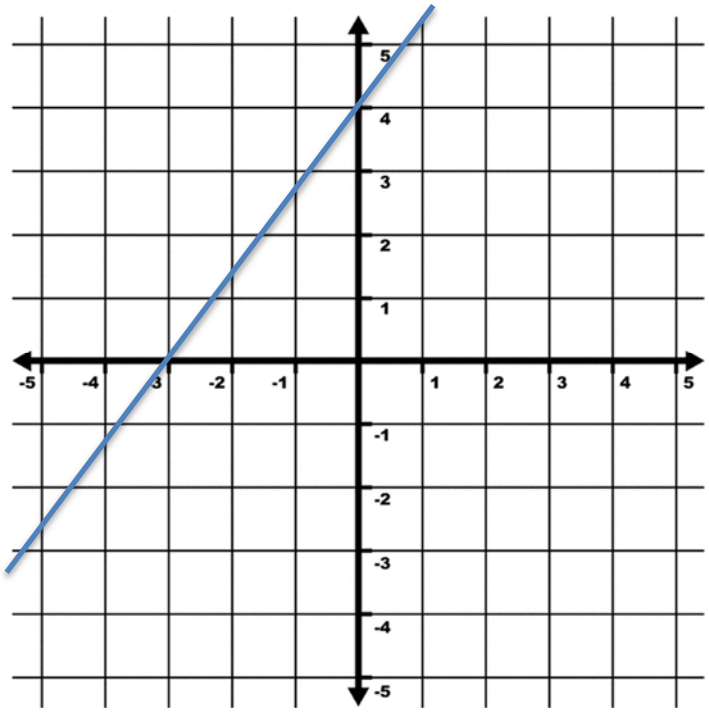
CSE-5368 Neural Networks
Exercise Problems 01

- Consider designing a one layer Perceptron network to classify 4 classes. Assume that the data set includes 200 samples and each sample is 10 dimensional.
  What is the size of the weight matrix (bias should be included in the weight matrix)?

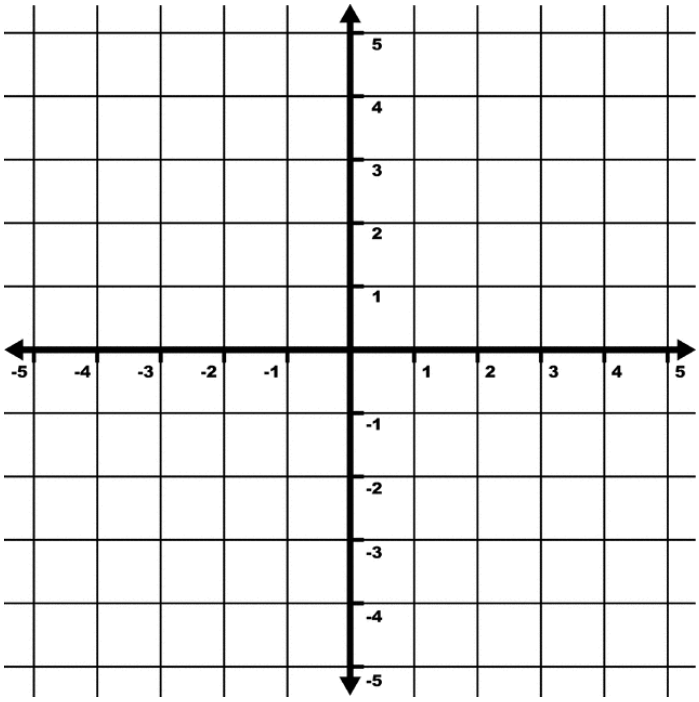
- The boundary for a one node perceptron with two inputs is shown below. Find the numerical values of the weight matrix.
  Note: Bias should be included in the weight matrix.



- Given a one node Perceptron with hard-limit activation function to classify the input in one of the possible two classes. Assuming that the input is a two dimensional vector and the weights and the bias are:

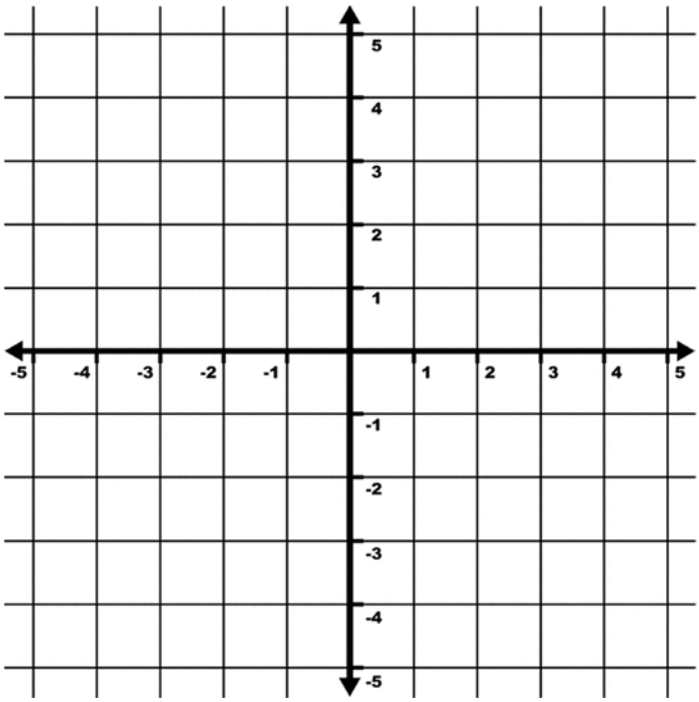
  $w_1 = 3$; $w_2 = 2$; $b = -6$

  Draw the boundary that separates the two classes.

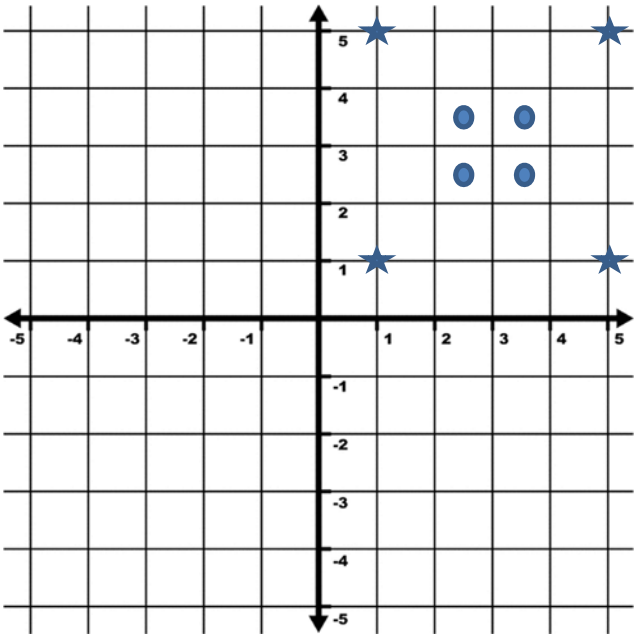


- Given a one-layer Perceptron with hard-limit activation function. The weight matrix which includes biases is shown below. Draw the boundary corresponding to each node and identify each region by its corresponding binary output code. Assume that bias is shown in the first column.

$$= \begin{bmatrix} -4 & -2 & 4 \\ -2 & 0 & 1 \\ 4 & 1 & 0 \\ 3 & 4 & 6 \end{bmatrix}$$

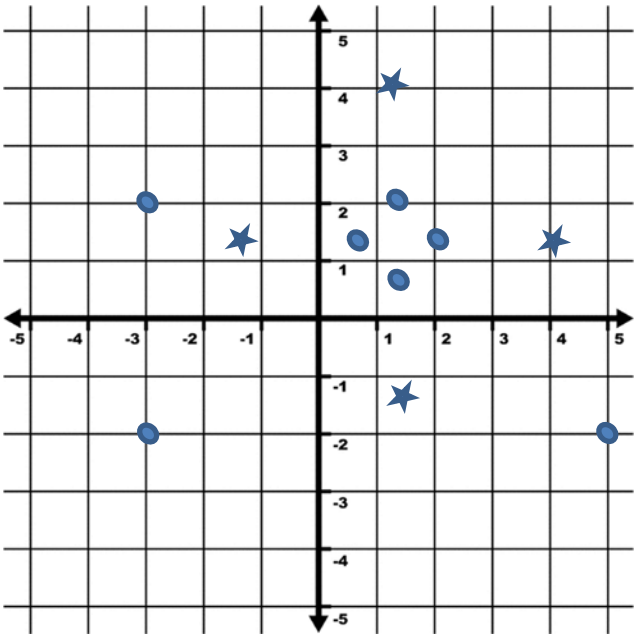


- Design a two-layer Perceptron neural network which will correctly classify the two classes (circles and stars) as shown below. Assume the activation (transfer) function for all the nodes are hard-limit with the output of 0 (star) and 1 (circle)



Show the weight matrices and biases for each layers.

- Design a multi-layer Perceptron neural network which will correctly classify the two classes (circles and stars) as shown below. Assume the activation (transfer) function for all the nodes are hardlimit with the output of 0 (star) and 1(Circle).



Show the weight matrices and biases for each layers.

- Consider the following training set for a Perceptron neural network.
  $\left\{p_1 = \begin{bmatrix}-1\\2\end{bmatrix}, t_1 = \begin{bmatrix}0\\0\end{bmatrix}\right\}, \left\{p_2 = \begin{bmatrix}1\\3\end{bmatrix}, t_2 = \begin{bmatrix}0\\1\end{bmatrix}\right\}, \left\{p_3 = \begin{bmatrix}1\\1\end{bmatrix}, t_3 = \begin{bmatrix}1\\0\end{bmatrix}\right\}, \left\{p_4 = \begin{bmatrix}3\\2\end{bmatrix}, t_4 = \begin{bmatrix}1\\1\end{bmatrix}\right\}$

  Design a **Perceptron** network with **two nodes** to solve this problem. i.e. find the weight matrix for this network. Bias should be included in the weight matrix.