Scientific Computing, G63.2043/G22.2112
Spring 2000
Professor Leslie Greengard

Lectures 4-5

Reading: Chapters 4-6 in "Numerical Methods with MATLAB."

Lecture Topics:

A) Series expansions, Aitken acceleration
B) Polynomial interpolation
C) Finding roots of functions of one variable

Problem Set 3: Due 2/24/00.
1) Problem 4.6 in Borse's text.
2) Problem 4.8 in Borse's text.
3) Implement the bisection method in MATLAB. Include tests to make sure the input is reasonable and that the number of iterations is less than a maximum number ITMAX. ITMAX should be a *user-defined* parameter. Demonstrate its performance for $\log x$ using 0.5 and 2 as bracketing points.
4) Implement a fixed point iteration scheme to determine a root of $f(x) = 0$ be rewriting it as $x = g(x)$. The scheme is simply

$$x_{n+1} = g(x_n),$$

after some initial guess. Stop when the iterates have gotten closer than a user-defined tolerance TOL (i.e. $|x_n - x_{n+1}| < TOL$). Try the method on $g(x) = \frac{x}{2} + \frac{1}{x}$ with initial guess $x_0 = 1$. Can you show that if $|g'(x)| \leq c < 1$, then the method converges? (Hint: the mean value theorem).

Remark on homework:

Matlab homework should be concise. The easiest way to do this is to write a program corresponding to the desired task as a Matlab M-file. You can then submit a printout of that file together with the results it generates.