Homework 3
Steve Hill

1 Problem 1

Define functional margin and geometric margin. Explain why functional margin is not a good objective to optimize in order to learn a maximum margin classifier:

Functional Margin - Functional margin is the margin defined by wx + b = 0. So if you multiply some point yi by the functional margin, you should get a classifier such that if classifier ¿ 0 then it is positive.

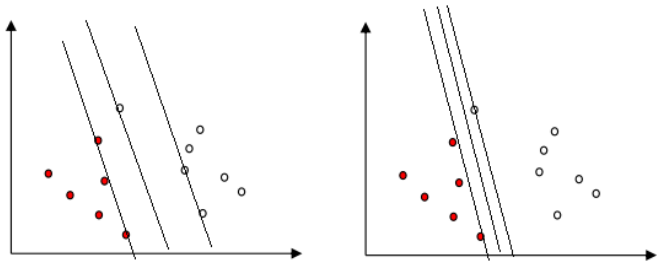
The problem comes if the bound is too tightly fit, we want things to fit better, so we should look to expand the margin.

Geometric Margin - The geometric margin is a wider margin respresented by the first useful example points in each class. By fitting two margins, wx + b = 1 and wx + b = -1, we can create a wider margin that is as large as possible. This is what we want.

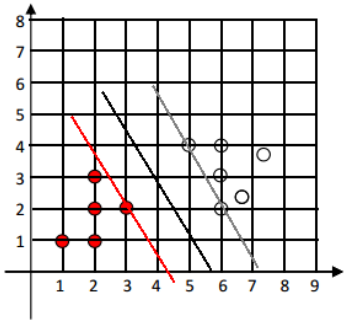
2 Problem 2

For the soft-margin SVM, parameter c controls the trade-off between maximizing the margin and minimizing the slack variables (aka the error of the fat decision boundary). Consider the following data set, what linear decision boundary will soft-margin SVM learn when:

Note that the outmost boundries are the fat boundry for each c value.



3 Problem 3



$$Gray = wx + b = 1$$

$$Red = wx + b = -1$$

$$Black = wx + b \ = 0$$

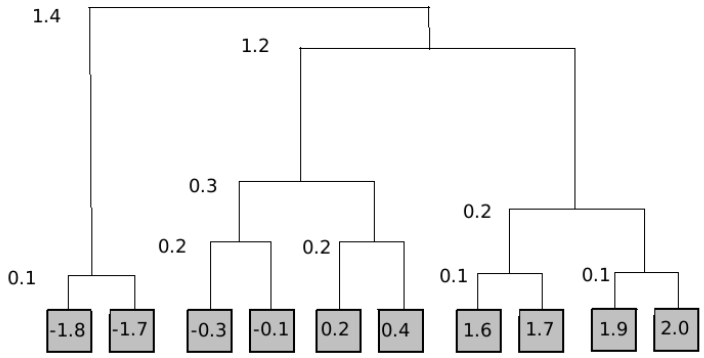
Part b) The Gray and Red lines represent two support vectors

Part c) The w value is (1, 2) and the b value is 10.

4 Problem 4

Data set: (-1.8, -1.7, -0.3, -.1, 0.2, 0.4, 1.6, 1.7, 1.9, 2.0)
Dendograms:

Single Link Clusters



Complete Link Clusters