Mathematics 373
Numerical Analysis I
PROGRAMMING ASSIGNMENT 1
Due Tuesday, February 22, 2000

We have several methods of finding zeros of functions. Write the following as procedures, using any language in which you can not only turn in the programs, but also give me printout of their usage. Maple V is a good candidate. Your programs must have correct terminating steps and print out steps on the way to a solution. You need not do fancy I/O. You may pass parameters to these routines either in calls to them or by the use of global variables. Input can be either from the console or a calling file, but you must be able to provide transcripts of your sessions using these routines.

The procedures:

1. Bisection: Input the endpoints and the tolerance either from the console or from a calling file. You may input the function as a global variable in a calling program. Check that you indeed straddle a root. Output not only the midpoint approximation p_n but also the endpoints of each interval straddling the root.

2. Newton's method: Input the starting point and maximum number of iterations. Terminate the program either with three close iterates or too many iterations. Output each approximation.

3. Secant method: Input two starting points, the tolerance, and the maximum number of iterations. Output each successive approximation. Terminate the program either with three close iterates or too many iterations.

4. Method of false position: Same instructions as for bisection, except here you should give a maximum number of iterations also.

Use of the procedures:

Run each of your procedures to find a zero for the following functions to within 10^{-5} with at most 50 iterations.

1. $f_1(x) = x - \sin(x) - 0.5$.

2. $f_2(x) = x^3 - \cos(x)$.