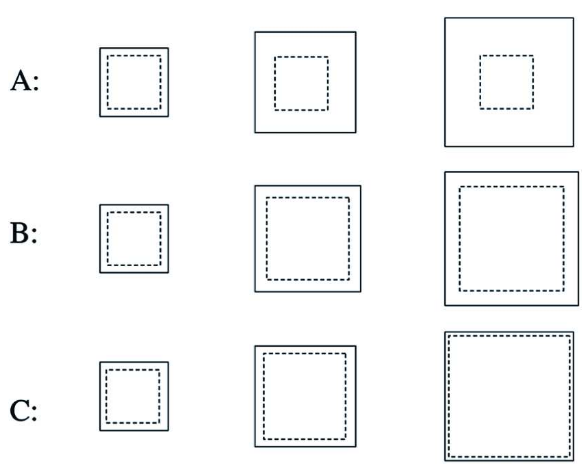
Question Set 8-9

CS 320

Show work. For example, the answer to 10.2 is $[\frac{-x_e}{z_e}, \frac{-y_e}{z_e}]$, which you could simply copy from the textbook. I expect to see a geometric argument, using similar triangles, that justifies this answer.

Chapter 10

1. Describe the differences between the pinhole camera's image for the cases of setting the film plane to be at $z = 1$ and $z = -1$.
2. Given a point $\tilde{p}$ with eye coordinates $[x_e, y_e, z_e]^t$, what are its normalized device coordinates, $[x_n, y_n]^t$?
3. Describe the canonical square.
4. Relative to a film plane position at $z = -1$, explain the effect on the image of moving the film plane to $z = -3$.
5. To obtain a field of view angle of θ, at what value of z should the film plane be placed?
6. For an immersive viewing experience, a wide field of view angle is desirable. Let's say that we want a vertical field of view angle of 135° and that we have a monitor with an image height of 7". To view an un-distorted image, how far should the observer's eyes be from the monitor when viewing the image?
7. Suppose we take a picture of an ice cube. In the following figures, the projection of the ice cube's front face is drawn with a solid outline and the rear face is drawn with a dotted outline. Three images are taken using fields of view of 40°, 30°, and 20°, respectively. All other camera parameters remain the same. Which of the following three image sequences, A, B, or C, is plausible? Why?



8. Draw figures illustrating the camera setups for the two following images. (Hints: remember that we can build a camera with a shifted film plane. The camera was at street-level for both images.)

(From *How to Photograph Architecture*, `http://photo.net/architectural/exterior`, copyright Phillip Greenspun.)

Chapter 11

1. Compute z_c and w_c.

$$\begin{bmatrix} x_n w_n \\ y_n w_n \\ z_n w_n \\ w_n \end{bmatrix} = \begin{bmatrix} x_c \\ y_c \\ z_c \\ w_c \end{bmatrix} = \begin{bmatrix} s_x & 0 & -c_x & 0 \\ 0 & s_y & -c_y & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & -1 & 0 \end{bmatrix} \begin{bmatrix} x_e \\ y_e \\ z_e \\ 1 \end{bmatrix}$$

2. Consider the two points $[0, 0, -1, 1]^t$ and $[0, 0, -2, 1]^t$. Each point is in eye coordinates. Compute z_n for each point. Should the graphics pipeline use $<$ or $>$ to determine which point is closer to the camera?

3. Are distances preserved by a projective transformation? Explain.