

CS-174A Discussion 1B, Week 2

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@ DODD 161 / Friday / 12:00pm-1:50pm

@ <https://github.com/luckiday/cs174a-1b-2019f> (<https://github.com/luckiday/cs174a-1b-2019f>)

(Short link: <https://bit.ly/32Zt3sg> (<https://bit.ly/32Zt3sg>))

Outline

- Transformations
 - Shearing
 - Reflection
- Make animation with tiny-graphics.js

Transformation

- Shearing
- Reflection

Shear

$$x' = x + \text{Sh}_x^y y + \text{Sh}_x^z z$$

$$y' = \text{Sh}_y^x x + y + \text{Sh}_y^z z$$

$$z' = \text{Sh}_z^x x + \text{Sh}_z^y y + z$$

$$\begin{pmatrix} x' \\ y' \\ z' \\ 1 \end{pmatrix} = \begin{pmatrix} 1 & \text{Sh}_x^y y & \text{Sh}_x^z z & 0 \\ \text{Sh}_y^x x & 1 & \text{Sh}_y^z z & 0 \\ \text{Sh}_z^x x & \text{Sh}_z^y y & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \\ 1 \end{pmatrix}$$

Reflection

To reflect a point through a plane $ax + by + cz = 0$ (which goes through the origin), if the L2 norm of a , b and c is unity, the transformation matrix can be expressed as:

$$\begin{pmatrix} x' \\ y' \\ z' \\ 1 \end{pmatrix} = \begin{pmatrix} 1 - 2a^2 & -2ab & -2ac & 0 \\ -2ab & 1 - 2b^2 & -2bc & 0 \\ -2ac & -2bc & 1 - 2c^2 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \\ 1 \end{pmatrix}$$

Make animation with tiny-graphics.js

- Draw a graph with outline
- Draw multiple shapes
- Animation