HOMEWORK ASSIGNMENT 1

Name: **Due:** Wednesday September 5

Problem 1: Strang 2.1 #9, page 42

Compute each $A\boldsymbol{x}$ by dot products of the rows with the column vector:

$$(a)\quad \begin{bmatrix} 1 & 2 & 4 \\ -2 & 3 & 1 \\ -4 & 1 & 2 \end{bmatrix} \begin{bmatrix} 2 \\ 2 \\ 3 \end{bmatrix} \qquad (b)\quad \begin{bmatrix} 2 & 1 & 0 & 0 \\ 1 & 2 & 1 & 0 \\ 0 & 1 & 2 & 1 \\ 0 & 0 & 1 & 2 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 1 \\ 2 \end{bmatrix}$$

Problem 2: Strang 2.1 #10, page 42

Compute each $A\boldsymbol{x}$ in Problem 1 as a combination of the columns:

$$9(a) \text{ becomes } \quad A\boldsymbol{x} = 2 \begin{bmatrix} 1 \\ -2 \\ -4 \end{bmatrix} + 2 \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix} + 3 \begin{bmatrix} 4 \\ 1 \\ 2 \end{bmatrix} = \begin{bmatrix} \quad \\ \quad \\ \quad \end{bmatrix}.$$

How many separate multiplications for $A\boldsymbol{x}$, when the matrix is "3 by 3"?

Problem 3: Strang 2.2 #3, page 53

What multiple of equation 1 should be *subtracted* from equation 2?

$$\begin{aligned} 2x - 4y &= 6, \\ -x + 5y &= 0. \end{aligned}$$

After this elimination step, solve the triangular system. If the right side changes to $(-6, 0)$, what is the new solution?

Problem 4: Strang 2.2 #6, page 54

Choose a coefficient b that makes this system singular. Then choose a right side g that makes it solvable. Find two solutions in that singular case.

$$\begin{aligned} 2x + by &= 16, \\ 4x + 8y &= g. \end{aligned}$$

Problem 5: Strang 2.2 #13, page 55

Apply elimination (circle the pivots) and back substitution to solve

$$\begin{aligned} 2x - 3y &= 3, \\ 4x - 5y + z &= 7, \\ 2x - y - 3z &= 5. \end{aligned}$$

List the three row operations: Substract ____ times row ____ from ____.

Problem 6: Strang 2.2 #19, page 56

Which number q makes this system singular and which right side t gives it infinitely many solutions? Find the solution that has $z = 1$.

$$\begin{aligned} x + 4y - 2z &= 1, \\ x + 7y - 6z &= 6, \\ 3y + qz &= t. \end{aligned}$$

Problem 7: Strang 2.4 #32, page 82

(*Very important*) Suppose you solve $A\boldsymbol{x} = b$ for three special right sides b:

$$A\boldsymbol{x}_1 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} \qquad A\boldsymbol{x}_2 = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \qquad A\boldsymbol{x}_3 = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}.$$

If the three solutions $\boldsymbol{x}_1, \boldsymbol{x}_2, \boldsymbol{x}_3$ are the columns of a matrix X, what is A times X?

Problem 8: Strang 2.5 #25, page 94

Find A^{-1} and B^{-1} (*if they exist*) by elimination on $[A \;\; I]$ and $[B \;\; I]$:

$$A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 1 & 1 & 2 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} 2 & -1 & -1 \\ -1 & 2 & -1 \\ -1 & -1 & 2 \end{bmatrix}$$

Problem 9:

Read Chapter 1 and Chapter 2 (Strang). Which concept was more confusing for you?