ECOR 2606 Assignment #3

1/. Write a function m-file (falsePos.m) that implements a false position search. Use bisect.m (available in the sample Matlab code folder) as a starting point and maintain the same general structure (i.e. same arguments, same display format, and so on). All you have done to do is change the formula used and (the interesting part) switch from using "maximum error" to "approximate error" (see the lecture 6 slides if don't know what this is). Note that on the first iteration the approximate error is undefined. Nothing should be displayed in the error column (and iteration should not stop).

The function $f(x) = e^{-x} - x$ has a root between 0 and 1. Execute the first three iterations of a bisection search and the first three iterations of a false position search by hand. In both cases use 0 and 1 as your initial limits. Check your results against those produced by bisect.m and your falsePos.m. Your hand calculations are not to be submitted. Your reward for doing this aspect of the assignment will come on the midterm.

Hand execute the first three iterations of a secant search with 0 and 0.1 as your starting points. Check you results against those produced by secant.m (available in the sample Matlab code folder). The same remarks apply.

2/. Use the principle of a Newton-Raphson search to derive an iterative formula for calculating the cube root of a number. The use your formula to create a function m-file (cubeRoot.m) that, given a positive value, returns the cube root of this number. Have your function stop iterating when the approximate error is reduced to 1×10^{-6}. Your function should generate an error if the value given to it is negative and should work properly (i.e. return zero) if the value is zero.

3/. (adapted from Chapra 7.22) The specific growth rate of a yeast is given by

$$g = \frac{2c}{4 + 0.8c + c^2 + 0.2c^3}$$

where g is the specific growth rate
c is the food concentration (in mg/L)

Growth is low at low food concentrations (for obvious reasons) and is also low at high food concentrations (due to toxicity effects). Plot g for c from 0 to 10 mg/L, Two values of c give g = 0.2. What are these values? Find the values using your false position search function (i.e. your answer to question 1) and them confirm that your function is working properly by repeating the process with *fzero*. What value of c maximizes g and what is the maximum value of g? Wrap up your solution to this question as a script m-file (yeast.m) that produces the plot, does all of the required calculations, and outputs all required values using *fprintf*.