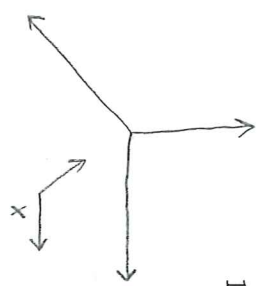


Example mid-term - 2007 MT. S Comp 676



1. (7 marks) Consider the following segment of code:

```
glMatrixMode(GL_MODELVIEW);
glLoadIdentity();
gluLookat(1.0, 0.0, 1.0, 0.0, 0.0, 0.0, 1.0, 0.0, 0.0);
```

Assume that you are only allowed to use functions in the GL library, replace the call to gluLookat by an equivalent sequence of calls to functions in the GL library. Please note that every function in the GL library begins with "gl", followed by an upper case character.

```
R ROTATE(45, 1, 0)
TRANSLATE(-1, 0, -1)
```

This question concerns the planet.c program, a copy of which is attached at the end of this test. You have to calculate the diameter of the planet (measured in pixels) when the planet is directly in front of the sun, i.e., it is in between the viewer and the sun. Assume that the window size is unchanged from its initial value.

void reshape (int w, int h) { This question also concerns the planet.c program, a copy of which is attached at the end of this test.

```
float top, right, left, bottom;
Modify the program so that the sizes of the sun and the planet, as displayed on the screen, stays unchanged when the window size is changed.
```

Your modification should be specified as a sequence of deletions and/or insertions in the program. Insertions should be specified as C codes.

```
Top = tan(30 * pi/180) * 500, attached at the end of this test.
```

You have to modify the program so that the viewpoint can be changed by using the key 'c'. By pressing the key 'c', the viewpoint is rotated upwards, while keeping the distance between the eye and the center of the sun constant. After pressing 'c' 3 times, the view should be directly on top of the sun. After pressing it 12 times, the view should return back to its original position (0, 0, 200);

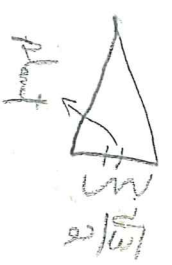
```
glTranslatef(0, 0, 200);
Your modification should be specified as a sequence of deletions and/or insertions in the program. Insertions should be specified as C codes.
```

```
glTranslatef(0, 0, 200);
gluLookAt(0.5, 0.5, 0, 0, 1, 0);
```



$$\tan 30^\circ = \frac{1}{2}$$

$$M = \frac{1}{2} \tan 30^\circ = \frac{1}{2} \cdot \frac{1}{\sqrt{3}} = \frac{1}{2\sqrt{3}}$$



$$\frac{1}{\sqrt{3}} = 500 \text{ pixels (vertical)}$$

$$0.4 = \frac{500}{\sqrt{3}} \times 0.4 \approx 577$$

58 px

```

#include <GL/glut.h>
#include <stdlib.h>

static int year = 0, day = 0;

void init(void)
{
    glClearColor (0.0, 0.0, 0.0, 0.0);
    glShadeModel (GL_FLAT);
}

void display(void)
{
    glClear (GL_COLOR_BUFFER_BIT);
    glColor3f (1.0, 1.0, 1.0);

    glPushMatrix();
    glutWireSphere(1.0, 20, 16); /* draw sun */
    glRotatetf ((GLfloat) year, 0.0, 1.0, 0.0);
    glTranslatetf (2.0, 0.0, 0.0);
    glRotatetf ((GLfloat) day, 0.0, 1.0, 0.0);
    glutWireSphere(0.2, 10, 8); /* draw smaller planet */
    glPopMatrix();
    glutSwapBuffers();
}

void reshape (int w, int h)
{
    glViewport (0, 0, (GLfloat) w, (GLfloat) h);
    glMatrixMode (GL_PROJECTION);
    glLoadIdentity ();
    gluPerspective(60.0, (GLfloat) w/(GLfloat) h, 1.0, 20.0);
    glMatrixMode(GL_MODELVIEW);
    glLoadIdentity();
    gluLookAt (0.0, 0.0, 5.0, 0.0, 0.0, 0.0, 1.0, 0.0);
}

void keyboard (unsigned char key, int x, int y)
{

```

vertical "slice"  
horizontal "slice"