# ELL 100 Minor I Time: 50 mts Marks: 100

**This minor is equivalent to 3 quizzes.**

Q. 1. (a) Determine and sketch the decision region and the decision boundaries of the network shown below, if the activation function of all neurons is a step function whose value is either 0 or 1. All weights not otherwise marked are equal to 1; the numbers inside the neurons indicate threshold (negative of offset). The inputs (x1, x2) lie in the range -1 to 1.
(b) Suggest a dataset of at least 5 patterns that would lead to the given network being learnt by a Pyramidal Delayed Perceptron approach. Mark the patterns on a sketch with the decision boundaries also indicated.
(c) Can you suggest any changes in the network weights that might improve the network's performance ?
(d) If a pattern at (3, 1) is now introduced, which belongs to class 1, how would you add neurons to the network in order to correct any errors that arise ?

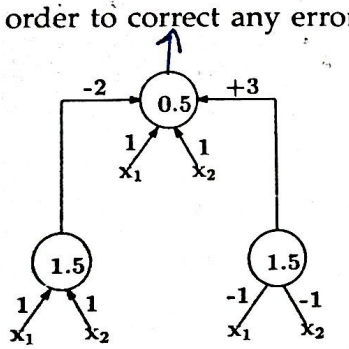
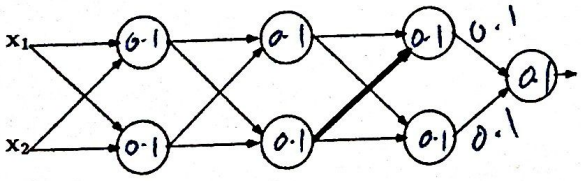



Fig. 1: Figure FQ1

(50)

Q. 2. The network in Fig. FQ2 is trained with 4 patterns located at (0,0), (0,1), (1,0), and (1,1) to learn the XOR function. The activation function is $f(x) = \frac{1}{1+exp(-5x)}$. All neurons have an initial bias of 0.1. Assume the initial values of all weights are given by $w_{ij} = 0.1 * (i - j)$.
(a) In the indicated network, label all the weights and neuron outputs. In each layer, neurons are numbered in increasing order starting from the topmost one.
(b) Determine the outputs of neurons in each layer
(c) Determine the error at the output
(d) Determine the change in the weight marked in bold for one epoch. Assume a learning rate of 0.1.




don't update all rates only bold

Fig. 2: Figure FQ2

(50)