Math 425 Applied and Computational Linear Algebra Spring 2022

hw1 , PART A: **due on iLearn by 12:30pm on Thursday, February 10**

Please write the solutions.

1. Solve the system

$$\begin{array}{rcrcrcr} u & + & v & + & w & = & -2 \\ 3u & + & 3v & - & w & = & 6 \\ u & - & v & + & w & = & -1 \end{array}$$

2. Choose h and k such that the system below has (a) no solution, (b) a unique solution, and (c) many solutions. Give separate answers for each part.

$$\begin{array}{rcrcr} x_1 & + & 3x_2 & = & 2 \\ 3x_1 & + & hx_2 & = & k \end{array}$$

3. Consider the system of equations below.

$$\begin{array}{rcrcrcr} 4x_1 & + & x_2 & + & 3x_3 & = & 9 \\ x_1 & - & 7x_2 & - & 2x_3 & = & 12 \\ 8x_1 & + & 6x_2 & - & 5x_3 & = & 15 \end{array}$$

(a) Column-space view: Find the vectors $\mathbf{v}_1$, $\mathbf{v}_2$, $\mathbf{v}_3$ and write the system as a vector equation

$$x_1\mathbf{v_1} + x_2\mathbf{v}_2 + x_3\mathbf{v}_3 = \begin{bmatrix} 9 \\ 12 \\ 15 \end{bmatrix}.$$

(b) Row-space view: Find the vectors $\mathbf{w}_1$, $\mathbf{w}_2$, $\mathbf{w}_3$ and $\mathbf{x}$ such that the system is equivalent to

$$\begin{array}{rcr} \mathbf{w}_1 \cdot \mathbf{x} & = & 9 \\ \mathbf{w}_2 \cdot \mathbf{x} & = & 12 \\ \mathbf{w}_3 \cdot \mathbf{x} & = & 15 \end{array}$$

4. Determine if $\mathbf{b}$ is a linear combination of the vectors formed from the columns of the matrix A.

$$A = \begin{bmatrix} 1 & -2 & -6 \\ 0 & 3 & 6 \\ 1 & -2 & 5 \end{bmatrix}, \quad \mathbf{b} = \begin{bmatrix} 11 \\ -5 \\ 9 \end{bmatrix}$$

5. Let $f(z) = az + b$ where $z \in \mathbb{C}$. Find a and b if $f(z)$ translates z one unit up and one unit to the right, rotates the result by $\dfrac{\pi}{2}$ clockwise and scales the resulting complex number by 2.

PART B: **due on Gradescope by 12:30pm on Thursday, February 10**

Please remember you can submit your code several times before the deadline.

A few must-dos:

- Complete your code in the template **hw1.py**.
- **Do not** change the name of the template. You must submit it as **hw1.py**
- **Do not** change the name of the procedures `tuple_sum`, `inv_dict`, `myUnion`, `transform` or their inputs.

Complete the procedures `tuple_sum`, `inv_dict`, `myUnion`, and `transform`. The description of the inputs and outputs are provided in the template **hw1.py**.