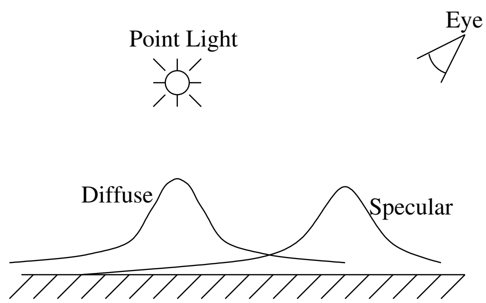
**CS 559: Computer Graphics**

**Homework 8**

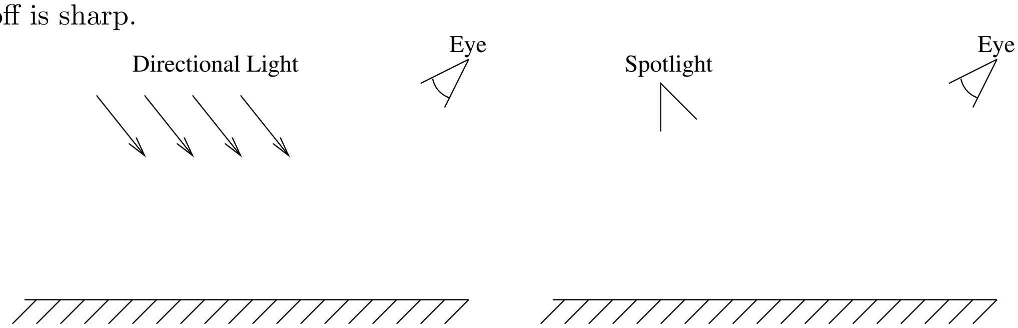
*This homework will not be graded. It is intended to enlarge the set of sample exam questions.*

## Question 1:

An illumination graph shows the brightness of s surface as a graph. Low values for the graph indicate the surface is dark, and high values indicate that it is bright. Below is the illumination graph showing the diffuse and specular components when a plane is lit by a point light source in the position shown, and is viewed from the position shown. Examine this graph to convince yourself of how it works.

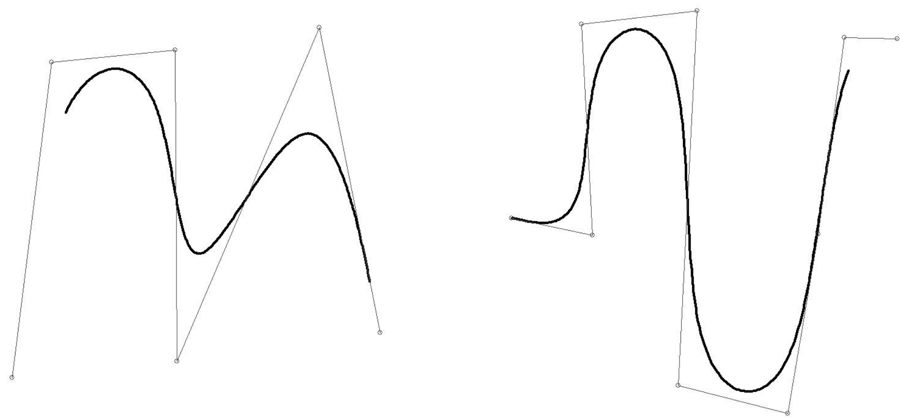



Now draw illumination graphs for the diffuse and specular components for the following two lighting situations. One has a directional light source from the direction shown (the position of the arrows doesn't matter). The other is a spotlight with the cut-off angles as indicated. Assume that the cut-off is sharp.



**Question 2:**

B-spline curves can be forced to be tangent with their control polygons or interpolate vertices by repeating control vertices multiple times. The figures below show B-spline curves and their control polygons. How many times is the left-most and right-most vertex of each curve repeated?



**Question 3:**

Draw a few polygons and some light sources and a viewer to demonstrate one situation in which both of the following are true:

- Raytracing does not give the correct image. Indicate a light path that raytracing fails to capture.
- Radiosity gives a different answer to raytracing, but still not the right answer. Indicate a path that radiosity captures but raytracing does not.

Mark the polygons as diffuse or specular, and indicate colors if that helps in explaining the scenario. Give a sentence or two describing how the raytraced and radiosity images will differ for your scenario.

**Question 4:**

Give an equation for finding the intersection point(s) between a ray and an infinite cone. Assume that the equation for the cone is $x^2+y^2 = z^2$. Write the ray as $\mathbf{x}(t) = \mathbf{x}_0 + t\mathbf{d}$ where $\mathbf{x}_0 = (x_0, y_0, z_0)$ and $\mathbf{d} = (d_x, d_y, d_z)$. Now, what would you do if you only wanted the intersection points with a cone that went from $z = -1$ to $z = 1$?