

370 Quiz 2: 3D Graphics and OpenGL

```

000 // LStrips.cpp
001
002 #include "../shared/gltools.h"
003 #include <math.h>
004
005 #define GL_PI 3.1415f
006
007 static GLfloat xRot = 0.0f;
008 static GLfloat yRot = 0.0f;
009
010 void RenderScene(void)
011 {
012     GLfloat x,y,z,angle;
013
014     glClear(GL_COLOR_BUFFER_BIT);
015     glPushMatrix();
016     glRotatef(xRot, 1.0f, 0.0f, 0.0f);
017     glRotatef(yRot, 0.0f, 1.0f, 0.0f);
018
019     glBegin(GL_LINE_STRIP);
020     z = -50.0f;
021     for(angle = 0.0f; angle <= (2.0f*3.1415f)*3.0f; angle += 0.1f)
022     {
023         x = 50.0f*sin(angle);
024         y = 50.0f*cos(angle);
025         glVertex3f(x, y, z);
026         z += 0.5f;
027     }
028     glEnd();
029
030     glPopMatrix();
031     glutSwapBuffers();
032 }
033
034 void SetupRC()
035 {
036     glClearColor(0.0f, 0.0f, 0.0f, 1.0f );
037     glColor3f(0.0f, 1.0f, 0.0f);
038 }
039
040 void SpecialKeys(int key, int x, int y)
041 {
042     if(key == GLUT_KEY_UP) xRot-= 5.0f;
043     if(key == GLUT_KEY_DOWN) xRot += 5.0f;
044     if(key == GLUT_KEY_LEFT) yRot -= 5.0f;
045     if(key == GLUT_KEY_RIGHT)yRot += 5.0f;
046     if(key > 356.0f) xRot = 0.0f;
047     if(key < -1.0f) xRot = 355.0f;
048     if(key > 356.0f) yRot = 0.0f;
049     if(key < -1.0f) yRot = 355.0f;
050     glutPostRedisplay();
051 }
052
053 void ChangeSize(int w, int h)
054 {
055     GLfloat nRange = 100.0f;
056     if(h == 0) h = 1;
057
058     glViewport(0, 0, w, h);
059     glMatrixMode(GL_PROJECTION);
060     glLoadIdentity();
061
062     if (w <= h)
063         glOrtho (-nRange, nRange, -nRange*h/w, nRange*h/w, -nRange, nRange);
064     else
065         glOrtho (-nRange*w/h, nRange*w/h, -nRange, nRange, -nRange, nRange);
066
067     glMatrixMode(GL_MODELVIEW);
068     glLoadIdentity();
069 }
070
071 int main(int argc, char* argv[])
072 {
073     glutInit(&argc, argv);
074     glutInitDisplayMode(GLUT_DOUBLE | GLUT_RGB | GLUT_DEPTH);
075     glutCreateWindow("Line Strips Example");
076     glutReshapeFunc(ChangeSize);
077     glutSpecialFunc(SpecialKeys);
078     glutDisplayFunc(RenderScene);
079     SetupRC();
080     glutMainLoop();
081
082     return 0;
083 }

```

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- 1) At which “line number” would the program begin execution?
- 2) Which line number has the command to restore the transformation stack to its prior state?
- 3) Which line numbers have commands that would NOT be used if using “single buffering.”
- 4) What are “ChangeSize,” “SpecialKeys”, and “RenderScene”?
- 5) Why are the glOrtho calls different in lines 63 and 65?

- 6) What library (included by including “gltools.h” in this case) talks to the native window manager to create a window to display these graphics?
- 7) What color is the background in this window?
- 8) What color are drawn graphics in this program?
- 9) Why is there only one glVertex command in the RenderScene() function? (How are things drawn with only one glVertex command)?

- 10) Which lines of code affect the MODELVIEW matrix that OpenGL stores and uses?
- 11) Which lines of code affect the PROJECTION matrix that OpenGL stores and uses?
- 12) Is it possible to directly set the values in the MODELVIEW matrix?
- 13) What command could be used in an easy manner to change the view as if viewing through a camera?

- 14) Where is OpenGL’s default view position located?
- 15) Where is OpenGL’s default view orientation? “Looking...”
- 16) Will this program be “hardware rendered”?

- 17) What does pressing an “arrow key” affect in this program, and how does it change the drawing?

- 18) Which line numbers contain commands that affect the clipping volume?
- 19) Draw what is shown when this program first begins executing:

- 20) Draw what is shown after the “right arrow key” or “left arrow key” has been held down long enough that SpecialKeys() gets executed about 18 times: