CS-174A Discussion 1B, Week 2

@ Yunqi Guo

@ 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

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

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

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

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

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