MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

VI SEMESTER BTECH. (COMPUTER SCIENCE AND ENGINEERING)

GRADE IMPROVEMENT/MAKEUP EXAMINATIONS, AUG 2021

SOFT COMPUTING PARADIGMS [CSE 4054]

PROGRAM ELECTIVE-II

REVISED CREDIT SYSTEM

Date: 12/08/2021

Time: 2 Hours **MAX. MARKS: 40**

Instructions:

Answer any FOUR full questions & missing data may be suitably assumed.

1A) List the important characteristics of Soft computing. Prepare a table to compare soft computing with hard computing. **5M**

1B) What is expert system? With a neat block diagram architecture of expert system explain each of its block. Also elaborate your explanation on functioning of expert system when these blocks are integrated. **5M**

2A) Draw the Gaussian Membership Function distribution graph for Gaussian function. Find out the membership function value corresponding to the given input value x = 9.0 with mean (c) = 10.0 and standard deviation (σ) = 3.0 Also determine the α-cut and strong α-cut for $\alpha = 0.6$ **4M**

2B) The fuzzy sets P and Q are defined over the universal set X

P = { (x1, 0.1), (x2, 0.2), (x3, 0.7), (x4, 0.5), (x5, 0.4)}

Q = { (x1, 0.9), (x2, 0.6), (x3, 0.3), (x4, 0.2), (x5, 0.8)}

Find the crisp set for the following:

i) $P_{0.2}$ and $P_{0.3}$ ii) $(P \cup Q)_{0.6}$ iii) $(P \cup \neg P)_{0.8}$ iv) $(P \cap Q)_{0.4}$

using Lambda-cut method. **6M**

3A) Design a neural network that satisfies the truth table given in Fig.Q3A using McCulloch Pitt model principles. x1 and x2 are the two inputs and Y is the output of the neural network.

x1	x2	Y
0	0	1
0	1	0
1	0	1
1	1	1

Fig. Q3A

Extend your design further to complement the output Y.

Draw the diagram of such a neural network with the designed values. Firing of the neuron is based on usage of the following activation function:

$f(z) = 1, \quad \text{if } z \geq \theta$

$f(z) = 0, \quad \text{if } z < \theta$ **5M**

3B) Write down the equations and related derivatives (Refer Fig. Q3B) of W_{19}, W_{16} and W_1 using Chain-rule to update the weights during Back propagation. The deduced derivatives in your equations must be ready to substitute the numeric values directly: **5M**

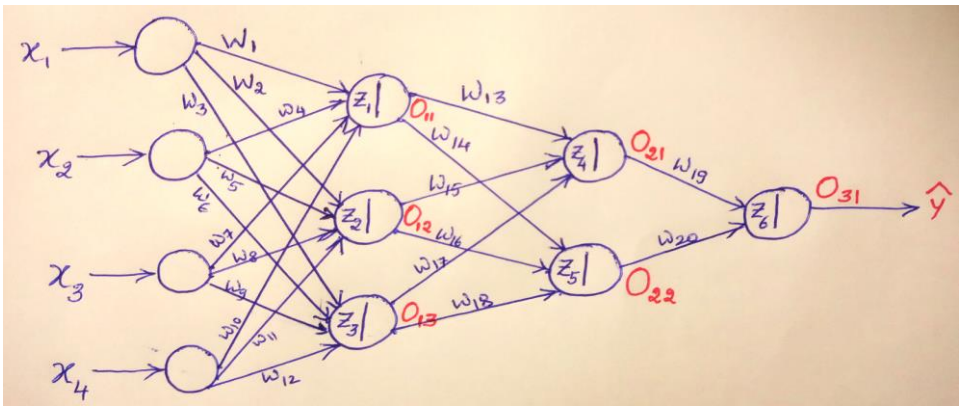

Fig. Q3B

4A) Train an Auto-associative neural network for input vector [-1 1 1 1] and also test the network for the same input vector. Test the neural network separately for one mistake entry and two missing entries in the input vector. Give your conclusion on the result of all the tests carried on. Draw a neat diagram of Auto-associative neural network by labelling all the design parameters. **5M**

4B) Construct a Kohonen's neural network to cluster three given vectors [1 1 0 0], [0 0 0 1], and [1 0 0 0]. It is required to form two clusters. The initial synaptic weights in the Kohonen's neural network are given to be $W_{11} = 0.2$, $W_{12} = 0.8$, $W_{21} = 0.6$, $W_{22} = 0.4$, $W_{31} = 0.5$, $W_{32} = 0.7$, $W_{41} = 0.9$ and $W_{42} = 0.3$ where W_{ij} is the synaptic weight of i^{th} neuron of the input layer to jth neuron of the output layer in the Kohonen's neural network. The learning rate is given to be 0.6 Write your conclusion after analyzing each of the four given vectors. Draw a neat diagram of Kohonen's neural network by labelling all the design parameters. **5M**

5A) Draw the flow chart of Simple Genetic Algorithm. Discuss in detail the working principle of it. **5M**

5B) Consider a real variable with bounds [8, 35] to be represented by a 3-bit binary string. Prepare a table for how to convert the 3-bit binary string from decoded value to real value. What is the obtainable accuracy ϵ. From the values you obtained above, represent a chromosome with any of the three of the real values to the Genes in phenotype. **5M**

6A) The Rule base to be followed for a Neuro Fuzzy system is given in Fig. Q6A where in I_1 and I_2 are the inputs and O is the output of the Controller. The neural network will consist of five layers. The input I_1 has been expressed using two linguistic terms: Low (LW) and High (H). Similarly the input I_2 has been expressed using 3 linguistic terms: Very Near (VN), Near (NR) and Far (FR).

The output O has been expressed using 3 linguistic terms: Slow (S), Fast (F). Draw a related neural network that assist to design a Fuzzy logic controller for a Neuro Fuzzy system. **5M**

I_2

I_1		VN	NR	FR
	LW	S	S	F
	H	S	F	F

Fig. Q6A

6B) For two of the fired rules in Neuro-Fuzzy system, the graphical representation for fuzzified output is shown in Fig. Q6B. Calculate the area and center of area of each of them and finally compute the crisp value of combined fuzzified output using Center of Sum (CoS) method. **5M**

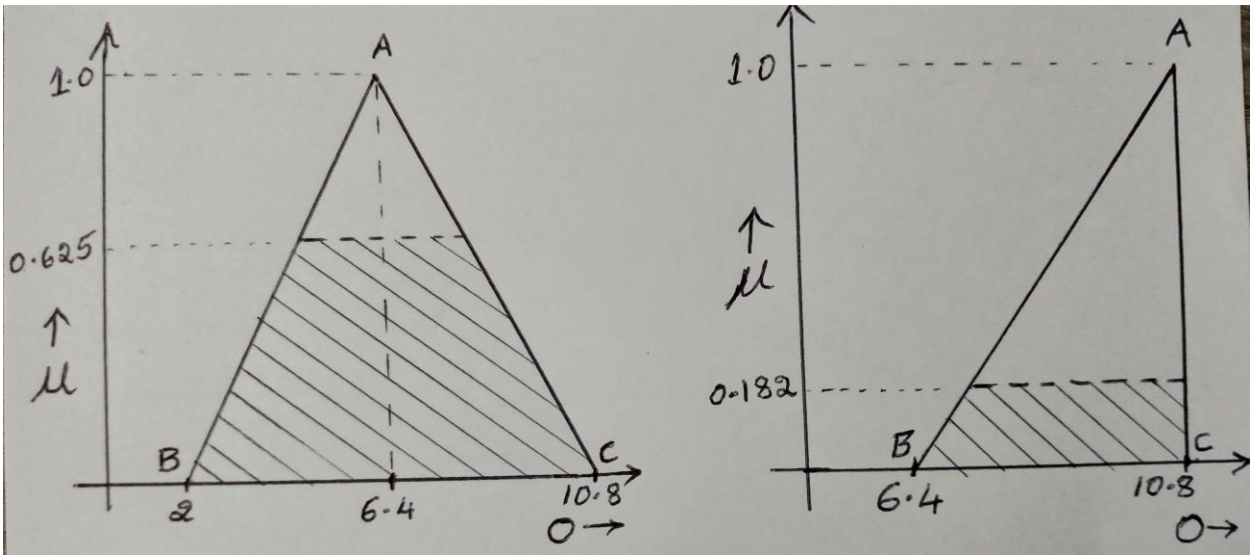

Fig. Q6B