AMATH 352 Homework 3

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Due Wednesday, July 11

Exercise 1

Let

$$\mathbf{A} = \begin{bmatrix} -1 & 2 & 2 \\ 1 & -2 & 4 \\ 0 & 0 & 3 \end{bmatrix}.$$

Use the MATLAB commands

```
g = @(x) det(A - x*eye(3));
f = @(x) arrayfun(g,x);
```

This defines the function $f(x)$ to be equal to $\det(\mathbf{A} - x)$. The `arrayfun` command calls g on each element of the array x. Plot the function $f(x)$ for all x in $[-4, 4]$. What can you conclude about the invertiblity of the matrix $\mathbf{A} - x$ for each x in this interval? Please include a plot with your homework and upload your code.

Exercise 2

Consider the matrix $\mathbf{C} = 1/10 I_{40}$ (the 40×40 identity). If we want to solve

$$\mathbf{Cx} = \mathbf{b},$$

it is clear that $\mathbf{C}$ is non-singular and $\mathbf{x} = 10\mathbf{b}$. Compute the determinant of $\mathbf{C}$. Next load the matrix $\mathbf{A}$ in the file `singular.mat` in the same way we did in Homework 2. Now compute the determinant of $\mathbf{A}$. The matrix $\mathbf{A}$ is actually (to numerical accuracy) singular. What do you conclude about the utility of the determinant from a numerical standpoint for large matrices? Please upload your code.

The following exercises should be done by hand, showing all steps.

Exercise 3

Olver & Shakiban — 2.1.2 — note that x^c is x to the power c.

Exercise 4

Olver & Skakiban — 2.2.2: b,d,f,h,j — be sure to justify your answers.

Exercise 5

Olver & Shakiban— 2.2.10

Exercise 6

Olver & Shakiban— 2.2.11

Exercise 7

Olver & Shakiban— 2.3.2

Exercise 8

Olver & Shakiban— 2.3.7