

CSCI 4229 Solutions for Assignment 1: Angel Probs 1.1,1.3,1.4, 1.7

Due: Jan. 22. – marks out of 10

1.1 (3pts) We can apply the formula from page 18:

$$\theta = 2 \tan^{-1} \frac{h}{2f},$$

where we have replaced the length of the camera d with the focal length of the lens f . Solving for f , we have

$$f = \frac{h}{2} \cot \frac{\theta}{2}$$

We can use the diagonal of the 24 mm x 36 mm
le for h . Solving, we find

$$f = 6\sqrt{13} \cot 45 = 6\sqrt{13} = 21.6mm$$

(I accepted solutions 18mm and 12mm as well)

1.3 (2pts) Suppose that the line segment is between the points $(x_1; y_1)$ and $(x_2; y_2)$: We can use the endpoints of the line segment to determine the slope and y intercept of a line of which the segment is part,i.e.

$$y = mx + h = \frac{y_2 - y_1}{x_2 - x_1}y + y_1 - \frac{y_2 - y_1}{x_2 - x_1}x_2$$

Note that we can deal with horizontal and vertical line segments as special cases. We can find the intersections with the sides of the window by substituting $y = y_{max}$, $y = y_{min}$, $x = x_{max}$, and $x = x_{min}$ (the equations for the sides of the window) into the above equation. We can check the locations of the points of intersection to determine if they are on the line segment or only on the line of which it is part.

1.4 (2pts) In Exercise 1.3 we saw that we could intersect the line of which the line segment is part independently against each of the sides of the window. We could do this process iteratively, each time shortening the line segment if it intersects one side of the window.

1.7 (3pts) We have to process 1280 x 1024 x 72 pixels/sec. If we process each successively, there is only about 10 nanoseconds to process each. For a 480 x 640 interlaced display operating at 60 Hz we must process only 480 x 640 x 30 pixels/sec which gives us about 109 nanoseconds to process each pixel.