Homework due. Wednesday 1/29/20 via upload to Canvas.

Reading material. Read sections A.1–A.2 from the appendix in the textbook. If you want to read ahead in the material, read A.3.1–A.3.2. (This material discusses some of the core computational skills that are used in practically all parts of linear algebra.)

Problems

1. Solve the following problems in the textbook:
   (a) Calculational exercise 5 in Chapter 4. ~~Calculational exercises 1, 5 in Chapter 4.~~[1]
   (b) Proof-writing exercises 3, 4 in Chapter 4. ~~Proof-writing exercises 1, 3, 4 in Chapter 4.~~[1]

2. Show two matrices A, B that have the property that $AB \neq BA$ (where AB, BA refer to matrix multiplication, described in the appendix). Thus matrix multiplication is not commutative, unlike the multiplication of real and complex numbers.

3. Show two matrices A, B that have the property that $AB = 0$ but both A and B are different from the zero matrix (that is, the zero matrix of the same respective width and height as A, B). This shows another way that matrix multiplication differs from number multiplication.

4. Given the three 2×2 matrices
$$A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}, \qquad B = \begin{pmatrix} p & q \\ r & s \end{pmatrix}, \qquad C = \begin{pmatrix} w & x \\ y & z \end{pmatrix}$$
perform the matrix multiplication ABC in the two possible orders in which it can be computed, that is:
$$M = (AB)C \quad \text{and} \quad N = A(BC).$$
to convince yourself through direct computation that $M = N$, i.e., associativity holds.

5. Define a 3×3 matrix M that depends on a parameter α by $M = \begin{pmatrix} \alpha & 0 & 3 \\ 3 & 1 & 5 \\ -1 & 0 & -2 \end{pmatrix}$.
   (a) For which value of α is the matrix $A = \begin{pmatrix} -2 & 0 & -3 \\ 1 & 1 & 4 \\ 1 & 0 & 1 \end{pmatrix}$ equal to the inverse matrix M^{-1} of M? (The inverse matrix is defined on page 140 in the textbook.)
   (b) Use the answer to (a) above to solve the linear system
$$\begin{cases} -2x & & - & 3z & = & 5 \\ x & + & y & + & 4z & = & 0 \\ x & & & + & z & = & -1 \end{cases}$$

[1] An earlier version of this assignment incorrectly included two of the problems you were assigned last week. Please ignore this. Sorry about the mistake.