System of Lnear Equation

submitted by:

Aquiro, Freddielyn E.

Canoza, Cherrylyn

Joaquin, Christopher Marc

Requirements:

1. Provide one (1) system of linear equations WORD problem and provide the source (i.e., book, website, online course, etc.): Make sure that the variables should be three (3), and a minimum of three (3) equations.
2. Represent a system of linear equations in the following ways: Standard bracketed form Linear Combination form (Matrix) Vector Visualization
3. A programmed algorithm for solving the problem.

Word Problem

Axel bought 1 book, 2 color pencils, 4 sharpie pens total of 2,840 php, Jack 3 books 2 prism color pencils , 7 sharpie pens total of 4,370 and Leslie bought 4 books , 1 prism color pencils and 12 sharpie pens total of 4,620 at National Bookstor. Since they spent their money on each item, Axel and his friends wants to know how much is the price of each item.

Standard Bracketed Form

$Let:$
$a = book\ , b = prism\ color\ pencil\ , c = sharpie\ pens$

$$Axel = \{\, a + 2b + 4c = 2840$$

$$Jack = \{\, 3a + 2b + 7c = 4370$$

$$Leslie = \{\, 4a + y + 12c = 4620$$

Linear Combination Form (Matrix) .

$$\begin{bmatrix} 1 & 2 & 4 \\ 3 & 2 & 7 \\ 4 & 1 & 12 \end{bmatrix} \cdot \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} 2840 \\ 4370 \\ 4620 \end{bmatrix}$$

Visualization of Vectors

```
1 import numpy as np
2 import matplotlib.pyplot as plt
3 %matplotlib inline
```

```python
1 A = np.array([
2             [1,2,4],
3             [3,2,7],
4             [4,1,12]
5             ])
6 fig = plt.figure()
7 ax = fig.gca(projection='3d')
8 ax.set_xlim([0,10])
9 ax.set_ylim([0,10])
10 ax.set_zlim([0, 10])
11
12 ax.quiver(0, 0, 0, A[0,0], A[0,1], A[0,2], arrow_length_ratio=0.10, colors='green')
13 ax.quiver(0, 0, 0, A[1,0], A[1,1], A[1,2], arrow_length_ratio=0.10, colors='orange')
14 ax.quiver(0, 0, 0, A[2,0], A[2,1], A[2,2], arrow_length_ratio=0.10, colors='pink')
15 plt.title("3d plot.")
```

Text(0.5, 0.92, '3d plot.')
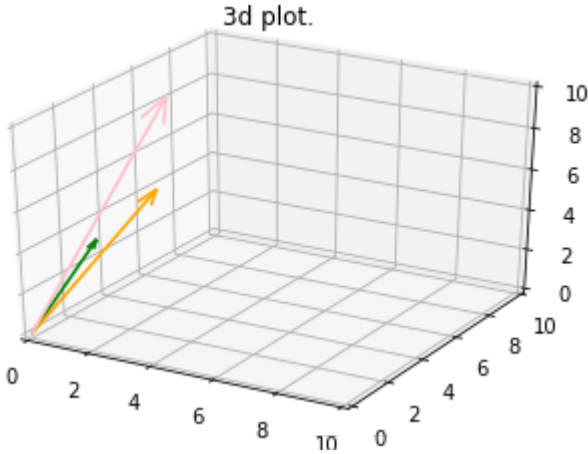

```python
1 ax= np.array([1,2,4])
2 jk= np.array([3,2,7])
3 ls = np.array([4,1,12])
4 ts = np.array([2840,4370,4620])
5
6 plt.figure(figsize=(10,5))
7 plt.title('Axel & Friends Expenses', fontdict={'fontsize':20}, color= 'Black')
8
9 plt.plot(ts, ax, color = 'red')
10 plt.plot(ts, jk, color = 'green')
11 plt.plot(ts, ls, color = 'blue')
12 plt.xlabel('Number of each item', fontdict={'fontsize':15}, color='green')
13 plt.ylabel('Total number of expenses', fontdict={'fontsize':15},  color='blue')
14
15 plt.grid(color = 'black')
16 plt.show()
```
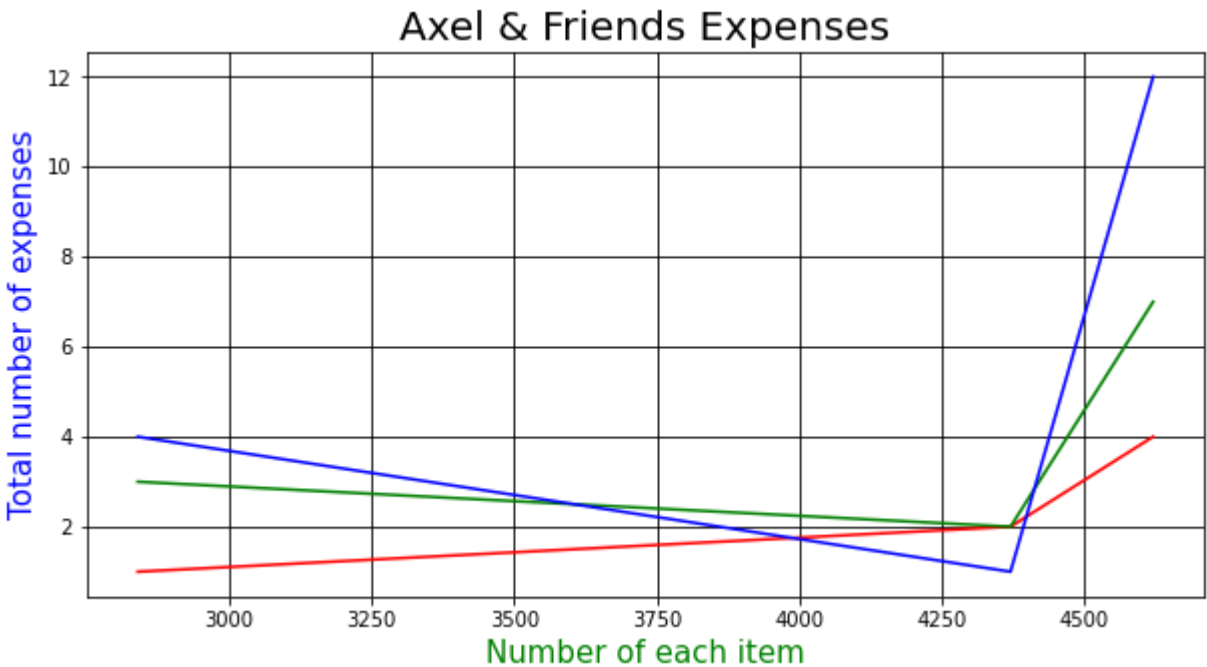
Solving the System of Linear System

```
1 qty = np.array([
2                 [1,2,4],
3                 [3,2,7],
4                 [4,1,12]
5                 ])
6 total_spent = np.array([
7                          [2840],
8                          [4370],
9                          [4620]
10                         ])
11 X = np.linalg.solve(qty, total_spent)
12 print (X)
```

```
    [[600.]
     [900.]
     [110.]]
```

```
1 qty = np.array([
2                 [1,2,4],
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6 total_spent = np.array([
7                          [2840],
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9                          [4620]
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11 X = np.linalg.solve(qty, total_spent)
12 print (X)
```

```
    [[600.]
     [900.]
     [110.]]
```

```
1 prices = np.linalg.inv(qty) @ total_spent
2 print(' the price of each book is: PHP {:2f}'.format(float(prices[0])))
3 print(' the price of each prism color pencil is: PHP {:2f}'.format(float(prices[1])))
4 print(' the price of each sharpie pens is: PHP {:2f}'.format(float(prices[2])))
```

```
    the price of each book is: PHP 600.000000
    the price of each prism color pencil is: PHP 900.000000
    the price of each sharpie pens is: PHP 110.000000
```

therefore the values of a = 600 , b = 900, c = 110 .