BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR

ME (EE) 2nd Semester Examination 2013

Subject: Neural Networks and Systems

Paper / Code No: EE – 1024   **Branch:** Electrical Engineering

Time: 3 Hours   **Full Marks:** 70

*Answer any THREE questions from Group-A and any TWO questions from Group-B*

GROUP – A

1. a) In what way our brain is superior than a computer? [3]

   b) Define an artificial neural network (ANN). What do you mean by "feed-back" and "feed-forward" neural network? [5]

   c) The weights of the network shown in the fig. below are $w_{31}=1$, $w_{32}=1$, $w_{41}=1$, $w_{42}=1$ and $w_{43}=1$. The threshold of the hidden unit (3) is 1.5 and the threshold of the output unit (4) is 0.5. The threshold of both input units (1 and 2) is 0.5. Which of the following Boolean function can be computed by this network? [6]
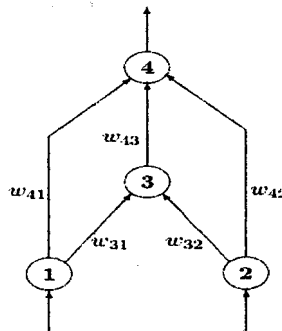
2. a) What is meant by gradient descent method? [4]

   b) What is the significance of learning rate in back-propagation learning? What is meant by generalization in feed-forward NN ? [4]

   c) Consider the following feed-forward network with one hidden layer of units. Assume that all the units have zero bias and sigmoid transfer function given by:

$$f(r) = \frac{1}{1 + \exp(-r)}$$
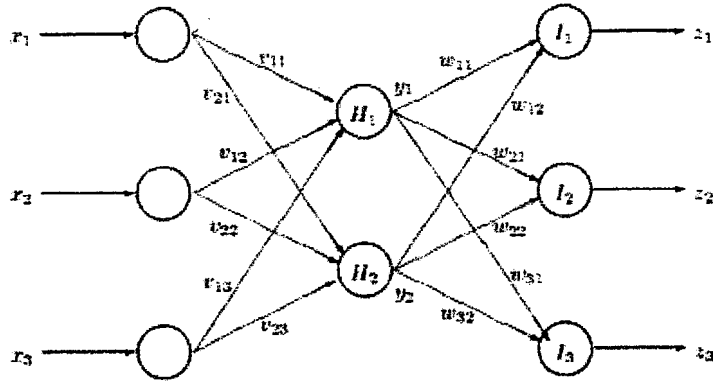
Given that :

$$v_1 = \begin{bmatrix} 0.4 \\ -0.6 \\ 1.9 \end{bmatrix}, \quad v_2 = \begin{bmatrix} -1.2 \\ 0.5 \\ -0.7 \end{bmatrix}, \quad w_1 = \begin{bmatrix} 1.0 \\ -3.5 \end{bmatrix}, \quad w_2 = \begin{bmatrix} 0.5 \\ -1.2 \end{bmatrix} \quad \text{and} \quad w_3 = \begin{bmatrix} 0.3 \\ 0.6 \end{bmatrix}.$$

Compute the output Z_1, if the input vector $x = [1\ 0\ 2]^T$. [6]

3. (a) Why a single layer perceptron cannot be used to solve linearly in seperable problem? [4]

(b) Using feed-forward back propagation training algorithm , find out the weights after first iteration of the following network , When $x_1 =1$, $x_2 =0$ and $Y =1$. Assume all the initial weights as 0.4 with transfer functions of hidden layers and output layer as sigmoid and linear respectively. Learning rate = 0.6. Bias in all the neurons are zero. [10]
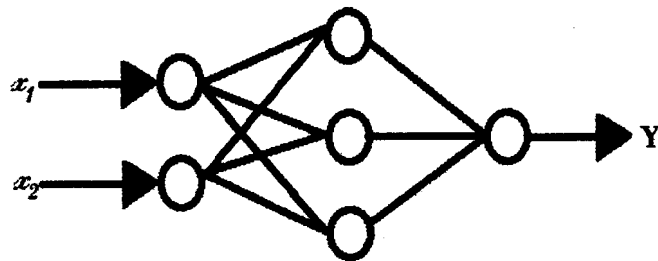
4. a) State the Cover's theorem. [3]

b) What is the natural capacity of seperability in Φ space? Explain with XOR problem. [6]

c) Compare MLP and RBF. [6]

5. a) What is Data mining? Explain its relevance in the field of ANN? [4]

b) Write short note on any dimentionality reduction technique. [5]

c) For the following Information system, find out the most relevant attribute? [5]

	A1	A2	A3	A4	class
O1	0	1	2	2	1
O2	1	0	2	1	1
O3	1	0	1	1	1
O4	2	0	2	1	2
O5	0	2	1	0	2
O6	0	1	2	1	2

GROUP – B

6. a) Define the terms 'competition phase' and 'reward phase' in a competitive learning process and explain the significance of each.

b) With the help of suitable diagrams, explain two schemes for updating the weight vectors associated with the winner neuron in a competitive learning network.

[6+8]

7. a) Discuss the significance of 'neighbourhood function' in Kohonen's Self-organizing Map (SOM). Explain, whether a 'Mexican Hat' type function can be used to model the neighbourhood function in Kohonen's SOM.

b) What do you understand by 'pattern classification'? Develop a flow chart showing the steps to be followed to classify the English alphabets into 26 distinct classes using Kohonen's Self-organizing Map (SOM).

[6+8]

8. a) What is 'objective function' and 'constraint' in an optimization problem? Describe how ANN can be used to solve a non-linear optimization problem like 'Travelling Salesman Problem (TSP)'.

b) What is 'Financial Forecasting'? Draw a flow chart showing the steps to be followed to develop an ANN based forecasting model.

[6+8]