Homework 4
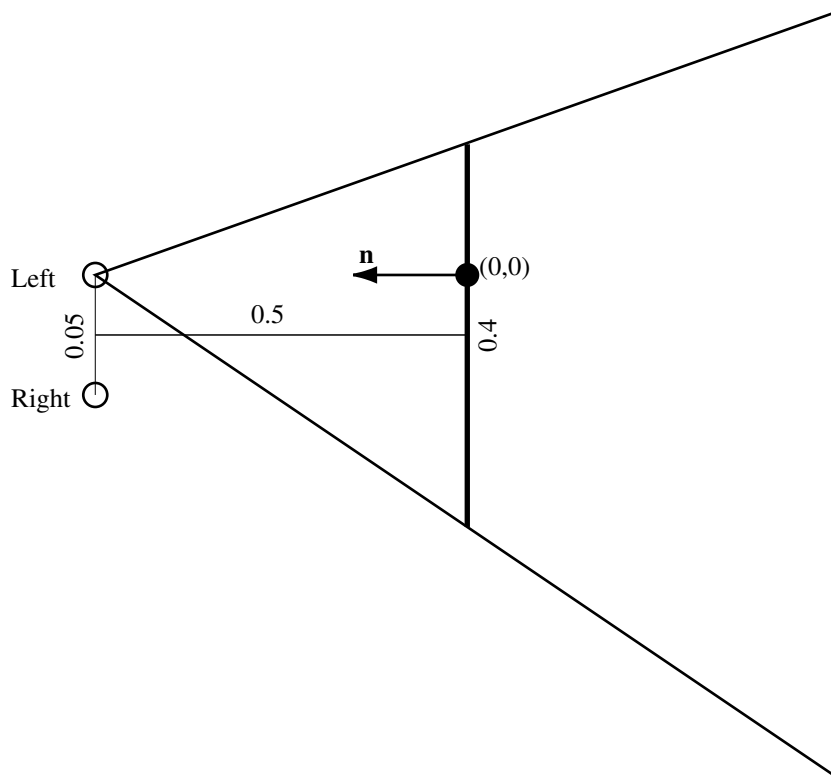
This homework must be done individually. Submission date is Tuesday, March 19 in class. It will be graded and available for collection before the midterm.

Question 1:

This question explores the perspective projection setup for stereo viewing. The situation is shown in the figure below. A user is wearing shutter-glasses, which are glasses that rapidly flicker in time to the monitor's refresh rate. The viewer sees one image with their left eye, then one with their right, and so on. The viewer's eyes are 0.05 units apart, and they are staring into infinity through a monitor that is 0.5 units away from them and 0.4 units wide. The monitor is centered so that a line passing through the midpoint between the viewer's eyes, in the direction they are looking, will pass through the center of the monitor and be perpendicular to it.
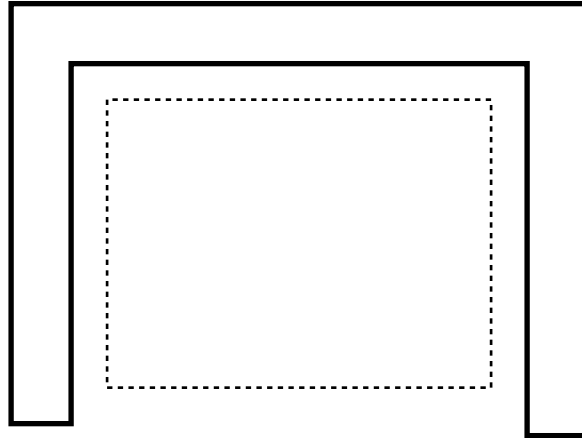

Consider the image that will be shown to the left eye. The image plane in view space is the plane of the monitor. The $(x, y) = (0, 0)$ point in the image plane in view space is shown on the figure, as is the view plane normal and the view frustum for this case.

a. What is an appropriate value to specify the near clipping plane?

b. What value would you use to specify the left clipping plane?

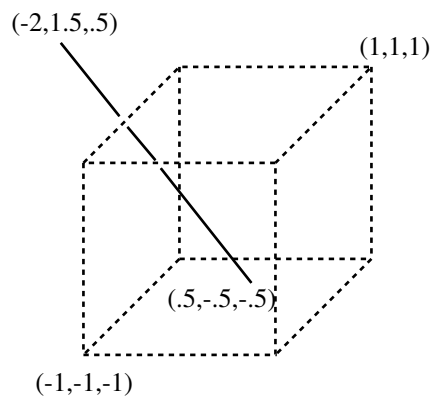c. What value would you use to specify the right clipping plane?

Question 2:

Perform Sutherland Hodgman clipping on the figure below to the rectangular clip region shown dashed. Show the intermediate results after clipping with the top edge, the results after clipping with the top and right edges, the results after the top, right and bottom edges, and the final results. (You should show 4 figures in all.)

Question 3:

This question explores Liang-Barsky clipping for the canonical 3D view volume. Consider the line segment and clip region shown below.

(-2,1.5,.5)
(1,1,1)
(.5,-.5,-.5)
(-1,-1,-1)

a. What is the parametric equation of the line? Write it in the form:

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} a \\ b \\ c \end{bmatrix} + t \begin{bmatrix} d \\ e \\ f \end{bmatrix}$$
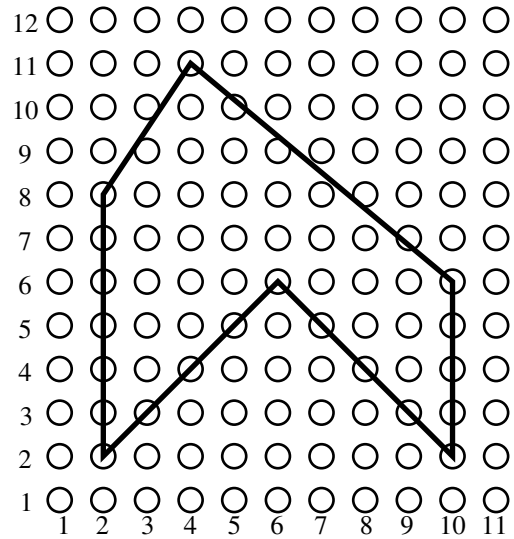
b. What are the six parametric coordinates (the t values) for the intersections of the line with each clip plane? Label them as entering or leaving intersections.

c. What are the parametric coordinates of the end-points of the visible segment?

d. What are the (x, y, z) coordinates of the end-points of the visible segment?

Question 4:

Fill out a table with the per-pixel values for x_i, y_i and p_i when Bresenham's algorithm is applied to the line from (1,3) to (7,5). There will be seven sets of values.

Question 5:

Consider the task of filling of the polygon shown:

a. Write out the edge table.

b. Show the active edge list for rows 1 to 11.

c. Draw a diagram showing which pixels are filled. You might just want to draw on the figure above. (Attach it well to the rest of your answers.)