Code No: NR411006 **NR**

IV B.Tech I Semester Supplementary Examinations, April/May 2005
NEURAL NETWORKS & FUZZY LOGIC CONTROL
(Common to Electronics & Instrumentation Engineering, Bio-Medical Engineering and Electronics & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Give the brief operation of biological neural network.
   (b) Explain how biological neural network is superior over a conventional computer system.

2. 6. A Hopfield network is designed to store the two fundamental memory patterns (+1, +1, -1, +1, +1) and (+1, -1, +1, -1, +1). The synaptic matrix of the network is given by

$$W = \begin{bmatrix} 0 & 0 & 0 & 0 & 2 \\ 0 & 0 & -2 & 2 & 0 \\ 0 & -2 & 0 & -2 & 0 \\ 0 & 2 & -2 & 0 & 0 \\ 2 & 0 & 0 & 0 & 0 \end{bmatrix}$$

   (a) The sum of the eigen values of the matrix W is zero why?
   (b) The state space of the network is a subspace of R^5. Specify the configuration of this subspace.

3. Explain architecture of Konens self-organizing network. Explain the training algorithm of Kohonens layer.

4. Explain the procedure of identification of dynamical system using neural networks.

5. (a) Prove $E(A) = E(A^c) = E(A \cap A^c) = E(A \cup A^c)$
   (b) Determine the intersections and unions of the following fuzzy sets:
      i. $\tilde{A} = \{(3, 10, (4, 0.2), (5, 0.3), (6, 0.4), (7, 0.6), (8, 0.8), (10, 1), (12, 0.8), (14, 0.6)\}$.
      ii. $\tilde{B} = \{(2, 0.4), (3, 0.6), (4, 0.8), (5, 1.0), (6, 0.8), (7, 0.6), (8, 0.4)\}$
      iii. $\tilde{C} = \{(2, 0.4), (4, 0.8), (5, 1.0), (7, 0.6)\}$

6. List the main components of fuzzy logic controller. Explain each of them in detail.

7. Explain the step-by-step procedure in designing of a fuzzy logic controller.

8. Given the discretized form of the fuzzy variables X, Y, Z_1, Z_2, Z_3.
   $X = \left\{\frac{0}{0} + \frac{.5}{1} + \frac{1}{2} + \frac{.5}{3} + \frac{0}{4}\right\}$
   $Y = \left\{\frac{0}{2} + \frac{.5}{3} + \frac{1}{4} + \frac{.5}{5} + \frac{0}{6}\right\}$
   $Z_1 = \left\{\frac{0}{5} + \frac{.5}{6} + \frac{1}{7} + \frac{.5}{8} + \frac{0}{9}\right\}$
   $Z_2 = \left\{\frac{0}{10} + \frac{.5}{11} + \frac{1}{12} + \frac{.5}{13} + \frac{0}{14}\right\}$
   $Z_3 = \left\{\frac{0}{20} + \frac{.5}{21} + \frac{1}{22} + \frac{.5}{23} + \frac{0}{24}\right\}$

(a) Form analogous continuous membership functions for X, Y, Z_1, Z_2, and Z_3.

(b) A system is described by a set of three rules, using the foregoing fuzzy variables. All the rules have to be satisfied simultaneously for the system to work. The rules are these:

i. If X and Y then Z_1,

ii. If X and Y then Z_2,

iii. If X and Y then Z_3,

Determine the output of the system by graphical inference, using the max-min technique, if x = 3 and y = 4, use the centroid method for defuzzification.

(c) What would be the output of the system if, for the system to work, either of the rules just described may be satisfied.

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