CENG 371 - Scientific Computing
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Homework 2

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1. (a) The implementation of Sherman's march algorithm is inside the shermans.m file.
   (b) The implementation of Pickett's charge algorithm is inside the picketts.m file.
   (c)
2. (a) The plot of relative errors of the algorithm is as follow :

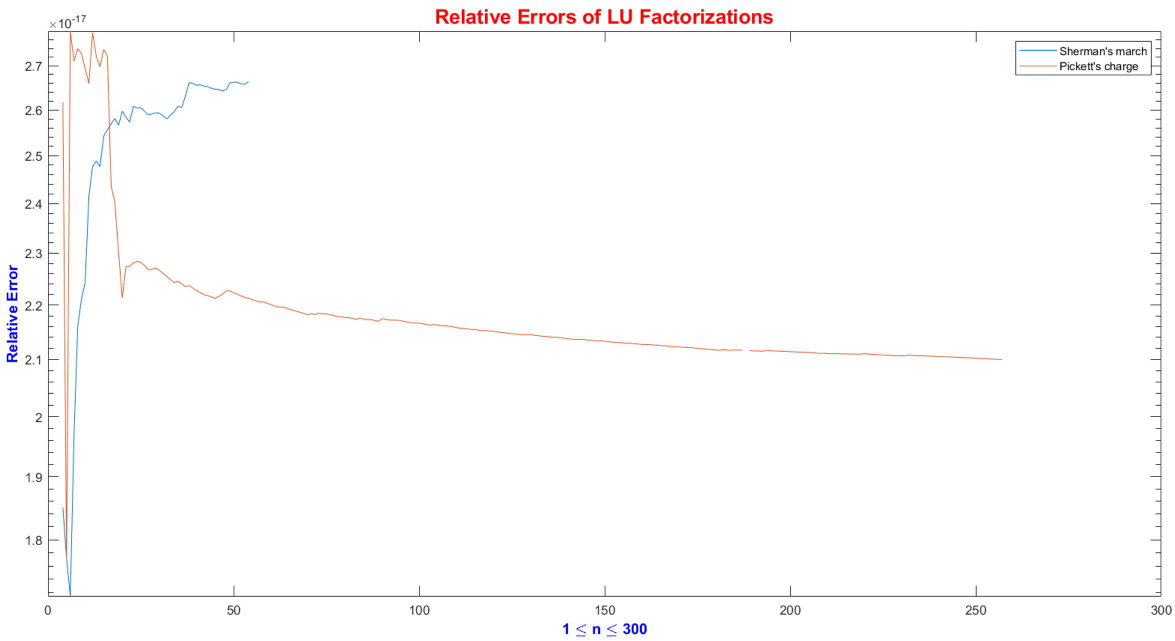

Figure 1: Plot of Relative Errors

The algorithm that I have implemented for Sherman's march factorizes the matrix An = hilb(n) for n = 53.When n is 54, it results minus infinity at the 55th column below the diagonal in L.After that, the NaN will appear.The same is also true for U.As a result, the relative error is calculated until the n = 54.After that, the relative errors appear as NaN.

The algorithm that I have implemented for Pickett's charge factorizes the matrix An = hilb(n) for n = 175.When n is 176, it result NaN in the diagonal entry, and does not calculate the L and U correctly after that.

If we look at the semilogy graph, until n = 16 , the sherman's march looks like better than pickett's charge in terms of their relative errors , but after that, picketts has a less relative error than shermans.Thus, if we look at the big picture, of course pickett's charge will have less relative error than sherman's march.

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Run Time of Sherman's March = 453.2677948999999558 sec
Run Time of Pickett's Charge = 37.8227454999999964 sec
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Figure 2: Run times

(b) Since all these three algorithms are different variations of the classical Gaussian elimination, which means they do not have any pivoting (partial or complete), they cannot factorize any square matrix.If we had a matrix A which consist of many zeros in the main diagonal, we would get a division by zero.Thus, we couldn't react the resulting LU factorization.However, if we have implemented these methods by considering the pivoting (permutations of rows and columns), we would get the LU factorization of any square matrix successfully.Thus, these algorithms are only applicable to the matrices that do not require any pivoting.

References

[1] This is the link that I get some for hilb in MatLab : Hilp in Matlab. *Mathworks*,

[2] This is the link that I get some help for second norm of matrices in MatLab 2nd Norm of Matrices in Matlab. *Mathworks*,

[3] This is the link that I get some help for the run-times of the methods : Tic Toc. *Mathworks*,

[4] This is the link that I get some help for semilogy in Matlab : Semilogy. *Mathworks*,