Assignment 2 : CS215

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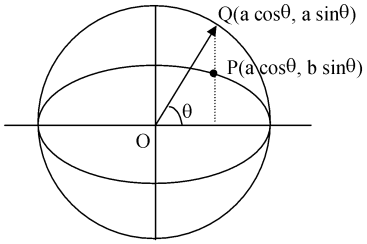
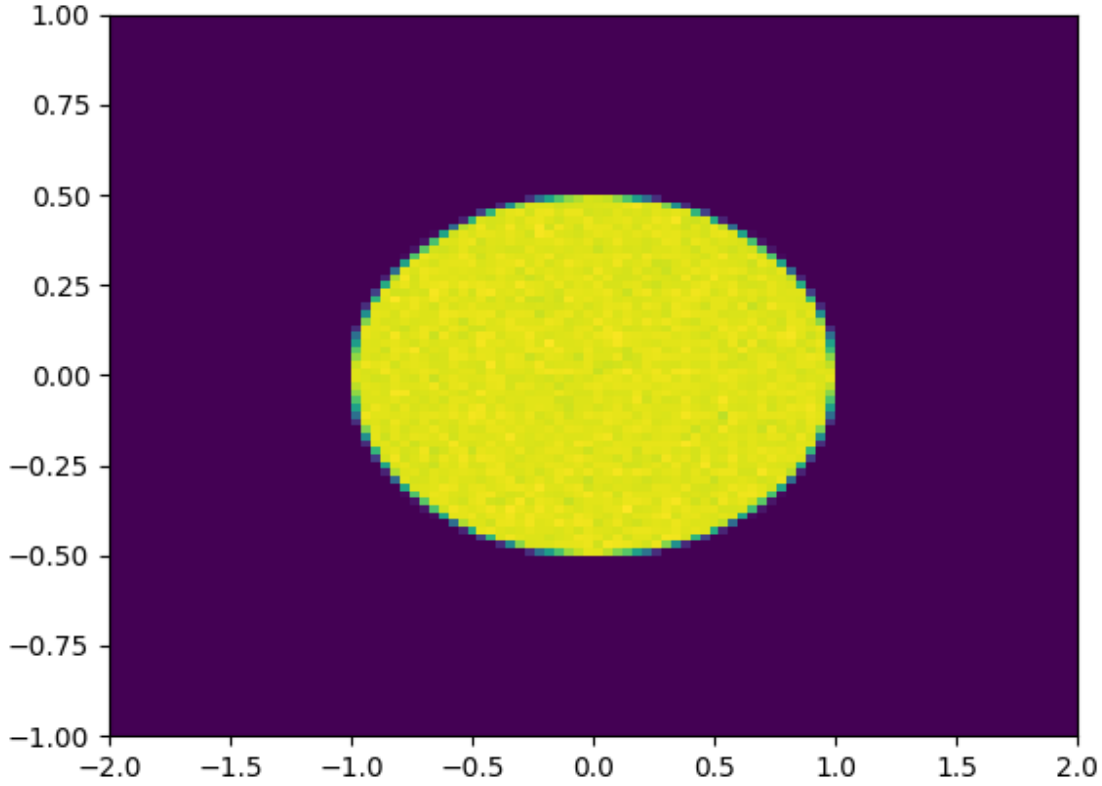
Question 1

**Instructions to run the code are given at the end**

**Question 1.1:**

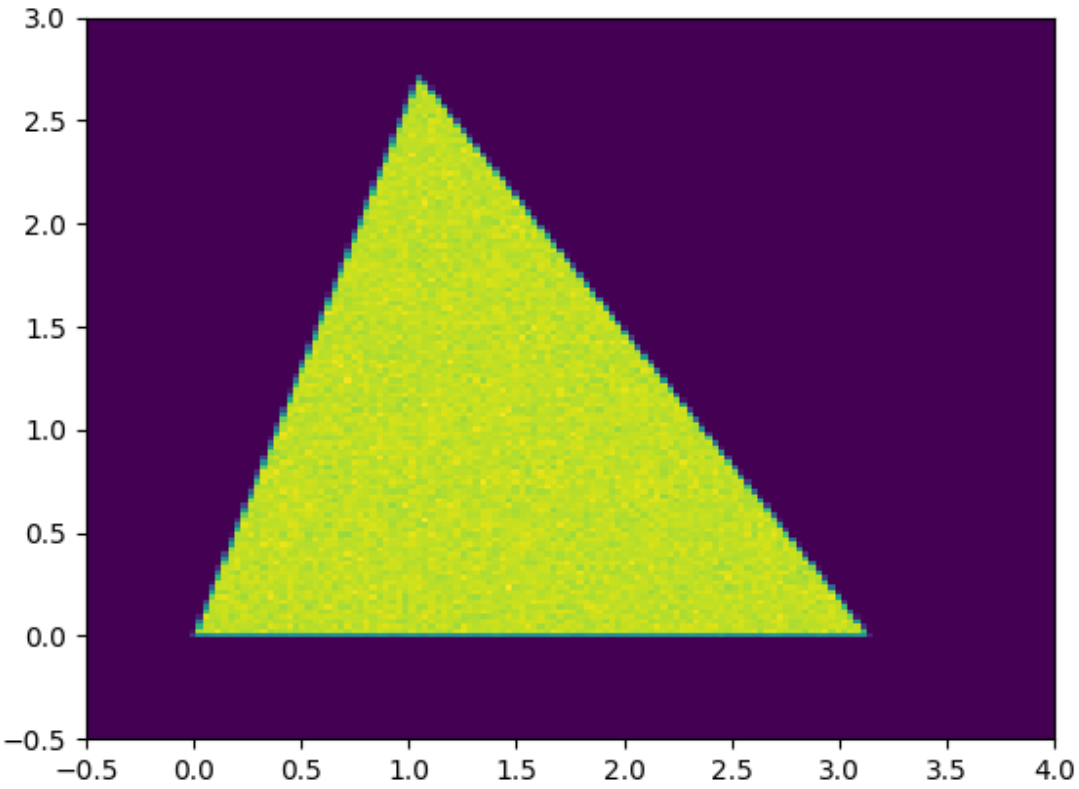
- Question is to propose an implementable algorithm for generating random points (in 2D) distributed uniformly inside the ellipse.
- Consider an ellipse, within a 2D Euclidean plane, with center at the origin, and with major and minor axes of lengths a and b along the cardinal axes.
- So first consider generating the angle,by generating a random number.
- Then made conditions to split θ values into 4 quadrants.
- Then x,y coordinates of the point on the ellipse are (acosθ,bsinθ). By generating random theta we can cover the perimeter of the ellipse.
- For entering the interior of an ellipse we need to multiply with a random number in [0,1] so that it comes into the ellipse.
- And storing all of them into an array.
- Finally plotting the histogram of points using the two coordinates in two arrays and **it may take a while for generating the picture as the number of points to be plotted is large.**



**Question 1.3:**

- Question is to propose an implementable algorithm for generating random points (in 2D) distributed uniformly inside the triangle.
- Consider a triangle in a 2D Euclidean plane with vertices at pt1,pt2,pt3.
- Now as to generate points inside the triangle
    - Creating points inside the triangle so the coordinates must be related to the the vertex coordinates.
    - Take a weighted mean of the 3 x-coordinates of the vertices (do similar with the y-coordinates) where those weights are determined randomly summing to 1.(Using two random values determine a relation between the weights)
    - Sort those 2 sets of coordinates into arrays.
    - Plot the histogram.



**Instructions to run the code are as follows**

Please move to the Q1 directory and

- Run **python3 ./code/q1a.py** for generating the random points inside the ellipse , the plot is plotted and saved to results directory as **q1a.png.** Plotting the ellipse in this case takes time as we are plotting for large numbers
- Run **python3 ./code/q1b.py** for generating the random points inside the ellipse, the plot is plotted and saved to the results directory as **q1b.png**