SE3032 – Graphics and Visualization
Lab 04

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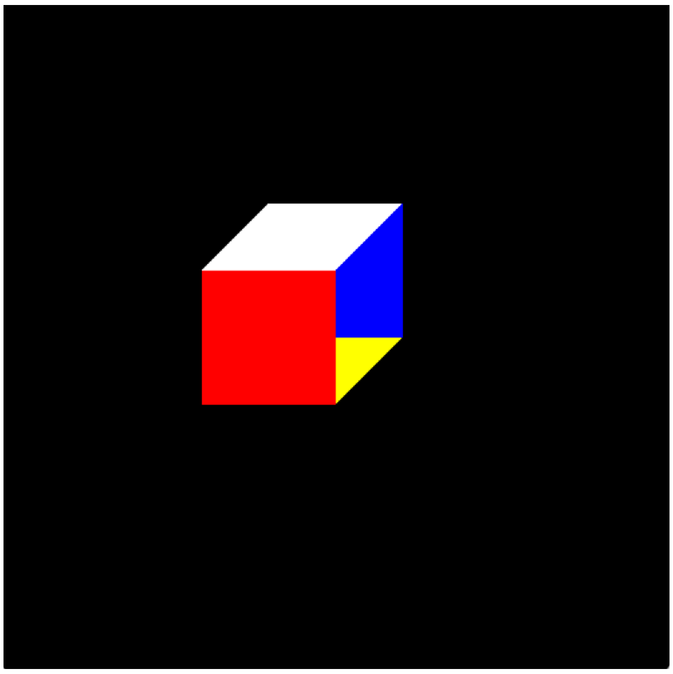
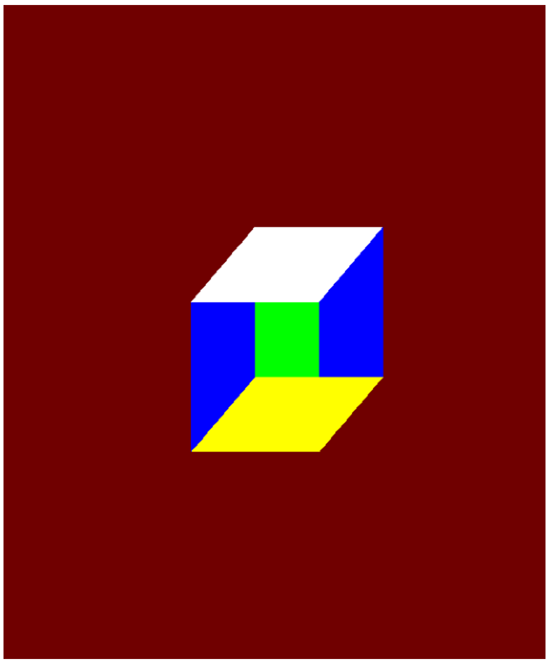
Activity 01

```
#define GL_SILENCE_DEPRECATION
#include <GLUT/glut.h>
#include <OpenGL/gl.h>
#include <OpenGL/glu.h>
#include <stdlib.h>

void createCube() {
   // Clear the color buffer
   glClear(GL_COLOR_BUFFER_BIT);

   // Back face (Green)
   glColor3f(0.0, 1.0, 0.0);
   glBegin(GL_POLYGON);
   glVertex3f(-0.2, 0.0, -0.4);
   glVertex3f(-0.2, 0.4, -0.4);
   glVertex3f(0.2, 0.4, -0.4);
   glVertex3f(0.2, 0.0, -0.4);
   glEnd();

   // Left face (Blue)
   glColor3f(0.0, 0.0, 1.0);
   glBegin(GL_POLYGON);
   glVertex3f(-0.4, -0.2, 0.0);
   glVertex3f(-0.4, 0.2, 0.0);
   glVertex3f(-0.2, 0.4, -0.4);
   glVertex3f(-0.2, 0.0, -0.4);
   glEnd();

   // Right face (Blue)
   glColor3f(0.0, 0.0, 1.0);
   glBegin(GL_POLYGON);
   glVertex3f(0.0, -0.2, 0.0);
   glVertex3f(0.0, 0.2, 0.0);
   glVertex3f(0.2, 0.4, -0.4);
   glVertex3f(0.2, 0.0, -0.4);
   glEnd();

   // Top face (White)
   glColor3f(1.0, 1.0, 1.0);
   glBegin(GL_POLYGON);
   glVertex3f(-0.4, 0.2, 0.0);
   glVertex3f(0.0, 0.2, 0.0);
   glVertex3f(0.2, 0.4, -0.4);
```

```
    glVertex3f(-0.2, 0.4, -0.4);
    glEnd();

    // Bottom face (Yellow)
    glColor3f(1.0, 1.0, 0.0);
    glBegin(GL_POLYGON);
    glVertex3f(-0.4, -0.2, 0.0);
    glVertex3f(0.0, -0.2, 0.0);
    glVertex3f(0.2, 0.0, -0.4);
    glVertex3f(-0.2, 0.0, -0.4);
    glEnd();

    // Front face (Red)
    glColor3f(1.0, 0.0, 0.0);
    glBegin(GL_POLYGON);
    glVertex3f(-0.4, -0.2, 0.0);
    glVertex3f(-0.4, 0.2, 0.0);
    glVertex3f(0.0, 0.2, 0.0);
    glVertex3f(0.0, -0.2, 0.0);
    glEnd();

    glFlush();  // Render the scene
}

void display(void) {
    createCube();
}

int main(int argc, char** argv) {
    glutInit(&argc, argv);
    glutInitDisplayMode(GLUT_SINGLE | GLUT_RGB);
    glutInitWindowPosition(500, 500);
    glutInitWindowSize(500, 500);
    glutCreateWindow("Cube of IT23226128");

    glClearColor(0.0, 0.0, 0.0, 0.0);

    glutDisplayFunc(display);
    glutMainLoop();
    return 0;
}
```

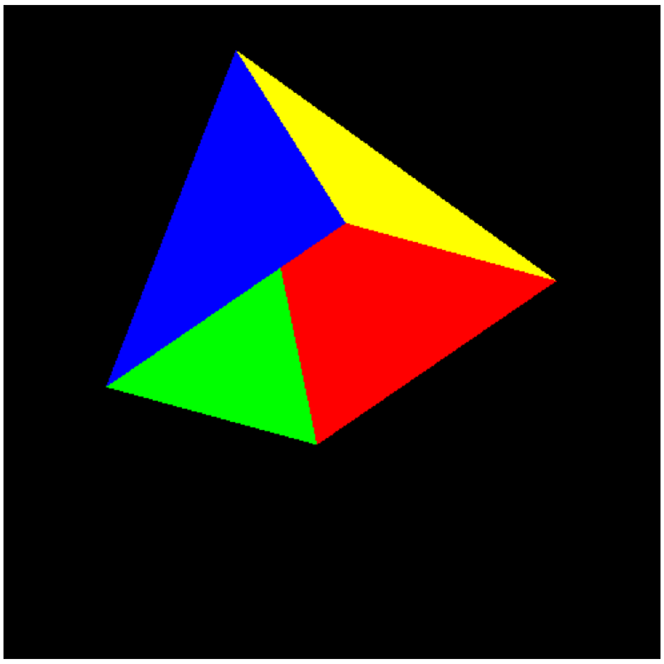




Activity 02

```
#define GL_SILENCE_DEPRECATION
#include <GLUT/glut.h>
#include <OpenGL/gl.h>
#include <OpenGL/glu.h>
#include <stdlib.h>

void createPyramid() {
  glClear(GL_COLOR_BUFFER_BIT);

  // Base (Square - using two triangles)
  glColor3f(0.5, 0.5, 0.5);

  // First triangle of base
  glBegin(GL_TRIANGLES);
  glVertex3f(-0.5, 0.0, -0.5);
  glVertex3f(0.5, 0.0, -0.5);
  glVertex3f(-0.5, 0.0, 0.5);
  glEnd();

  // Second triangle of base
  glBegin(GL_TRIANGLES);
  glVertex3f(0.5, 0.0, -0.5);
  glVertex3f(0.5, 0.0, 0.5);
  glVertex3f(-0.5, 0.0, 0.5);
  glEnd();

  // Front face (Red)
  glColor3f(1.0, 0.0, 0.0);
  glBegin(GL_TRIANGLES);
  glVertex3f(-0.5, 0.0, -0.5);
  glVertex3f(0.5, 0.0, -0.5);
  glVertex3f(0.0, 1.0, 0.0);
  glEnd();

  // Right face (Green)
  glColor3f(0.0, 1.0, 0.0);
  glBegin(GL_TRIANGLES);
  glVertex3f(0.5, 0.0, -0.5);
  glVertex3f(0.5, 0.0, 0.5);
  glVertex3f(0.0, 1.0, 0.0);
  glEnd();

  // Back face (Blue)
  glColor3f(0.0, 0.0, 1.0);
  glBegin(GL_TRIANGLES);
  glVertex3f(0.5, 0.0, 0.5);
  glVertex3f(-0.5, 0.0, 0.5);
  glVertex3f(0.0, 1.0, 0.0);
  glEnd();

  // Left face (Yellow)
```

```
    glColor3f(1.0, 1.0, 0.0);
    glBegin(GL_TRIANGLES);
    glVertex3f(-0.5, 0.0, 0.5);
    glVertex3f(-0.5, 0.0, -0.5);
    glVertex3f(0.0, 1.0, 0.0);
    glEnd();

    glFlush();
}

void display(void) {
    createPyramid();
}

void keyboard(unsigned char key, int x, int y) {
    switch (key) {
        case 'r': case 'R':
            glRotatef(10.0, 0.0, 1.0, 0.0); // Rotate around Y-axis
            break;
        case 'x': case 'X':
            glRotatef(10.0, 1.0, 0.0, 0.0); // Rotate around X-axis
            break;
        case 'q': case 'Q':
            exit(0);
            break;
    }
    glutPostRedisplay();
}

int main(int argc, char** argv) {
    glutInit(&argc, argv);
    glutInitDisplayMode(GLUT_SINGLE | GLUT_RGB);
    glutInitWindowPosition(200, 200);
    glutInitWindowSize(500, 500);
    glutCreateWindow("Pyramid - IT12345678");  // Replace with your IT index

    glClearColor(0.0, 0.0, 0.0, 1.0);

    glutKeyboardFunc(keyboard);
    glutDisplayFunc(display);
    glutMainLoop();
    return 0;
}
```



Assignment

```
#define GL_SILENCE_DEPRECATION
#include <GLUT/glut.h>
#include <stdlib.h>

static const float APEX_PUSH_X = 0.40f;

static void init(void) {
   glClearColor(0.0, 0.0, 0.0, 1.0);
   glEnable(GL_DEPTH_TEST);
   glDepthFunc(GL_LEQUAL);
   glClearDepth(1.0);
}

static void reshape(int w, int h) {
   glViewport(0, 0, w, h);
   glMatrixMode(GL_PROJECTION);
   glLoadIdentity();
   glOrtho(-1.0, 1.0,   -1.0, 1.0,   -1.0, 1.0); // z in [-1,1]
   glMatrixMode(GL_MODELVIEW);
   glLoadIdentity();
}

static void drawScene(void) {
   glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT);

   // Back face (Green)
   glColor3f(0.0, 1.0, 0.0);
   glBegin(GL_POLYGON);
      glVertex3f(-0.2f, 0.0f, -0.4f);
      glVertex3f(-0.2f, 0.4f, -0.4f);
      glVertex3f( 0.2f, 0.4f, -0.4f);
      glVertex3f( 0.2f, 0.0f, -0.4f);
   glEnd();

   // Left face (Blue)
   glColor3f(0.0, 0.0, 1.0);
   glBegin(GL_POLYGON);
      glVertex3f(-0.4f, -0.2f,  0.0f);
      glVertex3f(-0.4f,  0.2f,  0.0f);
      glVertex3f(-0.2f,  0.4f, -0.4f);
      glVertex3f(-0.2f,  0.0f, -0.4f);
   glEnd();

   // Top face (White)
   glColor3f(1.0, 1.0, 1.0);
   glBegin(GL_POLYGON);
      glVertex3f(-0.4f, 0.2f,  0.0f);
      glVertex3f( 0.0f, 0.2f,  0.0f);
      glVertex3f( 0.2f, 0.4f, -0.4f);
      glVertex3f(-0.2f, 0.4f, -0.4f);
```

```
    glEnd();

    // Bottom face (Yellow)
    glColor3f(1.0, 1.0, 0.0);
    glBegin(GL_POLYGON);
        glVertex3f(-0.4f, -0.2f,  0.0f);
        glVertex3f( 0.0f, -0.2f,  0.0f);
        glVertex3f( 0.2f,  0.0f, -0.4f);
        glVertex3f(-0.2f,  0.0f, -0.4f);
    glEnd();

    // Front face (Red)
    glColor3f(1.0, 0.0, 0.0);
    glBegin(GL_POLYGON);
        glVertex3f(-0.4f, -0.2f, 0.0f);
        glVertex3f(-0.4f,  0.2f, 0.0f);
        glVertex3f( 0.0f,  0.2f, 0.0f);
        glVertex3f( 0.0f, -0.2f, 0.0f);
    glEnd();


    const GLfloat B1[3] = { 0.0f, -0.2f,  0.0f };  // front-bottom-right
    const GLfloat B2[3] = { 0.0f,  0.2f,  0.0f };  // front-top-right
    const GLfloat B3[3] = { 0.2f,  0.4f, -0.4f };  // back-top-right
    const GLfloat B4[3] = { 0.2f,  0.0f, -0.4f };  // back-bottom-right


    const float cx = (B1[0] + B2[0] + B3[0] + B4[0]) * 0.25f; // ~0.1
    const float cy = (B1[1] + B2[1] + B3[1] + B4[1]) * 0.25f; // ~0.1
    const float cz = (B1[2] + B2[2] + B3[2] + B4[2]) * 0.25f; // ~-0.2

    // Apex pushed outward along +X (to the "right")
    const GLfloat A[3] = { cx + APEX_PUSH_X, cy, cz };

    // Four triangular sides around the base
    glColor3f(1.0f, 1.0f, 0.0f); // Yellow
    glBegin(GL_TRIANGLES); glVertex3fv(B1); glVertex3fv(B2); glVertex3fv(A); glEnd();

    glColor3f(0.0f, 1.0f, 1.0f); // Cyan
    glBegin(GL_TRIANGLES); glVertex3fv(B2); glVertex3fv(B3); glVertex3fv(A); glEnd();

    glColor3f(1.0f, 0.5f, 0.0f); // Orange
    glBegin(GL_TRIANGLES); glVertex3fv(B3); glVertex3fv(B4); glVertex3fv(A); glEnd();

    glColor3f(0.6f, 0.2f, 1.0f); // Purple
    glBegin(GL_TRIANGLES); glVertex3fv(B4); glVertex3fv(B1); glVertex3fv(A); glEnd();

    glutSwapBuffers();
}

int main(int argc, char** argv) {
    glutInit(&argc, argv);
    glutInitDisplayMode(GLUT_DOUBLE | GLUT_RGB | GLUT_DEPTH); // depth + double buffer
    glutInitWindowPosition(200, 200);
    glutInitWindowSize(500, 500);
    glutCreateWindow("Cube + Right-Side Pyramid (IT23226746)");

    init();
    glutReshapeFunc(reshape);
    glutDisplayFunc(drawScene);
    glutMainLoop();
    return 0;
}
```