

Reg No.: _____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER B. TECH (HONOURS) 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 What are the basic components of soft computing? How is the critic information being used in the learning process? (3)
- 2 What is the necessity of activation function? List the commonly used activation functions. (3)
- 3 Draw single-layer feed-forward network architecture. Indicate Why logical XOR cannot be designed by single layer classification network? (3)
- 4 State the testing algorithm used in perceptron network. What is the difference between excitatory and inhibitory weighted interconnections? (3)

PART B*Answer any two full questions, each carries 9 marks.*

- 5 a) Design a Hebb net to implement logical NOR function use bipolar inputs and targets. (6)
- b) Draw the graph to show the decision boundary for each training pair of NOR logical function. (3)
- 6 a) Write the algorithm required for the training process of Adaline network. (3)
- b) Find the weights required using Delta rule to perform the following classifications: Vectors (1,1,-1,-1) and (-1,-1,-1,-1) are belonging to class having target value 1 and Vectors (1,1,1,1) and (-1,-1,1,-1) are not belonging to the class having target value -1. Use a learning rate of 0.5 and assume random value of weights. Test the response of the net using each of the input vectors up to two epochs. (6)
- 7 a) State the significance of error portions f_k and f_j in BPN algorithm. (2)
- b) With a neat architecture, explain the training algorithm of back-propagation network. (7)

PART C*Answer all questions, each carries 3 marks.*

- 8 State the importance of fuzzy sets. Justify the statement "Partial membership is allowed in fuzzy sets". (3)
- 9 Consider the two fuzzy sets $T = \left\{ \frac{1}{2} + \frac{0.3}{4} + \frac{0.5}{6} + \frac{0.2}{8} \right\}$ and $R = \left\{ \frac{0.5}{2} + \frac{0.4}{4} + \frac{0.1}{6} + \frac{1}{8} \right\}$ Perform union, intersection and complement over fuzzy sets T and R . (3)

- 10 Explain the features of membership functions. (3)
- 11 What is fuzzification? Using inference approach, obtain the membership values for the triangular shapes of fuzzy sets I, R and T for a triangle with angles 40° , 60° and 80° . (3)

PART D

Answer any two full questions, each carries 9 marks.

- 12 a) How are the fuzzy relations represented in various forms? (2)
- b) Obtain fuzzy relation $T_{\sim}$ as a composition between the fuzzy relations when the two fuzzy relations are given by $R_{\sim} = \begin{bmatrix} 0.6 & 0.3 \\ 0.2 & 0.9 \end{bmatrix}$ and $S_{\sim} = \begin{bmatrix} 1 & 0.5 & 0.3 \\ 0.8 & 0.4 & 0.7 \end{bmatrix}$ (7)
- 13 a) List the properties of lambda-cut for fuzzy sets. (3)
- b) Determine the λ -cut sets using Zadeh's notation for the given fuzzy sets: (6)
- $P_{\sim} = \left\{ \frac{0}{0} + \frac{0.5}{20} + \frac{0.65}{40} + \frac{0.85}{60} + \frac{1.0}{80} + \frac{1.0}{100} \right\}$ and $Q_{\sim} = \left\{ \frac{0}{0} + \frac{0.45}{20} + \frac{0.6}{40} + \frac{0.8}{60} + \frac{0.95}{80} + \frac{1.0}{100} \right\}$ Find the following for $\lambda=0.5$:
- (i) $(P_{\sim} \cup Q_{\sim})$ (ii) $(P_{\sim} \cap Q_{\sim})$ (iii) $\overline{P_{\sim}}$
- (iv) $\overline{Q_{\sim}}$ (v) $\overline{P_{\sim}} \cup \overline{Q_{\sim}}$ (vi) $\overline{P_{\sim}} \cap \overline{Q_{\sim}}$
- 14 a) What are the different methods employed for converting fuzzy form into crisp form? (2)
- b) Many products, such as tar, petroleum jelly and petroleum are extracted from crude oil. In a newly drilled oil well, three sets of oil samples are taken and tested for their viscosity. The results are given in the form of the three fuzzy sets B_1 , B_2 all defined on a universe of normalized viscosity, as shown in the figure 1 (fuzzy set B_1), figure 2 (fuzzy set B_2) and figure 3 (fuzzy set B_3). Find Z^* for the three fuzzy viscosity sets using centroid and weighted average method. Also give reasons why max-membership method result is ambiguous. (7)

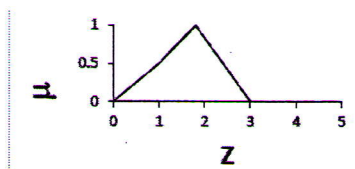


Figure 1

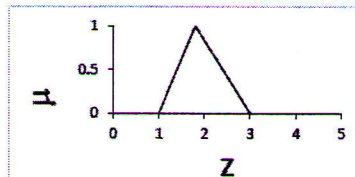


Figure 2

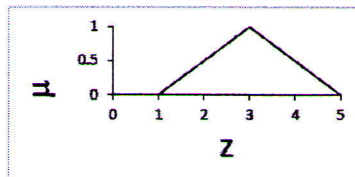


Figure 3

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PART E

Answer any four full questions, each carries 10 marks.

- 15 a) What are linguistic hedges? Give the characteristics of a linguistic variable. (4)
b) Write note on fuzzy propositions. (6)
- 16 a) Mention the methods of aggregation of fuzzy rules. (4)
b) How do you form rules and in what ways is the decomposition of compound linguistic rules are established? (6)
- 17 a) With a suitable block diagram, explain the working principle of an FIS. (4)
b) Describe in detail about the formation of inference rules in a Mamdani FIS. (6)
- 18 a) In what ways neuro-fuzzy best suited than general artificial neural network? How neuro fuzzy can be classified into the general neuro-fuzzy hybrid system? (4)
b) With necessary examples describe the different encoding process in GA (6)
- 19 Describe about the different types of cross over and mutation techniques? (10)
- 20 List some stopping conditions for genetic algorithm. Give description on the implementation concepts of Genetic Fuzzy Rule Based Systems (GFRBSs). (10)
