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Question Paper Code : 21401

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Eighth Semester

Electronics and Instrumentation Engineering

CS 2461/CS 812/10133 IC 704 – APPLIED SOFT COMPUTING

(Common to Seventh Semester Instrumentation and Control Engineering)

(Regulations 2008/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Suggest suitable activation functions for :

   (a) Binary classification

   (b) Clustering.

2. In a feed-forward network using a sigmoidal (logistic) activation function, why is it necessary to avoid setting target output values 0.0 and 1.0, and using 0.1 and 0.9 instead?

3. Justify the need for neuro-controller based inverted pendulum.

4. What are Spurious states in Hopfield networks?

5. What are the four basic elements of a fuzzy system?

6. Draw the Venn diagram for the fuzzy set union and intersection operations.

7. List the various configurations of neuro-fuzzy systems.

8. Identify the main components in a fuzzy logic based control system.

9. If the population size in a genetic algorithm is restricted to 1, what search algorithm does it correspond to?

10. Differentiate between genotypic and phenotypic representations.

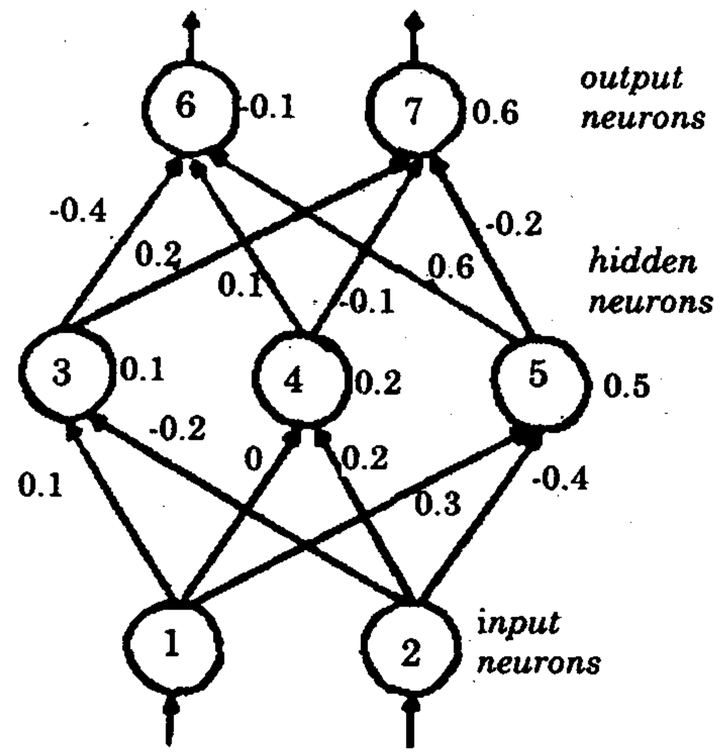
PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain the working of Biological and Artificial neurons with necessary illustrations. (8)

(ii) An input signal of unit amplitude is applied repeatedly to a synaptic connection whose initial value is unity. Calculate the variation in synaptic weight with time using Hebb rule with learning rate = 0.6 and covariance rule with pre-synaptic activity = 0 and post-synaptic activity = 1.0. (8)

Or

(b) Give the Back propagation algorithm and explain its working. Apply the algorithm for the network given below on the tuples {0.6, 0.1, 1}, {0.2, 0.3, -1). Calculate the values for one iteration with learning rate = 0.1.



12. (a) (i) Compare the working of Discrete and Continuous Hopfield networks and state their applications. (8)

(ii) Design a Hopfield network for 4-bit bipolar patterns S1: [1,1, -1, -1], S2: [-1, 1, -1, 1] S3: [-1, -1, -1, 1]. Find the weight matrix and energy. Determine the pattern to which the input [-1, 1, -1, -1] associates. (8)

Or

(b) (i) Design a Radial Basis Function Neural Network controller for controlling an inverted pendulum. (10)

(ii) Outline how neural networks can be used to improve the transient response of continuous time networks. (6)

13. (a) (i) Given X = {0.1/8+0.5/9+1/10+0.3/11+0.1/12}, Y={0.3/5 +1/6+0.9/7+0.2/8} and Z = {0.5/8+1/9+0.9/10+0.4/11+0/12} compute R = X × Y and P = Y × Z and S = P o R by max-product composition. (10)

(ii) Illustrate triangular and trapezoidal membership functions. (6)

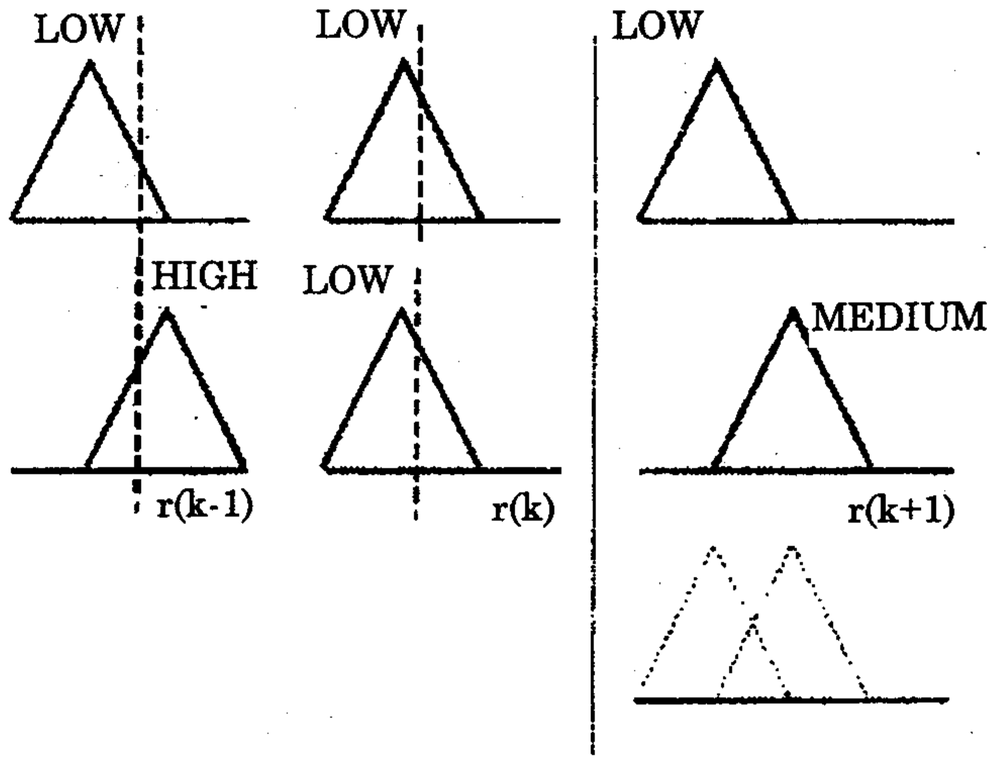
Or

(b) (i) A fuzzy tolerance relation R is reflexive and symmetric. Find the equivalence relation Re and classify it according to the alpha-cut levels = {0.9, 0.8, 0.5}. (8)

$$R = \begin{matrix} 1 & 0.8 & 0 & 0.2 & 0.1 \\ 0.8 & 1 & 0.9 & 0 & 0.4 \\ 0 & 0.9 & 1 & 0 & 0.3 \\ 0.2 & 0 & 0 & 1 & 0.5 \\ 0.1 & 0.4 & 0.3 & 0.5 & 1 \end{matrix}$$

(ii) Describe various de-fuzzification methods. (8)

14. (a) Consider the fuzzy rule base given below regarding a fuzzy prediction system for stock returns. The rule base relates the returns on day k + 1 given returns on day k and on day k – 1. Write down the rules that are in the rule base. Compute the fuzzy output of the rule base for the given inputs (indicated by dashed vertical lines) using the max-min reasoning and the max- product reasoning. (16)



Or

(b) (i) Describe how fuzzy membership functions can be optimized using neural networks. (8)

(ii) Design a fuzzy controller for a home heating system. (8)

15. (a) (i) Let the fitness f of bit string x with length 4 be the integer represented by the binary number x. Assume that the current Population is: 1010, 1000, 0100, 0110, 1100. Is it possible for a GA to generate an individual with the maximum fitness without using mutation, but only single point crossover? If so, give an example. If mutation has a rate other than 0, could the GA Possibly generate the fittest individual? Give an example. (8)

(ii) Write the pseudo-code and explain the working of Genetic Algorithms. (8)

Or

(b) (i) An airline company operates 3 planes and employs 5 cabin crews. Only one crew can operate on any plane on a single day and each crew cannot work for more than two days in a row. The company uses all planes every day. Propose a suitable chromosome structure, fitness function and generalize to n planes and m crews. Explain application of genetic algorithm in this application. (8)

(ii) Outline the similarities and differences between Genetic Algorithms and Evolutionary Strategies. (8)
