Paper / Subject Code: 53105 / 5) Soft Computing Date - 4/12/19

B.E. (IT) (Sem-VIII) (CBSGS)

(Time: 3 Hrs) **Marks: 80**

N.B. : 1. Question no. 1 is **compulsory**.
2. Solve any **Three** questions out of remaining **Five** questions.

Qu-1 Attempt any **FOUR** of the following.

a) **Demonstrate/outline** the working of Roulette-wheel selection. 5

b) A single-layer neural network has the weights w = [0.2 0.5 0.66 0.45] with bias b=0.3. It is given an input of I = [0.5 0.8 0.1 0.36].
Find/estimate the output if the sigmoidal activation function is used (slope = 0.3) 5

c) **Demonstrate/Outline** the excluded middle axioms, extended for fuzzy sets. 5

d) How do genetic Algorithms differ from conventional optimization algorithms? 5

e) Let us consider the discrete fuzzy set $A = \left\{ \frac{1}{a} + \frac{0.9}{b} + \frac{0.6}{c} + \frac{0.3}{d} + \frac{0.01}{e} + \frac{0}{f} \right\}$ using Zadeh's notation, defined on universe X = {a, b, c, d, e, f }.
Compute/Infer λ cut for: a) λ = 0.9 b) λ = 0.3 5

Qu-2 a) Using Mamdani fuzzy model design a fuzzy logic controller to determine the wash time of a domestic washing machine. Assume that the inputs are dirt and grease on cloths. Use three descriptors for each input variables and five descriptors for the output variable. Derive a set of rules for control action and defuzzification. The design should be supported by figures wherever possible. Show/Defend that if the clothes are soiled to a larger degree the wash time will be more and vice-versa. 10

b) Explain McCulloch Pitts neuron model with example. 10

Qu-3 a) Determine the weights after one iteration for Hebbian learning of a single neuron network starting with initial weights w = [1 -1]. The inputs are X_1 = [1 -2], X2 = [2 3], X_3 = [1, -1] and learning rate c=1. 10
a) Use Bipolar Binary activation function.
b) Use Bipolar continuous activation function.

b) What are Neuro-Fuzzy Systems? Explain the steps in Neuro-Fuzzy Hybrid System. 10

Qu-4 a) What is Linear Separability? Explain with example why single layer perceptron is not capable of solving Linearly Inseparable problems. 10

b) Using the binary input/output row matrix shown in table-1 train a hetero-associative network to store the input row vectors s = {s1, s2, s3, s4} to the output row vector t = {t1, t2}. Obtain/predict the final weight matrix 10

Table-1: Input row vectors {s1, s2, s3, s4} and output row vector {t1, t2}.

	s1	s2	s3	s4	t1	t2
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

Qu-5 Consider a 2-2-2 three-layer network as shown in figure-1. Perform calculations (upto 4 decimal places) assuming back-propagation learning for one iteration on the input, and desired output patterns given in Table-2. **20**

a) Learning rate $\eta = 0.8$, Momentum $\alpha = 0.8$ and Sigmoidal activation function.

Table-2: Input-Output pattern.

Pattern Index	Input		Output/desired	
	X1	X2	O1	O2
1	0.5	-0.5	0.9	0.1

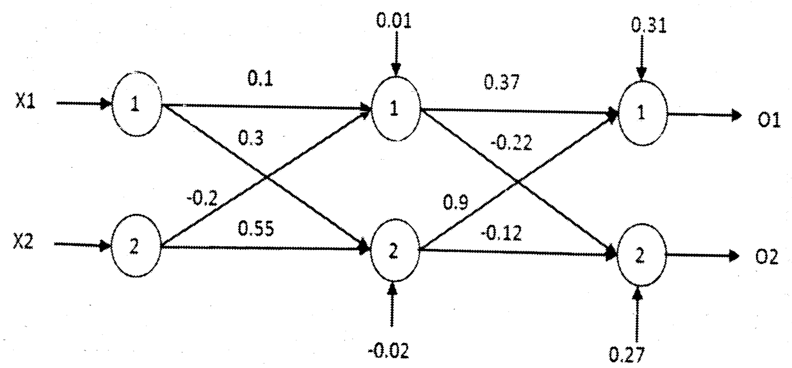

Figure-1: The MLP with initial weights

Qu-6 a) Describe Genetic Algorithms considering: Encoding, Selection, Crossover, Mutation, and Stopping Condition for Genetic Algorithms. **10**

b) Let R and S be two fuzzy relations defined as: **10**

$$R = \begin{array}{c} \\ x1 \\ x2 \end{array} \begin{array}{c} \begin{array}{ccc} y1 & y2 & y3 \end{array} \\ \begin{pmatrix} 0.0 & 0.2 & 0.8 \\ 0.3 & 0.6 & 1.0 \end{pmatrix} \end{array} \qquad S = \begin{array}{c} \\ y1 \\ y2 \\ y3 \end{array} \begin{array}{c} \begin{array}{ccc} z1 & z2 & z3 \end{array} \\ \begin{pmatrix} 0.3 & 0.7 & 1.0 \\ 0.5 & 1.0 & 0.6 \\ 1.0 & 0.2 & 0.0 \end{pmatrix} \end{array}$$

a) Compute/Infer the result of R°S using max-min composition.

b) Compute/Infer the result of R·S using max-product composition.
