Guide for Test 2

- The test is in class on Friday 13 May.
- Bring a calculator (for arithmetic).
- We did not cover Sections 9.1 and 9.2 in the homework. I suggest that you do Section 9.1 problems 3f and 6, and Section 9.2 problems 1a, 2a, 3a, 4a, and 5a.
- We will skip Successive Over-Relaxation from Section 7.3.
- You need to be able to state and use all the theorems. You may be asked to prove some of the easier ones. You will not be asked for the proofs of Theorems 7.3, 7.11, 7.32, 9.12, or 9.13.
- For Section 7.5, be able to prove Theorem 7.31, perform the method of steepest descent, and state and explain Theorem 7.32. For the conjugate gradient method itself, be able to determine when it applies, and explain the idea behind it and why people use it. You will not be asked to derive it or perform it.
- Guaranteed question:
  Let
  $$A = [***given***]$$
  1. Use the [*Jacobi/Gauss-Seidel*] iterative method twice, with starting vector **, to approximate the solution to
     $$Ax = [***Given***] .$$
  2. Determine if this iteration will converge. State any theorems that you use.
  3. Compute the condition number of A using the **** norm.
- Likely questions:
  1. For the matrix $B = ***$, do two steps of gradient descent starting at ***.
  2. State the main theorem on iterating using A-orthogonal directions.
  3. Explain the idea of the Conjugate Gradient method, in what situations it can be applied, and how and why pre-conditioning is used.
  4. Use the Gerschgorin Circle theorem to estimate the eigenvalues of $C = ***$. Give an algorithm for determining the middle eigenvalue and its corresponding eigenvector.
  5. Show that [more abstract proof]

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- You each have topics now, and should have started working on the project. I strongly suggest that you give me a rough draft or outline soon, so that I can make sure that you are on the right track.
- A draft of the report is due Monday 23 May. It should be essentially finished, but I will make comments and return them for revisions. There is no set length for the report, but to do a reasonable job it will probably be 10 pages, not including graphs, programs, etc. Use your good problem skills.
- You will give a presentation of about 15 minutes. I would like these to be in the Applied and Computational Mathematics seminar on Tuesday 31 May at 3:10pm (in 320 Morton). If that does not work out then we will do it in class.