Math 451 ASSIGNMENT 19, SPRING 2014

For this assignment you will need to go to 5/30 on the class schedule and download the *lagrange.m* script file that can be found there. That file evaluates that Lagrange polynomial for a set of data values at a single value of x. The eventual goal of this assignment is to turn the script file into a function file that reads in two data vectors (which give us a set of x values and corresponding y values) and then creates a plot of the data points with the graph of the Lagrange interpolating polynomial overlaid on those points.

1. (a) Download the script file and change its name to *yourfirstname_lagrange1*.
   (b) Add a line to the end of the script file that plots the data points as black stars (asterisks).
   (c) Change the initialized x value to a vector that starts one unit less than the smallest x data value and ends one unit larger than the largest x data value, and increments by tenths.
   (d) The objective is to create values of y for each value in the **x** vector, forming a vector **y** of Lagrange polynomial values for the data we are interpolating. To do this you must initialize **y** as a vector, then run the vector **x** through the loop to get the vector **y** of function values. You will have to make appropriate changes in the loop to make this happen.
   (e) Change your plot command so that it plots both the data points and the Lagrange polynomial. Let's just plot the polynomial as a blue (the default) curve.
   (f) Check to see that your script works. **E-mail this to me by 5 PM on Tuesday, June 3rd** in order to receive credit.

2. **Rename your file** *yourfirstname_lagrange2*. Now it is time to turn the script file into a function file. You might wish to write down the x and y data vectors to use later for testing, or you can just make some up later.

   (a) Change your script file so that it reads the size of the x data vector (we'll assume that the y data vector is the same length, in the sense of having the same number of components) and then replace the upper limits of counters with the appropriate variable.
   (b) Change the initialization of the vector **x** so that it will start one unit less than the smallest x data value and end one unit larger than the largest x data value regardless of what the x data vector is. (Assume that the values in the x vector are given in order from smallest to largest.) You will then need to change the initialization of the vector **y** so that it has the same length as the vector **x**.
   (c) Make any other changes in vector lengths that are necessary. Try running your file to make sure it works with all of these changes. **Add comment lines** for any new lines you put in, and **change existing comment lines** to reflect the fact that the file is working with vectors rather than single values.
   (d) Now get rid of the `xdata` and `ydata` lines in the script and change the file to a function file. Test it with the original data vectors and another data vector of a different length to make sure it works for vectors of any length. **Save it!**

3. **Final feature creep:**

   (a) **Rename your file** *yourfirstname_lagrange3*.
   (b) Try your code with x and y vectors that are longer, like 8 or 10 numbers in each. You will see that the part of the graph we really want to see is very flat. Use the `axis` command to fix this by setting minimum and maximum values for y as follows: Determine the minimum and maximum values of y between the lowest and highest x data values. Then determine the range between the minimum and maximum y values. Set the minimum y at 10% of that value below the minimum y between the lowest and highest x data values. Similarly, set the maximum y at 10% of that value above the maximum y between the lowest and highest x data values. Here are some suggestions:
      - *MATLAB* has minimum and maximum functions. Read about them somewhere.
      - Create a vector x with 10 components in the command window. *DO NOT* use the integers one through ten for its components. Then type `y=x(3:6)`. What is the result?
      - How many components does the vector x have that are less than the first component of the x data vector?
   (c) **E-mail me your final result by 9 AM on Thursday, June 5th**. Submit *lagrange2* if you cannot get *lagrange3* to work.