HÁSKÓLINN Í REYKJAVÍK
REYKJAVÍK UNIVERSITY

Tölvugrafík, haust 2010

T-511-TGRA

Lokapróf

Kennari: **Kári Halldórsson**
Dagsetning: **6. desember 2010**
Kl: **9:00 – 12:00 (3 klst)**

Hjálpargögn: Reiknivél & meðfylgjandi formúlublað

Nafn_____

Kennitala _____

1. (5%)
Explain how the following operations work and give an example of their usage.

```
glPushMatrix();
glPopMatrix();
```

2. (10%)
Describe the process of depth testing. What values are used and how, where are they found/calculated and where/when are they stored? (No actual calcualtions or formulas needed here).

3. (10%)
Use the Cohen-Sutherland clipping algorithm to clip a line with endpoints P1 = (0, 0) and P2 = (60, 30) against a window (W.l, W.b, W.r, W.t) = (10, 10, 40, 60). Explain the steps.

4. (15%)
A single light is in the light model in an OpenGL program. It has the ambient values (0.0, 0.0, 0.0), diffuse values (0.5, 0.3, 0.7), specular values (0.3, 0.8, 0.7) and position (5.0, 8.0, -1.0).
There is also a global ambient factor of (0.3, 0.2, 0.4) in the light model.
A camera is positioned in (4.0, 6.0, 5.0) and looks towards P.
P has the color values: ambient (0.4, 0.2, 0.3), diffuse (0.4, 0.7, 0.2) and specular (0.6, 0.6, 0.6). It has a shininess value of 9. It has the position (4.0, 4.0, 3.0) and a normal (0.0, 1.0, 0.0).
What will be the green color value for P on the screen ?

5. (50%)
Values are set in the Modelview matrix, transforming coordinates in relation to the direction and orientation of the camera like this:

$$\begin{bmatrix} u_X & u_Y & u_Z & -eye \circ u \\ v_X & v_Y & v_Z & -eye \circ v \\ n_X & n_Y & n_Z & -eye \circ n \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

a) How will the matrix look if the following code is run ? (20%)

```
glLoadIdentity();
gluLookAt(3.0, 3.0, 3.0, 5.0, 7.0, 3.0, 0.0, 0.0, -1.0);
```

b) Show the values in the modelview metrix if the this code is run following the previous code from a). (10%)

```
glScaled(1.0, 2.0, 3.0);
```

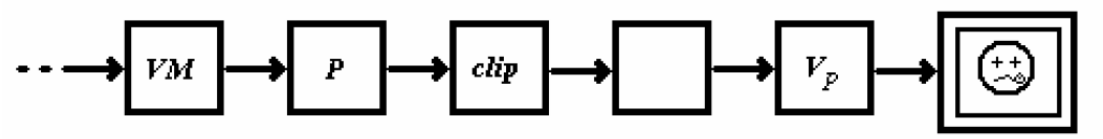
c) Describe what happens when the following code is run and show the values that will end up in the Projection matrix. (10%)

```
gluPerspective(75.0, 0.8, 1.0, 20.0);
```

d) Using the current matrix values, after the code from a), b) and c) has run, find the eye coordinates and clip coordinates for the following point. Will the point be displayed on the screen in the end? Explain. (10%)

```
glBegin(GL_POINTS);
      glVertex3f(4.0, 6.0, 4.0);
glEnd();
```

6. (10%)
Here is a simplified image of the OpenGL graphics pipeline. Point to the following locations on the image, on or between the boxes:
a) Changing the camera's „lens" will affect values here.
b) All point values are between -1 and 1 here
c) Values describing the location and orientation of the camera are stored here.
d) This is used to calculate the pseudodepth for a vertex.
e) The color value for a vertex is calculated here.



Bonus question (3%)

A: Do you like apples?
B: Yeah.
A: Well, I got her number. How do you like them apples?

Who are speaking and in which film ?