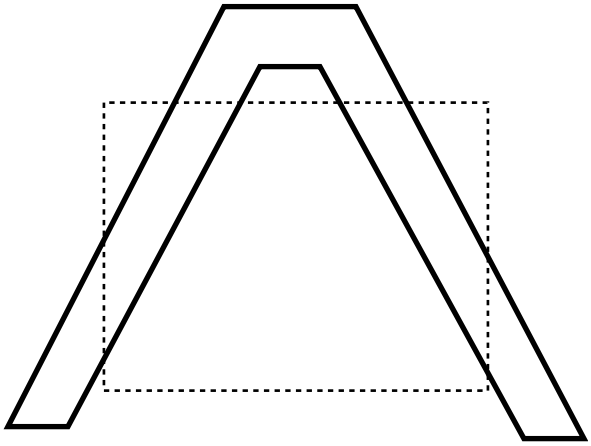
**CS 559: Computer Graphics**

**Homework 4 - Ungraded**

*This homework will not be graded. It is intended to help you prepare for the midterm. We strongly recommend that you try to do all the questions before looking at the solutions. In other words, treat it like a homework but grade yourself.*

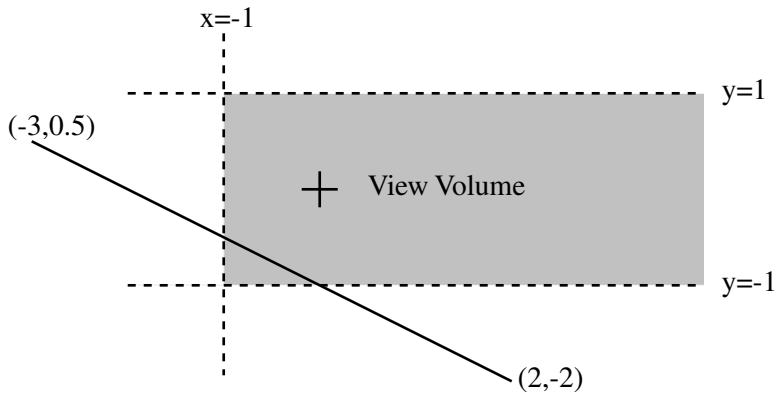
## Question 1:

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 2:

This question explores Liang-Barsky clipping. Consider the line segment and semi-infinite clip region shown below.




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

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} a \\ b \end{bmatrix} + t \begin{bmatrix} c \\ d \end{bmatrix}$$

b. What are the parametric coordinates (the $t$ values) for the intersections of the line with each clip edge? Label them as entering or leaving intersections.

c. What are the parametric coordinates of the endpoints of the visible segment?

d. What are the (x,y) coordinates of the endpoints of the visible segment?

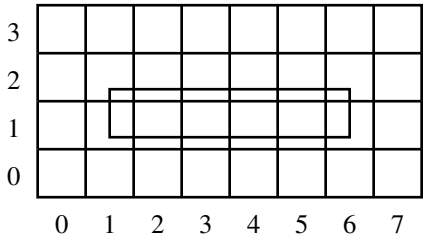
## Question 3:

Fill out a table with the per-pixel values for $x_i, y_i$ and $d_i$ when Bresenham's algorithm is applied to the line from (2,1) to (9,3). There will be eight sets of values.

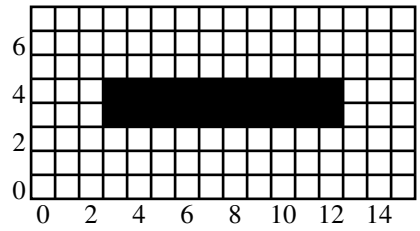
## Question 4:

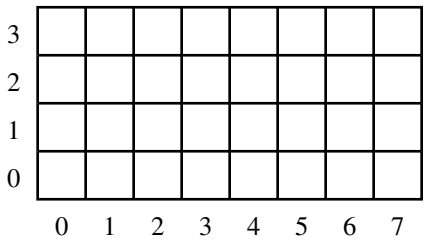
Consider a one pixel wide line from (1,1.25) to (6,1.25), with square endcaps. The outline of the line is shown on the figure below.

a. Assume we are doing area-weighted sampling, with the alpha of each pixel set in proportion to the amount of the pixel covered by the line. Give the alpha values of all the non-zero pixels.




b. Now assume we are doing supersampling. Below is the same line, drawn at twice the resolution using some version of point sampling which fills whole pixels. Halve the size of this image by averaging $2\times2$ blocks of pixels.




c. Assume you are working with a black line on a white background. Is the result of compositing the area sampled line the same as the result of super-sampling?