OCT 13

Z-Buffer / Perspective Issues

Remember: Transformed z is

simple version $z' = n + f - \frac{fn}{z}$

$z = n \quad z' = n$

$z = f \quad z' = f$

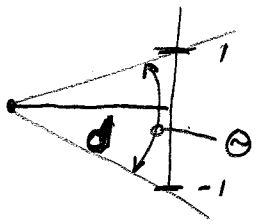
$$\begin{bmatrix} 1 & & & \\ & 1 & & \\ & & \frac{n+f}{n} & -f \\ & & \frac{1}{n} & \end{bmatrix}$$

$$\begin{bmatrix} 1 & & & \\ & 1 & & \\ & & \frac{n+f}{n-f} & \frac{-fn}{n-f} \\ & & 1 & \end{bmatrix}$$

$$z' = \frac{n+f}{n-f} - \frac{fn}{(n-f)z}$$

in book negative since we look down the $-z$ axis

Field of View vs. Focal Length



glu Perspective (fovy, aspect, near, far)

Z-Buffer Issues

- Precision of Z - historically fixed point
  - can't be $-\infty$ to ∞
  - instead near → far
  - since we're storing $\approx 1 - \frac{1}{z}$
    - not uniformly spaced - want n-f to be small

- order independent?
  - usually
  - if z = ← last (or first) drawn wins
  - if z close? rounding error may make =
    - Z-Fighting (flicker as things move)

- transparency

- performance / overdraw

10/16

Shading / BRDF

- recap
- emphasize independent of transport
  complex model ⟷ primitive
  simple model ⟷ fancy global transport

Triangles

Gouraud
Phong
Shaders

OpenGL

State Model

```
glBegin
  Normal
  Vertex
  ⋮
```

What does glColor do?
Material Model
Lighting Setup

Transforms
Lighting (must be after transforms)
Drawing