Homework Assignments: HW # 8
CMSE 823: Numerical Linear Algebra

1. Textbook problems. Lecture 18: 18.1.

2. Textbook problems. Lecture 19: 19.1.

3. Textbook problems. Lecture 20: 20.3; 20.4.

4. Textbook problems. Lecture 23: 23.1.

5. Code up the Gaussian elimination without pivoting to solve the linear system
$$H(n)\mathbf{x} = \mathbf{b},$$
where $H(n)$ is the $n \times n$ Hilbert matrix with $H_{ij} = \frac{1}{i+j-1}$ $(1 \leq i, j \leq n)$, $\mathbf{b}$ is taken such that the true solution is $\mathbf{x} = (1, \cdots, 1)^T$. The condition number of the $n \times n$ Hilbert matrix grows as $O\left((1+\sqrt{2})^{4n}/\sqrt{n}\right)$. To see the deteriorating accuracy, you will need to take $n = 2, 4, 6, 8, 10$.

6. Code up the Cholesky decomposition to solve the same linear system as above,
$$H(n)\mathbf{x} = \mathbf{b},$$
where $\mathbf{b}$ is taken such that the true solution is $\mathbf{x} = (1, \cdots, 1)^T$. To see the deteriorating accuracy, you will need to take $n = 2, 4, 6, 8, 10$.

7. You may compare the results obtained by the Gaussian elimination and the Cholesky decomposition with those obtained by QR decompositions. Please make pertinent comments on these methods.

8. What to turn in: you should write a short description (README file) of how to run the codes that you have written and email a tar ball of all the files to He Lyu at **lyuhe@msu.edu**. To make your email indicate that it is CMSE823 project, please put "**823 Homework**" in the subject line.

Due date: Thursday, March 12th, 2020. In class.