VI SEMESTER B.TECH. (COMPUTER SCIENCE AND ENGINEERING)

END SEMESTER EXAMINATIONS, MAY-JUNE 2023

SOFT COMPUTING PARADIGMS (PE-II) [CSE 4054]

Q1A. Design a neural network that satisfies the truth table given in Fig.Q1A 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. Q1A

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:

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

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

Q1B. Explain how computationally expensive problems and Space complexity parameters introduce limitations to hard computing? (3)

Q1C. Interpret the following activation functions with their activation formulae and related graphs:

i) Sigmoid ii) Hyperbolic tangent (2)

Q2A. Implement a logic AND gate using Hebb's rule for the input-output relation shown in Fig. Q2A where x1, x2 are the inputs to the AND gate, b is the bias term and Y is the output from AND gate.

x1	x2	b	Y
1	1	1	1
1	-1	1	-1
-1	1	1	-1
-1	-1	1	-1

Fig. Q2A

(4)

Q2B. Implement Radial Basis Function Neural Network for XOR gate with binary inputs. Do not increase the dimensionality. Use Gaussian function in your RBF network.

Receptors are to be considered one at (0, 0) and another at (1, 1) while finding the Euclidian's distance. Initial values of synaptic weight links from neurons of hidden layer to the neuron of the output layer is given as -1 and 1.
Give your conclusion on the answers you obtained.
Your numerical answers you write must be approximated to four decimal places after the decimal point.
(4)

Q2C. Describe the important features of an Auto associative neural network with its relevant architecture.

(2)

Q3A. Following rules are defined:

R1: if x is A then y is B

R2: y is B'

where A & A' are the fuzzy sets defined over same universal set X and B & B' are another fuzzy sets defined over another universal set Y.

The sets are given to be

X = {x1, x2, x3} Y = {y1, y2, y3}

A = {(x1, 0.5), (x2, 1.0), (x3, 0.6)} B = {(y1, 1.0), (y2, 0.4), (y3, 0.8)}

B' = {(y1, 0.9), (y2, 0.7), (y3, 0.3)}

Examine a conclusion in the form

x is A'

using Generalized Modus Tollens (GMT). (5)

Q3B.Discuss in detail the working principle of Simple Genetic algorithm. (3)

Q3C. A real variable with bounds [16, 40] 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? (2)

Q4A.For two of the fired rules in Neuro-Fuzzy system, the graphical representation for fuzzified output is shown in Fig. Q4A. 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.

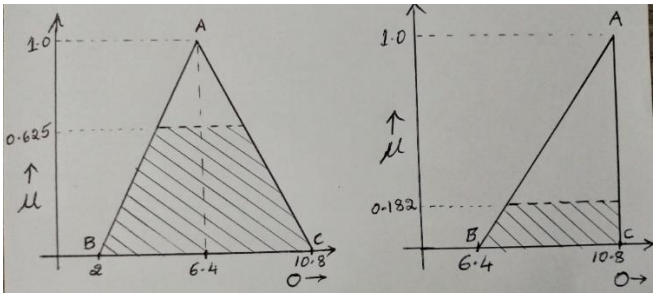

Fig. Q4A (5)

Q4B.

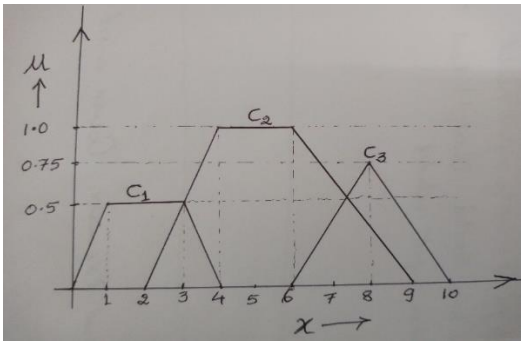

Fig. Q4B

Calculate the crisp output obtained from the fuzzy sets C1, C2 and C3 as in Fig. Q4B using weighted average method defuzzification technique. (3)

Q4C. Write and explain the primary premises of evolution. (2)

Q5A.

The Rule base to be followed for a Neuro Fuzzy system is given in Fig. Q5A wherein 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 3 linguistic terms: Low (LW), Medium (M) and High (H). Similarly, the input I_2 has been expressed using 2 linguistic terms: Near (NR) and Far (FR).

The output O has been expressed using 2 linguistic terms: Slow (S) and Fast (F). Sketch a related neural network that assist to design a Fuzzy logic controller for a Neuro Fuzzy system. Label each layer and also all the inputs and their outputs in each layers.

		I2	
		NR	**FR**
I1	**LW**	F	S
	M	S	F
	H	F	S

Fig. Q5A (5)

Q5B. Let I_1 be the one of the inputs to a Neuro-fuzzy system. I_1 is expressed using three linguistic terms: Near (NR), Far (FR) and Very Far (VFR). Assume that the initial value for I_1 is given to be 10.0 The membership distribution of I_1 is represented using triangular membership function. The normalized value of connecting weight of I_1 is given to be 0.6 The range of b_1 is given as $5 \leq b_1 \leq 15$ where b_1 represent the real value corresponding to the given normalized value of the connecting weight. Compute the real value and use it appropriately on your triangular membership function graph of I_1. (3)

Q5C. Discuss variation with the kinetochores points while joining each other in two different organism's body cells. (2)