CS 559: Computer Graphics

Homework 7

This homework WILL NOT BE GRADED. It is intended to help you prepare for the final exam. These questions were taken from last semester's final.

Question 1:

You wish to find the parameter values for any intersection points between a ray, $\mathbf{x} = \mathbf{x}_0 + t\mathbf{d}$ with $\mathbf{x}_0 = (x_0, y_0, z_0)$ and $\mathbf{d} = (d_x, d_y, d_x)$, and an cylinder of height 1 centered at the origin and aligned with the z-axis.

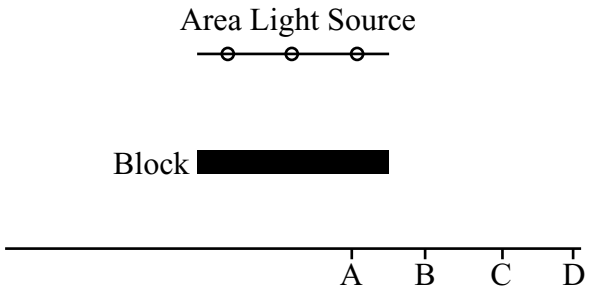
a. Assume for the moment that the cylinder has infinite height (that is, it goes all the way to positive and negative infinite z.) The implicit equation for this tube is $x^2 + y^2 - 1 = 0$. What equation do you need to solve to find the parametric values of the intersection points(s)?

b. How would you determine if the ray hit the original unit-height cylinder?

c. How would you determine if the ray passed through one (or both) of the endcaps of the cylinder?

Question 2:

Consider the area light source, light blocker and surface shown below. For ray-tracing, the area light source is approximated as three point sources distributed as shown.



a. Which point, A, B, C or D, will be the brightest?

b. Which point will be the darkest?

c. What is the relationship between the brightness at point B and the brightness at point C?

Question 3:

Recall the notation used in class for light paths. For example, the OpenGL model for diffuse illumination captures LDE paths.

a. What class of paths is captured by basic ray-tracing?

b. What class of paths is captured by a radiosity algorithm?

c. Sketch a situation in which radiosity and basic ray-tracing will give significantly different answers. Your diagram must contain a path that is captured by basic ray-tracing but not radiosity, and one that is captured by radiosity but not basic ray-tracing. Label these paths. Also indicate:

- the location of the light source
- the location of the viewer
- whether or not each surface is diffuse or specular (mirror-like)