

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: CS361

Course Name: SOFT COMPUTING

Duration: 3 Hours

Max. Marks: 100

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 $[x_1, x_2, x_3] = [0.8, 0.6, 0.4]$ and the weights are $[w_1, w_2, w_3] = [0.1, 0.3, -0.2]$ with bias = 0.35. Also find output for: i) Binary sigmoidal ii) Bipolar sigmoidal activation functions. | (3) |
| 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*

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|---|---|-----|
| 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*

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|----|--|-----|
| 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) |

$$\underline{S_1} = \left\{ \frac{0}{0} + \frac{0.5}{20} + \frac{0.65}{40} + \frac{0.85}{60} + \frac{1.0}{80} + \frac{1.0}{100} \right\}$$

$$\underline{S_2} = \left\{ \frac{0}{0} + \frac{0.45}{20} + \frac{0.6}{40} + \frac{0.8}{60} + \frac{0.95}{80} + \frac{1.0}{100} \right\}$$

Express the following for $\lambda = 0.5$

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

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:

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

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

- 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) $\overline{\underline{B}} \cup \overline{\underline{A}}$

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

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

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

- 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 $\underline{S} = \underline{M}_1 \circ \underline{R}$ using max-min composition.

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

- 14 a) Using Inference approach , find the membership values for the triangle shapes (5)
L,R,E,IR, and T for a triangle with angles of degrees 45,55,80.
- b) Consider the discrete fuzzy set defined on the universe $X=\{ a, b, c, d, e\}$ as (4)

$$\underline{A} = \left\{ \frac{1}{a} + \frac{0.9}{b} + \frac{0.6}{c} + \frac{0.3}{d} + \frac{0}{e} \right\}$$
, 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)
