



Linear Algebra

Laboratory Activity No. 5

Multidimensional Vectors

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I. Objectives

This laboratory activity aims to understand and visualize different plots with different dimension like 2D or 3D, it also requires analyzation of the whole data and codes for this activity.

II. Methods

This laboratory activity used the concept of using vectors and linear combination in order to create a multidimensional shapes and figures which requires the library of numpy and matplotlib to visualize the plot. The expected output of this laboratory is to plot a figure that has dimension depending on the linear combination or array combination that is encoded and those codes that are necessary for it to show the output.

III. Results

Creating a 2-Dimensional plot of a linear combination is just easy like a making a graph of it with a given vector. The whole coding process requires the use of array in manipulating the linear combination that was given, this some kind of matrix representation for the linear combination that will be inputted as an array is going to be the basis of the graph. Using the array function of the numpy, the linear combination can now be inputted and then the function of plotting will follow. The matplotlib library gives visualization to the plot that is why the x and y limits should be declared depending on what you desired it to be the start and the end of your x and y for the graph. The quiver function here allows to define the line or arrow it will be created that is why angles and scales are being declared. Adding more definition to the graph, adding grid will make it more specific and the show function to print the final output of the graph that is now a plot of a linear combination.

$$V = 12x + 10y$$

$$V = \begin{bmatrix} 12 \\ 10 \end{bmatrix}$$

Figure 1 Task 1 Equation

```
In [5]: vector = np.array([
        [12,10]
    ])

    plt.xlim(0,15)
    plt.ylim(0,15)
    plt.quiver([0,0],[0,0], vector[:,0], vector[:,1],
               angles='xy', scale_units='xy',scale=1,
               color=['purple'])
    plt.grid(color = 'red')
    plt.show()
```

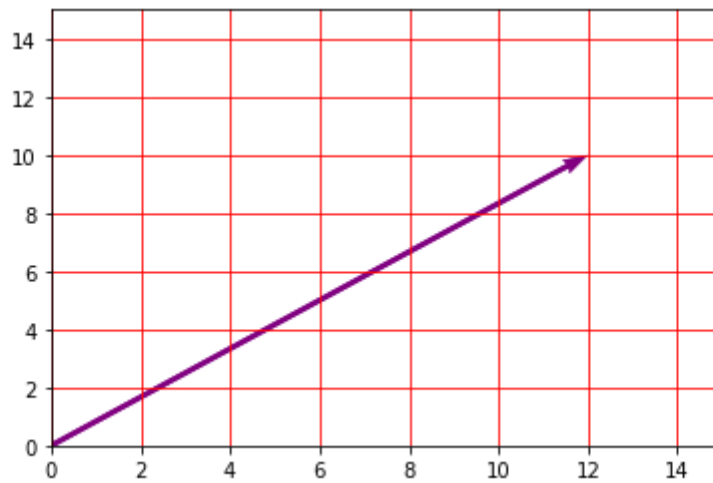


Figure 2 Task 1

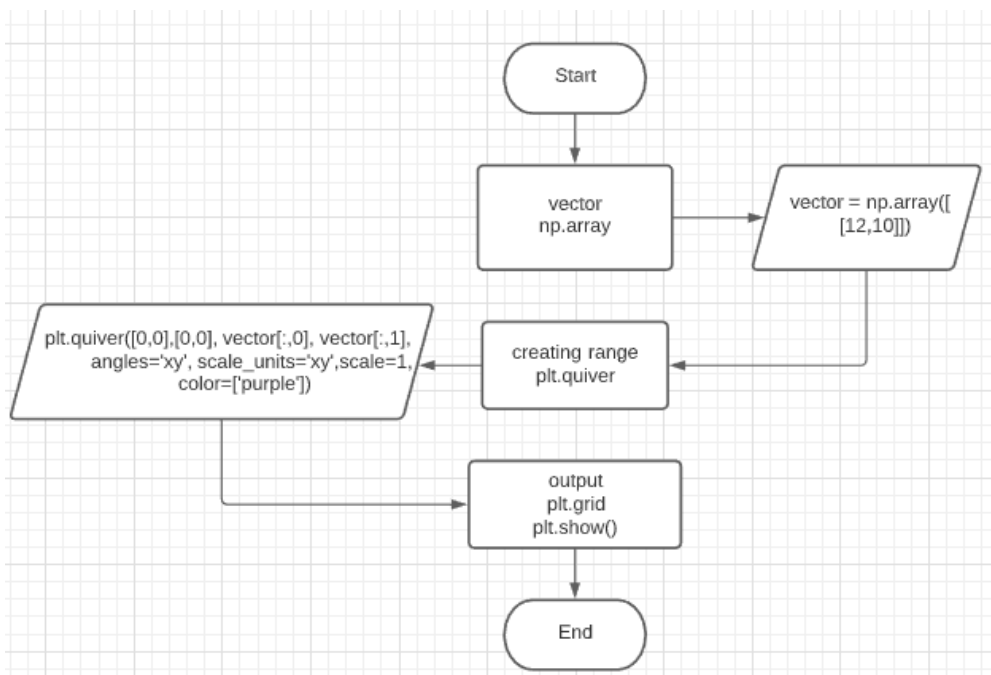


Figure 3 Task 1 Flowchart

Here in task 2, two linear combination are supposed to be plotted and so its term as a linear polynomial would be recommended as equal to each other. Using the array function of numpy again, the value of the linear combination will be inputted there and since it is two now, there should be two list of arrays inside. Creating three-dimensional graph needs a function that will declare the projection of being 3D then input the range function for the range and again, the desired limits of the x and y of the graph. Creating for loop will make the graph maintain its plot and shape then the methods will be done inside whereas the equation of the vectors are being declared and done. The final output is ready using the show function and the final plot for the linear combination will now appear.

$$X = \begin{bmatrix} -3 \\ 5 \end{bmatrix}, Y = \begin{bmatrix} -6 \\ 2 \end{bmatrix}$$

Figure 4 Task 2 Equation

```
In [3]: vector = np.array([
        [6,8,2],
        [7,4,5],
    ])
fig = plt.figure()
ax1 = fig.gca(projection='3d')

c = np.arange(0,2)

ax1.set_xlim([0, 15])
ax1.set_ylim([0, 15])

colors = ['green', 'red']
for i in range(vector.shape[0]):
    ax1.plot(c*vector[i,0],c*vector[i,1],c*vector[i,2], color=colors[i])
plt.show()
```

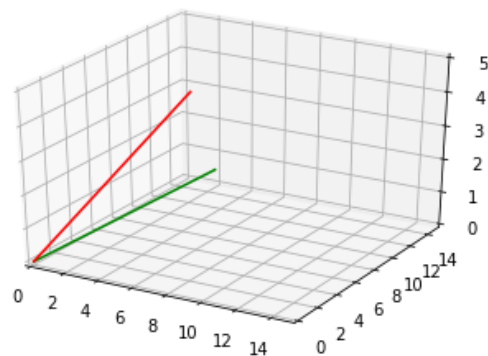


Figure 5 Task 2

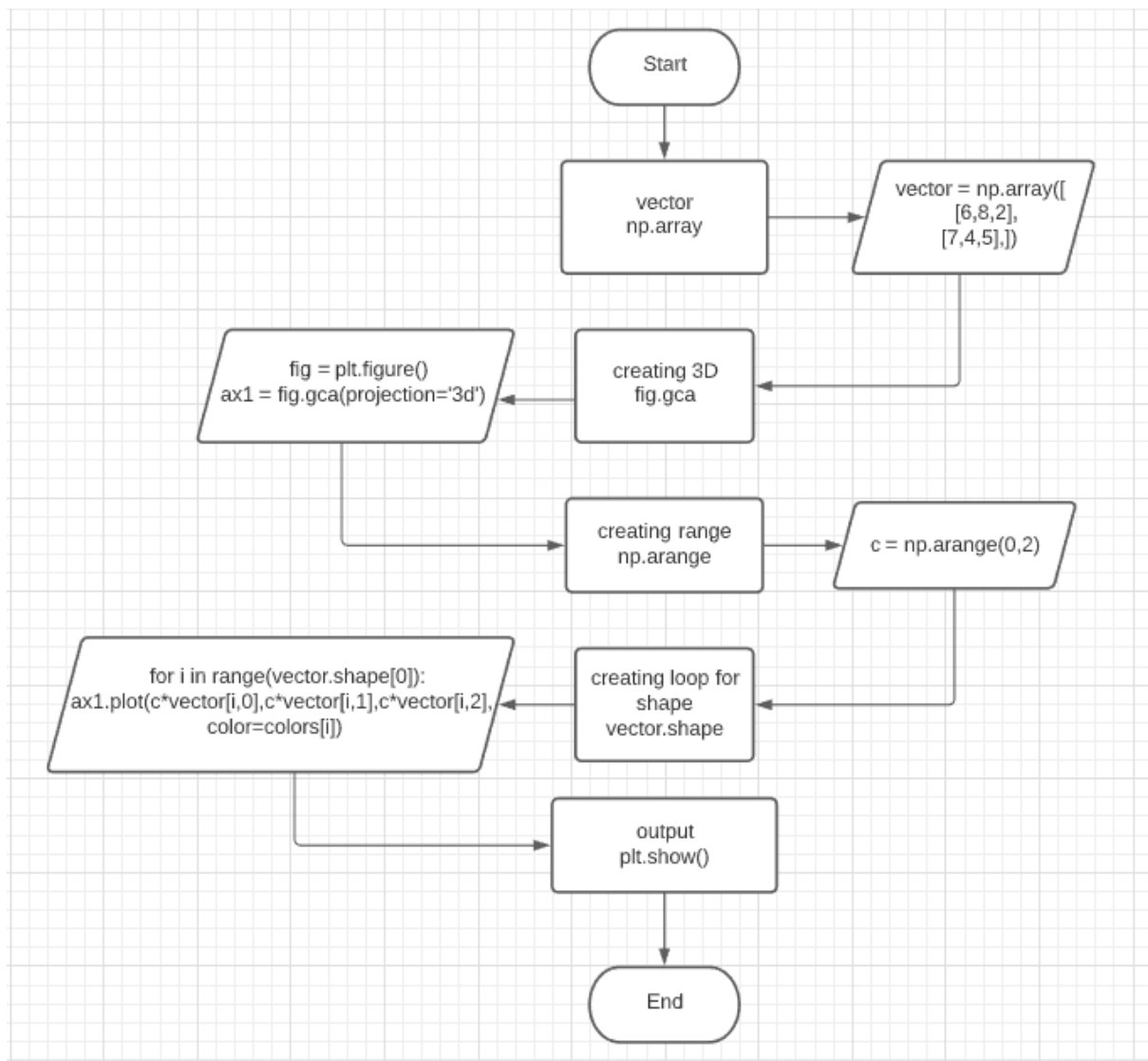


Figure 6 Task 2 Flowchart

Discussion Questions

1. What other types of data can be plotted in the 2-D or 3-D plane?

There are different types of data actually in creating different dimensional figures or shape and it is always with the proper manipulation of numbers combined with codes. Other than scatter plots, the polar area diagrams, time series diagrams, timelines and line graphs can be used as representation of plane [2]. These data visualizations are easily be achieved with different libraries of python that is why synchronization of number and codes will be helpful in order to visualize new 2D or 3D using other type of concept.

2. Is it possible for data to have more than 3 dimensions? If no, why not? If so how can they be visualized? Justify your answer.

Plotting three-dimensional figures can be complicated since you have to think of a combination of array that will give an exact shape as what is being visualized. It is no limit with the idea of plotting three or more dimension when you know how to manipulate codes using libraries in function that is why python have different libraries that can be used to access different concepts like creating graphs and plots. There are huge possibility in creating multidimensional figures in coding but it needs a whole lot of understanding, analysis and creative using of codes to access the desired output of plot.

IV. Conclusion

The summation of the idea and concept that can be absorbed using this laboratory activity is that linear combinations in a form of vectors or vectors as it is can form a plot or graph with different dimensions. These can be done by manipulations and analyzing the codes, creating functions from python libraries and other necessary information for the graph in order to print out the desired output and to see what figure it will project. As for the application of this concept in the business world, it is a good representation for visualization of data for most especially for picturing trends that are so necessary to the business. This idea could create line and bar graph that is useful to understand data for such like demands and needs that is very a business-type idea and so, this can be a good application for having innovative analyzing of their data in order to visualize the effects of such things that could affect a business.

References

- [1] D.J.D. Lopez. "Adamson University Computer Engineering Department Honor Code," AdU-CpE Departmental Policies, 2020.
- [2] What is Data Visualization? Definitions, Graph Types and How to Use Them. (n.d.). Retrieved December 09, 2020, from <https://www.klipfolio.com/resources/articles/what-is-data-visualization>

Code Link

https://github.com/cherrylyncanoza/Linear-Algebra/tree/main/LinAlg_Lab5