Total Pages: 2

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: CS361

Course Name: SOFT COMPUTING (CS)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1 Explain the different learning mechanisms used in Artificial Neural Networks with the help of necessary diagrams. (3)

2 With the help of an example, state the role of bias in determining the net output of an Artificial Neural Network. (3)

3 Illustrate the different steps involved in the training algorithm of Perceptrons. (3)

4 State the concept of delta-rule used in Adaptive Linear Neurons. (3)

PART B

Answer any two full questions, each carries 9 marks.

5 Design a Hebb network to realize logical OR function. (9)

6 Implement AND logical function using Perceptrons. (9)

7 a) How is the training algorithm performed in back-propagation neural networks? (5)

b) With graphical representations, explain the activation functions used in Artificial Neural Networks. (4)

PART C

Answer all questions, each carries 3 marks.

8 List and explain the various operations that can be performed in fuzzy relations. (3)

9 Law of contradiction and law of excluded middle cannot be applied to fuzzy sets. Give proper justification to the statement. (3)

10 With the help of a figure, explain the features of fuzzy membership functions. (3)

11 How can the role of lambda-cuts in defuzzification be justified? Give examples. (3)

PART D

Answer any two full questions, each carries 9 marks.

12 a) Given two fuzzy sets, $M_{\sim}$ and $N_{\sim}$, such that $M_{\sim} = \left\{\frac{0}{x1} + \frac{0.8}{x2} + \frac{1}{x3} + \frac{0.8}{x4} + \frac{0}{x5}\right\}$ and $N_{\sim} = \left\{\frac{0}{y1} + \frac{0.2}{y2} + \frac{0.7}{y3} + \frac{1}{y4} + \frac{0.7}{y5} + \frac{0.2}{y6} + \frac{0}{y7}\right\}$. Construct a relation $R_{\sim} = M_{\sim} \times N_{\sim}$. (4)

b) Introduce another fuzzy set $M_{1\sim} = \left\{\frac{0}{x1} + \frac{0.8}{x2} + \frac{1}{x3} + \frac{0.6}{x4} + \frac{0}{x5}\right\}$. Find $M_{1\sim} \circ R_{\sim}$ using max-min composition. (5)

13 a) Consider the following two fuzzy sets: (4)

$A_{\sim} = \left\{\frac{0.2}{1} + \frac{0.3}{2} + \frac{0.4}{3} + \frac{0.5}{4}\right\}$

$B_{\sim} = \left\{\frac{0.1}{1} + \frac{0.2}{2} + \frac{0.2}{3} + \frac{1}{4}\right\}$

Find the algebraic sum, algebraic product, bounded sum, and bounded difference of the given sets.

b) Using inference method, find the membership values of the triangular shapes; isosceles (I), right angled (R), isosceles and right angled (IR), equilateral (E), and other triangles (T); for a triangle with angles 60, 55, and 65. (5)

14 a) Consider the following fuzzy relation, $R_{\sim} = \begin{bmatrix} 1 & 0.8 & 0 & 0.1 & 0.2 \\ 0.8 & 1 & 0.4 & 0 & 0.9 \\ 0 & 0.4 & 1 & 0 & 0 \\ 0.1 & 0 & 0 & 1 & 0.5 \\ 0.2 & 0.9 & 0 & 0.5 & 1 \end{bmatrix}$ (4.5)

Show that the above relation is a tolerance relation.

b) Also, show that the λ-cut relation of the above relation results in a crisp tolerance relation. (4.5)

PART E

Answer any four full questions, each carries 10 marks.

15 a) "A compound rule may be decomposed and reduced into a number of simple canonical rule forms". Explain the different methods to do so. (6)

b) How can one perform the aggregation of fuzzy rules? (4)

16 With the help of necessary block diagrams, compare Mamdani and Sugeno Fuzzy Inference Systems. (10)

17 a) With the help of examples, explain the various fuzzy propositions. (6)

b) Explain the different methods for fuzzy approximate reasoning. (4)

18 a) Explain the different methods of encoding that are possible in genetic algorithm. (6)

b) "Termination criterion for a genetic algorithm brings the search to a halt". Explain the various termination techniques. (4)

19 With the help of examples, explain the various crossover techniques employed in genetic algorithms. (10)

20 a) Illustrate the different steps in genetic-neuro hybrid systems with the help of a neat block diagram. (6)

b) Distinguish between the processes of tuning and learning in genetic-fuzzy rule based systems. (4)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: CS361

Course Name: SOFT COMPUTING

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks Marks

1 Define artificial neural network, Draw its mathematical model? (3)

2 Obtain the output of the neuron for a network with inputs are given as [x1,x2,x3]=[0.8,0.6,0.4] and the weights are [w1,w2,w3]=[0.1,0.3,-0.2] with bias= 0.35. Also find output for: (3)

i) Binary sigmoidal ii) Bipolar sigmoidal activation functions.

3 Define the Perceptron learning rule and state the importance of Delta rule in Adaline? (3)

4 List the stage involved in Back Propagation Algorithm? (3)

PART B

Answer any two full questions, each carries 9 marks

5 a) Discuss the concept of M P Neuron? (3)

b) Implement AND function using MP neuron (take binary data)? (6)

6 a) Design logical AND using Perceptron network for bipolar inputs and targets? (7)

b) Using linear separability, draw the decision boundary for logical AND? (2)

7 Design and implement OR function with bipolar inputs and targets using Adaline network? Find total mean square error of 3 epochs? (9)

PART C

Answer all questions, each carries 3 marks

8 Define Fuzzy set and write basic fuzzy set operations? (3)

9 Discuss fuzzy equivalence relations and list out its properties? (3)

10 How Induction Reasoning is used for Fuzzification process? (3)

11 Using Zadeh's notation, determine the λ- cut sets for the given fuzzy sets: (3)

$$\underline{S1} = \{ \frac{0}{0} + \frac{0.5}{20} + \frac{0.65}{40} + \frac{0.85}{60} + \frac{1.0}{80} + \frac{1.0}{100} \}$$

$$\underline{S2} = \{ \frac{0}{0} + \frac{0.45}{20} + \frac{0.6}{40} + \frac{0.8}{60} + \frac{0.95}{80} + \frac{1.0}{100} \}$$

Express the following for $\lambda = 0.5$

i) $S_1 \cup S_2$ ii) $S_1 \cap S_2$ iii) $\overline{S_1}$ iv) $\overline{S_2}$

PART D

Answer any two full questions, each carries 9 marks

12 a) Let U be the universe of military aircraft of interest as defines as below, (5)

U= { a10, b52, c130, f2,f9}

Let A be the fuzzy set of fighter class aircraft:

$$\underline{A} = \left\{ \frac{0.3}{a10} + \frac{0.4}{b52} + \frac{0.2}{c130} + \frac{0.1}{f2} + \frac{1}{f9} \right\}$$

$$\underline{B} = \left\{ \frac{0.1}{a10} + \frac{0.2}{b52} + \frac{0.8}{c130} + \frac{0.7}{f2} + \frac{0}{f9} \right\}$$, then find the following:

i) $\underline{A} \cup \underline{B}$ ii) $\underline{A} \cap \underline{B}$ iii) $\overline{\underline{B}}$ iv) $\underline{A}/\underline{B}$ v) $\underline{B}/\underline{A}$

vi) $\overline{\underline{A} \cup \underline{B}}$ vii) $\overline{\underline{A} \cap \underline{B}}$ viii) $\overline{\underline{A}} \cup \overline{\underline{B}}$ ix) $\overline{\underline{B}} \cup \underline{A}$

b) The discretized membership function of a transistor and a resistor are given below, (4)

$$\mu\underline{T} = \left\{ \frac{0}{0} + \frac{0.2}{1} + \frac{0.7}{2} + \frac{0.8}{3} + \frac{0.9}{4} + \frac{1}{5} \right\}$$

$$\mu\underline{R} = \left\{ \frac{0}{0} + \frac{0.1}{1} + \frac{0.3}{2} + \frac{0.2}{3} + \frac{0.4}{4} + \frac{0.5}{5} \right\}$$. Find the following

i) Algebraic Sum ii) Algebraic Product

iii) Bounded Sum iv) Bounded difference

13 a) Consider a universe of aircraft speed near the speed of sound as (6)
X={ 0.72, 0.725, 0.75, 0.775, 0.78} and a fuzzy set on this universe for the speed "near mach 0.75"= $\underline{M}$

$$\underline{M} = \left\{ \frac{0}{0.72} + \frac{0.8}{0.725} + \frac{1}{0.75} + \frac{0.8}{0.775} + \frac{0}{0.78} \right\}$$

Define a universe of altitudes Y={ 21,22, 23,24,25,26,27} in K-feet and a fuzzy set on this universe for the altitude fuzzy set "approximately 24,000 feet" = $\underline{N}$where

$$\underline{N} = \left\{ \frac{0}{21k} + \frac{0.2}{22k} + \frac{0.7}{23k} + \frac{1}{24k} + \frac{0.7}{25k} + \frac{0.2}{26k} + \frac{0}{27k} \right\}$$

i) Construct a relation $\underline{R} = \underline{M} \times \underline{N}$

ii) For another aircraft speed , say M_1 in the region of mach 0.75 where

$$\underline{M_1} = \left\{ \frac{0}{0.72} + \frac{0.8}{0.725} + \frac{1}{0.75} + \frac{0.6}{0.775} + \frac{0}{0.78} \right\}$$

Then find relation $\underline{\mathbf{S}} = \underline{\mathbf{M_1}} \circ \underline{\mathbf{R}}$ using max-min composition.

b) Using your own intuition and definitions of the universe of discourse, plot fuzzy membership functions for "weight of people". (3)

14 a) Using Inference approach , find the membership values for the triangle shapes I,R,E,IR, and T for a triangle with angles of degrees 45,55,80. (5)

b) Consider the discrete fuzzy set defined on the universe X={ a, b, c, d, e} as (4)

A= $\{\frac{1}{a} + \frac{0.9}{b} + \frac{0.6}{c} + \frac{0.3}{d} + \frac{0}{e}\}$, Using Zadeh's notation, find the **λ**- cut sets for $\lambda = 1, 0.9, 0.6, 0.3, 0^{+}$ and 0.

PART E

Answer any four full questions, each carries 10 marks

15 a) Explain formation of fuzzy rule with an example? (5)

b) Discuss the classification of Neuro Fuzzy Hybrid System? (5)

16 a) What is the concept of crossover in Genetic Algorithm? (5)

b) Explain various coding techniques in GA with examples? (5)

17 Explain Genetic Neuro - Hybrid systems, list out its advantages also? (10)

18 Explain Fuzzy inference models with examples? (10)

19 a) Explain Various selection methods? (5)

b) Illustrate the Mutation process in GA? (5)

20 Explain Genetic Fuzzy Rule Based systems? (10)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: CS361

Course Name: SOFT COMPUTING

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1 Compare feed forward and feedback networks. (3)

2 Why McCulloch-Pitts neuron widely used in logic functions? (3)

3 Explain the concept of Widrow-Hoff rule. (3)

4 State the significance of error portion δ_k and δ_j in Back Propagation Network. (3)

PART B

Answer any two full questions, each carries 9 marks.

5 Implement AND function using bipolar inputs and targets using Hebb rule method. (9)

6 Implement OR function using perceptron training algorithm with binary inputs and bipolar targets. (9)

7 a) Explain training algorithm used in adaptive linear neuron. (5)

b) Implement AND function using McCulloch-Pitts neuron (using binary data representation). (4)

PART C

Answer all questions, each carries 3 marks.

8 Distinguish between fuzzy and probability with example. (3)

9 Explain any two methods of composition techniques on fuzzy relations with examples (3)

10 State the relevance of fuzzification. Explain different types. (3)

11 Using the intuition method develop fuzzy membership functions for the following shapes. (3)
(a) Trapezoid. (b) Gaussian function. (c) Isosceles triangle.

PART D

Answer any two full questions, each carries 9 marks.

12 a) Consider the two fuzzy sets (5)

$$\underset{\sim}{A} = \{\frac{0}{0.2} + \frac{0.8}{0.4} + \frac{1}{0.6}\} \quad \underset{\sim}{B} = \{\frac{0.9}{0.2} + \frac{0.7}{0.4} + \frac{0.3}{0.6}\}$$

Using Zadeh's notation express the fuzzy sets into ƛ- cut sets for ƛ = 0.4 for the following operations.

(i) $A_{\sim} \cap B_{\sim}$ (ii) $A_{\sim} \cup B_{\sim}$ (iii) $\overline{A}_{\sim} \cup \overline{B}_{\sim}$ (iv) $\overline{A}_{\sim} \cap \overline{B}_{\sim}$ (v) $\overline{B}_{\sim}$

b) Explain the features of fuzzy membership functions with proper diagrams. (4)

13 a) Consider the three fuzzy sets (5)

$\underset{\sim}{A} = \{\frac{0.7}{50} + \frac{0.8}{55} + \frac{.9}{60}\}$, $\underset{\sim}{B} = \{\frac{0.1}{1} + \frac{0.6}{2} + \frac{0.8}{6}\}$, $\underset{\sim}{C} = \{\frac{0.5}{50} + \frac{1}{55} + \frac{0.7}{60}\}$

Find

(i) R = $\underset{\sim}{A}$ x $\underset{\sim}{B}$

(ii) S = $\underset{\sim}{C}$ ∘ R using max product composition.

b) Using the inference approach, find the membership values for the triangular shapes I~, R~, E~, IR~ for a triangle with angles 45°, 55° and 80°. (4)

14 a) Explain any five defuzzification methods. (5)

b) Consider the following two fuzzy sets.

$\underset{\sim}{A} = \{\frac{0.2}{1} + \frac{0.3}{2} + \frac{0.4}{3} + \frac{1}{4}\}$ $\underset{\sim}{B} = \{\frac{0.1}{1} + \frac{0.2}{2} + \frac{0.3}{3} + \frac{0.5}{4}\}$ (4)

Find the algebraic sum, algebraic product, bounded sum & bounded difference.

PART E

Answer any four full questions, each carries 10 marks.

15 a) Mention the stopping condition for genetic algorithm flow. (5)

b) Difference between uniform and three parent cross over. (5)

16 Define Fuzzy Propositions. Explain different fuzzy propositions. (10)

17 a) Mention the general forms that exist for a linguistic variable. (5)

b) Differentiate between Mamdani FIS and Sugeno FIS. (5)

18 Explain the characteristics and different classifications of a neuro-fuzzy hybrid system. (10)

19 Explain different types of Encoding Techniques. (10)

20 Compare genetic learning of rule bases and knowledge bases. (10)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2019

Course Code: CS361

Course Name: SOFT COMPUTING

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1		Describe the importance of Back Propagation Network.	(3)
2		Write three application scope of the Neural Network.	(3)
3		Explain Perceptron Training Algorithm for Single Output Class.	(3)
4		What is Activation Function and write its importance.	(3)

PART B

Answer any two full questions, each carries 9 marks.

5	a)	Implement ANDNOT function using McCulloch-Pitts neuron model. (Use binary data representation).	(7)
	b)	Differentiate between Hard Computing and Soft Computing.	(2)
6	a)	Explain the training algorithm for Hebb Network.	(6)
	b)	Write the learning factors of Back Propagation Network.	(3)
7	a)	With the help of an example explain Supervised, Unsupervised, Reinforcement learning.	(6)
	b)	What is ADALINE . Why it is trained using least mean square rule.	(3)

PART C

Answer all questions, each carries 3 marks.

8		Represent the standard fuzzy set operations using Venn diagram.	(3)
9		Why the excluded middle law does not get satisfied in fuzzy logic.	(3)
10		Describe the features of membership function.	(3)
11		Consider the discrete fuzzy set defined on the universe **X= {a, b, c, d, e}** as **A=** $\left\{\frac{1}{a}+\frac{0.9}{b}+\frac{0.6}{c}+\frac{0.3}{d}+\frac{0}{e}\right\}$.Using Zadhe's notation , find the λ– cut sets for **λ=0.6,0.3,0$^+$.**	(3)

PART D

Answer any two full questions, each carries 9 marks.

12	a)	Using the inference approach, obtain the membership values for the triangular shapes**, (I,R,T)** for a triangle with angles **40^o , 60^o , 80^o.**	(6)
	b)	What is cardinality of a fuzzy set. Whether a power set can be formed for a fuzzy set. Justify your answer.	(3)

13 a) Differentiate the following (3)

(a) Convex and Nonconvex Fuzzy Set.

(b) Normal and Subnormal Fuzzy Set.

b) For a speed control of DC motor, the membership function of series resistance, armature current and speed are given as follows (6)

$\mathbf{R_{se}} = \left\{\frac{0.4}{30} + \frac{0.6}{60} + \frac{1.0}{100} + \frac{0.1}{120}\right\}$

$\mathbf{I_a} = \left\{\frac{0.2}{20} + \frac{0.3}{40} + \frac{0.6}{60} + \frac{0.8}{80} + \frac{1.0}{100} + \frac{0.2}{120}\right\}$

$\mathbf{N} = \left\{\frac{0.35}{500} + \frac{0.67}{1000} + \frac{0.97}{1500} + \frac{0.25}{1800}\right\}$

Compute relation T for relating series resistance to motor speed ie R_{se} to N. Perform max-min composition.

14 Explain different defuzzification methods. (9)

PART E

Answer any four full questions, each carries 10 marks.

15 a) With the help of a block diagram explain Genetic Neuro Hybrid Systems. (6)

b) Write a note on Fuzzy Qualifiers. (4)

16 a) Explain the methods used for decomposing compound linguistic rules into simple canonical rules. (6)

b) Explain the steps of Genetic Algorithm. (4)

17 a) Describe two methods used for Aggregation of Fuzzy Rules. (3)

b) Write any three advantages of Neuro- Genetic hybrid system. (3)

c) Explain Value Encoding and Permutation Encoding with example. (4)

18 a) Explain stopping condition for Genetic Algorithm. (5)

b) Describe 5 types of Crossover. (5)

19 a) Distinguish between Mamdani FIS and Sugeno FIS. (6)

b) Explain Stochastic Universal Sampling with example. (4)

20 a) Explain the following terms (10)

(a) Cooperative Neural Fuzzy Systems

(b) General Neuro Fuzzy Hybrid Systems

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2019

Course Code: CS361

Course Name: SOFT COMPUTING

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1		Describe the importance of Back Propagation Network.	(3)
2		Write three application scope of the Neural Network.	(3)
3		Explain Perceptron Training Algorithm for Single Output Class.	(3)
4		What is Activation Function and write its importance.	(3)

PART B

Answer any two full questions, each carries 9 marks.

5	a)	Implement ANDNOT function using McCulloch-Pitts neuron model. (Use binary data representation).	(7)
	b)	Differentiate between Hard Computing and Soft Computing.	(2)
6	a)	Explain the training algorithm for Hebb Network.	(6)
	b)	Write the learning factors of Back Propagation Network.	(3)
7	a)	With the help of an example explain Supervised, Unsupervised, Reinforcement learning.	(6)
	b)	What is ADALINE . Why it is trained using least mean square rule.	(3)

PART C

Answer all questions, each carries 3 marks.

8		Represent the standard fuzzy set operations using Venn diagram.	(3)
9		Why the excluded middle law does not get satisfied in fuzzy logic.	(3)
10		Describe the features of membership function.	(3)
11		Consider the discrete fuzzy set defined on the universe **X= {a, b, c, d, e}** as **A=** $\left\{\frac{1}{a}+\frac{0.9}{b}+\frac{0.6}{c}+\frac{0.3}{d}+\frac{0}{e}\right\}$.Using Zadhe's notation , find the λ– cut sets for **λ=0.6,0.3,0$^+$.**	(3)

PART D

Answer any two full questions, each carries 9 marks.

12	a)	Using the inference approach, obtain the membership values for the triangular shapes**, (I,R,T)** for a triangle with angles **40^o , 60^o , 80^o.**	(6)
	b)	What is cardinality of a fuzzy set. Whether a power set can be formed for a fuzzy set. Justify your answer.	(3)

13 a) Differentiate the following (3)

(a) Convex and Nonconvex Fuzzy Set.

(b) Normal and Subnormal Fuzzy Set.

b) For a speed control of DC motor, the membership function of series resistance, armature current and speed are given as follows (6)

$\mathbf{R_{se}} = \left\{\frac{0.4}{30} + \frac{0.6}{60} + \frac{1.0}{100} + \frac{0.1}{120}\right\}$

$\mathbf{I_a} = \left\{\frac{0.2}{20} + \frac{0.3}{40} + \frac{0.6}{60} + \frac{0.8}{80} + \frac{1.0}{100} + \frac{0.2}{120}\right\}$

$\mathbf{N} = \left\{\frac{0.35}{500} + \frac{0.67}{1000} + \frac{0.97}{1500} + \frac{0.25}{1800}\right\}$

Compute relation T for relating series resistance to motor speed ie R_{se} to N. Perform max-min composition.

14 Explain different defuzzification methods. (9)

PART E

Answer any four full questions, each carries 10 marks.

15 a) With the help of a block diagram explain Genetic Neuro Hybrid Systems. (6)

b) Write a note on Fuzzy Qualifiers. (4)

16 a) Explain the methods used for decomposing compound linguistic rules into simple canonical rules. (6)

b) Explain the steps of Genetic Algorithm. (4)

17 a) Describe two methods used for Aggregation of Fuzzy Rules. (3)

b) Write any three advantages of Neuro- Genetic hybrid system. (3)

c) Explain Value Encoding and Permutation Encoding with example. (4)

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b) Describe 5 types of Crossover. (5)

19 a) Distinguish between Mamdani FIS and Sugeno FIS. (6)

b) Explain Stochastic Universal Sampling with example. (4)

20 a) Explain the following terms (10)

(a) Cooperative Neural Fuzzy Systems

(b) General Neuro Fuzzy Hybrid Systems

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2019

Course Code: CS361

Course Name: SOFT COMPUTING

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1		Describe the importance of Back Propagation Network.	(3)
2		Write three application scope of the Neural Network.	(3)
3		Explain Perceptron Training Algorithm for Single Output Class.	(3)
4		What is Activation Function and write its importance.	(3)

PART B

Answer any two full questions, each carries 9 marks.

5	a)	Implement ANDNOT function using McCulloch-Pitts neuron model. (Use binary data representation).	(7)
	b)	Differentiate between Hard Computing and Soft Computing.	(2)
6	a)	Explain the training algorithm for Hebb Network.	(6)
	b)	Write the learning factors of Back Propagation Network.	(3)
7	a)	With the help of an example explain Supervised, Unsupervised, Reinforcement learning.	(6)
	b)	What is ADALINE . Why it is trained using least mean square rule.	(3)

PART C

Answer all questions, each carries 3 marks.

8		Represent the standard fuzzy set operations using Venn diagram.	(3)
9		Why the excluded middle law does not get satisfied in fuzzy logic.	(3)
10		Describe the features of membership function.	(3)
11		Consider the discrete fuzzy set defined on the universe **X= {a, b, c, d, e}** as **A=** $\left\{\frac{1}{a}+\frac{0.9}{b}+\frac{0.6}{c}+\frac{0.3}{d}+\frac{0}{e}\right\}$.Using Zadhe's notation , find the λ– cut sets for **λ=0.6,0.3,0$^+$.**	(3)

PART D

Answer any two full questions, each carries 9 marks.

12	a)	Using the inference approach, obtain the membership values for the triangular shapes**, (I,R,T)** for a triangle with angles **40^o , 60^o , 80^o.**	(6)
	b)	What is cardinality of a fuzzy set. Whether a power set can be formed for a fuzzy set. Justify your answer.	(3)

13 a) Differentiate the following (3)

(a) Convex and Nonconvex Fuzzy Set.

(b) Normal and Subnormal Fuzzy Set.

b) For a speed control of DC motor, the membership function of series resistance, armature current and speed are given as follows (6)

$\mathbf{R_{se}} = \left\{\frac{0.4}{30} + \frac{0.6}{60} + \frac{1.0}{100} + \frac{0.1}{120}\right\}$

$\mathbf{I_a} = \left\{\frac{0.2}{20} + \frac{0.3}{40} + \frac{0.6}{60} + \frac{0.8}{80} + \frac{1.0}{100} + \frac{0.2}{120}\right\}$

$\mathbf{N} = \left\{\frac{0.35}{500} + \frac{0.67}{1000} + \frac{0.97}{1500} + \frac{0.25}{1800}\right\}$

Compute relation T for relating series resistance to motor speed ie R_{se} to N. Perform max-min composition.

14 Explain different defuzzification methods. (9)

PART E

Answer any four full questions, each carries 10 marks.

15 a) With the help of a block diagram explain Genetic Neuro Hybrid Systems. (6)

b) Write a note on Fuzzy Qualifiers. (4)

16 a) Explain the methods used for decomposing compound linguistic rules into simple canonical rules. (6)

b) Explain the steps of Genetic Algorithm. (4)

17 a) Describe two methods used for Aggregation of Fuzzy Rules. (3)

b) Write any three advantages of Neuro- Genetic hybrid system. (3)

c) Explain Value Encoding and Permutation Encoding with example. (4)

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b) Explain Stochastic Universal Sampling with example. (4)

20 a) Explain the following terms (10)

(a) Cooperative Neural Fuzzy Systems

(b) General Neuro Fuzzy Hybrid Systems

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

Course Code: CS361

Course Name: SOFT COMPUTING

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1 Compare and contrast biological neuron and artificial neuron (3 points) (3)

2 Obtain the output of the neuron for a network with inputs are given as [x1, x2] = [0.7, 0.8] and the weights are [w1, w2] = [0.2, 0.3] with bias = 0.9. (3)

Use i) Binary sigmoidal activation function

ii) Bipolar sigmoid activation function

3 State the training algorithm for multiple output classes in Perceptron. (3)

4 What is the role of Widrow-Hoff rule in Adaptive Linear neuron? Give appropriate equations. (3)

PART B

Answer any two full questions, each carries 9 marks.

5 a) List any four activation functions with their equations and graphs. (4)

b) Implement $NOR(x_1, x_2)$ where $x_1, x_2 \in [0,1]$ using MP neuron. (5)

6 a) Draw the flowchart of Hebb training algorithm. (4)

b) Design a Hebb net to implement NOR function using with bipolar inputs and targets. (5)

7 a) Find the weights required to perform the following classifications using perceptron network: (5)
The vectors (1, 1, -1, -1) and (1,-1. 1, -1) are belonging to a class having target value 1. The vectors (-1, -1, -1, 1) and (-1, -1, 1, 1) are belonging to a class having target value -1. Assume learning rate 1 and initial weights as 0.

b) Draw the architecture of Back-Propagation network. Write its testing algorithm. (4)

PART C

Answer all questions, each carries 3 marks.

8 Why the Law of Excluded Middle does not get satisfied in fuzzy sets? (3)

9 Consider a local area network (LAN) of interconnected workstations that communicate using Ethernet protocols at a maximum rate of 20 Mbit/s. The two fuzzy sets given below represent the loading of the LAN: (3)

$$\underset{\sim}{\mu_S}(x) = \left\{\frac{1.0}{0} + \frac{1.0}{1} + \frac{0.9}{2} + \frac{0.4}{5} + \frac{0.1}{7} + \frac{0.3}{9} + \frac{0.0}{10}\right\}$$

$$\underset{\sim}{\mu_C}(x) = \left\{\frac{0.0}{0} + \frac{0.1}{1} + \frac{0.3}{2} + \frac{0.5}{5} + \frac{0.3}{7} + \frac{0.8}{9} + \frac{1.0}{10}\right\}$$

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

10 State the conditions for fuzzy tolerance and fuzzy equivalence relations? (3)

11 The fuzzy relations are given as (3)

$$\underset{\sim}{R} = \begin{array}{c} \\ x_1 \\ x_2 \end{array}\begin{array}{c} \begin{array}{ccc} y_1 & y_2 & y_3 \end{array} \\ \begin{bmatrix} 0.1 & 0.2 & 0.3 \\ 0.4 & 0.5 & 0.6 \end{bmatrix} \end{array} \qquad \underset{\sim}{S} = \begin{array}{c} \\ y_1 \\ y_2 \\ y_3 \end{array}\begin{array}{c} \begin{array}{cc} z_1 & z_2 \end{array} \\ \begin{bmatrix} 0.8 & 0.1 \\ 0.6 & 0.9 \\ 0.4 & 1.0 \end{bmatrix} \end{array}$$

Perform composition over the two given fuzzy relations and obtain a fuzzy relation T~.

PART D

Answer any two full questions, each carries 9 marks.

12 a) An athletic race was conducted. The following membership functions are defined based on the speed of athletes: (6)

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

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

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

Find the following:

(a) R~=Low x Medium

(b) S~=Medium x High

(c) T~=R ∘ S using max-min composition

b) Explain any two defuzzification methods? (3)

13 a) Explain the features of membership functions? (3)

b) Differentiate between Normal and subnormal fuzzy set. (2)

c) Using intuition and your own definition of the universe of discourse, plot fuzzy membership functions to the following variables: (4)

(i) Liquid level in the tank

(a) Very small

(b) Small

(c) Empty

(d) Full

(e) Very full

14 a) What is meant by Lambda cut of a fuzzy set? Show that Lambda cut relation of fuzzy relation is crisp. (4)

b) Using inference approach, find the membership values for each of the triangular shapes ($I_{\sim}$,$R_{\sim}$,$E_{\sim}$,$IR_{\sim}$,$T_{\sim}$) for each of the following (all in degrees): (5)

(a) 20^{o} , 40^{o} , 120^{o}

PART E

Answer any four full questions, each carries 10 marks.

15 a) Define Tautology. Prove the tautology $(P \Rightarrow Q) \vee (Q \Rightarrow P)$ using Truth values in Fuzzy Logic? (5)

b) What are Fuzzy propositions? List the operations on Fuzzy propositions? (5)

16 a) Give the Canonical form of Fuzzy Rule Based System. Give the syntax for the formation of Fuzzy rule using (5)

i) Assignment statements

ii) Conditional statements

iii) Unconditional statements

b) Explain any two methods for the decomposition of fuzzy rules. (5)

17 What is Fuzzy Inference System (FIS)? Illustrate Mamdani FIS and Sugeno FIS with examples? (10)

18 What are Genetic Algorithms (GA)? Explain the operators in GA? (10)

19 a) Explain *four* mutation methods? (8)

b) List the stopping condition for Genetic Algorithm Flow? (2)

20 a) State the properties of Genetic Neuro Hybrid System. Draw the block diagram of Genetic Neuro Hybrid System. (5)

b) What is Cooperative Neural Fuzzy system? Illustrate its classification types? (5)

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Reg No.:_____ **00000CS36112190** Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth semester B.Tech degree examinations (S) September 2020

Course Code: CS361

Course Name: SOFT COMPUTING

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1 List out the steps in perceptron learning algorithm for single output classes. (3)

2 Using linear separability concept, obtain the response for NAND function. (take bipolar inputs and bipolar targets). (3)

3 Examine the various aspects of sigmoidal activation function. List the drawbacks. (3)

4 Compare supervised and unsupervised learning approaches in ANN. (3)

PART B

Answer any two full questions, each carries 9 marks.

5 a) Implement NAND function using McCulloch-Pitts neuron model. (Use binary data representation). (5)

b) Explain why Widrow-Hoff rule is adopted to minimize error in ANN learning. (4)

6 Explain the architecture and training algorithm of Back Propagation network. Describe the various terminologies used in the algorithm. (9)

7 Use Adaline network to train AND NOT function with bipolar inputs and targets. Calculate total mean error after 1 epoch of training. Initially the weights and bias have assumed a random value say 0.2. The learning rate is also set to 0.2. (9)

x1	x2	b	t
1	1	1	-1
1	-1	1	1
-1	1	1	-1
-1	-1	1	-1

PART C

Answer all questions, each carries 3 marks.

8 Using your own intuition and definition of universe of discourse, plot membership functions for liquid level in the tank. (empty, very less, less, full, very full) (3)

9 Using inference approach, find the membership values for each of the triangular shapes (I, R, IR, E, T) for a triangle with angles $120°, 50°, 10°$ (3)

10 Consider two fuzzy sets (3)

$$A = \{\frac{0.2}{0} + \frac{0.3}{1} + \frac{1}{2} + \frac{0.1}{3} + \frac{0.5}{4}\}$$

$$B = \{\frac{0.1}{0} + \frac{0.25}{1} + \frac{0.9}{2} + \frac{0.7}{3} + \frac{0.3}{4} + \frac{0.2}{5}\}$$

Find the following:

(a) Algebraic sum

(b) Bounded sum

(c)Bounded Difference

11 Represent the standard fuzzy set operations using Venn diagram. (3)

PART D

Answer any two full questions, each carries 9 marks.

12 Given two universes X={x1,x2,x3,x4,x5} and Y={y1,y2,y3,y4,y5},the fuzzy sets A defined on X and fuzzy set B defined on Y are given below.

i) Find the relation $R = A \times B$ (2)

$$A = \{\frac{0.4}{x1} + \frac{0.7}{x2} + \frac{1}{x3} + \frac{0.8}{x4} + \frac{0.6}{x5}\}$$

$$B = \{\frac{0.2}{y1} + \frac{0.6}{y2} + \frac{1}{y3} + \frac{0.9}{y4} + \frac{0.7}{y5}\}$$

Consider another fuzzy set C defined on the universe V ={v1,v2,v3} (2)

$$C = \{\frac{0.4}{v1} + \frac{1}{v2} + \frac{0.8}{v3}\}$$ (5)

ii) Find $P = B \times C$.

iii) Using max-min composition find RoP

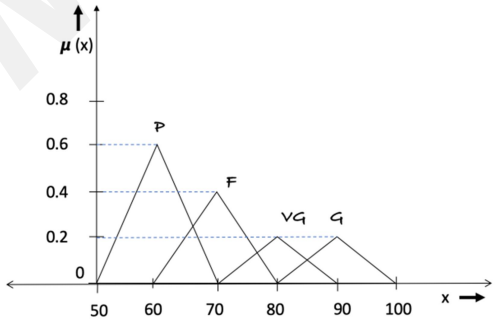
13 The following data was determined by the pairwise comparison of work preferences of 100 people: When it was compared with software (S), 40 persons polled preferred hardware (H), 38 of them preferred teaching (T), 48 of them preferred business (B) and 30 preferred textile (TX). On comparison with hardware (H), the preferences were 60 for S, 52 for T, 53 for B and 35 for TX. When compared with teaching, the preferences were 62 for S, 48 for H, 65 for B and 56 for TX. On comparison with business, the preferences were 52 for S, 47 for H, 35 for T, 60 for TX. When compared with textile, the preferences were 70 for S, 65 for H, 44 for T and 40 for B. Using rank ordering plot the membership function for the "most preferred work." (9)

14 a) Consider the fuzzy relation (4)

$$R = \begin{bmatrix} 1 & 0.8 & 0 & 0.1 & 0.2 \\ 0.8 & 1 & 0.4 & 0 & 0.9 \\ 0 & 0.4 & 1 & 0 & 0 \\ 0.1 & 0 & 0 & 1 & 0.5 \\ 0.2 & 0.9 & 0 & 0.5 & 1 \end{bmatrix}$$

Perform λ-cut operations for the values of $\lambda = 0.9, 0^+$

b) Let A be a fuzzy set that tells about a student as shown in figure below. Here, the linguistic variable P represents a Pass student, F stands for a Fair student, G represents a Good student and VG represents a Very Good student. Calculate the defuzzified value for the fuzzy set A with weighted average method and center of sums. (5)



PART E

Answer any four full questions, each carries 10 marks.

15 a) Differentiate between Mamdani FIS and Sugeno FIS. (5)

	b)	List the five functional blocks FIS is constructed on with a block diagram.	(5)
16	a)	Explain the methods used for decomposition of compound linguistic rules into simple canonical rules.	(6)
	b)	List the basic logic operations performed over the propositions.	(4)
17		What are the classifications of neuro-fuzzy hybrid systems? Discuss in detail.	(10)
18	a)	Compare and contrast traditional algorithm and genetic algorithm.	(5)
	b)	Explain various types of crossover techniques.	(5)
19	a)	Explain the Roulette wheel technique for traditional GA selection.	(5)
	b)	Describe the various stopping conditions for genetic algorithm flow.	(5)
20	a)	Give the advantages of Neuro-Genetic hybrids.	(5)
	b)	Explain the concepts of Genetic Fuzzy Systems.	(5)

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