CS 559: Computer Graphics

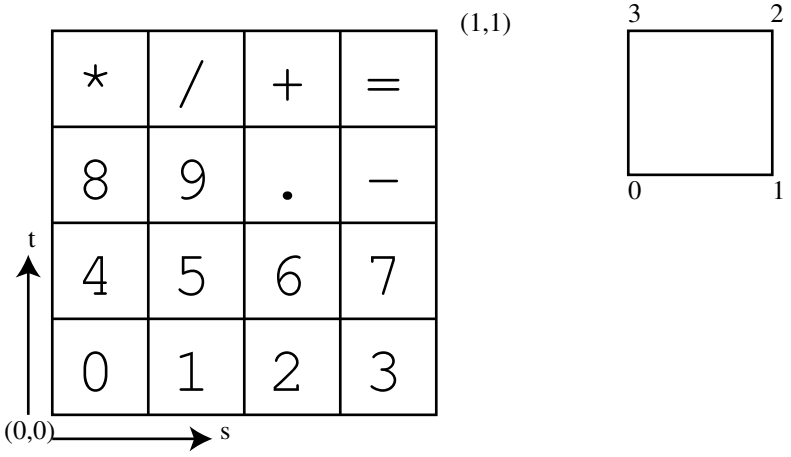
Homework 5

This homework must be done individually. Submission date is Tuesday, April 23 in class.

Question 1:

This question concerns texture mapping.

a. Consider the numbers texture shown below. It might be used as a single texture map to provide numbers and operators for a 3D calculator application. Beside the texture map is a polygon that will be used for the number "1" button on the calculator. For each vertex, 0 through 3, give the (s, t) texture coordinates to use for that vertex in order to place a "1" on the polygon.

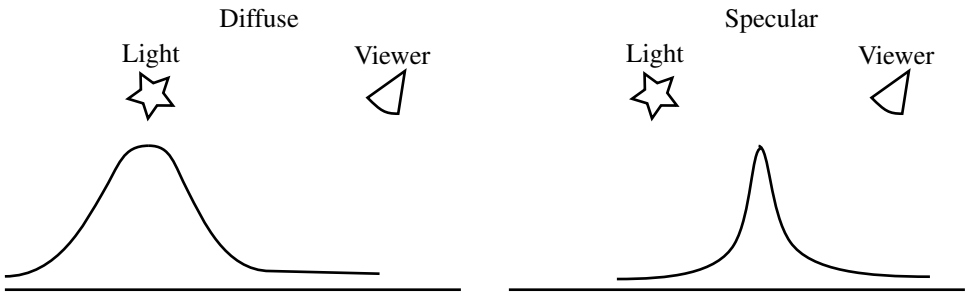


b. Sketch a texture that you would use to put the dashed lane markings onto a road. What format, repeat or clamp, would you use for the s dimension of the texture? Which would you use for the t dimension?

c. Sketch another texture, this time for a brick wall. What format, repeat or clamp, would you use for the s dimension of the texture? Which would you use for the t dimension?

Question 2:

Below are shown the illumination graphs for the diffuse and specular components of a flat surface lit by a light as shown with a viewer in the position indicated.



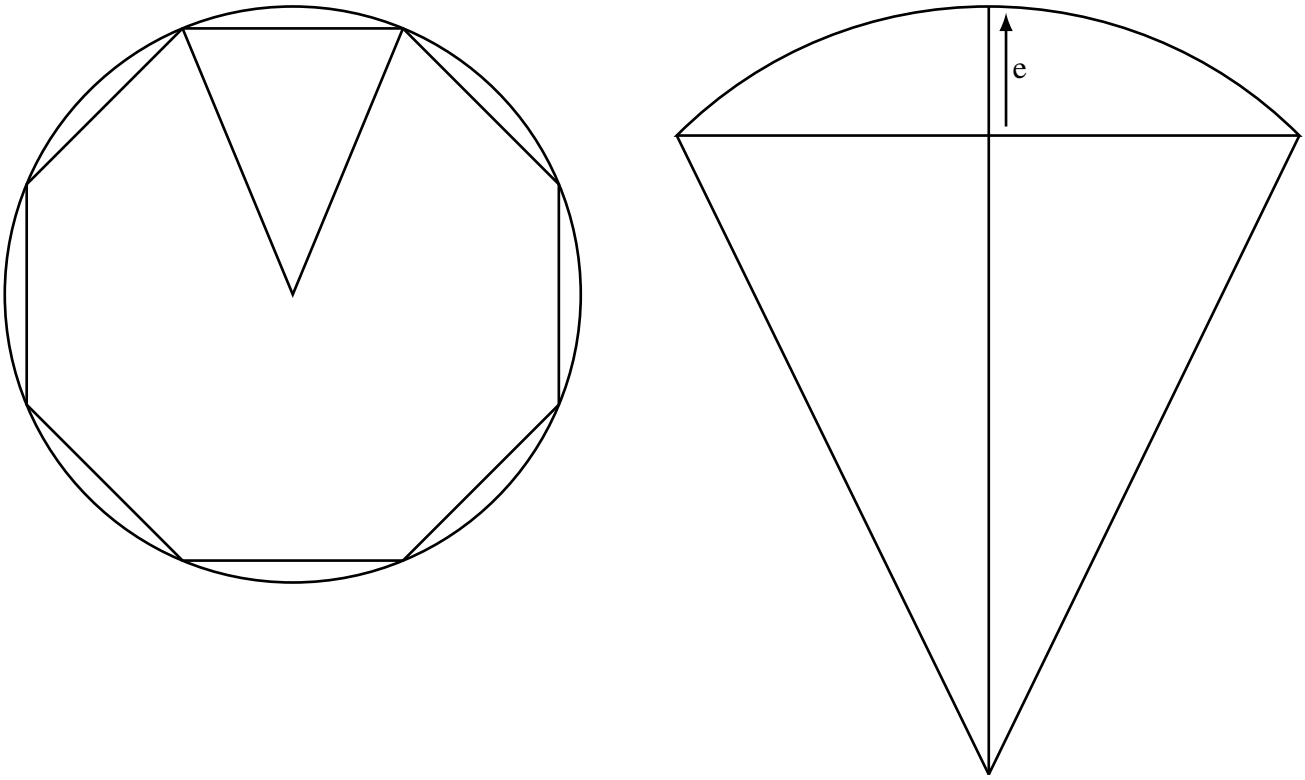
a. Draw two more graphs, one for the diffuse and one for the specular component of the same flat surface. However, now make the distant light assumption, using a directional light source coming from vertically above.

b. Draw two more graphs, but now make the distant viewer assumption, assuming that the viewer is looking from a constant direction vertically down to the surface. Use the point light from the original example, NOT a directional light.

c. Draw two more graphs, showing the effect of **both** a directional light coming from above and a distant viewer looking from above.

Question 3:

This question explores the quality of a polygonal approximation to a cylinder. The figure below shows, on the left, a circle with an eight sided polygon that will be used to approximate it. On the right is a close up of one facet of the polygon and the neighboring circular region.



a. Let e be the error in the approximation, as indicated on the figure. Assuming that the radius of the circle is 1, what is the value for e for the 8-sided approximation shown?

b. What is a general formula for e in terms of the number of sides in the polygon, assuming it is regular and the radius of the circle is 1?

c. How many sides are needed to half the error of an 8-sided polygon?

d. How many are needed to give an error of $e = 0.01$?