Exam i Computer Graphics

18 august 2006, 8-13

Electronic calculator allowed

1. (a) Give a formula for the reflection of *a* vector a with respect to another vector *b*. *(0.5)*
   (b) What are *homogenous coordinates*? *(0.5)*

2. (a) What is a *cube map* and what is it usual used for? *(0.2)*
   (b) Explain the algorithm for its use. *(0.8)*

3. (a) What is *Catmull-Rom-interpolation*? *(0.5)*
   (b) Explain how *radiosity calculations* are done. *(0.5)*

4. (a) State the per-pixel and per-vertex expressions for the diffuse reflection according to Phong's reflection model in a point with barycentric coordinates (b_0, b_1, b_2). The vertices of the triangle have normals $(\mathbf{n}_0, \mathbf{n}_1, \mathbf{n}_2)$ the light comes from a directional light source such that the light vector is *L* and the light intensity at the triangle is *I*. *(0.8)*.

   (b) In Phong's reflection model there is a so called *ambient* term. What is that and what is its purpose? *(0.2)*

5. (a) Describe what is displayed on the screen after a call to the function draw() below *(0.8)*.

```
def draw():
    glColor(1,0,0)
    glPushMatrix()
    glTranslate(2,0,0)
    glScale(2,1,1)
    glRotate(90, 0,0,1)
    glPushMatrix()
    glTranslate(3,0,0)
    drawSquare()

    glColor(0,1,0)
    glPopMatrix()
    glRotate(180, 0,0,1)
    glPushMatrix()
    glTranslate(4,0,0)
    drawSquare()

def drawSquare():
    glBegin(GL_QUADS)
    glVertex(0,0,0)
    glVertex(0,1,0)
    glVertex(1,1,0)
    glVertex(1,0,0)
    glEnd()
```

   (b) What is the effect of the following OpenGL call *(0.2)*:

```
glTexParameteri(GL_TEXTURE_2D, GL_TEXTURE_WRAP_S, GL_REPEAT)
```

6. Where in the image plane is a point with world coordinates (*0,4,-2*) rendered if the camera is positioned in (*7,0,15*), has up vector (*0,1,0*), is pointed towards the world origin, and has a zoom factor (distance to the projection plane) of *3.8* and the render surface has (*640,480*) square pixels? (*1.0*)

THE END!