PHYS 391, Homework #3
Due Thursday, February 12, by noon

Key Concepts

- Weighted Mean
- Least Squares Fitting

Reading: Taylor Chapters 7-8

Homework Problems (taken from Taylor):

1. Problem 7.1 - Please work this out "by hand." There aren't that many values, and it is good to see exactly how this works at least once.
2. Problem 7.7
3. Problem 7.8
4. Use your MATLAB function from lab 2 to read in a set of values with errors from a text file and compute the weighted average and the uncertainty on the weighted average. Write down the formula(e) you are using and prove to me that it works by producing weighted average and uncertainty results for the data given in problems 7.1 and 7.4. I don't need to see your exact code, rather you can just write down your function (symbolically) and provide the results.
5. Problem 8.1 - Do this "by hand" first using the appropriate equations, then compare with the MATLAB function `polyfit(x, y, 1)` which does a least-squares fit to a 1st order polynomial. Alternately, if you just plot the data, from the plot menu bar you can choose *Tools:Basic Fitting* and get the same result. See section 5.2 in Pratap for more information.
6. Problem 8.10 - In addition to the values A and B, you should also calculate the uncertainties on A and B (see problem 8.19 for the relevant equations). Here you can do the weighted fit any way you want. Either by hand, by performing the calculations in MATLAB, or perhaps most useful try to learn the built-in MATLAB functions to do this. To fit weighted data, you need to use both the `fit` command and the `fitoptions` command. Note that `fitoptions` allows you to specify a vector of *weights* not errors. One benefit of using `fit` is that it returns the uncertainty (quoted at 95% confidence level) on the fit parameters.
7. Problem 8.20
8. Problem 8.25 - Here you do not need to worry about the errors (that would be Problem 8.26 and there are some subtleties in this approach we will cover in Lab 4). Be careful in how you linearize this, but fundamentally you can do a non-weighted linear fit.