3450:427/527 Applied Numerical Methods I, Kreider, Fall 2012

Homework Set 2

Each problem is worth 10 points.

Due date: Thursday 27 September

For these problems, you should write a function file for the algorithm, and use the function in a script file to solve the problem.

1. Use the fixed point algorithm to find the fixed point of

$$x = \frac{1}{x}\left(\sin x + \frac{1}{x}(\cos x - 1)\right)$$

   There is a fixed point in the interval $[0, 0.5]$. You do not need to verify it. Write a MATLAB file to solve this. Use a tolerance of 10^{-10}. Turn in the code listing and the solution, printed with at least 8 significant digits. It is most convenient to define g(x) in the script file as an anonymous function:

```
g = @(x) (1/x)*(sin(x)+(cos(x)-1)/x)
```

2. Find all the roots in $[-5, 5]$ of $f(x) = \cos x + \dfrac{1}{x^3 + 200}$ using the bisection algorithm with a tolerance of 10^{-10}. Plot the function first to see how many roots there are, then run the algorithm the indicated number of times to get the roots one at a time. Turn in a code listing and the answers, printed with at least 8 significant digits. Also report the number of iterations it took to find each root.

3. Apply the method of regula falsi to the problem above. Use the same tolerance and initial intervals as you did above. Turn in the same information.

4. Write a Newton's Method code with the stopping criterion of (abserr $<$ tol) and (relerr $<$ tol). Set tol to 1.0e-10. Apply the code to the function below and print the root using at least 8 significant digits. Use a starting value of $p_0 = 50$.

$$f(x) \quad = x^3 - .001x^2 + x - .001$$

   Turn in a code listing, the answers, and the number of iterations.

5. Apply the Secant Method to the problem above with the same stopping criterion. Use initial guesses $p_0 = 50$ and $p_1 = 49$. Turn in a code listing, the answers, and the number of iterations.

6. For 527 students: Use the Steffensen Acceleration method described in class (not program 2.7 in the text) to solve problem 1. Turn in the same information, and note the savings in terms of number of iterations to convergence.