

You should solve the first problem on your own. We will go to the computer lab for the second problem, and you may talk to each other for assistance. As before, write a script file for the solution, use “publish to HTML” to get a nice summary to print, then turn in the printout.

1. Exercise 8, p. 241 (No Matlab required)
2. (Matlab) Load the dataset from the class webpage **TestData1.mat**. Start Matlab- to load the data as a matrix  $X$  that is  $93 \times 2$  (93 points in  $\mathbb{R}^2$ ), type **load TestData1**

Write a script file that will:

- (a) Mean subtract the data (as 93 points in the plane). Be sure to show the numerical values in the mean.
- (b) Find the covariance matrix of  $X$ . Show the resulting  $2 \times 2$  matrix.
- (c) Find (and show) the eigenvalues and eigenvectors of the covariance matrix.

*Note:* The Matlab command to find the eigenvalues and eigenvectors of a general matrix  $A$  is: **[V,D]=eig(A)**, where  $V$  is a matrix with eigenvectors as columns, and  $D$  is a diagonal matrix with the corresponding eigenvalues.

- (d) Write the projection matrix to the space spanned by the first eigenvector as a matrix  $P$ . Verify that this is a projector by plotting the data after projecting all the points.

*Note:* To plot points from a matrix  $A$  that is  $m \times 2$ , use the command

**plot(A(:,1),A(:,2),'.')**

There are other options available as well- type **doc plot** for the help file.

- (e) Find the equation of the best fitting line through the original data in  $X$ . Verify (using the equation of the line) that the line goes through the mean of the data. Use linear algebra to solve this problem- not the GUI (if you don't know what I mean, you're probably fine).