**

Q.4 **(a)** Draw a flowchart and explain an evolutionary algorithm with its advantages.   **07**
  (b) How TSP can be solved using GA. Describe operation performed in different phases using suitable examples.   **07**

Q.4 **(a)** Describe different selection methods for GA.   **07**
  (b) Table 2 shows a population of strings of four numbers. Assuming that the string represents a binary encoding of a number n, and the fitness function is given by $F_i = 100/n$, Fill in the rest of the table using Rank selection algorithm to generate a matting pool of size 4.write down the mating pool in table 3.   **07**

String No.	String	n	F_i	$F_i / \sum F_i$	No. of Copies Selected
1	10111	23	4.35		
2	00111				
3	01001				
4	01010				

Table 2

Mating pool	Mate	Crossover Point	New population	n	New F_i

Table 3

Q.5 (a) Write a short note on: Competitive learning with its limitations **07**

(b) What is membership function? With suitable block diagram, explain the **07** working principle of FIS.

OR

Q.5 (a) Describe Mamdani FIS with its advantages. Differentiate between **07** Mamdani FIS and Sugeno FIS.

(b) i. In a network of fig. 2, the set of input training vectors is as **04** following: x_1=[1 -2 0 1] x_2=[0 1.5 -0.5 -1] and x_3= [-1 1 0.5 -1] and the initial weight vector w is [1 -1 0 0.5]. The learning constant is assumed to be η= 0.1. The teachers desired responses for x_1, x_2, x_3 are d_1= -1, d_2= -1 and d_3=1, respectively. Train the network according to the perceptron training algorithm.

Fig.2
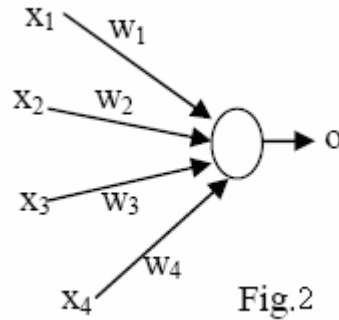
 ii. Discuss the effect of learning rate, initial weights, and momentum **03** term of network learning.

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