Homework 1

1. Consider the following four data points:
   Class 1: $\begin{pmatrix}0\\0\end{pmatrix}, \begin{pmatrix}0\\1\end{pmatrix}$
   Class 2: $\begin{pmatrix}1\\1\end{pmatrix}, \begin{pmatrix}1\\0\end{pmatrix}$

   (a) Are they linearly separable?
   (b) Find the linear decision boundary by applying fixed-increment single-sample perception procedure with initial weight vector **0** and plot it in the feature space.
   (c) Repeat (b) by using MSE procedure.
   (d) Implement the Ho-Kashyap algorithm in MATLAB and repeat (b).
   (e) Repeat (a) through (d) with the following data points:
   Class 1: $\begin{pmatrix}0\\0\end{pmatrix}, \begin{pmatrix}1\\1\end{pmatrix}$
   Class 2: $\begin{pmatrix}0\\1\end{pmatrix}, \begin{pmatrix}1\\0\end{pmatrix}$
   (f) Comment on the three procedures used.

2. Suppose that the following are a set of points in two classes:
   Class 1: $\begin{pmatrix}1\\1\end{pmatrix}, \begin{pmatrix}1\\2\end{pmatrix}, \begin{pmatrix}2\\1\end{pmatrix}$
   Class 2: $\begin{pmatrix}0\\0\end{pmatrix}, \begin{pmatrix}1\\0\end{pmatrix}, \begin{pmatrix}0\\1\end{pmatrix}$

   Plot them and find the optimal separating line. What are the support vectors and what is the margin?