

Math 313/513, Homework 3 (due Thurs. Feb. 2)

Name: _____ 313 or 513 (circle)

Reading

- Read sections 2.3 – 2.6 of Strang

Book problems

- Math 313:
 - section 2.3: 1, 3, 12, 18
 - section 2.4: 1, 5, 6, 32 (be sure to explain your answer to problem 32)
 - section 2.5: 1, 10, 11, 25
 - section 2.6: 16
 - By hand, find the LU factorization of:

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 4 & 5 \\ 0 & 4 & 0 \end{bmatrix}$$

- Use your above LU factorization to solve $A\vec{x} = \vec{b}$, where \vec{b} has entries 1, 0–1. (i.e., let $\vec{y} = U\vec{x}$, so $L\vec{y} = \vec{b}$, and proceed from there).
- Math 513: all of the above, plus:
 - section 2.5: 15, 40
 - section 2.6: 13

MATLAB assignment

Our goal is to investigate how long it takes to solve a random $n \times n$ linear system in MATLAB.

- Learn how to use MATLAB's `rand` command to generate random matrices/vectors of specified dimension.
- See <http://www.mathworks.com/help/techdoc/ref/tic.html> for the `tic` and `toc` commands. Borrow the code there (don't forget to cite it in your comments!) that keeps track of the run time of solving random $n \times n$ systems, where n varies. Comment this with your own comments after you make sure you understand exactly what it is doing. (OVER)

- Modify the code so that n runs from 1 to 2001 in steps of 40 (if your machine struggle with this, use 1001 instead). Create two vectors: one that holds these different values of n and the other that holds the amount of time it took to solve each random system.
- Generate a plot of these vectors to see how the run time increases with n .
- Use MATLAB's `polyfit` command (see <http://www.mathworks.com/help/techdoc/ref/polyfit.html>) to find a fourth-degree polynomial that is a best fit to your data (in the sense of least-squares, which we will study later).
- Generate a single plot that overlays your data with the best fit polynomial.

Now, put all your code together into a `.m` file, being sure to include your comments. Submit to Blackboard.