Math 446/546   **Spring 2009**   **Guide for Test 2**

Test 2 is on Friday May 1, and covers Chapter 7. Bring a calculator for arithmetic. Here are some sample questions from Chapter 7.

1. Guaranteed question:
   Let
   $$A = [* * *\text{given, at most } 4 \times 4 * **]$$

   (a) Use the [*Jacobi or Gauss-Seidel*] iterative method [*once or twice*], with starting vector [**], to approximate the solution to
   $$Ax = [* * *\text{given} * **].$$

   (b) Determine if this iteration will converge. State any theorems that you use.

2. Guaranteed question:
   Let
   $$A = [* * *\text{given, at most } 3 \times 3 * **]$$

   (a) Compute the condition number of A using the **** norm.

   (b) Use the condition number to estimate the relative error in x when you solve $Ax = b$ if the relative error in b is ϵ.

3. Likely questions:

   (a) For the matrix $B = * * *$, do two steps of gradient descent starting at ***.

   (b) State the main theorem on iterating using A-orthogonal directions. (Theorem 7.32)

   (c) Explain the idea of the Conjugate Gradient method, in what situations it can be applied, why people use it, and how and why pre-conditioning is used. [You will not be asked to derive it or perform it.]

4. **Math 446 students:** Make sure you wrote your name on the test.

   Math 546 students: The book has the following theorem:
   Theorem: [**either Theorem 7.11, 7.19, or 7.31**]

   Prove this theorem. If you use any other theorems from the book during your proof, then you need to state those theorems.