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)
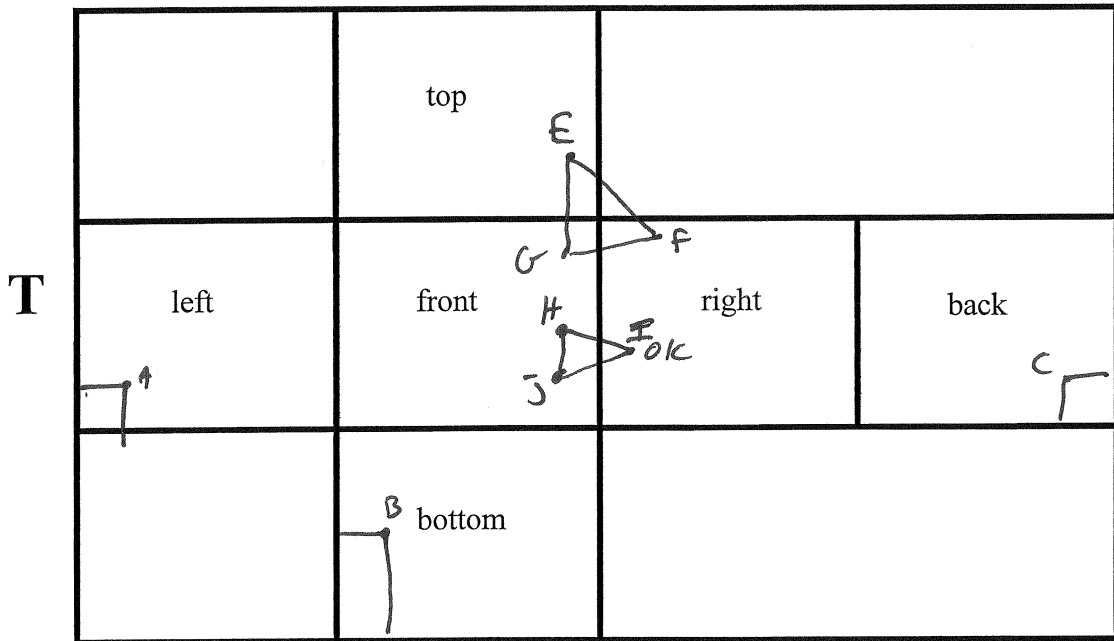4. CS 6610 students, answer all 6 questions

si/o

1. spelling of silhouette ?

silouette

silhouette

1

1. [20 pts] Draw and Explain why a cube-map can not be laid out as a single texture map:
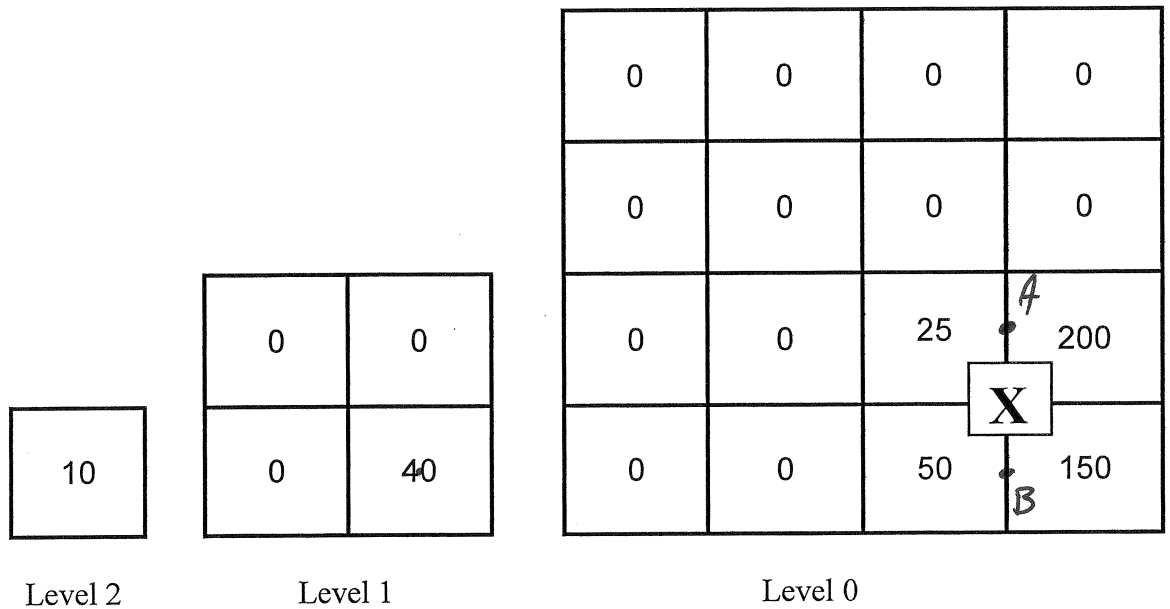
```
                    ┌──────────────┐
                    │     top      │
                    │         E    │
      ┌─────────────┼──────┐   ╱│  │
      │             │      G ╱  F  │
T     │    left     │ front  ╲    │   right    │   back
      │             │   H ╱╲      │
      │         ⌐4  │  ╱  ╲ I→OK  │           C⌐
      │             │ J────        │
      ├─────────────┼──────────────┤
      │         B   │              │
      │   bottom    │              │
      └─────────────┴──────────────┘
```

S

s;t integration falls outside of valid range
of texture region

e.g: Δ ABC spans   left, bottom, back faces
     clearly s;T fails

     Δ EFG fails for edge $\overline{EF}$ where (s,t)
            goes outside valid region

     ΔHFJ is ok

−5 didn't specify above but
gave other reason
           valid

Level 2   Level 1   Level 0

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**.

$$A = 25 + \frac{200-25}{2} = 112.50$$

$$B = 50 + \frac{150-50}{2} = 100$$

$$X = 100 + \frac{112.5-100}{2} = 106.25$$

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

-7.5: average rather than interp

← d is closer to finest level (0)
no mip-mapping

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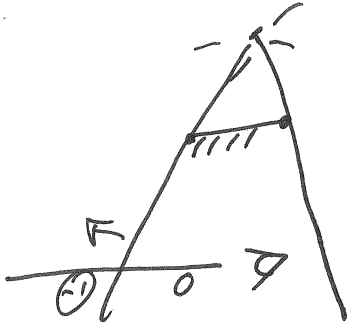   magnification filter set at: GL_LINEAR

Same   d is closer to level 0 ; Mip-Map is nearest
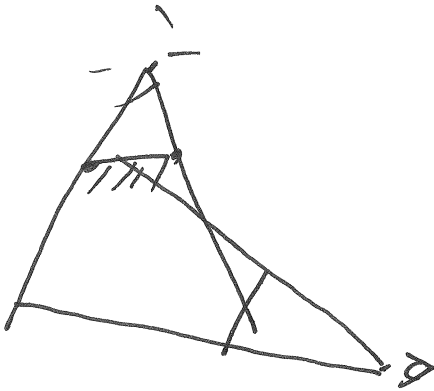
-5: wrong linear or nearest

-1 wrong √ neighbor

MIPMAP

3

→ what does it mean?

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-fail

4

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)

```
glStencil func (GL_ALWAYS, 0x1 , 0xFF)
glStencil Op (GL_keep , GL_REPLACE , GL_REPLACE
Draw Polygon A
```

→ 1's cover polygon A


```
glStencil func (GL_EQUAL, 0x1, 0xFf)
glStencil Op (GL_KEEP, GL_INCR, GL_INCR)
Draw Polygon B
```


2's at intersection
1's elsewhere A∩B
0's elsewhere in B

```
glStencilFunc (GL_ALways, 0x1, 0xFF)
glStencil Op (GL_KEEP, GL_DECR, GL_DECR)
Draw Polygon A
```


1 where A∩B
0's elsewhere

5

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
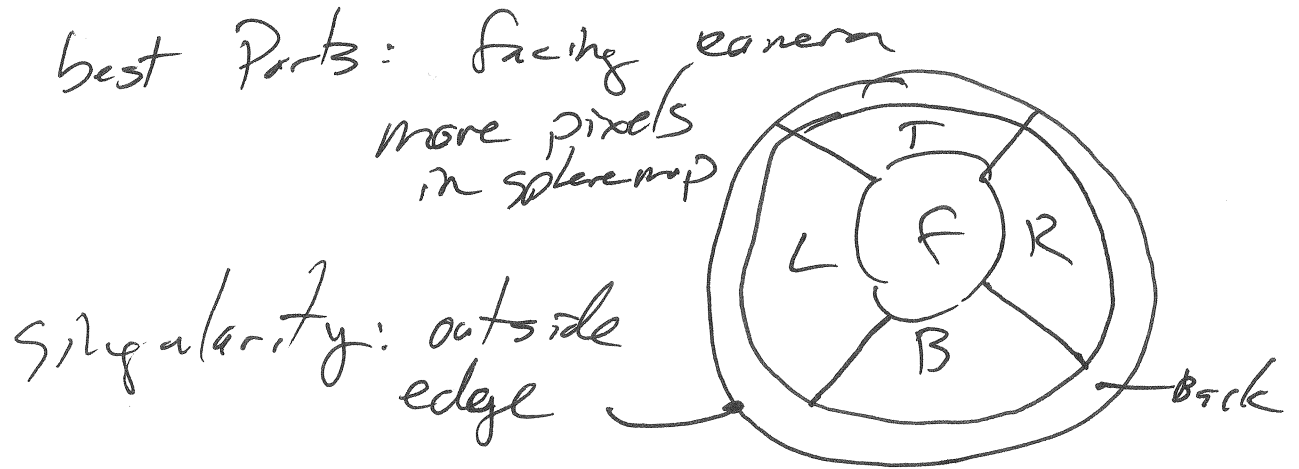
-5 for part a or b

-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 1. turn off depth buffer

1. Enable Stencil test
2. Enable Stencil func/OP to count
3. draw polygons

4. Read FB & find max
   & sum vals

5. max = max
   avg = vals/pixels

gl
gl Enable (GL_StencilTest)
gl StencilFunc (GL Always, 0x1, 0xff)
gl Stencl OP(GL INCR, GL INCR, GL INCR)
Draw polygons

compute max/avg.

-5 wrong OP
-1 wrong Mask
-2 no stencil enable

-2 need to read on CPU

7