Homework II

Deadline: 2017-10-25

1. (10 pts) Conduct Gaussian elimination on

$$\boldsymbol{A} = \begin{pmatrix} 1 & 0 & 0 & 5 \\ 1 & 1 & -3 & -1 \\ 2 & 3 & -1 & 1 \\ -2 & 3 & -2 & 0 \end{pmatrix},$$

   and find its LU decomposition.

2. (10 pts) Write your own codes for forward substitution or back substitution (choose the one you like). Conduct random tests to show that its computational complexity is proportional to n^2 (n is the size of the matrix) by making a plot similar to Figure 1. (**Hint:** for each tested n, conduct for example 10 random tests and compute the average time.)

3. (20 pts) Write your own codes for the LU decomposition of a matrix $\boldsymbol{A}$ and test the correctness of your codes by computing the error between $\boldsymbol{A}$ and $\boldsymbol{LU}$, where $\boldsymbol{L}$ and $\boldsymbol{U}$ are the lower triangular and upper triangular matrices obtained from your codes. Conduct random tests to show that its computational complexity is proportional to n^3 (n is the size of the matrix) by making a plot similar to Figure 1.

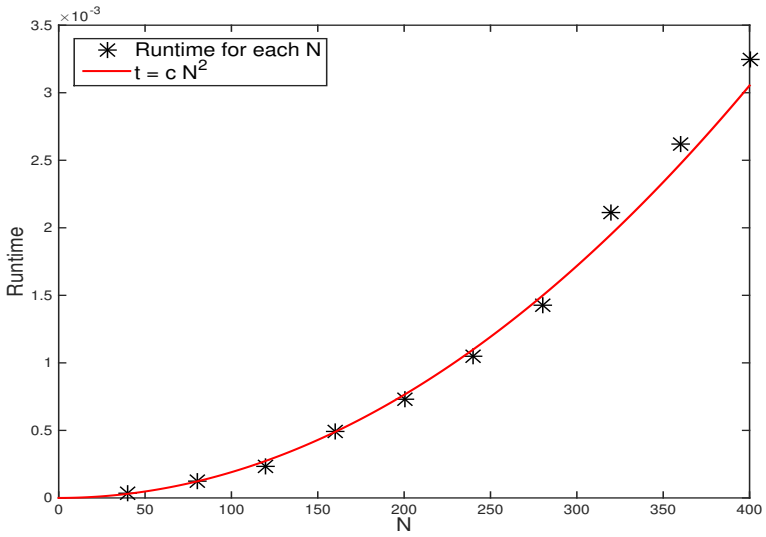

Figure 1: Runtime vs. N