Assignment #5
and
Review for Midterm on Monday, 2 November

NOT DUE!
Solutions to problems from Kincaid & Cheney
will be distributed Friday 30 October, 2009

Problems from Kincaid & Cheney:

- Read sections 4.0 and 4.1, through page 145; the "Partitioned Matrices" material can be skipped.
- **Problems 4.1, exercise 1**.
- **Problems 4.1, exercise 3**.
- **Problems 4.1s, exercise 6**.
- **Computer Problems 4.1, exercise 2bc**.

Review:

Chapter 1. Know these concepts from calculus, and easy applications:

- Intermediate Value Theorem
- Mean Value Theorem
- Taylor's Theorem with (Lagrange) remainder

Know these definitions:

- "$\{x_n\}$ converges to L" $\iff$ "$\lim_{n\to\infty} x_n = L$"
- "$\{x_n\}$ *converges linearly*"
- "$\{x_n\}$ *converges super-linearly*"
- "$\{x_n\}$ *converges at rate* α"

Chapter 3. Each of the algorithms listed below solves

$$f(x) = 0.$$

For each of these algorithms, be able to (*i*) derive the algorithm, (*ii*) be able to do a couple of steps by-hand, (*iii*) give rate of convergence (when it converges): linear, superlinear, quadratic, (*iv*) whether convergence is certain, (*v*) state advantages and disadvantages relative to other two methods:

- bisection method
- Newton's method
- secant method

Know these definitions:

- $F(x)$ has a *fixed point*
- *fixed point iteration* for $F(x)$
- $F(x)$ is contractive

Be able to state the Fixed Point Theorem and give an example
(Note we skipped sections 3.5 and 3.6 entirely.)

Chapter 4. Know the following recent stuff from systems of linear equations (linear algebra):

- how to multiply by-hand an $m \times n$ matrix times a $n \times 1$ vector
- how to multiply by-hand an $m \times n$ matrix times a $n \times q$ matrix
- solve a small (2 or 3 equation) system by-hand by Gauss elimination
- what *back-substitution* and *forward-substitution* refer to, and what systems they solve, and for these methods know (*i*) when they fail, and (*ii*) how to count operations (from a statement of the algorithm), and (*iii*) that they take $O(n^2)$ operations for systems of n equations in n unknowns
- give examples of each of the *elementary operations* their corresponding *elementary matrices*

In MATLAB/OCTAVE, know how to

- solve a system which you write as `A x = b`
- extract entries of, or blocks of, a matrix using "colon notation"
- difference between `A^2` and `A.^2` if `A` is a square matrix

(Note that the first topic *not* on the exam is "LU decomposition.")