CS 559: Computer Graphics

Homework 6

This homework must be done individually. Submission date is Tuesday, April 24, 2001, in class.

Question 1:

When using OpenGL texturing, the wrapping parameters control what happens when texture parameter values fall outside the range $[0, 1]$. Two of the options are to CLAMP and REPEAT. For each of the following situations, sketch what the texture image might look like, and state which wrapping parameter is most applicable for the s texture coordinate, and which is applicable for the t coordinate: (12 points)

a. A brick wall, where the bricks extend over the entire wall. Assume that s runs up and down the wall and t runs across the wall.

b. An interior wall with a floral band of wallpaper around the top, but otherwise of constant color. Assume that s runs up the wall and t runs across the wall.

c. The label on a wine bottle, where s runs up the bottle and t runs around the circumference. Assume that there is only one piece of label and that it does not go all the way around the bottle.

You have artistic freedom in designing the texture, but note that you should provide a sketch of the texture image itself, **not** a sketch of what it looks like once it is applied. Label the axes of your sketch with the s and t directions.

Question 2:

Which of the modeling techniques covered in class would be most applicable for modeling each of the following objects. If there are several good candidates, feel free to mention more than one technique. (8 points)

a. Swiss cheese

b. A nut, in the nut-and-bolt sense

c. A christmas tree

d. A bowl

e. A set of bookshelves

f. A fluffy cloud

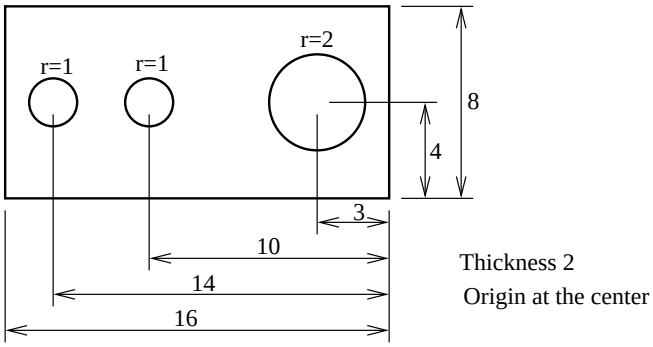
g. Cloth

h. Roof guttering

Question 3:

Give a CSG tree that models the drilled plate shown below. Assume that your primitives consist of a unit cube (side length 1 for all sides) with its origin at the center, and a unit cylinder (radius 1 and length 1) with its origin at the center. Label the interior nodes with the CSG operation,

label the edges with the transformations that must be applied, and label the leaves with the type of primitive. The origin of the resulting plate should be at its center. (8 points)



Question 4:

Prove the tangent property for Bezier curves: that the tangent to the curve at the parameter value $t = 0$ points along the line joining the first and second control points, and that the tangent at $t = 1$ points along the line joining the second last and last control points. It suffices to prove that at $t = 0$

$$\frac{dx}{dt} = k_1(x_1 - x_0)$$

and at $t = 1$

$$\frac{dx}{dt} = k_2(x_3 - x_2)$$

where x_0, x_1, x_2 and x_3 are the x coordinates of the control points, and k_1 and k_2 are constants. What are the values for k_1 and k_2? (8 points)

Question 5:

Which of the following must **not** be cubic Bezier curves, and why not? (8 points)