

Written Assignment #3

15-462 Graphics I, Fall 2003

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Due: Tuesday, November 18, 2003 (**before lecture**)

80 POINTS

November 7, 2003

- The work must be all your own.
- The assignment is due before lecture on Tuesday, November 18.
- 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 7 (Discrete Techniques), Exercise 7.8

Suppose that we have two translucent surfaces characterized by opacities α_1 and α_2 . What is the opacity of the translucent material that we create by using the two in series? Given an expression for the transparency of the combined material.

2 Angel, Chapter 7 (Discrete Techniques), Exercise 7.10

In Section 7.9 we used $1 - \alpha$ and α for the destination and source blending factors, respectively. What would be the visual difference if we used 1 for the destination factor, and kept α for the source factor?

3 Angel, Chapter 7 (Discrete Techniques), Exercise 7.14

When we supersample a scene using jitter, why should we use a random jitter pattern?

4 Angel, Chapter 8 (Implementation of a Renderer), Exercise 8.12

Devise a method for testing whether one planar polygon is fully on one side of another planar polygon, i.e., so that there exists a separating line.

5 Angel, Chapter 13 (Advanced Rendering), Exercise 13.3

Derive an implicit equation for a torus whose center is at the origin. (You can derive the equation by noting that a plane that cuts through the torus reveals two circles on the same radius.)

6 Angel, Chapter 13 (Advanced Rendering), Exercise 13.4

Using your previous result (from 13.3), show that you can ray trace a torus using the quadratic equation to find the required intersections.

7 Angel, Chapter 13 (Advanced Rendering), Exercise 13.12

Suppose that you have an algebraic function in which the highest term is $x^i y^j z^k$. What is the degree of the polynomial that we need to solve for the intersection of a ray with the surface defined by this function. Provide a derivation.

8 Angel, Chapter 13 (Advanced Rendering), Exercise 13.13

Consider again an algebraic function in which the highest term is $x^i y^j z^k$. If $i = j = k$, how many terms are in the polynomial that is created when we intersect the surface with a parametric ray?