Reg No.										

MANIPAL INSTITUTE OF TECHNOLOGY

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Makeup

SEVENTH SEMESTER B.E (CSE) DEGREE EXAMINATION
January 2013

NEURAL NETWORKS AND FUZZY SYSTEMS (CSE 405.1)

DATE: 03/01/2013

TIME : 3 HOURS **MAX.MARKS : 50**

Instruction to Candidates
- Answer **any five** full questions

1A. Describe any three characteristics of neuron model. **[6]**

1B. Explain the competitive learning mechanism with a neat diagram. **[4]**

2A. Prove that for any two linearly separable classes there is a solution weight vector $\mathbf{w_0}$ after at most n_{max} iterations given by

$$n_{max} = \frac{\beta \|\mathbf{w_0}\|^2}{\alpha^2}$$

where α and β are positive constants. **[7]**

2B. Logistic function as a continuously differentiable nonlinear activation function for multilayer perceptron is given by

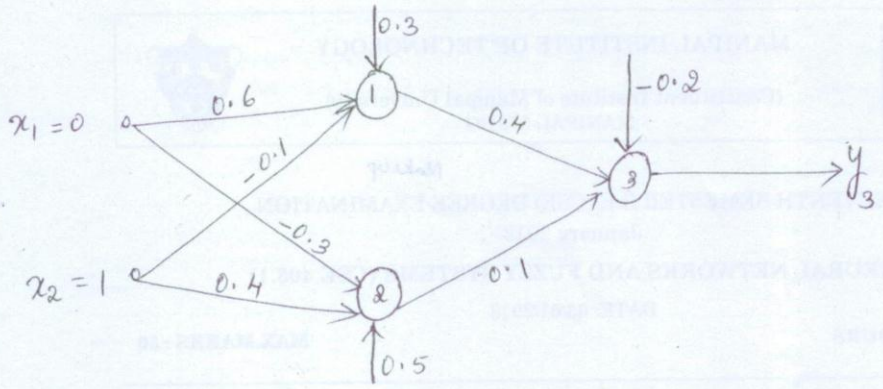
$$\psi\left(v_j(n)\right) = \frac{1}{1+\exp(-av_j(n))} \quad a > 0 \ \ and \ \ -\infty < v_j(n) < +\infty$$

For the above function derive the following:

(i) Local gradient $\delta_j(n)$ for a neuron j located in the output layer.

(ii) Local gradient $\delta_j(n)$ for a neuron j located in the hidden layer.
(Note: Eliminate the exponential term and represent local gradient in terms of $y_j(n)$). **[3]**

3A. Using Backpropagation network find the new weights for the following network. It is presented with the input pattern [0, 1] and the target output is 1. Use learning rate to be 0.25 and sigmoidal activation function. **[6]**



3B. Describe how the momentum constant affects the rate of learning in Back-propagation algorithm. **[4]**

4A. Consider a Kohonen network with two cluster units and three input units. The weight vector for the cluster units are (0.9, 0.7, 0.6) and (0.4, 0.3, 0.5). Find the winning cluster unit for the input vector (0.4, 0.2, 0.1). Use learning rate $\eta = 0.2$. Also find new weights for the winning neuron. **[3]**

4B. Explain any four important properties of feature map Φ obtained from the convergence of self-organizing map. **[7]**

(i) Vector quantization
(ii) Toplogical ordering
(iii) Density matching
(iv) Feature selection

5A. Explain the energy function and energy minimization required to stabilize auto-associative discrete Hopfield network. **[7]**

5B. Give the mathematical representation to the process of storing patterns and associating new pattern to already stored patterns in Bidirectional associative memory. **[3]**

6A. You are asked to select an implementation technology for a numerical processor. Computation throughput is directly related to clock speed. Assume that all implementations will be in the same family (eg., CMOS).

You are considering whether the design should be implemented using medium scale integration (MSI), field programmable array parts (FPGA), or multichip modules (MCM). Define the universe of potential clock speeds as X, and define MSI, FPGA and MCM as fuzzy sets of clock frequencies that should be implemented in each of these technologies. The following table defines the membership values for each of the three fuzzy sets.

Clock frequency , MHz	MSI	FPGA	MCM
1	0	0.3	0
10	0.7	1	0
20	0.4	1	0.5
40	0	0.5	0.7
80	0	0.2	1
100	0	0	1

Representing the three fuzzy sets as MSI=M, FPGA=F and MCM =C, find the following:

(i) $\mu_{M \cup F}(x)$ (ii) $\mu_{M \cap F}(x)$ (iii) $\mu_{\overline{M \cap C}}(x)$ (iv) $\mu_{\overline{F \cup C}}(x)$ **[4]**

6B. Write a short notes on the following.

(i) Fuzzy inference method.

(ii) Sequential and Batch mode learning **[6]**

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