Test 2
CS 5610/6610
Advanced Computer Graphics
Spring 2016

Name: ____________________________

Student ID: _______________________

Rules:
1. One page of notes
2. No calculators, computers, or phones
3. CS 5610 students, answer any 4 questions (no extra credit)
4. CS 6610 students, answer all 5 questions
1. Definitions [20 points] Be sure to answer the WHY portions!

[5 pts] Name an image-space shadow method (explain why you chose this)

shadow map

uses an image from the light's point of view. All comparisons are done in image space.

[5 pts] When does the stencil operation take place with respect to the fragment shader?

after, along with the depth comparison.

[5 pts] Name an object space shadow method (explain why you chose this)

shadow volumes

- create shadow volumes in object space.

[5 pts] What part of a spherical environment map has the worst resolution and why?

outside edge because many parts of the scene are encoded in just a few pixels, it is the portion behind the reflective sphere.
2a. [5 pts] What is the difference between a skybox and an environment map?

A skybox is infinitely far and represents the scene's background. It is always drawn in relation to the camera.

An environment is used for reflections whereas the skybox is used to represent the 'far-away' parts for the scene.

2b. [5 pts] Which has more aliasing problems: Shadow Maps or Shadow Volumes?

Shadow maps have many more aliasing problems.
2c. [5 pts] How many passes does the scene have to be rendered to create a cube map and is it the same for a cube-map and spherical environment map?

6 passes with a 90° frustum centered on the object which reflects.

It is the same for cube maps & spherical env. maps.


No, it assumes it is reflecting all other objects in the scene.
3a. [10 pts] Describe two aliasing artifacts with Shadow Maps

- **Self-shadowing** / **bias**
- **Shadow acne / noise pattern**

- **Due to** frustra

- **When the surface being shadowed is nearly orthogonal to the light**

- **Poor resolution of the shadow map**

3b. [10 pts] Draw a case where shadow volumes may have a problem.

- **Viewer in the shadow volume**

- **Shadow quad clipping near plane**
4. [20 pts] Give the OpenGL code that would leave the non-intersecting pixels of two filled polygons in the stencil buffer, represented as a value of '1' with all other locations having a value of zero. (hint: write out the steps involved, then write the OpenGL calls to achieve those steps.

Assume:
The ModelView and Projection matrix are appropriately set (no viewing calls are required).
The stencil buffer and depth buffer are cleared.
There are two routines: DrawPolygonA(), DrawPolygonB()
You must set all other necessary state.
You must use appropriate stenciling calls (glStencilFunc and glStencilOp)
glStencilFunc( GLenum func, GLint ref, GLuint mask )
glStencilOp( GLenum fail, GLenum zfail, GLenum zpass )

\[ \text{glStencilFunc}( \text{GL ALWAYS}, \text{0x1}, \text{0xff}) \]
\[ \text{glStencilOp}( \text{GL REPLACE}, \text{GL REPLACE}, \text{GL REPLACE}) \]

Draw Polygon A():

\[ \text{glStencilFunc}( \text{GL EQUAL}, \text{0x1}, \text{0xff}) \]
\[ \text{glStencilOp}( \text{GL REPLACE}, \text{GL ZERO}, \text{GL ZERO}) \]

Draw Polygon B():

Shaded region has 1's in stencil buffer
5a. [10 pts]: Which is more fill bound and why: shadow maps or shadow volumes

Shadow volumes: because the shadow quads create more seam to be rasterized.

5b. [10 pts] Silhouettes can be approximated in image space in a fragment shader. Describe how you would do this and what would need to be varying/interpolated across the polygon to the fragment to accomplish it.

1) use interpolated normals. Threshold where nearly orthogonal to the viewpoint.

2) use a depth map to look for discontinuities.