Date: 2020-08-31

Announcements:

Test: Friday, September 11th, or moved to Monday 14th if still catching up.
Assignment: Sec 1.4 (1-4, 51-58)

0.0.1 Matrix Arithmetic

Theorem 1 (1.4.1 Properties of matrix arithmetic)**.** *Assuming that the sizes of the matrices are such that the indicated operations can be performed, the following rules of matrix arithmetic are valid.*

- $A + B = B + A$
- $A + (B + C) = (A + B) + C$
- $A(BC) = (AB)C$

$$A_{m\times n}B_{n\times r}C_{r\times w}$$

  "Operations must be valid"

- $A(B + C) = AB + AC$
- $(B + C)A = BA + CA$
- $A(B - C) = AB - AC$
- $(B - C)A = BA - CA$
- $a(A + B) = aA + aB$
- $a(A - B) = aA - aB$
- $(a + b)A = aA + bA$
- $(a - b)A = aA - bA$
- $a(bC) = (ab)C$
- $a(BC) = (aB)C = B(aC)$

How to Verify $a(A + B) = aA + aB$:

1. Must show that each side produces a matrix of the same size:
   let A be an $m \times n$ matrix.
   let B be an $m \times n$ matrix
   A+B is defined as an $m \times n$ matrix
   a(A+B) is defined and is an $m \times n$ matrix
   Let A be an $m \times n$ matrix. Let B be an $m \times n$ matrix
   aA is an $m \times n$ matrix.
   aB is an $m \times n$ matrix.
   $\boxed{aA + aB \text{ is defined and is an } m \times n \text{ matrix.}}$

2. Show that the corresponding entries of each side are equal:
   $a(A+B)$
   $(a(A+B))_{ij} = a(a_{ij} + b_{ij})$ {ALL SCALARS $\implies$
   $= aa_{ij} + ab_{ij}$
   $= a(A)_{ij} + a(B)_{ij}$
   $= aA + aB$

Example 1 (Theorem 1.4.1)**.** *Example to be done outside class. Prove 1.4.1 Theorems. 1.4.1c is the hardest.*

Same thing with 1.4.2

Inverse of a Matrix

Definition 1 (Inverse Matrix)**.** *If A is a square matrix, and if a matrix B of the same size can be found such that $AB = BA = I$, then A is said to be invertible (or nonsingular) and B is called the inverse of A. If no such B can be found, then A is said to be not invertible or singular.*