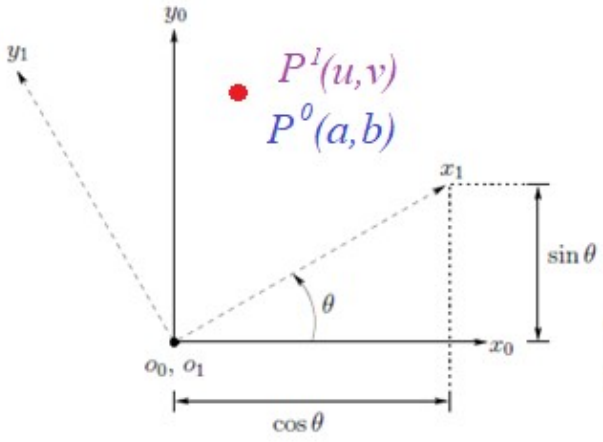
Quiz #1 – 60 minutes. *Ok to copy partial code from your HW.*



$$\begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} u \\ v \end{bmatrix}$$

The Cartesian coordinates of a point P in the coordinate frames [0] and [1] can be converted as given above.

Write a Python program to

(1) Read from the file "data1.txt" of the coordinates of points defined in the coordinate frame **[1]** and stores them in a "N x 2" array. **(20%)**

(2) Read from the console of an rotation angle θ (in degrees). Let's use 25^o in this quiz.

(3) Create a function that takes an angle (in degrees) and the "N x 2" coordinates array (step 1) as input arguments, and returns the converted coordinates in frame **[0]** in another "N x 2" array. **(40%)**

(4) Create a NumPy array for the returned frame [0] coordinates array (still "N x 2").

(5) Write the coordinates of points in step (4) to a CSV file "frame0.csv" in which we use (a) one point per line, (b) 3 digits after decimal point for float numbers. A sample is given in Fig. 1. **(20%)**

(6) import mapplotlib.pyplot as plt

(7) Use plt.plot and plt.bar functions to draw these points in coordinate frame **[0]**. The plot should look like Fig. 2 in the next page. **(20%)**

(8) Execution and plot are shown for your reference.

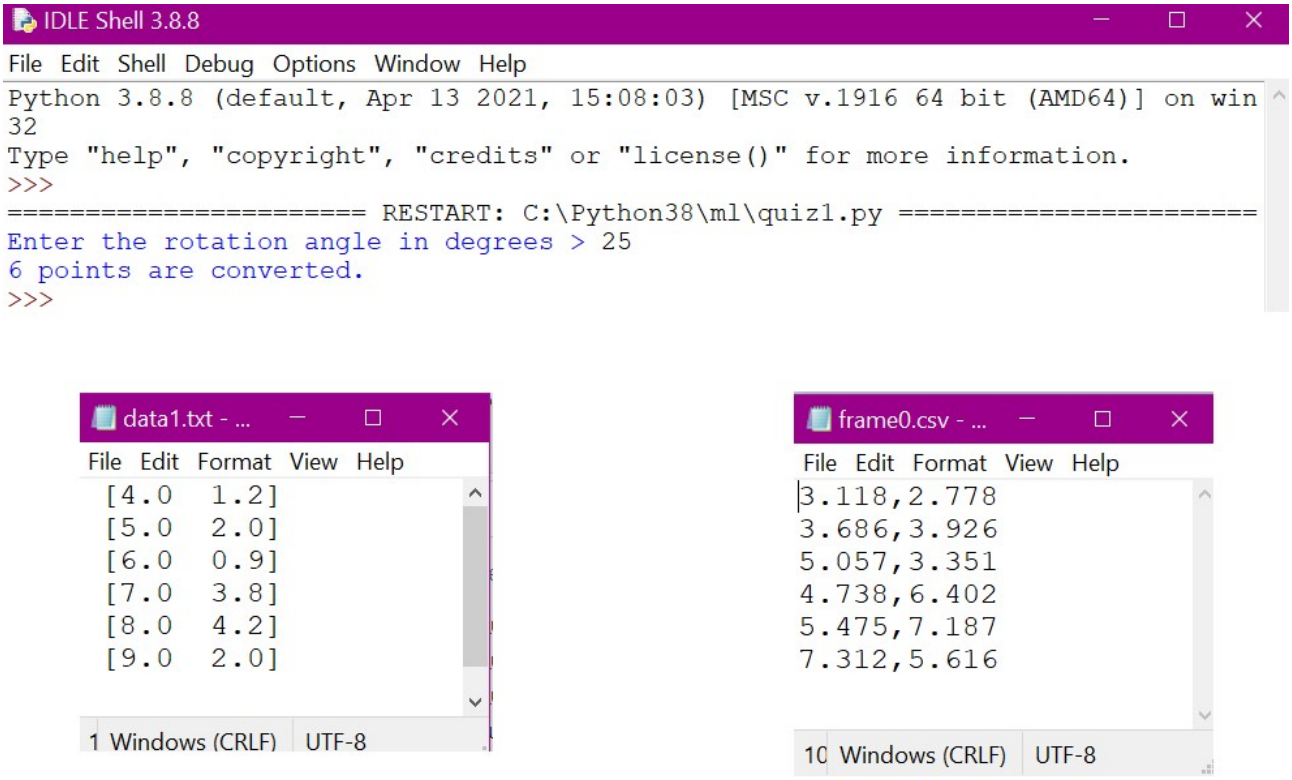

IDLE Shell 3.8.8
File Edit Shell Debug Options Window Help
Python 3.8.8 (default, Apr 13 2021, 15:08:03) [MSC v.1916 64 bit (AMD64)] on win
32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
========== RESTART: C:\Python38\ml\quiz1.py ==========
Enter the rotation angle in degrees > 25
6 points are converted.
>>>
data1.txt - ...
File Edit Format View Help
[4.0 1.2]
[5.0 2.0]
[6.0 0.9]
[7.0 3.8]
[8.0 4.2]
[9.0 2.0]
1 Windows (CRLF) UTF-8
frame0.csv - ...
File Edit Format View Help
3.118,2.778
3.686,3.926
5.057,3.351
4.738,6.402
5.475,7.187
7.312,5.616
10 Windows (CRLF) UTF-8

Fig.1

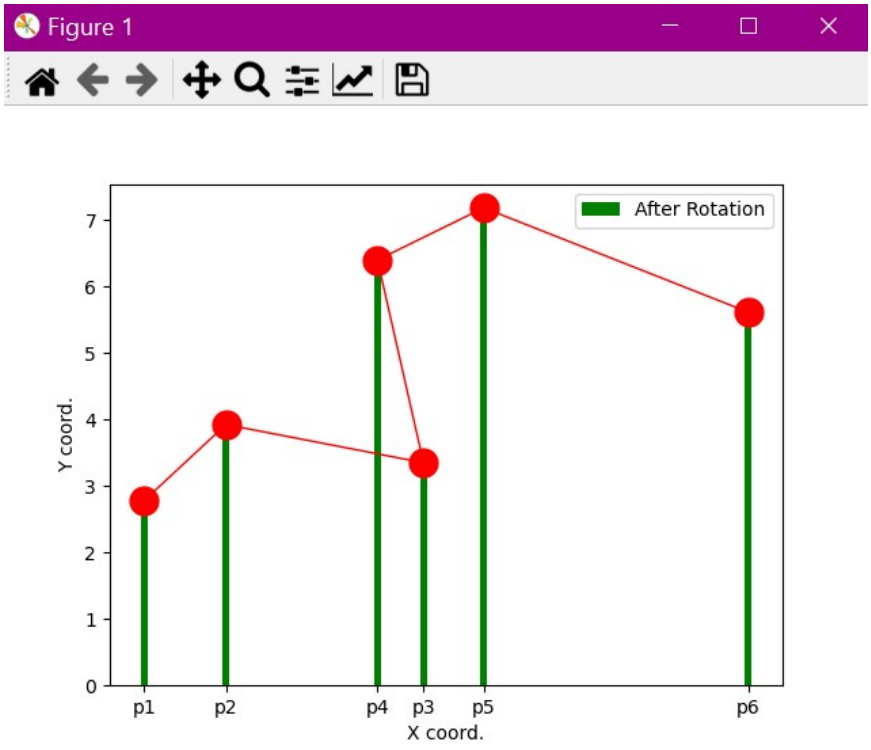


Figure 1
After Rotation
Y coord.
X coord.
0
1
2
3
4
5
6
7
p1
p2
p4
p3
p5
p6

Fig.2