AMATH 352 Homework 2

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Due Friday, July 6

Even though this homework is due on July 6, homework 3 will be posted on July 4 and be due on July 11

Exercise 1

Use the pseudo-code on page 14 of the text to write your own version of regular Gaussian elimination in MATLAB . Run your code on the two matrices in `A.mat` and `B.mat`. To load these files, first put them in the same directory as the `.m` file and use the command `load('A.mat')` and `load('B.mat')`. In both cases, the variable `A` will automatically be defined to be the correct matrix. What do you notice? Please upload your code to the moodle page.

Exercise 2

Use your code in Exercise 1 to solve the system

$$Ax = \begin{bmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{bmatrix},$$

where A is the matrix in `A.mat`.

- Augment the matrix by adding on a column of ones $(A|\mathbf{1})$.
- Perform regular Gaussian elimnation to reduce the augmented matrix to upper triangular form $M = (U|b)$.
- Download `backsubs.m`, put it in your working directory, and use the command `backsubs(M)` on your augmented, triangular matrix M to return the solution.

The following exercises should be done by hand with all steps shown.

Exercise 3

Solve the system

$$Ax = \begin{bmatrix} -1 \\ 1 \end{bmatrix},$$

assuming

$$\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} A = \begin{bmatrix} 1 & 0 \\ -2 & 1 \end{bmatrix} \begin{bmatrix} 2 & 1 \\ 0 & 2 \end{bmatrix}.$$

Exercise 4

Olver & Shakiban - 1.4.19 - b & d — just find the factorizations.

Exercise 5

(a) Use Gauss-Jordan elimination to show that if

$$L = \begin{bmatrix} 1 & 0 & 0 \\ a & 1 & 0 \\ b & 0 & 1 \end{bmatrix}, \text{ then } L^{-1} = \begin{bmatrix} 1 & 0 & 0 \\ -a & 1 & 0 \\ -b & 0 & 1 \end{bmatrix}.$$

(b) Use Gauss-Jordan elimination to find M^{-1} when

$$M^1 = \begin{bmatrix} 1 & 0 & 0 \\ a & 1 & 0 \\ b & c & 1 \end{bmatrix}.$$

Note that

$$M^{-1} \neq \begin{bmatrix} 1 & 0 & 0 \\ -a & 1 & 0 \\ -b & -c & 1 \end{bmatrix}.$$

Exercise 6

Olver & Shakiban - 1.6.19–1.6.21 — No credit will be given without justification.

Exercise 7

Using Gaussian elimination compute

$$\det \begin{bmatrix} 1 & 2 & -2 & 5 \\ -3 & 1 & 0 & -5 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 2 & -2 \end{bmatrix}.$$

What relationship does this determinant share with that of

$$\begin{bmatrix} 1 & 2 \\ -3 & 1 \end{bmatrix} \text{ and } \begin{bmatrix} 1 & 3 \\ 2 & -2 \end{bmatrix}?$$