Code No: 07A80303 **R07** **Set No. 2**

IV B.Tech II Semester Examinations,APRIL 2011
NEURAL NETWORKS AND FUZZY LOGIC SYSTEMS
Common to Mechanical Engineering, Mechatronics, Automobile Engineering
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain the following terms:
   (a) Resting potential.
   (b) Nernst equation.
   (c) Action potential.
   (d) Refractory periods.
   (e) Chemical synapses. [16]
2. (a) Explain how ANN is used for process control.
   (b) Explain in detail how classification is done using Fuzzy logic. [8+8]
3. (a) Explain in detail "Recall in Neural Networks".
   (b) Explain autonomous and non-autonomous dynamical systems. [8+8]
4. For the data shown in the following data table show the first iteration in trying to compute the membership values for the input variables p and Q into the regions A, B, & C.

P	Q	A	B	C
0.6	0.78	1	0	0

   (a) Use 2 x 2 x 3 network with initial random weights
   (b) Use sigmoid activation function Calculate the membership value for the following input data using the above calculated weights.

P	Q
0.12	0.3.

   [16]
5. Consider the fuzzy sets & defined on the interval X=[0,5] of real numbers,by the membership grade functions.
   $\mu(x) = \frac{X}{X+1}$, $\mu\ \tilde{B}\ (x) = 2^{-x}$
   Determine the mathematical formulae and graphs of the membership grade functions of each of the following sets.
   (a) A^c,B^c.
   (b) A ∩ B.
   (c) A ∪ B .
   (d) $(A \cup B)^c$. [16]

6. Determine the weights of a network with 4 input and 2 output units using delta learning law with f(a) $=\frac{1}{1+e^{-a}}$ for the following input-output pairs:
   Input : $[1\ \ 1\ \ 0\ \ 0]^T\ \ [1\ \ 0\ \ 0\ \ 1]^T\ \ [0\ \ 0\ \ 1\ \ 1]^T\ \ [0\ \ 1\ \ 1\ \ 0]^T$
   Output : $[1\ \ 1]^T\ \ [1\ \ 0]^T\ \ [0\ \ 1]^T\ \ [0\ \ 0]^T$. [16]

7. A fully connected feedforward network has 10 source nodes, 2 hidden layers, one with 4 neurons and the other with 3 neurons, and a single output neuron. Construct an architectural graph of this network. [16]

8. Consider a simple Hopfield network made up of two neurons. The synaptic weight matrix of the network is
$$W = \begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix}$$
The bias applied to each neuron is zero. The four possible states of the Network are
$$x1 = [+1, +1]^T,\ x2 = [-1, +1]^T$$
$$x3 = [-1, -1]^T,\ x4 = [+1, -1]^T$$
Demonstrate that states x2 and x4 are stable, whereas states x1 and x3 exhibit a limit cycle. Do this demonstration using the following tools:
   (a) The alignment (stability) condition.
   (b) The energy function. [16]

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

Answer any FIVE Questions
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1. Explain Linear Machine and Minimum Distance Classification with a suitable example. [16]
2. (a) Differentiate single layer and multilayer networks.
   (b) Generate the output of OR, NOT function using McCulloch-Pitts Neuron. [8+8]
3. Explain the role of neural networks in Power System Planning. [16]
4. (a) Give a brief note on multilayer perceptrons.
   (b) What is the activation function used in the perceptron network. [8+8]
5. (a) Develop an electronic summing network that converts a multidimensional analog signal into a 4-dimensional binary unipolar output employing least squared error criterion.
   (b) Explain the recurrent associate memories storage algorithm. [8+8]
6. (a) Mention the properties of λ cut.
   (b) Explain min-max method of implication with a suitable example. [8+8]
7. Design and train a feed forward networks for the problems.
   (a) Consider a 4 input and 1 output problem where the output required to be 'one', if the input configuration is symmetrical and 'zero' otherwise.
   (b) Why back propagation is also called as generalized delta rule. [16]
8. (a) Suppose 1000 people respond to a questionnaire about their pairwise preferences among five colors X {Red,Orange, Y ellow,Green,Blue}. Define a Fuzzy Set on the Universe of Colors "best Colors".
   (b) In color perception, blue and yellows are complements of one another. The membership functions for these two colors are given here on a normalized universe of discourse. [0,100], with 0 indicating absolute yellow (complete absence of blue) and 100 indicating absolute (i.e. completely saturated), blue.
   "Y ellow" $= \{\frac{1}{0} + \frac{0.9}{10} + \frac{0.8}{20} + \frac{0.7}{30} + \frac{0.6}{40} + \frac{0.5}{50} + \frac{0.4}{60} + \frac{0.3}{70} + \frac{0.2}{80} + \frac{0.1}{90} + \frac{0}{100}\}$
   "Blue" $= \{\frac{0}{0} + \frac{0.1}{10} + \frac{0.2}{20} + \frac{0.3}{30} + \frac{0.4}{40} + \frac{0.5}{50} + \frac{0.6}{60} + \frac{0.7}{70} + \frac{0.8}{80} + \frac{0.9}{90} + \frac{1}{100}\}$
   calculate the member ship functions for the following mix of colors:
   i. Not very blue
   ii. Blue or fairly yellow

iii. Very blue and not very yellow
iv. Fairly yellow minus very blue
v. Fairly yellow plus very yellow. [16]

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Code No: 07A80303 **R07** **Set No. 1**

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1. (a) Compare and contrast supervised and unsupervised learning strategies.
   (b) Distinguish between Batch learning and incremental(stepwise) learning. [8+8]
2. (a) Using MC-Culloch pitts model implement the following logic functions.
      i. Ex-OR gate.
      ii. Ex-NOR gate.
      iii. AND gate.
      iv. NAND gate.
   (b) Explain the organization of the brain in detail. [16]
3. State and prove the perceptron convergence theorem. [16]
4. (a) Define recurrent network. Give some examples.
   (b) Draw the flowchart of producing solution of optimization problems using feedback networks. [8+8]
5. Using your own intuition and your own definitions of the universe of discourse, plot fuzzy membership functions for the following variables :
   Weight of people
   (a) Very light.
   (b) Light.
   (c) Average.
   (d) Heavy.
   (e) Very heavy. [16]
6. Generalize the XOR problem to a parity problem for N(>2) variables by considering a network for the two variables first and then extending the network considering the output of the first network as one variable and the third variable as another. Repeat this for n=4 and design a network for solving the parity problem for 4 variables. [16]
7. (a) What are the hardware requirements in Neuro computing explain them in brief
   (b) Describe how fuzzy logic can be used in LF control and economic dispatch. [8+8]

8. (a) Suppose 1000 people respond to a questionnaire about their pairwise preferences among five colors X {Red,Orange, Y ellow,Green,Blue}. Define a Fuzzy Set on the Universe of Colors "best Colors".

   (b) In color perception, blue and yellows are complements of one another. The membership functions for these two colors are given here on a normalized universe of discourse. [0,100], with 0 indicating absolute yellow (complete absence of blue) and 100 indicating absolute (i.e. completely saturated), blue.
   "Y ellow" $= \{\frac{1}{0} + \frac{0.9}{10} + \frac{0.8}{20} + \frac{0.7}{30} + \frac{0.6}{40} + \frac{0.5}{50} + \frac{0.4}{60} + \frac{0.3}{70} + \frac{0.2}{80} + \frac{0.1}{90} + \frac{0}{100}\}$
   "Blue" $= \{\frac{0}{0} + \frac{0.1}{10} + \frac{0.2}{20} + \frac{0.3}{30} + \frac{0.4}{40} + \frac{0.5}{50} + \frac{0.6}{60} + \frac{0.7}{70} + \frac{0.8}{80} + \frac{0.9}{90} + \frac{1}{100}\}$
   calculate the member ship functions for the following mix of colors:

   i. Not very blue
   ii. Blue or fairly yellow
   iii. Very blue and not very yellow
   iv. Fairly yellow minus very blue
   v. Fairly yellow plus very yellow. [16]

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Code No: 07A80303 **R07** **Set No. 3**

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1. (a) Explain how Back Propagation Network is used as differentiator.
   (b) Explain about cross validation technique. [8+8]
2. Explain the following terms in brief.
   (a) Associative memory.
   (b) Stimuli.
   (c) Memory convergence.
   (d) Dummy augmentation. [16]
3. Explain briefly about intelligent control. Give few applications in industries. [16]
4. Using your own intuition, develop fuzzy membership functions on the real line for the fuzzy number "approximately 2 *to* approximately 8", using the following function shapes:
   (a) Symmetric triangles
   (b) Trapezoids.
   (c) Gaussian functions. [16]
5. Draw a single layer network with continuous perceptions and present the delta learning rule. [16]
6. (a) List the models of neuron in the evolution order and explain how the limitations of preceding model are overcome in successive models.
   (b) Distinguish between artificial intelligence and neural network models. [8+8]
7. Using your own intuition, and your own definitions of the universe of discourse, plot fuzzy membership functions for the following variables:
   (a) Weight of people:
      i. Very light.
      ii. Light.
      iii. Average.
      iv. Heavy.
      v. Very heavy.
   (b) Age of people:

i. Very young.
ii. Young.
iii. Middle-aged.
iv. Old.
v. Very old.

(c) Education of people:

i. Fairly educated.
ii. Educated.
iii. Highly educated.
iv. Not highly educated.
v. More or less educated. [16]

8. Using the perceptron learning rule, find the weights required to perform the following classifications. Vectors (1 1 1 1),(-1 1 -1 -1) and (1 -1 -1 1) are members of class (having value -1). Use learning rate of 1 and starting weights of 0. Using each of the training and vectors as input , test the response of the net. [16]

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