

Exam in Computer Graphics

20 April 2009, 14-19

Electronic calculator NOT allowed

- 1 (a) Give the formula of the vector operation *cross product*. (0.5)
(b) Describe in words the result of the this operation. (0.5)
- 2 (a) Explain how *linear interpolation* is done in two dimensions. (0.6)
(b) Explain how *bilinear interpolation* is done. (0.4)
- 3 (a) Scene descriptions often uses hierarchical structures. Which are the benefits of this technique? (0.6)
(b) Describe how these structures are traversed at rendering. (0.4)
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 \mathbf{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)
    glTranslate(1, 2, 0)
    glPushMatrix()
    glScale(2, 3, 1)
    drawSquare()

    glColor(0, 1, 0)
    glPopMatrix()
    glScale(1, 2, 1)
    glPushMatrix()
    glRotate(90, 0,0,-1)
    glTranslate(-2, -1, 0)
    drawSquare()

    glColor(0, 0, 1)
    glPopMatrix()
    glPushMatrix()
    glTranslate(2, 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 a *display list* in OpenGL (0.2):

6. (a) *Raytracing* and *environment mapping* can give very similar effects. What would you look for in order to tell the difference? Explain why. (0.5)
- (b) *Bump mapping* requires tangent and binormal information to be available at each vertex of the mesh. Explain why this is necessary. (0.5)

THE END!