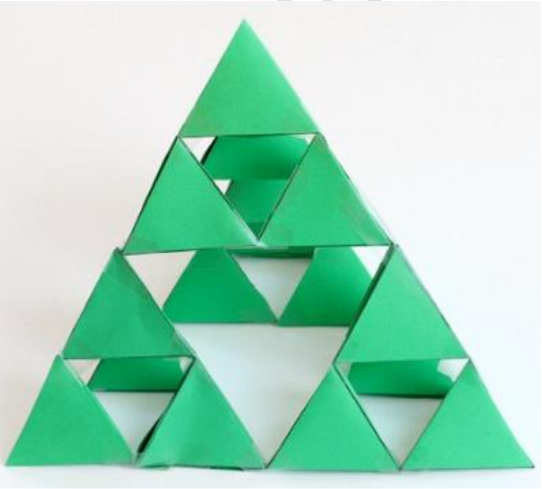
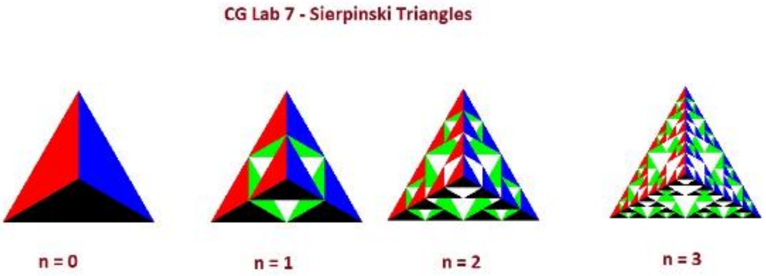
7. Program to recursively subdivide a tetrahedron to from 3D Sierpinski gasket. The number of recursive steps is to be specified by the user



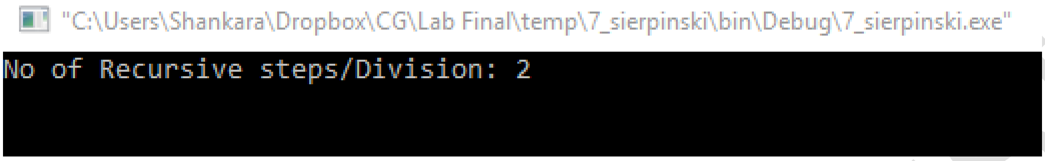
```
#include<stdlib.h>
#include<stdio.h>
#include<GL/glut.h>

typedef float point[3];
point v[]= {{0, 0, 1}, {0, 1, 0}, {-1, -0.5, 0}, {1, -0.5, 0}};
int n;

void triangle(point a, point b, point c)
{
    glBegin(GL_POLYGON);
          glVertex3fv(a);
          glVertex3fv(b);
          glVertex3fv(c);
    glEnd();
}

void divide_triangle(point a, point b, point c, int n)
{
    point v1,v2,v3;
    int j;

    if(n>0)
    {
        for(j=0; j<3; j++)
            v1[j] = (a[j]+b[j])/2;  // calculate mid-point between a and b

        for(j=0; j<3; j++)
            v2[j] = (a[j]+c[j])/2;  // calculate mid-point between a and c

        for(j=0; j<3; j++)
            v3[j] = (c[j]+b[j])/2;  // calculate mid-point between c and b

        divide_triangle(a,v1,v2,n-1); // divide triangle between points a, ab/2, ac/2 recursively

        divide_triangle(c,v2,v3,n-1);

        divide_triangle(b,v3,v1,n-1);

    }

    else
         triangle (a,b,c);// draw triangle
}
```



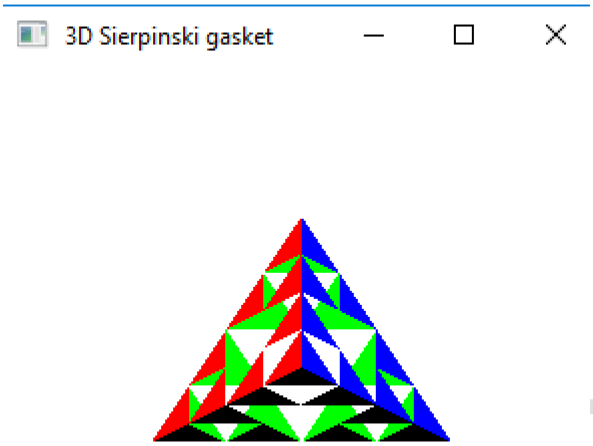
```
void tetrahedron(int n)
{
    glColor3f(1, 0, 0);                      // assign color for each of the side
    divide_triangle(v[0], v[1], v[2], n);    // draw triangle between a, b, c

    glColor3f(0,  1,  0);
    divide_triangle(v[3], v[2], v[1], n);

    glColor3f(0,  0,  1);
    divide_triangle(v[0], v[3], v[1], n);

    glColor3f(0,  0,  0);
    divide_triangle(v[0], v[2], v[3], n);

}

void display(void)
{
    glClear(GL_COLOR_BUFFER_BIT|GL_DEPTH_BUFFER_BIT);
    glLoadIdentity();
    tetrahedron(n);
    glFlush();                               // show the output
}

void myReshape(int w,int h)          // please see the earlier program for explanation on this
{
    glViewport(0, 0, w, h);
    glMatrixMode(GL_PROJECTION);
    glLoadIdentity();

    if(w<=h)
        glOrtho(-2, 2, -2*(GLfloat)h/(GLfloat)w, 2*(GLfloat)h/(GLfloat)w, -10, 10);
    else
        glOrtho(-2*(GLfloat)w/(GLfloat)h, 2*(GLfloat)w/(GLfloat)h, -2, 2, -10, 10);

    glMatrixMode(GL_MODELVIEW);
    glutPostRedisplay();
}

int main(int argc,char ** argv)
{
    printf("No of Recursive steps/Division: ");
    scanf("%d",&n);
    glutInit(&argc,argv);
    glutInitDisplayMode(GLUT_SINGLE|GLUT_RGB|GLUT_DEPTH);
    glutCreateWindow(" 3D Sierpinski gasket");

    glutReshapeFunc(myReshape);
    glutDisplayFunc(display);        // call display function

    glEnable(GL_DEPTH_TEST);  // do depth comparisons and update the depth buffer.

    glClearColor(1, 1, 1, 0);
    glutMainLoop();

    return 0;
}
```

****

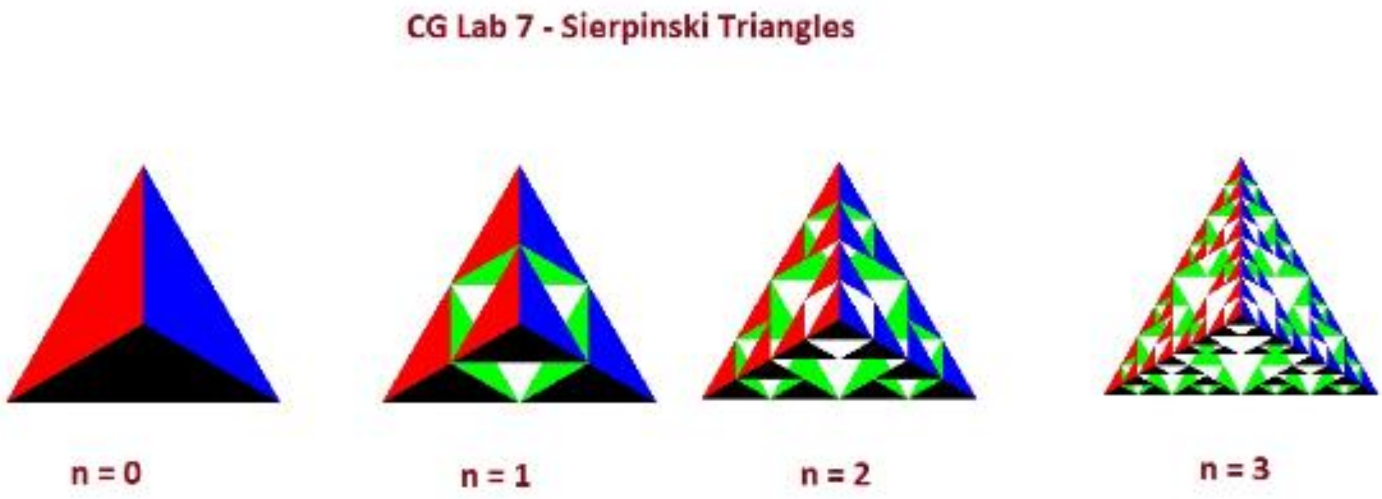
OUTPUT



```
"C:\Users\Shankara\Dropbox\CG\Lab Final\temp\7_sierpinski\bin\Debug\7_sierpinski.exe"
No of Recursive steps/Division: 2
```



// for your information & understanding


CG Lab 7 - Sierpinski Triangles
n = 0
n = 1
n = 2
n = 3