Math 451 ASSIGNMENT 4 **Due at 4 PM Monday, April 7th**

For this assignment you will write a script file that finds the solution to $\cos x = x$ (there is only one solution) using Newton's Method. Note that as x increases from zero to $\frac{\pi}{2} \approx 1.5$, $\cos x$ decreases *continuously* from one to zero, so somewhere between zero and one they have to "cross paths." (Plot both $y = \cos x$ and $y = x$ together on your graphing calculator to see this.) Recall that the iteration formula for finding a solution to $f(x) = 0$ is

$$x_n = x_{n-1} - \frac{f(x_{n-1})}{f'(x_{n-1})} \tag{1}$$

1. You will need to define the function f to write your script. To find out how to do this, look either in the introductory chapter of the book or in the documentation center that is linked to at the class web page. If you use the latter, do a search for *anonymous functions*. Try writing and calling a simple anonymous function (*this is not the same as writing a function file like you did before!*) in the command window to make sure you know how to do it.

2. Write your script, naming it *yourname_assn4*. Use an initial guess of 1, and have it continue until two consecutive x_ns are within 10^{-6} of each other. (Include a "safety" stopping condition of 100 iterations.) Have the script output (only) the vector of successive approximations to the root and a graph of the sequence values.

   NOTE: You may wish to do this by modifying one of your Fibonacci files. Recall how we had to create an "artificial" first term of the ratio, sequence before starting into the `while` loop, so that two terms of the sequence existed for the test at the start of the while loop. You will need to do that here as well, so the initial guess of one will actually be x_2. x_1 can be anything that does not stop the loop before any iterations!

3. Add comments to your code, including a comment at the top that tells *specifically and precisely* what the script does. Then save it and e-mail it to me.

Math 451 ASSIGNMENT 6 **Due at 2 PM Tuesday, April 8th**

For this assignment you will write a script file that finds the solution to $\cos x = x$ using the Bisection Method, starting with an initial interval $[a_1, b_1]$ in which a root is believed to lie. Here is a rough description of the algorithm:

- Test the product $f(a_1)f(b_1)$ to make sure there is a guaranteed root in the interval. If not return a message to that effect and stop.
- If the test indicates a root in the interval,
  - find the midpoint m of the interval,
  - test $f(a_1)f(m)$ to see if there is a root in $[a_1, m]$. If there is, set $a_2 = a_1$ and $b_2 = m$.
  - Otherwise, set $a_2 = m$ and $b_2 = b_1$.
- Repeat until the desired tolerance is obtained.

1. Write your script, naming it *yourname_assn6*. Have it continue until two consecutive x_ns are within 10^{-4} of each other. (Include a "safety" stopping condition of 100 iterations.) Have the script output *two* vectors, one with the of successive values of a_n and the other with the successive values of b_n.

2. We now wish to create a plot that shows the values of both the a and b sequences together on the same plot. Write a command to plot the a sequence in some color and with each point indicated by some symbol. Try `help plot` to see your options - have a little fun with this. Now add a line that says `hold on` and then add another line for plotting the b sequence with another color and symbol. This should give the desired graph.

3. Add comments to your code, including a comment at the top that tells *specifically and precisely* what the script does. Then save it and e-mail it to me.