VIT-AP UNIVERSITY	Continuous Assessment Test – Winter Sem(2024-25) -JAN 2025	
	Maximum Marks: 50	Duration: 90 Mins
Course Code: CSE2009	Course Title: Soft Computing	
Set No: 1	Exam Type : **Open Notebook**	School: SCOPE
Date: 28-01-25	Slot: B2+TB2	Session: AN

Keeping mobile phone/smart watch, even in 'off' position is treated as exam malpractice

General Instructions if any Open Book/Open Notebook/Closed Book:

1. **"*fx* series" - non Programmable calculator are permitted : YES**
2. **Reference tables permitted : NO (if Yes, Please specify:)**

PART – A: Answer any ALL Questions, Each Question Carries 10 Marks (5×10=50 Marks)

1. Consider a machine learning model that predicts house prices based on features such as size, number of rooms, and location. The model is trained with gradient descent to minimize the Mean Squared Error (MSE). The dataset contains 1 million samples, making the training process computationally intensive.

   a. Explain the purpose of gradient descent in training the model. Describe how gradients guide the model's parameter updates to minimize the loss function. **(4 M)**
   b. Discuss the differences between batch gradient descent, stochastic gradient descent (SGD), and mini-batch gradient descent. **(3 M)**
   c. Identify which approach is most suitable for the given dataset and justify your answer. Explain one advantage and one limitation of the recommended gradient descent approach for this scenario. **(3 M)**

2. A neural network is developed for predicting the likelihood of a customer purchasing a product based on attributes such as age, gender, browsing history, and past purchase behaviour. Choose an appropriate ANN architecture based on the complexity of the problem and the amount of data available.

   a. Describe the different types of ANN architectures and explain which one would be most suitable for this task. Justify your choice based on the data and problem requirements. **(5 M)**
   b. Discuss the number of layers, the number of neurons per layer, and activation functions. How would you approach the training process and evaluate the model's performance? **(5 M)**

3. Perform backpropagation on the given neural network to calculate the change in error for one iteration. The network consists of two input neurons, two hidden neurons, and one output neurons. The provided data includes input values [0.05, 0.10], target output values [0.01], and a learning rate of 0.5. The weights connecting the input layer to the hidden layer are $w_1 = 0.15$, $w_2 = 0.20$ (for the first hidden neuron) and $w_3 = 0.25$, $w_4 = 0.30$ (for the second hidden neuron). The weights connecting the hidden layer to the output layer are $w_5 = 0.40$ and $w_6 = 0.45$. The biases for the hidden and output layers are b1=0.35 and b2=0.60 respectively. Calculate the error reduction after this iteration. **(10 M)**

4. A company is developing two neural network-based systems. A model that can correct incomplete customer records (e.g., fill missing email addresses based on stored customer profiles). Another model that include product recommendation based on a user's recent purchase. Explain how a neural network can store patterns to reconstruct incomplete data using existing stored patterns. Associate one type of input pattern with a different output pattern. Highlight the key distinction in how these two systems process patterns. Describe how the stored patterns can help reconstruct missing data when partial inputs are provided. Outline the steps involved in associating a purchase input with a relevant product suggestion. Discuss one practical challenge for each system and suggest a solution to improve their performance. **(10 M)**

5. A language translation system is developed using a neural network to store paired patterns of English phrases and their corresponding French translations. For example: ("Hello" → "Bonjour" and "Goodbye" → "Au revoir")
    a. Describe how the neural network can store these paired patterns with the help of bidirectional retrieval (retrieving the French phrase "Bonjour" given "Hello" or vice versa).
    b. Explain the role of the weight matrix in storing and retrieving.
    c. Outline the steps to store the phrases and retrieve the correct output when provided with either an English or French phrase as input.
    d. Discuss the challenges the system might face in ensuring accurate retrieval when the input phrases are incomplete or noisy (e.g., "Hell" instead of "Hello"). Suggest potential strategies to address these challenges.

(10 M)

QP MAPPING

Q. No.	E/A/T	Module Number	Marks	BL	CO Mapped	PO Mapped	PEO Mapped	PSO Mapped
Q1	A	1	10	2	1	3, 12		1, 2
Q2	E	1	10	3	1	3, 4, 12		1, 2
Q3	T	1	10	4	1	1, 12	1	2
Q4	A	2	10	3	1	3, 12		3
Q5	A	2	10	3	1	3, 12		2, 3

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VIT-AP UNIVERSITY	Continuous Assessment Test – Winter Sem(2024-25) -JAN 2025	
	Maximum Marks: 50	Duration: 90 Mins
Course Code: CSE2009	Course Title: Soft Computing	
Set No: (5)	Exam Type : **Open Notebook**	School: SCOPE
Date: 28-01-25	Slot: B1+TB1	Session: FN
Keeping mobile phone/smart watch, even in 'off' position is treated as exam malpractice		
General Instructions if any Open Book/Open Notebook/Closed Book: 1. **"*fx* series" - non Programmable calculator are permitted : YES** 2. **Reference tables permitted : NO (if Yes, Please specify:)**		

PART – A: Answer ALL Questions, Each Question Carries 10 Marks (5×10=50 Marks)

1. What is Computational Intelligence and how a conventional Intelligence is different from Computational Intelligence. Explain the difference between soft computing and traditional computing. **(10M)**
2. A. What is the bias-variance tradeoff, and how is it related to underfitting and overfitting? **(6M)**

   B. Explain the working principle of a single-layer perceptron. **(4M)**
3. A neural network with one hidden layer and one output layer uses the following parameters:
   -Input: x1=0.6, x2=0.9.
   -Weights for hidden layer: w1=0.5, w2= −0.4.
   -Weight for the output layer: wo =0.7.
   -Activation function: Sigmoid.
   Compute the forward pass and backpropagation gradients for one training example with target y=1 and learning rate of 0.5. **(10M)**
4. Compare the storage and retrieval mechanisms of autocorrelative memory with heterocorrelative memory. Which one is better suited for storing orthogonal patterns, and why? **(10M)**
5. A. How is Bidirectional Associative Memory utilized in real-world scenarios? **(4M)**

   B. Describe the architecture of a BAM, including its input layer, output layer, and bidirectional connections with a neat diagram. **(6M)**

QP MAPPING

Q. No.	E/A/T	Module Number	Marks	BL	CO Mapped	PO Mapped	PEO Mapped	PSO Mapped
Q1	A	1	10	1	CO1	1,2	2	3
Q2	A	1	10	1	CO1	1,2,3,12	1	1
Q3	T	1	10	3	CO1	1,2,12	4	3
Q4	A	2	10	3	CO1	2,12	3	2
Q5	E	2	10	2	CO1	2,3,12	2	3

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QUESTION PAPER

Name of the Examination: CAT (Long Summer 2022-2023)

Course Code: CSE2009 | **Course Title: Soft Computing**

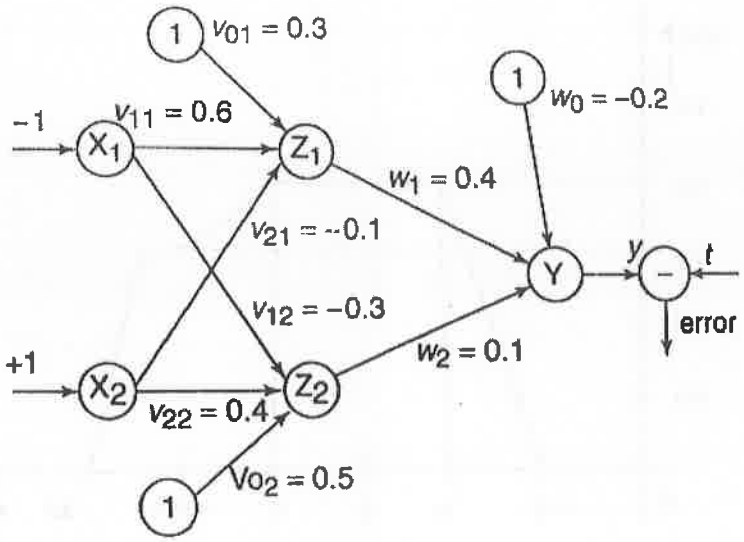
Slot: I | **Date of Exam:** 19/06/2023 (FN) (AN)

Duration: 90 min | **Total Marks: 50**

Instructions:

1. Assume Data wherever necessary.
2. Any assumptions made should be clearly stated.

Q1. Find the new weights using backpropagation model for the network below. The network is presented with input pattern [-1, 1] and the target output is +1. Use a learning rate of α=0.25 and bipolar sigmoidal activation function. **(10M)**



Q2. Check the autoassociative network for input vector [-1 1 1 1]. Form the weight vector using outer product rule. Test whether the net can recognize the inputs [0 1 1 1] and [-1 -1 1 1]. Use the bipolar step out function. **(10M)**

Q3. Consider a Kohonen self-organizing net with two cluster units and five input units. The weight vectors for the cluster units are given by $W_1 = [1.0 \quad 0.9 \quad 0.7 \quad 0.5 \quad 0.3]$ and $W_2 = [0.3 \quad 0.5 \quad 0.7 \quad 0.9 \quad 1.0]$. Use the square of the Euclidean distance to find the winning cluster unit for the input pattern $X = [0.0 \quad 0.5 \quad 1.0 \quad 0.5 \quad 0.0]$. Using a learning rate of 0.25, find the new weights for the winning unit. **(10M)**

Q4. Consider a local area network (LAN) of interconnected workstations that communicate using Ethernet protocols at a maximum rate of 12 Mbits/s. The two fuzzy sets given below represent the loading of the LAN: **(10M)**

$$\varphi_s(x) = \left\{\frac{1.0}{0} + \frac{1.0}{1} + \frac{0.8}{2} + \frac{0.2}{5} + \frac{0.1}{7} + \frac{0.0}{9} + \frac{0.0}{10}\right\}$$

$$\varphi_c(x) = \left\{\frac{0.0}{0} + \frac{0.0}{1} + \frac{0.0}{2} + \frac{0.5}{5} + \frac{0.7}{7} + \frac{0.8}{9} + \frac{0.0}{10}\right\}$$

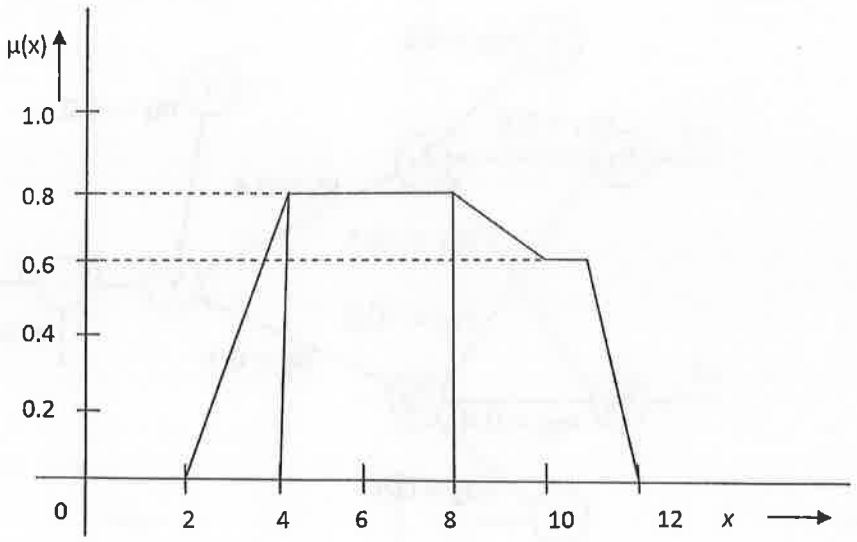
where S represents silent, and C represents congestion. Perform algebraic sum, algebraic product, bounded sum, and bounded difference over the two fuzzy sets.

Q5. a) For the fuzzy relation R, **(5M)**

$$R = \begin{bmatrix} 0 & 0.2 & 0.4 \\ 0.3 & 0.7 & 0.1 \\ 0.8 & 0.9 & 1.0 \end{bmatrix}$$

Determine the crisp α-cut relation when α= 0.1, 0.3, 0.9, 0, 0^+.

b) Determine the defuzzified values for the following membership graph using Maxima methods (First, Last and Mean). **(5M)**



QP MAPPING

Q. No.	Module Number	CO Mapped	PO Mapped	PEO Mapped	PSO Mapped	Marks
Q1	1	1, 2	2, 3, 5, 9			10
Q2	2	1, 2	4, 5			10
Q3	2	1, 2	4, 5			10
Q4	3	1, 2	2, 4, 5			10
Q5	3	1, 2	2, 4, 5			10

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QUESTION PAPER

Name of the Examination: Fast Track Fall 2023-24 Semester – CAT

Course Code: CSE2009 | **Course Title: SOFT COMPUTING**

Set number: 2 | **Date of Exam:** 05/07/2023 (FN)

Duration: 1 Hr 30 Minutes | **Total Marks: 50** (C1)

Instructions:

1. Assume data wherever necessary.
2. Any assumptions made should be clearly stated.

Q1. Using the Hebb rule find the weights required to perform the following classification of given input pattern. The symbol "+"represents the value 1 and "*" indicate -1. Consider "A" belongs to member of class (so has target value 1) and "E" does not member of class (so has target value -1) **(10M)**

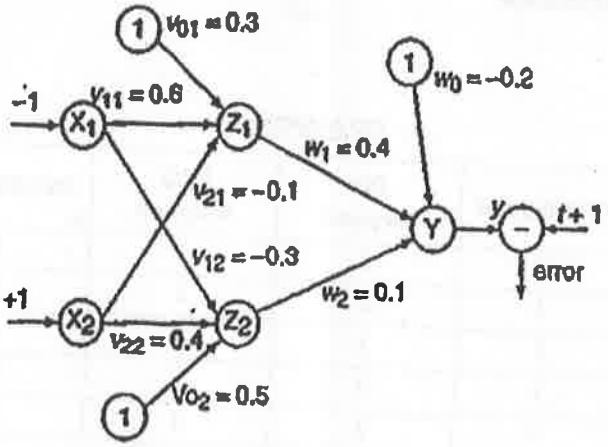
"A"

+	+	+
+	*	+
+	+	+
+	*	+
+	*	+

"E"

+	+	+
+	*	*
+	+	+
+	*	*
+	+	+

Q2. Find the new weights, using back-propagation network for the network. The network is presented with the input pattern [-1, 1] and the target output is + 1. Use a learning rate of a = 0.25 and sigmoidal activation function. **(10M)**



Q3. Construct an auto-associative network to store vector [1 1 -1 1], [-1 -1 1 1], [1 1 1 1]. Use iterative auto-associative network to test following scenarios

- Test the Input vectors as output vectors
- Test first three mistake elements from 1st Input vector.
- Test last three missing elements from 2nd Input vector
- Test alternative missing elements from 3rd Input vector **(10M)**

Q4. Consider a Kohonen net with two cluster units and five input units. The Weights vectors for the cluster units are

W1 = (1.0 0.9 0.7 0.3 0.2)
W2 = (0.6 0.7 0.5 0.4 1.0).

Use the square of the Euclidean distance to find the winning cluster unit for the input pattern X = (0.0 0.2 0.1 0.2 0.0), using a learning rate of 0.2, find the new weights for the winning unit. **(10M)**

Q5. Consider a Local Area Network (LAN) of interconnected workstations that communicate using Ethernet Protocols at a maximum rate of 12 Mbit/s. The two fuzzy sets given below represent the loading of the LAN:

$$\mu S(x) = \left\{\frac{1.0}{0} + \frac{1.0}{1} + \frac{0.8}{2} + \frac{0.2}{5} + \frac{0.1}{7} + \frac{0.0}{9} + \frac{0.0}{10}\right\}$$

$$\mu C(x) = \left\{\frac{0.0}{0} + \frac{0.0}{1} + \frac{0.0}{2} + \frac{0.5}{5} + \frac{0.7}{7} + \frac{0.8}{9} + \frac{1.0}{10}\right\}$$

where S represents Silent and C represents Congestion. Perform the following operations over the Two Fuzzy sets:

1. Algebraic Sum,
2. Algebraic Product,
3. Bounded Sum and
4. Bounded Difference **(10M)**

QP MAPPING

Q. No.	Module Number	CO Mapped	PO Mapped	PEO Mapped	PSO Mapped	Marks
Q1	1	1	2	1	1	10
Q2	1	1	2	1	1	10
Q3	2	1	3	1	1	10
Q4	2	1	3	1	1	10
Q5	3	2	2	1	1	10

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QUESTION PAPER

Name of the Examination: Fast Track Fall 2023-24 Semester – CAT

Course Code: CSE2009 **Course Title: Soft Computing**

Set number: 3 **Date of Exam:** 07/07/2023 (FN) (E1)

Duration: 90 mins **Total Marks: 50**

Instructions:

1. Assume data wherever necessary.
2. Any assumptions made should be clearly stated.

Answer ALL Questions (5×10 = 50)

Q1. Find the weights required to perform the following classification using perceptron network .The vectors (1, 1,-1,-1) and (1,-1,-1,-1) are belonging to the class (so the target value 1) vector (-1,-1,-1, 1) and (-1,-1,1,1) are not belonging class(so the target value -1).Assume learning rate 1 and initial weights as 0. [10M]

Q2. Using back-propagation network, find the new weights for the network shown in the Figure 1. The network is presented with the input pattern [1,-1] and target output 1.Use learning rate of α=0.3 and bi-polar sigmoidal activation function. [10M]

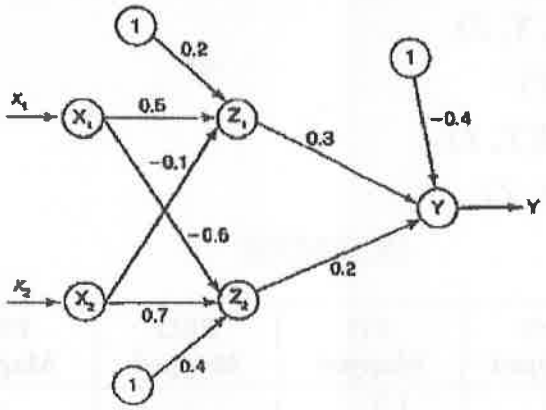

Figure 1

Q3. Use outer products rule to store vectors [-l-1 -1 1] and [1 1 1 -1] in an auto associative network. [10M]

a) Find the weight matrix.
b) Test vector using [-1-1-1-1] as input.
c) Test network using [1 1 1 1] as input.
d) Test the net using [0 1 1 0] as input.

Q4. Find the Weight matrix in bipolar form for the bidirectional associative memory using outer product rule for the following [10M]
Input-output vector pair

$s_1 = (1\ 0\ 0\ 0)$, $t_1=(1\ 0)$
$s_2 =(1\ 0\ 0\ 1)$, $t_2=(1\ 0)$
$s_3=(0\ 1\ 0\ 0)$, $t_3=(0\ 1)$
$s_4 =(0\ 1\ 1\ 0)$, $t_4=(0\ 1)$

Q5. Consider the following three fuzzy set and perform the following operation over the fuzzy set [10M]

X={(1,0.5),(2,0.7),(3,0.6),(4,0.9)(5,1)}

Y={(1,0.5),(2,0.4),(3,1),(4,0.3)(5,1)}

Z={(1,0.0),(2,0.8),(3,0.2),(4,0.3)(5,0.7)}

a) Associative law of(X, Y, Z)

b) Distributive law of(X, Y, Z)

c) Algebraic sum of(X, Y)

d) Bounded difference of(Y, Z)

e) Bounded Product of(X, Z)

QP MAPPIN

Q. No.	Module Number	CO Mapped	PO Mapped	PEO Mapped	PSO Mapped	Marks
Q1	1	1	1,2	-	-	10
Q2	1	1	1,2	-	-	10
Q3	2	2	1,2,4	-	-	10
Q4	2	2	1,2,4	-	-	10
Q5	3	3	1,2,4,6	-	-	10

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QUESTION PAPER

Name of the Examination: Fast Track Fall 2023-24 Semester – CAT

Course Code: CSE2009 | **Course Title: Soft Computing**

Set number: 4 | **Date of Exam:** 05/09/2023 (AN)(C2)

Duration: 90 mins | **Total Marks: 50**

Instructions:

1. Assume data wherever necessary.
2. Any assumptions made should be clearly stated.

Answer ALL Questions (5×10 = 50)

Q1. Using the Hebb rule find the weights required to perform the following classification of given input pattern shown in Figure 1.The symbol "+"represents the value 1 and " . " indicate -1.Consider "I" belongs to member of class (so has target value 1) and " O " does not member of class (so has target value -1). [10M]

+	.	+
.	+	+
+	.	+
.	+	+

+	+	+
.	.	+
+	.	.
+	+	+

Q2). Find the weights using perceptron network for ANDNOT function when all the inputs are presented only one time .Use bipolar inputs and targets. [10M]

Q3). Train an auto associative network for input vector [-1 1 1 - l] and also test the network with same input vector. Test the auto associative network with one missing, one mistake, two missing and two mistake entries in test vector. [10M]

Q4). Construct an ART 1 network for clustering three input vectors with low vigilance parameter of 0.4 into three clusters. The three input vectors are (1, 0, 1, 1), (1, 1, 1, 0), (1, 0, 0, 0). [10M]

Q5) Consider a universe of sports car and the relative speed are denoted in fuzzy representation. [10M]

$$Speed\ (S) = \left\{\frac{0}{maruthi}, \frac{0.8}{ferrari}, \frac{1}{bugatti}, \frac{0.8}{BMW}, \frac{0}{kia}\right\}$$

Corresponding milage of cars under different speed are given in the below fuzzy set

$$Mileage\ (M) = \frac{0}{180km/h}, \frac{0.2}{160km/h}, \frac{0.7}{120km/h}, \frac{1}{90km/h}, \frac{0.7}{115km/h}, \frac{0.2}{150km/h}, \frac{0}{190km/h}$$

Performance of each car are given in the below fuzzy set

$$Performance\ (P) = \left\{\frac{0}{maruthi}, \frac{0.8}{ferrari}, \frac{1}{bugatti}, \frac{0.6}{BMW}, \frac{0}{kia}\right\}$$

Construct the relation $R = S \times N$ and $S = P \cdot R$ using min max composition.

QP MAPPING

Q. No.	Module Number	CO Mapped	PO Mapped	PEO Mapped	PSO Mapped	Marks
Q1	1	1	1,2	-	-	10
Q2	1	1	1,2	-	-	10
Q3	2	2	1,2,4	-	-	10
Q4	2	2	1,2,4	-	-	10
Q5	3	3	1,2,4,6	-	-	10

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QUESTION PAPER

Name of the Examination: Fast Track Fall 2023-24 Semester – CAT

Course Code: CSE2009 | **Course Title: SOFT COMPUTING**

Set number: 6 | **Date of Exam:** 07/07/2023 (AN) (E2)

Duration: 1 Hr 30 Minutes | **Total Marks: 50**

Instructions:

1. Assume data wherever necessary.
2. Any assumptions made should be clearly stated.

Q1. Using the Hebb rule find the weights required to perform the following classification of given input pattern. The symbol "+"represents the value 1 and "*" indicate -1. Consider "I" belongs to member of class (so has target value 1) and "F" does not member of class (so has target value -1) **(10M)**

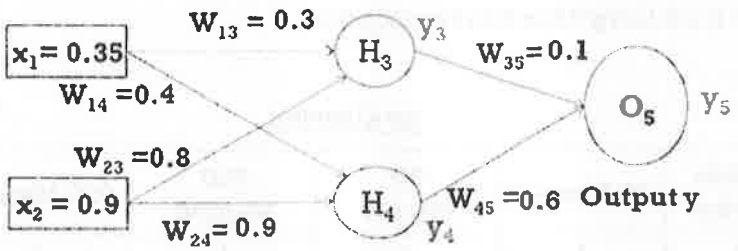
"I"

+	+	+
*	+	*
*	+	*
*	+	*
+	+	+

"F"

+	+	+
+	*	*
+	+	+
+	*	*
+	*	*

Q2. Find the new weights for the activation function with the network using Backpropagation Neural Network. The network is presented with the target output is 1. Use learning rate of a = 0.45 and use sigmoidal activation function **(10M)**



Q3. Construct a Hetero-associative network for the given pattern,
The target of "O" and "C" arc (1, -1) and (-1, 1) respectively.

Store the pattern and as well recognize the "O" pattern from random two mistakes and two missing in different vector and justify the response. **(10M)**

"O"

+	+	+
+	*	+
+	*	+
+	+	+

"C"

+	+	+
+	*	*
+	*	*
+	+	+

Q4. Construct a Learning Vector Quantization net with Three input vectors assigned to 2 classes, where the weight matrix is

W1 = [0 1 1 0]
W2 = [1 1 0 0]

Input Vector	Class
[0 0 0 1]	2
[1 0 0 0]	2
[0 1 1 0]	1

(10M)

Q5. An Athletic race was conducted. The following membership functions are defined based the Speed of Athletes:

$$\text{Low} = \left\{\frac{0}{100} + \frac{0.1}{200} + \frac{0.3}{300}\right\}$$

$$\text{Medium} = \left\{\frac{0.5}{100} + \frac{0.57}{200} + \frac{0.6}{300}\right\}$$

$$\text{High} = \left\{\frac{0.8}{100} + \frac{0.9}{200} + \frac{1.0}{300}\right\}$$

Find the following:

R = Low × Medium

S = Medium × High

T = R o S Using Max-Min Composition **(10M)**

QP MAPPING

Q. No.	Module Number	CO Mapped	PO Mapped	PEO Mapped	PSO Mapped	Marks
Q1	1	1	2	1	1	10
Q2	1	1	2	1	1	10
Q3	2	1	3	1	1	10
Q4	2	1	3	1	1	10
Q5	3	2	2	1	1	10

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QUESTION PAPER

Name of the Examination: Short Summer Semester-2

Course Code: CSE2009 **Course Title:** Soft Computing

Set number: **Date of Exam:** 19/07/2023 (FN) (A1)

Duration: 90 Mins **Total Marks:** 60

Instructions:

Q1. Train a heteroassociative memory network to store the input vectors s = (S_0, S_1, S_2, S_3) to the output vectors t = (t_1, t_2). The vector pairs are given in Table 1. Also test the performance of the network using its training input as testing input.

Table 1

Input & target	S_0	S1	S2	S3	t1	t2
1st	1	0	0	0	0	1
2nd	1	1	0	0	0	1
3rd	0	0	0	1	1	0
4th	0	0	1	1	1	0

(15)

Q2. A) Let a fuzzy relational matrix R is given below. Find out R is an equivalent relationship or not (7)

$$R=\begin{bmatrix}1.0 & 0.8 & 0.4 & 0.5 & 0.8\\ 0.8 & 1.0 & 0.4 & 0.5 & 0.9\\ 0.4 & 0.4 & 1.0 & 0.4 & 0.4\\ 0.5 & 0.5 & 0.4 & 1.0 & 0.5\\ 0.8 & 0.9 & 0.4 & 0.5 & 1.0\end{bmatrix}$$

B) Let $\tilde{A}= (a, 0.5), (b, 0.6), (c, 0.7), (d, 0.8), (e, 0.9), (f, 0.9)$ and

$\tilde{B}= (p, 0.9), (q, 0.8), (s, 0.3), (r, 0.2), (s, 0.7), (t, 0.2), (z, 0.2).$

i. **Find out the λ-cut sets for the values of λ= 1,0.9, 0.5 and 0.2 for $\tilde{A}$ and $\tilde{B}$**

ii. **Find out the λ-cut sets for the values of $\lambda= 0.9^+$, 0.5^+ and 0.2^+ for $\tilde{A}$ and $\tilde{B}$.**

iii. **Find out the Complement of $\breve{B}$** **(8)**

Q3. Let $\breve{P}$ and $\breve{Q}$ are two fuzzy set.

$$\breve{P}=\left\{\frac{0.6}{m}+\frac{0.8}{n}+\frac{1.0}{r}\right\} \text{ and } \breve{Q}=\left\{\frac{0.5}{m}+\frac{0.7}{n}+\frac{0.3}{r}\right\}$$

Find the union, intersection, complement, difference and bounded difference over the fuzzy set $\tilde{P}$ and $\tilde{Q}$.

(15M)

Q4. Consider a simple optimization problem where you want to find the minimum value of the function f(x) = x^2 - 6x + 5 using a genetic algorithm, where x is a real number in the range [0, 10]. Describe the genetic algorithm to solve this optimization problem.

A) Define the encoding scheme for the chromosomes in the population. Is it possible to encode the chromosome using real number encoding?

B) Define the fitness function for evaluating the fitness of each chromosome.

C)Write the steps of the genetic algorithm, including selection, crossover, and mutation, for generating the next generation of chromosomes. (15M)

QP MAPPING

Q. No.	Module Number	CO Mapped	PO Mapped	PEO Mapped	PSO Mapped	Marks
Q1	1,2	1	1	2	1	15
Q2	3	2	1	2	1	15
Q3	4	3	1	2	1	15
Q4	5	2	4	-	1	15

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QUESTION PAPER

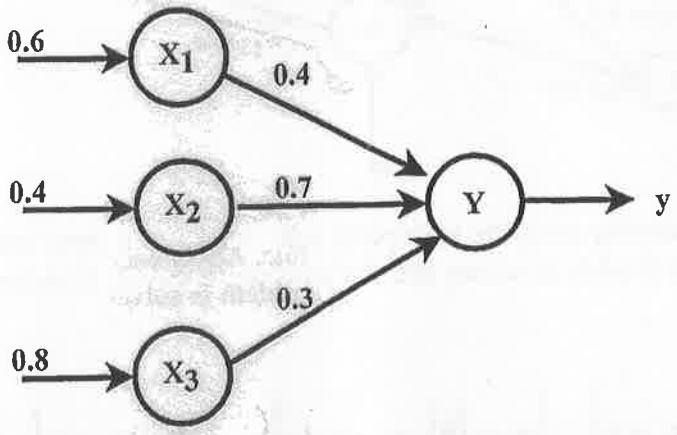
Name of the Examination: WINTER 2022-2023 – CAT-1

Course Code: CSE2009 **Course Title: Soft Computing**

Set number: 1 **Date of Exam:** 16-02-2023 (AN)

Duration: 90 Mins **Total Marks: 50** (D2)

Q1. a) For the network shown in the figure below, Calculate the net input to the output neuron by using Hard limit and the binary sigmoid activation function. **(5M)**

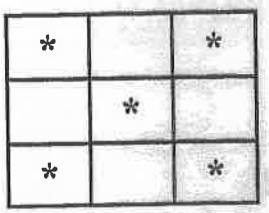


b) Train Auto Associative network for the input vector **[1 1 -1 -1]** and perform the following. **(5M)**

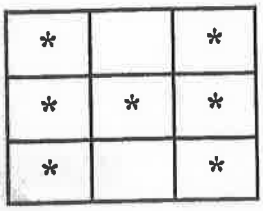
i. Test the input vector with **[-1 1 -1 -1]**

ii. Test the input vector with **[1 0 -1 -1]**

Q2. Train and Test the net to perform following classification for the given input pattern using the Hebb rule. **(10M)**



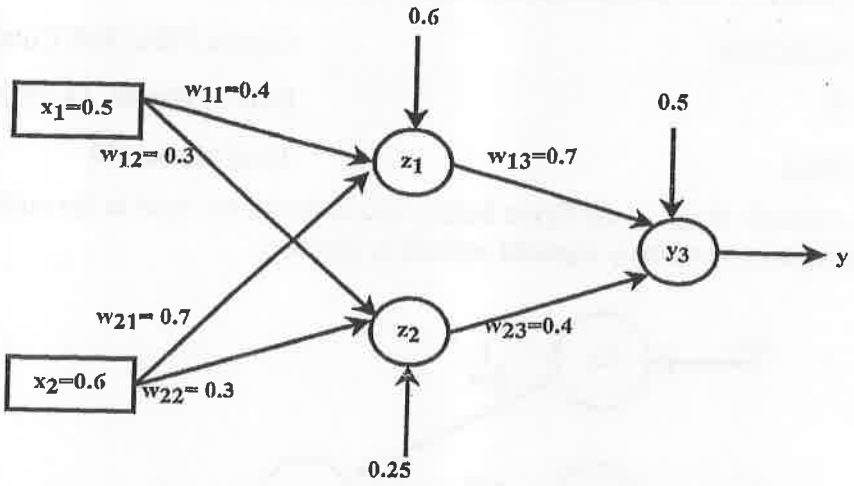
Target=-1



Target=1

Q3. Using the backpropagation network, find the new weights for the network given below. Use the learning rate as 0.5 and the binary sigmoid activation function. The actual output of y is 1.

(10M)



Q4. Perform the learning using the perceptron rule. Apply each input vector in order, for as many repetitions as it takes to ensure that the problem is solved. (Use binary step activation function)

(10M)

$$\left\{p_1 = \begin{bmatrix}-2\\-3\end{bmatrix}, t_1 = 0\right\} \quad \left\{p_2 = \begin{bmatrix}2\\3\end{bmatrix}, t_1 = 1\right\} \quad \left\{p_3 = \begin{bmatrix}-3\\-2\end{bmatrix}, t_1 = 1\right\} \quad \left\{p_4 = \begin{bmatrix}2\\-3\end{bmatrix}, t_1 = 0\right\}$$

Q5. Use the outer product rule of discrete BAM, and find the weight matrix to store the following binary input-output pattern pairs.

(10M)

s(1)= (1,0,1) **t(1)=(1,0)**

s(2)= (0,1,0) **t(2)=(0,1)**

QP MAPPING

Q. No.	Module Number	CO Mapped	PO Mapped	PEO Mapped	PSO Mapped	Marks
Q1	2	1	3,4,5	1,4	3	10
Q2	1	1	3,4,5	1,4	3	10
Q3	1	1	3,4,5	1,4	3	10
Q4	1	1	3,4,5	1,4	3	10
Q5	2	1	3,4,5	1,4	3	10

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QUESTION PAPER

Name of the Examination: WINTER 2022-2023 – CAT-1

Course Code: CSE2009 **Course Title: Soft Computing**

Set number: 2 **Date of Exam:** 17-02-2023 (FN)

Duration: 90 Mins **Total Marks: 50** (EI)

Q1. Perform the learning using the perceptron rule. Apply each input vector in order, for as many repetitions as it takes to ensure that the problem is solved. (Use binary step activation function). **(10M)**

x_1	x_2	t
2	-3	0
3	2	1
-3	-2	1
2	3	1

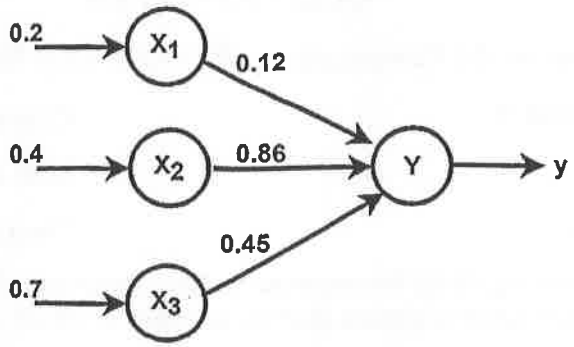
Q2. Use ADALINE network to train the given ANDNOT function with bipolar inputs and targets. Perform one epoch of training and give the results. (Consider $W_1=W_2=b=\alpha=0.1$) **(10M)**

x_1	x_2	t
1	1	-1
1	-1	1
-1	1	-1
-1	-1	-1

Q3. Train and Test the net to perform following classification for the given input pattern using the Hebb rule. **(10M)**

Pattern	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	t
O	1	1	1	1	-1	1	1	1	1	-1
P	1	1	1	1	1	1	1	-1	-1	1

Q4. a) For the network shown in the figure below, Calculate the net input to the output neuron by using Hard limit and the binary sigmoid activation function. **(5M)**



b) Train the network using Auto Associative Memory for the input vector **[1 -1 1 -1]** and perform the following. **(5M)**

i. Test the input vector with **[-1 1 1 -1]**

ii. Test the input vector with **[0 -1 1 -1]**

Q5. For the given input vector S=(s_1,s_2,s_3,s_4) and output vector T=(t_1,t_2), Construct and Test the net using hetero associative memory. **(10M)**

Input /Targets	s_1	s_2	s_3	s_4	t_1	t_2
1ST	1	0	1	0	1	1
2ND	0	0	1	1	0	1
3RD	1	0	0	1	0	1
4TH	1	1	0	1	1	0

QP MAPPING

Q. No.	Module Number	CO Mapped	PO Mapped	PEO Mapped	PSO Mapped	Marks
Q1	1	1	3,4,5	1,4	3	10
Q2	1	1	3,4,5	1,4	3	10
Q3	1	1	3,4,5	1,4	3	10
Q4	2	1	3,4,5	1,4	3	10
Q5	2	1	3,4,5	1,4	3	10

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QUESTION PAPER

Name of the Examination: WINTER 2022-2023 – CAT-1

Course Code: CSE2009 **Course Title:** Soft Computing

Set number: 4 **Date of Exam:** 16-2-2023 (FN)

Duration: 90 Mins **Total Marks:** 50 (D1)

Instructions:

1. Assume data wherever necessary.
2. Any assumptions made should be clearly stated.

Q1.

Given a two-input neuron with the following parameters: b=12, W=[3,2,4], and P=[-1,10,11]^T

i. What is the net input to the transfer function?

ii. What is the output of the neuron if it has the following transfer functions? [10]

a. Hard limit

b. Linear

c. Log-sigmoid

Q2.

Train the auto associative network for input vector [-2 2 2 2] and also test for the same input vector. [10]

Q3. Design a Hebb's network to train the set of data in following table. Show that this data set is linearly separable. [10]

q	$\mathbf{s}^{(q)}$	$t^{(q)}$
1	[1 1]	1
2	[1 -1]	-1
3	[-1 1]	-1
4	[-1 -1]	-1

Q4. Train the hetero associative network to store the given bipolar input vector S={s_1, s_2 ,s_3, s_4} to output vector t={ t_1, t_2}. Also test performance of the network with missing and mistaken data in test vector. [10]

s_1	s_2	s_3	s_4	t_1	t_2
2	-2	-2	-2	-1	1
2	2	-2	-2	-1	1
-2	-2	-2	2	1	-1
-2	-2	2	2	1	-1

Q5.

Solve the following problem with the perceptron rule. Apply each input vector in order, for as many repetitions as it takes to ensure that the problem is solved. [10]

$$\left\{\mathbf{p}_1 = \begin{bmatrix}2\\2\end{bmatrix}, t_1 = 0\right\}\left\{\mathbf{p}_2 = \begin{bmatrix}1\\-2\end{bmatrix}, t_2 = 1\right\}\left\{\mathbf{p}_3 = \begin{bmatrix}-2\\2\end{bmatrix}, t_3 = 0\right\}\left\{\mathbf{p}_4 = \begin{bmatrix}-1\\1\end{bmatrix}, t_4 = 1\right\}$$

QP Mapping

Q. No.	Module Number	COMapped	PO Mapped	PEO Mapped	PSO Mapped	Marks
Q1	1	CO2	PO2			10
Q2	2	CO2	PO1			10
Q3	1	CO1	PO2			10
Q4	2	CO2	PO1			10
Q5	1	CO2	PO2			10

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QUESTION PAPER

Name of the Examination: CAT-1 (Winter 2022-2023)

Course Code: CSE2009 | **Course Title: Soft Computing**

Slot: 6 | **Date of Exam:** 17-2-2023 (AN)

Duration: 90 min | **Total Marks: 50** (E2)

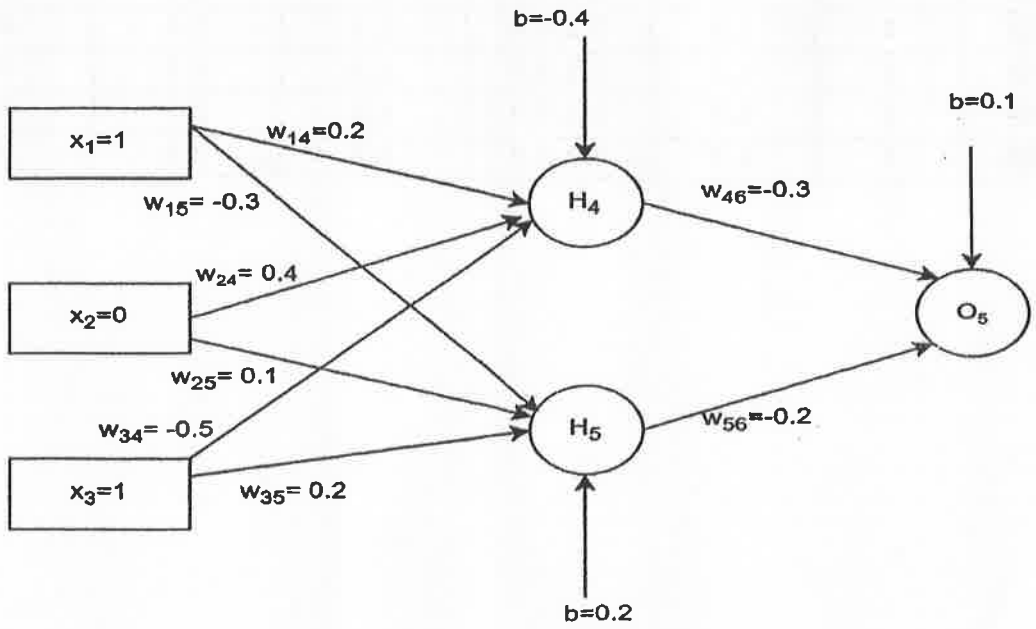
Instructions:

1. Assume Data wherever necessary.
2. Any assumptions made should be clearly stated.

Q1. Design a Hebb network for the below training input data. Also obtain the separating line equation and depict the decision boundary graph. **(10M)**

Inputs			Target
x_1	x_2	b	y
1	1	1	1
1	-1	1	-1
-1	1	1	-1
-1	-1	1	-1

Q2. Using the back-propagation network, find the new weights for the network below. Use learning rate of $\propto$=0.3, and binary sigmoidal activation function. The actual output of y is 1. **(10M)**



Q3. Consider the following classification problem. Use the perceptron rule for calculating the final weights. Training should be performed for one epoch. Use the initial weights and bias as zero. Assume the learning rate is 1 and threshold is 0. **(10M)**

Inputs		Target
x_1	x_2	y
1	1	1
1	0	1
0	1	1
0	0	-1

Q4. Check the autoassociative network for input vector [1 1 -1]. Form the weight vector with no self-confidence. Test whether the net can recognize for the input [1 0 -1]. **(10M)**

Q5. Find the weight matrix for the bidirectional associative memory using Hebbian rule for the following binary input-output pairs. **(10M)**

$s(1) = (1\ 0\ 0\ 0), \quad t(1) = (0\ 1)$
$s(1) = (0\ 1\ 1\ 0), \quad t(2) = (1\ 0)$

Use the binary step out function and validate the response of the network for each input patterns.

QP MAPPING

Q. No.	Module Number	CO Mapped	PO Mapped	PEO Mapped	PSO Mapped	Marks
Q1	1	1, 2	2, 3, 5, 9	1, 2	2, 3	10
Q2	1	1, 2	2, 3, 5, 9	1, 2	2, 3	10
Q3	1	1, 2	2, 3, 5, 9	1, 2	2, 3	10
Q4	2	1, 2	2, 3, 5, 9	1, 2	2, 3	10
Q5	2	1, 2	2, 3, 5, 9	1, 2	2, 3	10

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QUESTION PAPER

Name of the Examination: WINTER 2022-2023 – CAT-1

Course Code: CSE2009 **Course Title:** Soft Computing

Set number: 3 **Date of Exam:** 20-02-2023 (AN)

Duration: 90 Mins **Total Marks:** 50 (G12)

Q1.
Describe a Hebb's algorithm and use it to solve the following problem. Show that this data set is linearly separable. [10]

$$\left\{\mathbf{p}_1 = \begin{bmatrix}0\\0\end{bmatrix}, t_1 = 0\right\}\left\{\mathbf{p}_2 = \begin{bmatrix}0\\1\end{bmatrix}, t_2 = 0\right\}\left\{\mathbf{p}_3 = \begin{bmatrix}1\\0\end{bmatrix}, t_3 = 0\right\}\left\{\mathbf{p}_4 = \begin{bmatrix}1\\1\end{bmatrix}, t_4 = 1\right\}.$$

Q2.
Describe the perceptron rule algorithm and apply it to solve the AND function. Apply each input vector in order, for as many repetitions as it takes to ensure that the problem is solved. [10]

Q3. Train the autoassociative network for input vector [-4 4 4 4] and also test for the same input vector. [10]

Q4. Train the hetero associative network to store the given bipolar input vector $S=\{s_1, s_2, s_3, s_4\}$ to output vector $t=\{t_1, t_2\}$. Also test performance of the network with missing and mistaken data in test vector. [10]

s_1=[5 5 -5 -5], s_2=[-5 5 -5 -5], s_3=[-5 -5 -5 -5], s_4=[5 5 -5 -5], t_1=[-1 -1 1 1] and t_2=[1 1 -1 -1]

Q5. Given a two-input neuron with the following parameters: b=1, W=[3,2], and P=$[-1,10]^T$ [10]

i. **What is the net input to the transfer function?**
ii. **What is the neuron output?**
iii. **What is the output of the neuron if it has the following transfer functions?**
   a. **Hard limit**
   b. **Linear**
   c. **Log-sigmoid**

QP Mapping

Q. No.	Module Number	COMapped	PO Mapped	PEO Mapped	PSO Mapped	Marks
Q1	1	CO2	PO2			10
Q2	1	CO2	PO1			10
Q3	2	CO1	PO2			10
Q4	2	CO2	PO1			10
Q5	2	CO2	PO2			10

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QUESTION PAPER

Name of the Examination: Fall 2023-24 Semester – CAT-1

Course Code: CSE2009 | **Course Title: Soft Computing**

Set number: 2 | **Date of Exam:** 12/09/2023 (FN) (C1)

Duration: 90 Minutes | **Total Marks: 50**

Instructions:

1. **Assume data wherever necessary.**
2. **Any assumptions made should be clearly stated.**

1. Implement NOR function using Hebb net with bi-polar inputs and target **(10M)**

2. Using back-propagation network, find the new weights for the network shown in the Figure 1. The network is presented with the input pattern [-1, 0] and target output 1.Use learning rate of **α=0.3 and binary sigmoidal activation function** **(10M)**

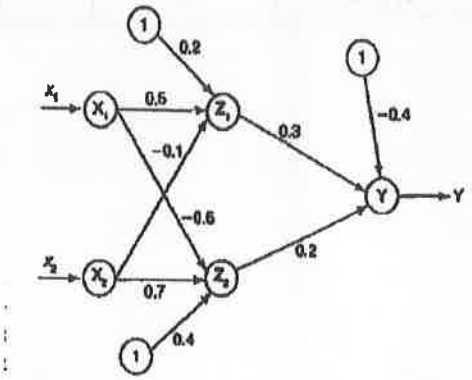

Figure 1

3. Construct an auto associative network to store vector [1 1 -1 +1]. Use iterative auto associative network to test the vector with three missing elements **(10M)**

4. Find the weight matrix in bipolar form for the BAM using outer products rule for the following binary input-output vector pairs **(10M)**

s (1)= (1 0 0 0), t(1)=(0 1)

s (2)=(0 11 0), t(2)=(1 0)

5. Construct a Kohen self-organizing feature map to cluster four vectors [0 0 1 1], [1 0 0 1], [0 1 0 1], {1 1 1 1}. The maximum number of clusters to be formed is 2 and assume learning rate as 0.5. Assume random initial weights **(10M)**

QP MAPPING

Q. No.	Module Number	CO Mapped	PO Mapped	PEO Mapped	PSO Mapped	Marks
Q1	1	1	1, 2, 3	1	1	10
Q2	1	1	1, 2, 3	1	1	10
Q3	2	1	1, 2, 3, 4	1	1	10
Q4	2	1	1, 2, 3	1	1	10
Q5	2	1	1, 2, 3, 4	1	1	10