Adamson University
College of Engineering
Computer Engineering Department

Linear Algebra

Laboratory Activity No. 8

System of Linear Equation

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I.   Objectives

This laboratory activity aims to teach the student to be familiar with the system of linear equations, as well as to be able to solve it using various linear algebra techniques with the use of Python programming.

II.   Methods

In this laboratory activity numpy or np and matplotlib was used in order for the codes to function correctly. In this activity it also shows what the students have learned during their high school and senior high mathematics lessons, where a problem is given and they have to solve them with an equation the problem is that many students often times forget the equation needed In order to solve the give problem, but with this set of codes and knowledge, it will be easier, thinking of this as a digitalized way of answering math problems.

Mrs. Elenie hired 3 person to paint her house for 3 days. Paolo was able to paint for 6 hours, while mark was able to paint for 4 hours and Jasmine was able to paint for 2 hours, they were given a total of 1,250 pesos for painting. The next day Paolo was able to paint for 4 hours, while mark was able to paint for 8 hours and jasmine for 3 hours. They were given a total of 1,050 pesos for painting. For the last day of work Paolo was able to paint for 5 hours, while Mark was able to work for 4 hours and Jasmine was able to work for 7 hours and they were given a total of 1,570 pesos for their labor and hardwork. how much were they paid for each of them?

$$\begin{bmatrix} 6 & 4 & 5 \\ 4 & 8 & 4 \\ 2 & 3 & 7 \end{bmatrix} \cdot \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} 1,250 \\ 1,050 \\ 1,570 \end{bmatrix}$$

The following formula will help solve the question on how much does each of them are getting paid

Figure 1: Given problem

As for figure number 1, it shows the problem given by the program to fulfill the given activity, it somehow has a similar way like the example given by the professor. The programmer remembered not being able to solve this kind of problem during his high school days. Given the situation, it is great to solve the same problem but with a different approach.

```python
workers = np.array([        ##These are the number of hour Paolo, Mark, and Jasmine painted
    [6,4,2],
    [4,8,3],
    [5,4,7]
])

total = np.array([          ##Total amount they were given to them as a whole
    [1250],
    [1050],
    [1570]
])
```

```python
Payment = np.linalg.inv(workers) @ total
print('The price Paolo was able to earn is: PHP{:.2f}'.format(float(Payment[0])))
print('The price Mark was able to earn is: PHP {:.2f}'.format(float(Payment[1])))
print('The price Jasmine was able to earn is: PHP {:.2f}'.format(float(Payment[2])))
```

Figure 2: codes used for the 1st task

Similar to the previous activity, this task also uses different matrix and assigning the function on the "Payment" and using the code np.linalg.inv and the @ sign to multiply the given vectors.

```
##using np.linalg.solve()
workers = np.array([[6,4,2],[4,8,3],[5,4,7]])
total = np.array([1250,1050,1570])
Payment = np.linalg.solve(workers,total)

print(Payment)
```

Figure 3: Using the alternative

As seen on the figure 3, a different version was used which is the np.linalg.solve() which works the same as an alternative, the results were the same. The way the codes are written are somehow different but it is the same it is way simple

III. Results

```
The price Paolo was able to earn is: PHP169.02
The price Mark was able to earn is: PHP 10.06
The price Jasmine was able to earn is: PHP 97.80
```

Figure 4: Results for the inverse

As seen from figure 4, these are the results from the program of np.linalg.inv.

```
[169.02439024  10.06097561  97.80487805]
```

Figure 5: Results of solve

Upon figure 5, np.linalg.solve() there is a small difference in using the inverse and the solve, in using the solve the answers are specific whereas as seen from the figure above there are a lot of decimal numbers from the answer but it is still the same in using the inverse.

IV. Conclusion

Having the system of linear equations and being able to solve complex mathematical equations is a huge help especially to the programmers, solving and wasting countless numbers of hours for just one number can now be done in an instant. When it comes to the application in robotics, since we are also using matrix here, these can plot the movements of the robots, as well as solving mathematical equations when given. This can also be used for camera matrix which can be used for the vision of the robots. There are a lot of applications of linear equations for robotics.

Github Repository:

https://github.com/ReyesCarl/LinAlg-Lab8

References

[1] D.J.D. Lopez. "Adamson University Computer Engineering Department Honor Code," AdU-CpE Departmental Policies, 2020.