Test 2

CS 5610/6610

Advanced Computer Graphics

Fall 2009

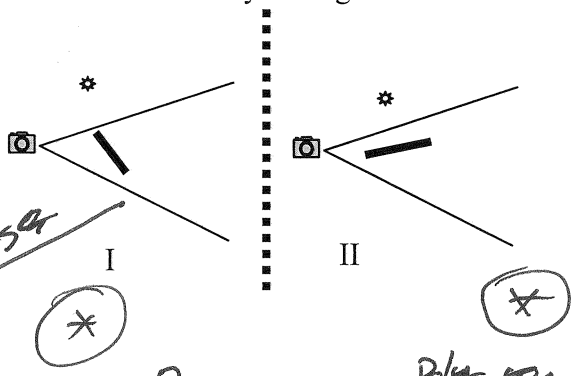
Name:_____

Student ID: _____

Rules:

1. Open book and no notes
2. No calculators, computers, or phones
3. CS 5610 students, answer any 4 questions (no extra credit)
4. CS 6610 students, answer all 6 questions

1. [20 pts] Which leads to more aliasing errors with shadow maps and why?
(I) A large polygon fully in the field of view from the light whose normal is nearly orthogonal to the light or (II) a large polygon in fully in the field of view from the camera whose normal is nearly orthogonal to the camera.



I

really the I case is the most likely to alias

fall off of

Z-values quantized into depth buffer w/ lead to aliasing when transformed to light

Polygon only produces small area in image but the z may/may not be in front/behind in light/cam

give credit for either

-2 no mention of light vs camera transformation

- light transformed to camera

2. [20 pts] Draw a diagram and explain precisely the algorithm for shadow mapping

1. render scene from light's point of view
2. save depth map
3. render scene from camera's point of view
4. transform each fragment to light's POV
5. compare depth
6. if frag is farther from light than light's depth map then shaden
   else lit.

-5 mixed up light & Camera Space
-5 no transformation

3. [20 pts] **You are given a room with 4 walls, a ceiling and a floor. There is a large window in one of the walls; there is a small rectangular area light source on the wall opposite the window.**

(5 pts) a. What is the minimum number of polygons needed to form the enclosure for a radiosity solution? You can assume polygons with holes are valid.

ceiling - 1
floor - 1
wall - 1
wall - 1
4

wall w/ window - 1
wall w/ light - 1
window - 1
light 1
4 or 18

or 8
- 8
- 1
- 1
or 18

ceiling - 1
floor - 1
3 walls - 3
wall w/ hole - 1
window - 1
7

(5 pts) b. Would this produce a decent picture? Why or why not?

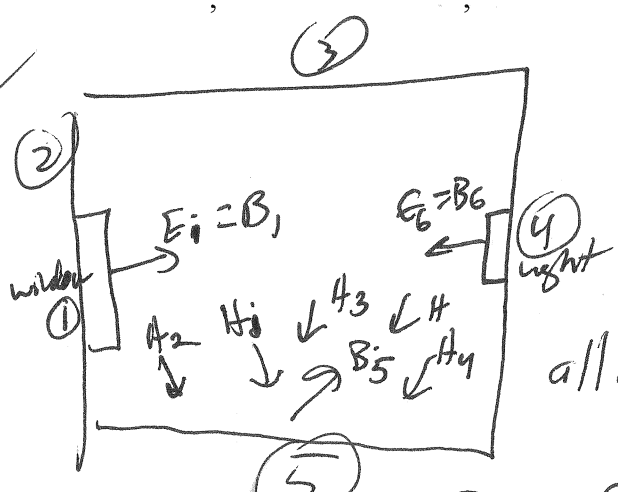
no, each polygon is just a single shade

-5 tessalation implies single color for each polygon

(10 pts) c. Draw the scene showing the walls (labeled) in the enclosure (looking down from the ceiling; you do not need to draw the ceiling and floor, 2D is OK).
Use labels/arrows to describe the radiosity equation for the light and the wall with the window, include any information you can about what would be the values of the terms in the diagram. State any assumptions you are making.
The radiosity equations:

$$B_i = E_i + \rho_i H_i \quad , \quad H_i = \sum_{j=1}^{N} B_j \frac{A_j F_{ji}}{A_i} \quad , \quad B_i = E_i + \rho_i \sum_{j=1}^{N} B_j F_{ij} \qquad 1 \le i \le N$$

check Eqns



window - 1
wall w/ window - 2
wall - 3
wall - 4
wall - 5
light - 6
all other walls are the same

$$B_5 = \rho_5 \sum_{j=1}^{N} B_j F_{ij}$$

missed light & window emitting but right idea -2

missed idea 5

tried to answer. +10

4. [20 pts] Explosion maps:

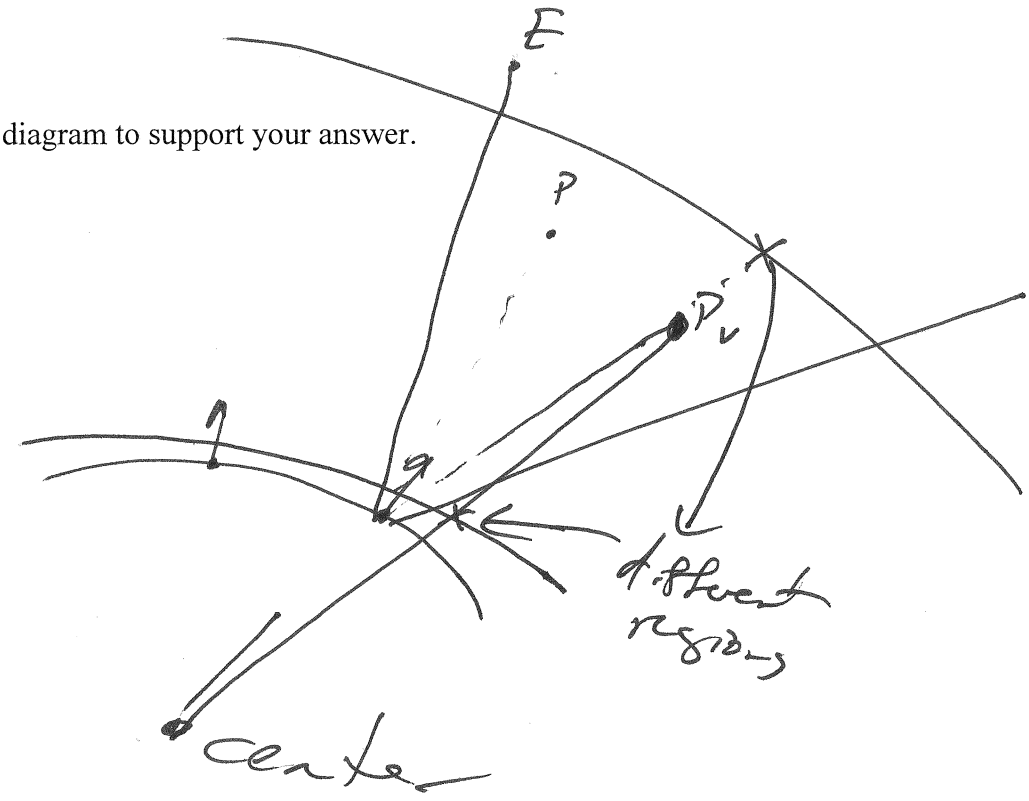
(5 pts) a. Why are there two spheres?

sphere bounds the object & scene.
if gives wrong answers for some points

(5 pts) b. Are two spheres really necessary? Why or why not?

yes, without there are more errors

(10 pts) c. Draw a diagram to support your answer.



5. [20 pts] What is the difference between 'varying' and 'uniform' in GLSL?

varying: interpolated during rasterization, passed between Shaders

uniform: constant/local variable

6. [20pts] Show how to compute a cross-product with swizzle operations

$$\mathbf{a} = \mathbf{b} \times \mathbf{c} \qquad \begin{aligned} a_x &= b_y c_z - b_z c_y \\ a_y &= b_z c_x - b_x c_z \\ a_z &= b_x c_y - b_y c_x. \end{aligned}$$

Mul – multiply
Add – add
Op = destination, src1, src2

```
MUL  temp,  B.yzxw  ,  C.zxyw
mut  temp2  B.zxyw  ,  C.yzxw
Add  Result ,  Temp ,  -temp2
```