COMP 4983: Lab Exercise #9

Instructions:

In this lab, you will

- construct the maximal margin classifier on paper for a trivial dataset

Maximal Margin Classifier (on paper)

In this lab, you will

- draw a hyperplane in a 2-dimensional space
- construct a maximal margin classifier for a trivial dataset

1) Draw the hyperplane $1 + 3X_1 - X_2 = 0$. Indicate the region for which $1 + 3X_1 - X_2 > 0$, as well as the region for which $1 + 3X_1 - X_2 < 0$.
2) Consider a training set consisting of the following seven (7) training samples:

Sample	Input Vector	Output Value
x_1	(3, 4)	Red
x_2	(2, 2)	Red
x_3	(4, 4)	Red
x_4	(1, 4)	Red
x_5	(2, 1)	Blue
x_6	(4, 3)	Blue
x_7	(4, 1)	Blue

   a) Plot the training samples and draw the maximal margin hyperplane given the training samples.
   b) Indicate the margin, M, for the maximal margin hyperplane.
   c) Derive the equation for the maximal margin hyperplane in the form of $\beta_0 + \beta_1 X_1 + \beta_2 X_2 = 0$ subject to $\sum_{j=1}^{p} \beta_j^2 = 1$.
   d) Predict the output value for the test sample (3.5, 2).