Homework 7 (Due on Tuesday, Feb 22)

1. On the class website is some data that was taken from 4 measurements of 150 samples of three kinds of iris. If you download `IrisData.mat` from the class website, and in Matlab type `load IrisData`, two matrices will appear: X will be 150×4 are represent the four measurements per flower (so it has size "number of points" $\times$ "dimension"). The desired output is in the array Y. If the flower is a "class 1" iris, the corresponding Y has row $(1, 0, 0)$. Class 2 is $(0, 1, 0)$, and Class 3 is $(0, 0, 1)$.

   (Question to think about: Why are the "targets" not the integers $1, 2, 3$?)

   There is a sample script that was started for you online. The only thing that is missing is the part where we send the data to Widrow-Hoff to get W, b.

   It would be hard to assess the classification using a graph, and so we compute a "confusion matrix". Read the code over and see if you can figure out what the confusion matrix is.

   - Try training with the data in the order given, with a learning rate of about $0.5-0.1$, and about 500 iterations. Record what you see in the "confusion matrix".
   - Try again, but re-order the data randomly (note: a Matlab command that might be useful is `randperm`). Again record the confusion matrix.
   - Try to understand what you see-

2. - Write a Matlab function `myfunc` that will input a vector $\mathbf{x} \in \mathbb{R}^3$ and output two things- the scalar $f(\mathbf{x})$ and the vector $\nabla f(\mathbf{x})$ for

   $$f(\mathbf{x}) = 5x_1^2 - x_1x_2 + 6x_2^2$$

   - Use your previous Matlab function to illustrate gradient descent. Write a script file that has you starting at the point $(1, 1)$

3. Write the solution to exercise 8 from the appendix.

4. (To be added on Friday: A novelty detection problem).