**In-Lab Group Activity for Week 3**

**Spring 2022**

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**Topics: Vector Parametric form and Cramer's Rule**

**Problem 1.** A system of equations is written in matrix form and is then reduced to RREF. The result is that the **reduced** **augmented matrix** is:

**a.** Circle **all** the free variables:

**b.** Write the solution in **parametric vector form**. Express each basic variable in terms of free variables and constants selected from the *RAM*. Write each free variable as itself.

**c.** Factor out the free variables and write the solution as a **linear combination** of a particular solution and three independent homogeneous solutions.

**-1**

**-2**

**-2**

## 

**Particular Solution**

**🡨 Homogeneous Solutions    🡪**

**d.** Enter the coefficient matrix *A* and the vector in MATLAB.Then declare *A* to be symbolic to force exact solutions. >> A = sym(A); part = **linsolve**(A,b)

**i.** Note that **linsolve** only returns one solution.

**Yes**

Is this the same as your particular solution above?

**ii.** Next find a basis for the null space of *A* using: homog = null(A)

**Yes**

Do the two columns agree with the vectors you obtained above?

**e.** Is this vector a solution?

**Yes**

**Problem 2.** **Cramer 's Rule:** A student has five and ten-dollar bills in their wallet. Let the number of fives be and the number of tens be .

**a.** Write two linear equations, each in the form , that capture the information below.

***5x1 + 10x2 = 200***

***x1 + x2 = 30***

**Eqn. 1:** The wallet contains $200.

**Eqn. 2:** The total number of bills is 30.

**200**

**30**

**b.** Give the coefficient matrix          and the vector          for your system.

**c.** Find the solution using **MATLAB**. Provide your code and the answers. Use **linsolve**.

**10**

10

**20**

%% Problem 2c

clear, clc

A = [5, 10; 1, 1];

b = [200; 30];

x = linsolve(A, b)

**d.** Consider the linear system where and .

**5\*1-10\*1 = -5**

Verify the determinant of *A* is not zero:

**+ –**

Show your work for the determinant using the **two-arrow rule**.

**c.** Explicitly show each of the matrices obtained when the *i*th column of *A* is replaced by .

**d.** Give the **determinant** of each matrix using the **two-arrow rule**. Show both terms and then combine for the final result.

**5\*30-1\*200 = -50**

**200\*1-30\*10 = -100**

**e.** Find each unknown using Cramer's rulewhich states that .

Simplify and give each answer as an **integer**.

**-50/-5 = 10**

**-100/-5 = 20**

**Problem 3.** Solve the following system of equations using Cramer’s Rule:

**a.** Fill in the coefficient matrix and the vector

Next, we verify the determinant of *A* is not zero using the **six-arrow rule of Sarrus** for matrices. The trick is to copy the first two columns and place them to the right of the matrix. Work out the signed products along all six arrows and combine. Done for free!

**+ + + –  –  –**

**c.** Explicitly show each of the matrices obtained when the *i*th column of *A* is replaced by .

**d.** Give the **determinant** of each matrix using the six-arrow rule. Show all details including the column duplication. Trace in the six arrows lightly.

**First done for free!**

0 + (-6) + (-3)\*2\*(-7) – 5\*(-3) – (-7) – 0 = **58**

0 + 5 + (-6)\*2\*(-4) – 0 – (-4)\*5 – (-7)\*2 = **87**

**e.** Find each unknown using Cramer's rulewhich states that .

Simplify and give each answer as an **integer**.

**87/29=3**

**29/29 = 1**

**58/29=2**

**f.** Check your work by verifying where is the solution you just found in vector form.

= = b