Midterm
Computer Graphics 462
Fall, 2001
Thursday, October 18th

There are 6 questions, each worth 17 points. The test is closed book and closed note.

General Test-Taking Strategies: read through all questions before you start writing, don't spend too long on a question if you don't know the answer, don't leave any question blank (give me a chance to give you partial credit!), and if you think a question is unclear without making some assumption, write down the assumption.

1. Splines:

a. Suppose that we render Bezier patches by adaptive subdivision, so that each patch can be subdivided a different number of times. Do we maintain continuity along the edges of the patches? Explain your answer.

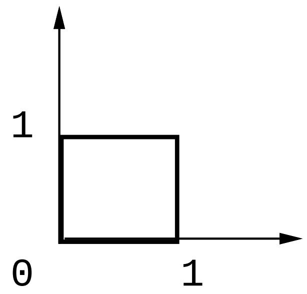
b. Define C_0, C_1, and C_2 continuity.

c. What is the difference between a Hermite and a Bezier spline?

2. Line Clipping:
a. Given the following binary outcode assignment:

Above	Below	Right	Left
X	X	X	X

and a unit square clipping window in the first quadrant:

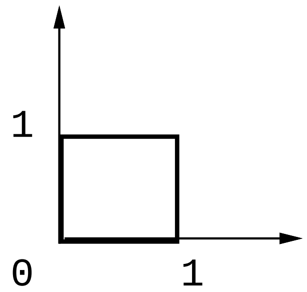


determine the outcodes of the following points:

1. (0.3, 1.2) ________
2. (-0.1, -0.1) ________
3. (0.2, 0.3) ________

b. Can a line segment with vertex outcodes (1010, 0110) be trivially rejected? ________
c. Can a line segment with vertex outcodes (1001, 0100) be trivially rejected? ________
d. What is the maximum number of times that a line can be clipped using the Cohen-Sutherland Algorithm? ________

Draw such a line for this clipping region:



3. Modeling

a. Explain two different ways to get a texture map onto an arbitrary polygonal object.

b. Suppose that you wanted to model a scene with a car engine, an aerodynamic fairing for a new sports car, and an elaborate hood ornament all sitting in a field of grass. What modeling technique would you use to construct each model? Explain why that technique is a good choice.

c. What are parametric and implicit functions and why is each useful in modeling?

4. Shadows

a. Define the penumbra and umbra of a shadow. Draw a picture to illustrate your definition.

b. Describe the key steps of the shadow z-buffer algorithm.

5. Transformations:

a. Because normals and vertices can both be represented in homogenous coordinates, both can be operated on by the model-view transformation. Explain why normals may not be preserved by the transformation.

b. Stereo pairs are two views of the same scene from slightly different locations. How could you make the calculation of stereo images more efficient than calculating two independent images?

6. Illumination Model:

a. Describe the difference you would expect to see between Phong illumination with $(\mathrm{N} \cdot \mathrm{H})^n$ and $(\mathrm{R} \cdot \mathrm{V})^n$. $\mathrm{H} = (\mathrm{L} + \mathrm{V})/2$ and L is the vector from the point to the light source, N is the normal to the surface, and V is the vector from the point to the viewer.

b. The Phong illumination model is

$$I = I_a k_a + I_i(k_d(\mathrm{N} \cdot \mathrm{L}) + k_s(\mathrm{H} \cdot \mathrm{V})^n)$$

What purpose do each of the ambient ($I_a k_a$), diffuse ($I_i k_d(\mathrm{N} \cdot \mathrm{L})$) and specular ($I_i k_s(\mathrm{H} \cdot \mathrm{V})^n$) terms play in the display of an object?

c. In the equation for Phong illumination, the parameters are dependent on the scene, on the objects, or on the light sources. Define each of the parameters in the table below and explain what it is dependent on.

Parameter	Definition
I_a	
k_a	
I_i	
k_d	
L	
N	
k_s	
H	
V	
n	