

Written Assignment #2: Appearances, Curves and Surfaces

15-462 Graphics I, Fall 2003

Doug James

Due: Thursday, October 9, 2003 (**before lecture**)

70 POINTS

October 1, 2003

- The work must be all your own.
- The assignment is due before lecture on Thursday, October 9.
- Be explicit, define your symbols, and explain your steps. This will make it a lot easier for us to assign partial credit.
- Use geometric intuition *together* with trigonometry and linear algebra.
- Verify whether your answer is meaningful with a simple example.

1 Angel, Chapter 6, Exercise 6.14

Show that the halfway vector \mathbf{h} is at the angle at which a surface must be oriented so that the maximum amount of reflected light reaches the viewer.

2 Angel, Chapter 6, Exercise 6.22

Generalize the shadow-generation algorithm (Section 5.10) to handle flat surfaces at arbitrary orientations. (NOTE: This is similar to your second programming assignment.)

3 Angel, Chapter 7, Exercise 7.3

How is an image produced with an environment map different from a ray-traced image of the same scene?

4 Angel, Chapter 10, Exercise 10.4

Show that, as long as the four control points for the cubic interpolating curve are defined at unique values of the parameter u , the interpolating geometry matrix always exists.

5 Angel, Chapter 10, Exercise 10.6

Verify the C^2 continuity of the cubic spline.

6 Angel, Chapter 10, Exercise 10.16

Find the zeros of the Hermite blending functions. Why do these zeros imply that the Hermite curve is smooth in the interval $(0,1)$?

7 Angel, Chapter 10, Exercise 10.18

For a 1024×1024 display screen, what is the maximum number of subdivisions that are needed to render a cubic polynomial surface?