Preparation guide for final exam

The exam problems will be closely related to your homework problems. Make sure you understand all of them.

1. Review study guide for quiz 05 and previous exams.

2. Section 7.1: Review basic properties of matrix norm, Theorem 7.11.

3. Section 7.2: Review basic properties of spectral radius, Theorem 7.15, 7.17.

4. Section 7.3: Review Jacobi and Gauss-Siedel iterations. For general iterative methods, study how the error of k-th iteration depends on $\rho(T)$ and/or $\|T\|$ (Theorem 7.18-7.20).

5. Section 7.4: Review the derivation of SOR, firstly in componentwise form, then its expression in matrix notations.

6. Section 7.3-7.4: Practice implementation of Jacobi, Gauss-Siedel and SOR iterations.

7. Section 7.3-7.4: Read and understand the statements of 7.22, 7.25-26. The proof of these theorems are beyond the scope of this course. For your information, the proof of Theorem 7.25 can be found in section 7.3, problem 19, and section 7.4, problem 14.

   Their statements will be provided in the exam if they are needed (so you need to at least understand the statements).

8. Section 7.5: Study the derivation of condition number and how it affects the accuracy of the solution of a linear system. Study how to calculate it for a given matrix.

   Skip 'Iterative Refinement' part.

9. Section 8.1: Study the derivation of linear system for least square approximation (the normal equation) both for the discrete case (x_i, y_i) for polynomial approximation (p509-51a) and the continuum counterpart $\int_a^b (\cdots)^2 dx$.

10. Contents to review from midterm 01 and 02:

    Basic formula for differentiation, integration and their error estimates. How is order of convergence related to degree of precision. How to estimate number of iterations for various iterative methods. How to compute the Jacobian matrix of vector valued functions. How to solve for nonlinear equations, both the scalar case and the system case. Source of floating pointing point error and how to overcome.

    Some of them are necessary for solving problems from week 13-17. Some of them may be similar problems from midterm 01 and 02: