Math 451 Assignment 16, Spring 2014 **Due at 4 PM Friday, May 23rd**

This is a "paper and pencil" assignment, with the help of *MATLAB* or your calculator. The data below and to the right is the weights (in thousands of pounds) and mileages for four different automobiles.

weight	mpg
4.360	16.9
3.605	19.2
2.155	30.0
2.560	27.5

1. (a) Suppose that we thought there was a linear relationship between the mileage m and the weight w. That is, we assume that $m = a_0 + a_1 w$ for some constants a_0 and a_1. Give the system of equations that is obtained by applying this assumption to the four data pairs.

   (b) Give the matrix A and vectors $\mathbf{x}$ and $\mathbf{b}$ when considering the system from (a) as the matrix equation $A\mathbf{x} = \mathbf{b}$.

   (c) Enter A and $\mathbf{b}$ in *MATLAB* and try solving the system with `rref([A,b])`. What is the resulting matrix trying to tell you, and how is it saying it?

   (d) Use a least squares approximation to find $\mathbf{x}$, which is a_0 and a_1. Use *MATLAB* (or your calculator) to do the necessary computation and give your values to four places past the decimal. *If you don't know how to do this, read Section 8.5 of my Linear Algebra textbook or find something online.*

   (e) Give the error vector $A\mathbf{x} - \mathbf{b}$ and the error $\|A\mathbf{x} - \mathbf{b}\|$, with all values rounded to four places past the decimal.

Math 451 Assignment 17, Spring 2014 **Due at the start of class on Wednesday, May 28th**

Repeat Assignment 16, but assuming that the relationship between mileage and weight is quadratic: $m = a_0 + a_1 x + a_2 x^2$.

Assignment 18 is on the next page!

Math 451 Assignment 18, Spring 2014 **Due at 4 PM Friday, May 30th**

1. Go to the class web page and download the weight/mpg data linked to under 5/22.
2. Import the weight and mpg data as two column vectors. If you do a search you might be able to find the video I found on importing Excel data into *MATLAB*.
3. In the command window, try graphing the data as points. Don't use any fancy symbols - it will clutter up the graph too much.
4. Write a script file named *yourfirstname_regr* that has two parts:
   (a) The first part uses least-squares to find an equation of the form $y = a_0 + a_1 x$ that best fits the data. Then plot the line together with the data points. Your plot should of course have the axes labeled and a title. Compute the value of a variable `errorlin` that is the error $\|A\mathbf{x} - \mathbf{b}\|$.
   (b) Then use least-squares to find an equation of the form $y = a_0 + a_1 x + a_2 x^2$ that best fits the data. Create a new plot that has this curve together with the data, and compute `errorquad` for this situation.
5. Put the `pause on` command right after your `clear all`, and then a `pause` between the two methods so that I can look at the first plot before going on to the second.
6. Make sure that the only outputs are the errors and the plots - you can also include the equations if you can figure out a way to do that.
7. Let's comment this file. I should have been making you do that all along, but I've been slacking!