Fall 2017 Math 395 Midterm Review

The midterm will cover Chapter 1-6. Closed book. No Calculators allowed.

Office hours: Monday 10/23, 4-5 pm (Extra)
Tuesday 10/24, 10:30- 11:30 am (Regular)

Concepts:

1. Understand Bisection, Newton, and Secant methods. Be able to compute iterations. Fixed point method and be able to apply Theorem 1.5.

2. Binary representation. Rounding down, rounding up, and rounding to the nearest. How to break the tie when rounding to the nearest in binary? How to add up two numbers in floating number arithmetic? Machine precision.

3. Compute ℓ_p norm of a vector. Block matrix multiplication. Positive definite matrices and its 3 criteria. Positive semidefinite matrix. Advantages of an ONB (Theorem 3.10). Properties of matrix norm. Compute operator norm of a matrix.

4. Compute LU factorization. FLOP counts. Partial pivoting and scaled partial pivoting. Cholesky factorization. Least square solution, projection matrix, normal equation. Solving least square via Cholesky, SVD and QR. Algorithms for SVD and QR will be provided.

5. Definition of SVD and reduced SVD. Compute singular values of any matrix. Compute singular values of a symmetric matrix. Rank-s approximation.

6. Difference between stability of a problem and stability of an algorithm. Stability of a linear system. Compute condition number. Gram-Schmidt algorithm. Orthogonal complement. Hyperplane. Theorem 6.7. Formula for Householder reflector. Use Householder reflector to transform x to $\pm\|x\|_2 e_1$ (need to know formula (6.7)). Compute QR or reduced QR using Gram-Schmidt or Householder.

- Review your homework problems and quiz problems. Also work on Chapter 6 Exercise 9-12.
- Read the class notes thoroughly. (Remember you get extra credit when you find a mistake, and tell me!)