

CS 211 Assignment2

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Code: <https://github.com/UCR-HPC/cs211-hw2-solving-large-linear-system-LucasL258.git>

Question 1

$$A = \begin{pmatrix} 1 & 2 & 3 & 1 & 2 & 3 & 1 & 2 & 3 \\ 4 & 13 & 18 & 4 & 5 & 6 & 4 & 5 & 6 \\ 7 & 54 & 78 & 7 & 40 & 57 & 7 & 8 & 9 \end{pmatrix}$$

So for $A = LU$

$$L = \begin{pmatrix} 1 & 0 & 0 \\ 4 & 1 & 0 \\ 7 & 8 & 1 \end{pmatrix} \quad U = \begin{pmatrix} 1 & 2 & 3 \\ 0 & 5 & 6 \\ 0 & 0 & 9 \end{pmatrix}$$

Question 2

Matrix size \ code	my	lapack
1000	0.293556s	0.083454s
2000	2.147591s	0.475916s
3000	7.213021s	1.317801s
4000	16.943788s	1.639566s
5000	34.620473s	2.971550s

Gflop for my code: around 100 GHz

Gflop for LAPACK: around 350 GHz

Question 3

$$A = \begin{pmatrix} 1 & 2 & 3 & 4 & 1 & 2 & 3 & 4 & 1 & 2 & 3 & 4 \\ 2 & 9 & 12 & 15 & 2 & 9 & 12 & 15 & 2 & 5 & 12 & 15 \\ 3 & 26 & 41 & 49 & 3 & 26 & 41 & 49 & 3 & 20 & 41 & 49 \\ 5 & 40 & 107 & 135 & 5 & 40 & 107 & 135 & 5 & 30 & 107 & 135 \\ 1 & 2 & 3 & 4 & 1 & 2 & 3 & 4 & 1 & 2 & 3 & 4 \\ 2 & 5 & 12 & 15 & 2 & 5 & 6 & 7 & 2 & 5 & 6 & 7 \\ 3 & 4 & 41 & 49 & 3 & 4 & 41 & 49 & 3 & 4 & 8 & 9 \\ 5 & 6 & 107 & 135 & 5 & 6 & 107 & 135 & 5 & 6 & 56 & 73 \\ 1 & 2 & 3 & 4 & & & & & & & & \\ 2 & 5 & 6 & 7 & & & & & & & & \\ 3 & 4 & 8 & 9 & & & & & & & & \\ 5 & 6 & 7 & 10 & & & & & & & & \end{pmatrix}$$

So for $A = LU$

$$\begin{array}{cccc}
 & 1 & 0 & 0 & 0 \\
 & 2 & 1 & 0 & 0 \\
 & 3 & 4 & 1 & 0 \\
 L = & 5 & 6 & 7 & 1
 \end{array}
 \quad
 \begin{array}{cccc}
 & 1 & 2 & 3 & 4 \\
 & 0 & 5 & 6 & 7 \\
 & 0 & 0 & 8 & 9 \\
 U = & 0 & 0 & 0 & 10
 \end{array}$$

Question 4