INFO371 Lab2

Your name:

Deadline: Wed, Jan 17, 11:59pm

Introduction

Please submit the completed lab by end of the day. You should submit a) your code (notebooks, rmd, whatever) and b) the lab in a final output form (html or pdf).

Note: you may want to do some of it on paper instead of computer. You are welcome to do it but please include the result as an image into your final file.

Working together is fun and useful but you have to submit your own work. Discussing the solutions and problems with your classmates is all right but do not copy-paste their solution! Please list all your collaborators below:

1.

2. ...

2D Transformation Matrices

In the class we introduced the rotation matrix

$$\mathsf{R}(\alpha) = \begin{pmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{pmatrix}$$

The matrix rotates an object matrix *clockwise* by angle α if you post-multiply the object matrix by it:

$$\mathsf{A}^{\alpha} = \mathsf{A} \times \mathsf{R}(\alpha)$$

where A is a $n \times 2$ matrix of x and y coordinates. For instance

$$\mathsf{A} = \begin{pmatrix} 0 & 0 \\ 0 & 1 \\ 0.5 & 0.5 \end{pmatrix}$$

will give the flipped-1 we used in the class.

Problem 1:

Your task is to play with this and other similar transformation matrices and show how the alter the image.

1. Use the example matrix A and plot it's image using a few different transformations: a) $+45°$, b) $-225°$, c) a rotation of your own choice.

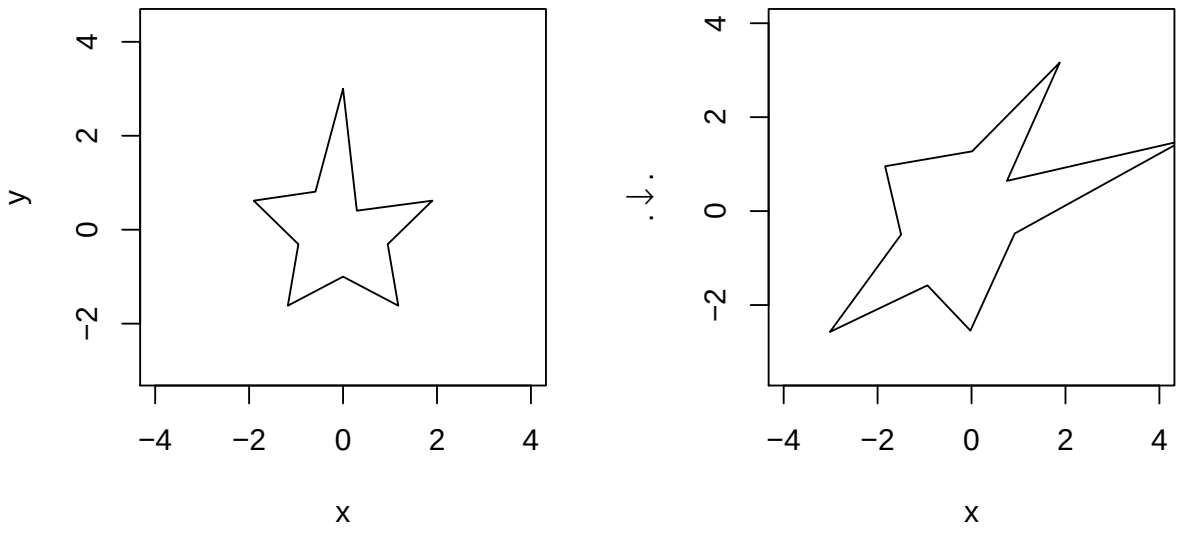
2. Create a new simple object of your choice. The object should be asymmetric. Print this matrix.

3. Show the object (rotation 0) and a few rotated images of that object.

4. Construct the "flip-x" matrix $\mathsf{F}^{\mathtt{x}}$. This matrix should mirror (flip) the $\mathtt{x}$ components but leave the $\mathtt{y}$ components untouched. Demonstrate this with your own object.

5. Create the "stretch-$\mathtt{y}$" matrix $\mathsf{S}^{\mathtt{y}}(\mathtt{s})$. This matrix should stretch (or compress) the $\mathtt{y}$ components by amount $\mathtt{s}$ while leaving $\mathtt{x}$ components untouched. Demonstrate it with your object.

6. Use these transformations you created and the image provided in the file *l2_image.tsv*. Perform the following operation: mirror your object's image from 45°-line, and stretch it 2× along the 45°-line (see the example). Note: you may want to break the lines between different groups.



7. Above we discussed the transformations by right-multiplication. How can you transform the problem in a way that you can pre-multiply instead of post-multiply if you want to perform an operation? Demonstrate it with $\mathsf{R}(\alpha)$.