Questions from Students.

Test 1
CS 5610/6610
Advanced Computer Graphics
Fall 2009

Name: ____________________________________________

Student ID: ____________________________________________

Rules:
1. Closed 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. Spelling of silhouette?
   silhouette
   silhouette
1. [20 pts] Draw and Explain why a cube-map cannot be laid out as a single texture map:

S: t integration falls outside of valid range of texture region
E.g.: ΔABC spans left, bottom, back faces clearly Ss'T fails
ΔEFG fails for edge EF where (s, t) goes outside valid region
ΔHJF is ok

-5 didn't specify above but gave another reason valid
Given the above luminance texture. Counting from zero at Level 0, a fragment’s center falls at the X. The texel values shown are at the center of the texels (as shown)

It’s projection is \( d = 0.25 \).

2a. [10 pts] What is the assigned value of a fragment with:
minification filter set at: GL_LINEAR
magnification filter set at: GL_LINEAR

\[
\begin{align*}
A &= \frac{25 + \frac{200 - 25}{2}}{2} = 112.5 \\
B &= 50 + \frac{150 - 50}{2} = 100 \\
X &= 100 + \frac{112.5 - 100}{2} = 106.25
\end{align*}
\]

2b. [10 pts] What is the final luminance value:
minification filter set at: GL_LINEAR_MIPMAP_NEAREST
magnification filter set at: GL_LINEAR

Same due is closer to level 0 & Mip-Map closest nearest

-5: wrong linear or nearest
-1: wrong neighbor
3. [20 pts] Draw a 2D case where the naïve implementation of shadow volumes fail, describe why and how to fix it.

- Viewer in frustum
- Fix: hit correctly

- Near (projection) plane is split with shadow quad
- Fix: z = -1
4. [20 pts] Give the OpenGL code that would leave the intersection 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 )

```gl
glStencilFunc( GL_ALWAYS, 0x1, 0xFF )
glStencilOp( GL_KEEP, GL_KEEP, GL_REPLACE )
```

**Draw Polygon A**

1. **Cover Polygon A**
   ```gl
   glStencilFunc( GL_EQUAL, 0x1, 0xFF )
glStencilOp( GL_KEEP, GL_INCR, GL_INCR )
   ``
   **Draw Polygon B**

2. **At Intersection**
   ```gl
   glStencilFunc( GL_ALWAYS, 0x1, 0xFF )
glStencilOp( GL_KEEP, GL_DECR, GL_DECR )
   ``
   **Draw Polygon A**

3. **Where A/B**
   ```gl
   glStencilFunc( GL ALWAYS, 0x1, 0xFF )
glStencilOp( GL KEEP, GL DECR, GL DECR )
   ``
   **Where A/B**

4. **Where A/B**
   ```gl
   glStencilFunc( GL ALWAYS, 0x1, 0xFF )
glStencilOp( GL KEEP, GL DECR, GL DECR )
   ```
   **Where A/B**

5. **Where A/B**
   ```gl
   glStencilFunc( GL ALWAYS, 0x1, 0xFF )
glStencilOp( GL KEEP, GL DECR, GL DECR )
   ```
   **Where A/B**
5. [20 pts] When environment mapping with a spheremap, which parts of the environment are better represented and why? Are there any singularities in a spheremap and if so, where do they occur?

Best Parts: facing camera

More pixels in spheremap

Singularity: outside edge

-5 for part a or b

-10 for both wrong
6. [20pts] Depth complexity is the number of polygons that render to a pixel including those not seen due to Z-buffering. It is usually described in terms of an average over an image and/or the maximum depth complexity of a given pixel.

Give the OpenGL code that computes the depth complexity.

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 Lighting is appropriately set.
All buffers (color, depth, stencil) are cleared.
There is a drawing routine: DrawPolygons().
You must set all other necessary state.
You must use appropriate stenciling calls (glStencilFunc and glStencilOp)

```
optional: turn off depth buffer
23. Enable Stencil Test
23. Enable Stencil Func/Op to count
34. Draw polygons
45. Read FB & sad max
56. max = any

908 = vals/pixels
```

```
-5 wrong op
-1 wrong mask
2 no stencil enable
-2 need to read on CPY
```