ENES104Y

This assignment uses many of the techniques that we discussed in the two MATLAB lectures. You may use any MATLAB reference (e.g. online) that you can find, and the lecture notes and the MATLAB script the rotates a rectangle. You should modify the script to implement the problem steps given below.

1) Generate a triangle. When we entered the rectangle, we entered a very simple rectangle. For this problem, generate a triangle at a grid of points that are finely spaced in the x dimension. The triangle is defined as follows:

$$\begin{aligned}&\text{triangle:}\\&\quad\text{Side 1: } y=0 \text{ for } x=0 \text{ to } 2.\\&\quad\text{Side 2: } x=0 \text{ for } y=0 \text{ to } 1.\\&\quad\text{Side 3 (hypotenuese): } y=1-0.5x \text{ for } x=0 \text{ to } 2.\end{aligned} \tag{1.1}$$

Alternatively, we can define the triangle as

$$\begin{aligned}&\text{triangle:}\\&\quad\text{Side 1: } y=0 \text{ for } x=0 \text{ to } 2.\\&\quad\text{Side 2: } x=0 \text{ for } y=0 \text{ to } 1.\\&\quad\text{Side 3 (hypotenuese): } x=2-2y \text{ for } y=0 \text{ to } 1.\end{aligned} \tag{1.2}$$

You will need both definitions.

MATLAB part I:

I.1 Generate a $1\times n$ array **x** containing the values of 0 to 2 in steps of 0.1. Then, using (1.1), generate the corresponding array **y**. This gives you the hypotenuse. Using the definition of the rectangle in the m-file provided as a guide, create a $2\times(n+2)$ array **Triangle** that contains the points necessary to plot the triangle, with the *x*-coordinates in the first row and the *y*-coordinates in the second row.

I.2 Plot your triangle to show that you have defined things correctly

I.3 Compute the *centroid* in the *x*-dimension using the equation

$$x_c=\frac{\sum_{k=1}^{n}x_k y_k}{\sum_{k=1}^{n}x_k} \tag{1.3}$$

MATLAB part II

II.1 Generate an array **y** containing the values of 0 to 1 in steps of 0.05. Then, using (1.2), generate the corresponding array **x**. This gives you the hypotenuse. Using the definition of the rectangle in the m-file provided as a guide, create a $1\times(n+2)$ array **Triangle** that contains the points necessary to plot the triangle, with the *x*-coordinates in the first row and the *y*-coordinates in the second row.

II.2 Plot your triangle to show that you have defined things correctly and show that the triangle overlaps the triangle given in part II.

II.3 Compute the *centroid* in the *y*-dimension using the equation

$$y_c = \frac{\sum_{k=1}^{n} x_k y_k}{\sum_{k=1}^{n} y_k} \tag{1.4}$$

MATLAB part III

III.1 Using the triangle generated in either of the previous sections, rotate the triangle around a full circle. You may use the m-file provided as a guide. At each step of the rotation, plot the resultant triangle, as is done in the m-file.

III.2 Offset every point in the triangle by the coordinates (x_c, y_c). This value is fixed for every rotation angle, do not have the triangle "walk" in the manner implemented in the m-file. Then rotate the offset triangle in the same manner as III.1. Is the rotated triangle the same or different as the triangle in III.2. If different, what is the difference.

What to turn in?

1) Turn in your MATLAB m-file, a script that implements part I, part II and part III of the assignment. The name of your MATLAB script should be "<Initials>_F12_ENES104Y.m", where "initials" are your initials. DO NOT include the delimiters "<" and ">" in your file name.
2) E-mail your MATLAB m-file to chuck.laberge@umbc.edu and to rheingan@umbc.edu by 6 PM on November 2. The subject of the e-mail should be "<Initials>_F12_ENES101Y". DO NOT include the delimiters "<" and ">" in your subject line.
3) TEST your routine before you hand it in.
4) Cooperation is permitted in discussing the assignment, but you MUST develop your own code. I will be checking the submitted code VERY carefully to see that you have implemented your MATLAB by yourself. I have ways to detect plagiarism, as four members of the S12 ENES101 can verify.

Hints:

A) Use the m-file as a guide.
B) Remember that MATLAB likes vector operations, and the operations we defined in class.
C) You may ask me for clarification through Wednesday, via e-mail at chuck.laberge@umbc.edu.