

CS 405 Computer Graphics

3D Project Part 1

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Table of Contents:

[Environment Information](#)

[VAO Information:](#)

[Sphere:](#)

[Donut:](#)

[Spike:](#)

[Cube:](#)

[Scenes](#)

[First Scene](#)

[Screenshots:](#)

[First Scene Specs:](#)

[Second Scene](#)

[Screenshots:](#)

[Second Scene Specs:](#)

[Third Scene](#)

[Screenshots:](#)

[Third Scene Specs:](#)

[Fourth Scene](#)

[Screenshots:](#)

[Fourth Scene Specs:](#)

[Fifth Scene](#)

[Screenshots:](#)

[Fifth Scene Specs:](#)

[Sixth Scene](#)

[Screenshots:](#)

[Sixth Scene Specs:](#)

Environment Information

Processor: 2,6 GHz 6-Core Intel Core i7

Memory: 16 GB 2667 MHz DDR4

OS: macOS Big Sur 11.0.1

VAO Information:

Sphere:

```
GenerateParametricShapeFrom2D(positions, normals, indices, ParametricCircle, 16, 16);  
VAO donutVAO(positions, normals, indices);
```

Donut:

```
GenerateParametricShapeFrom2D(positions, normals, indices, ParametricHalfCircle, 16, 16);  
VAO sphereVAO(positions, normals, indices);
```

Spike:

```
GenerateParametricShapeFrom2D(positions, normals, indices, ParametricSpikes, 64, 32);  
VAO torusVAO(positions, normals, indices);
```

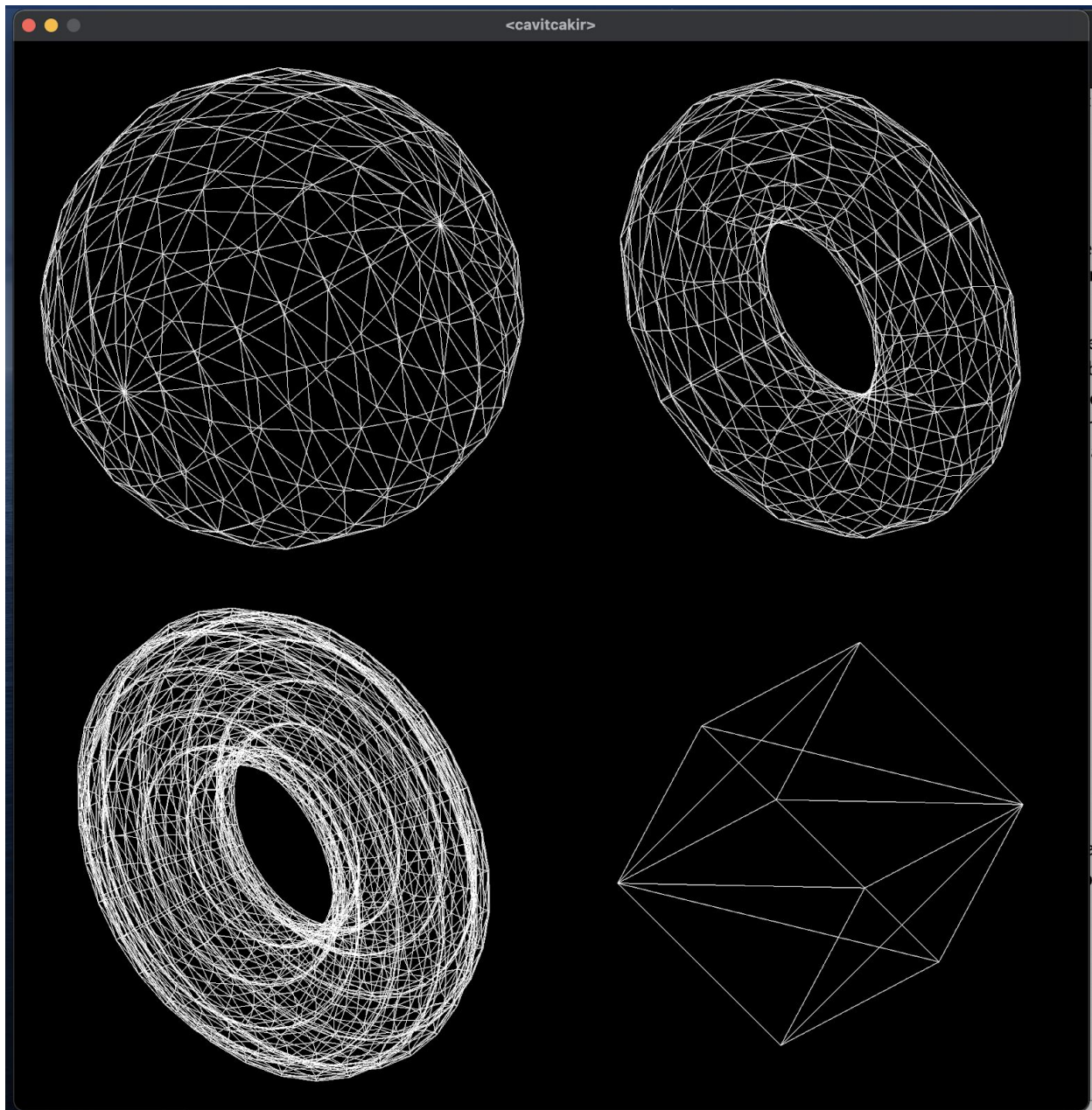
Cube:

Created from an array of positions, normals and indices.

Scenes

First Scene

Screenshots:



First Scene Specs:

Colors: `out_color = vec4(vec3(1, 1, 1), 1);`

Polygon mode: `glPolygonMode(GL_FRONT_AND_BACK, GL_LINE);`

Sphere(up-left) =

```
glm::translate(glm::vec3(-0.5, 0.5, 0));  
glm::scale(transform, glm::vec3(0.45));  
glm::rotate(glm::radians(float glfwGetTime()) * 10), glm::vec3(1, 1, 0));
```

Donut(up-right) =

```
glm::translate(glm::vec3(glm::vec3(0.5, 0.5, 0)));  
glm::scale(transform, glm::vec3(0.45));  
glm::rotate(glm::radians(float glfwGetTime()) * 10), glm::vec3(1, 1, 0));
```

Spikes(down-left) =

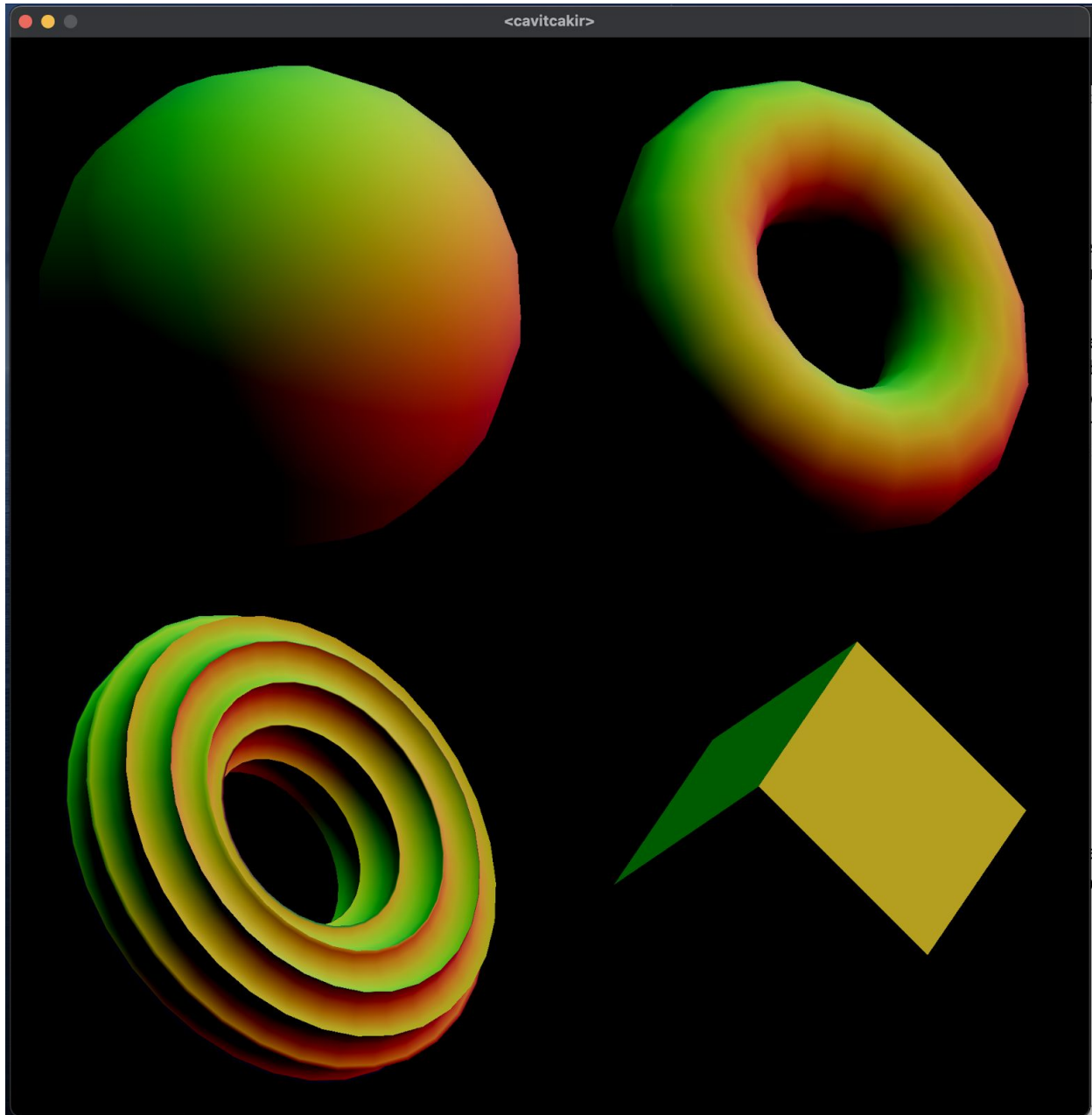
```
glm::translate(glm::vec3(-0.5, -0.5, 0));  
glm::scale(transform, glm::vec3(0.45));  
glm::rotate(glm::radians(float glfwGetTime()) * 10), glm::vec3(1, 1, 0));
```

Cube(down-right) =

```
glm::translate(glm::vec3(0.5, -0.5, 0));  
glm::scale(transform, glm::vec3(0.45));  
glm::rotate(glm::radians(float glfwGetTime()) * 10), glm::vec3(1, 1, 0));
```

Second Scene

Screenshots:



Second Scene Specs:

Colors: `vec3 color = vertex_normal;`

Sphere(up-left) =

```
glm::translate(glm::vec3(-0.5, 0.5, 0));  
glm::scale(transform, glm::vec3(0.45));  
glm::rotate(glm::radians(float glfwGetTime()) * 10), glm::vec3(1, 1, 0));
```

Donut(up-right) =

```
glm::translate(glm::vec3(glm::vec3(0.5, 0.5, 0)));  
glm::scale(transform, glm::vec3(0.45));  
glm::rotate(glm::radians(float glfwGetTime()) * 10), glm::vec3(1, 1, 0));
```

Spikes(down-left) =

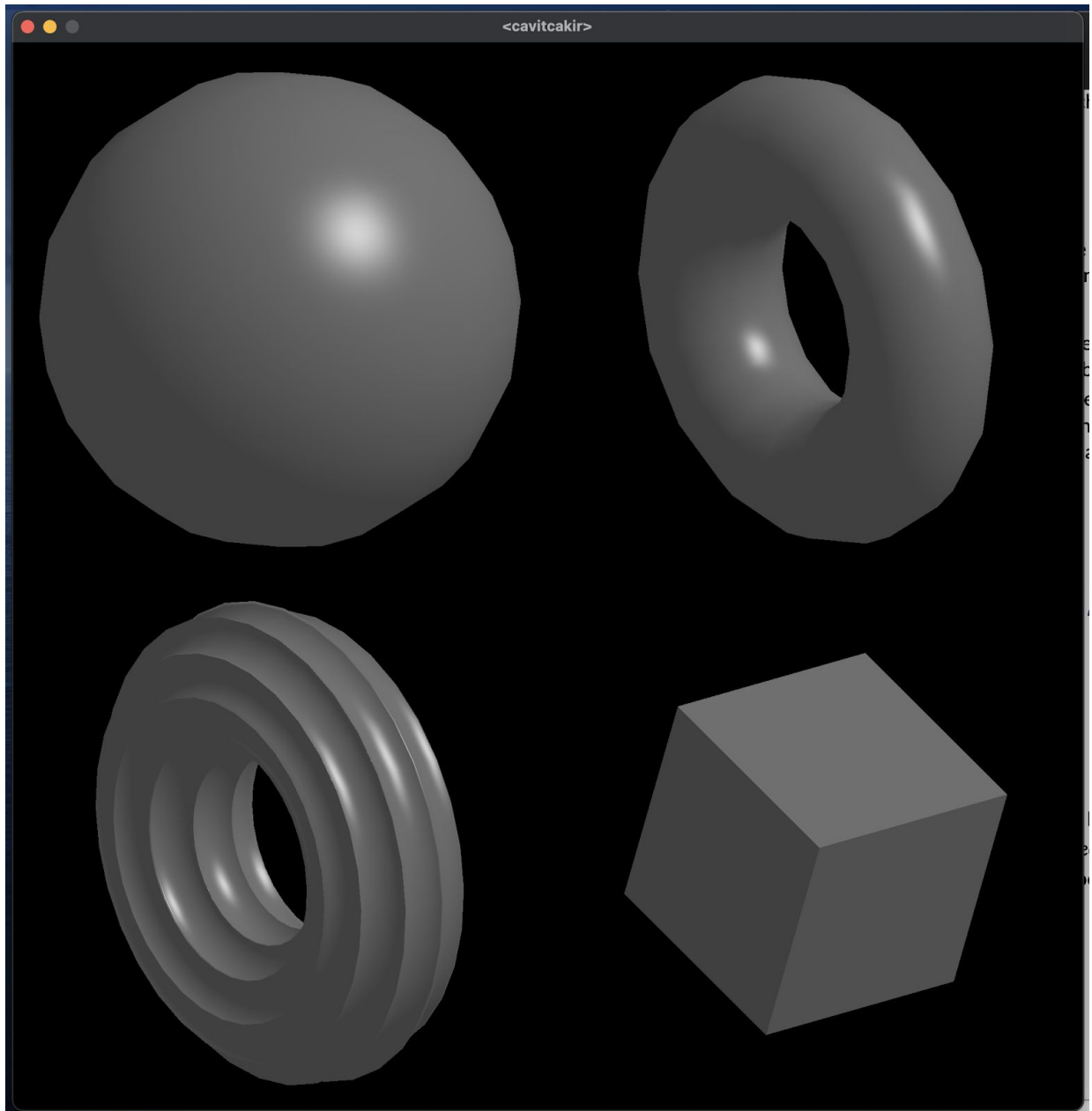
```
glm::translate(glm::vec3(-0.5, -0.5, 0));  
glm::scale(transform, glm::vec3(0.45));  
glm::rotate(glm::radians(float glfwGetTime()) * 10), glm::vec3(1, 1, 0));
```

Cube(down-right) =

```
glm::translate(glm::vec3(0.5, -0.5, 0));  
glm::scale(transform, glm::vec3(0.45));  
glm::rotate(glm::radians(float glfwGetTime()) * 10), glm::vec3(1, 1, 0));
```

Third Scene

Screenshots:



Third Scene Specs:

Colors: `vec3 surface_color = vec3(0.5, 0.5, 0.5);`
shininess : 64;

Sphere(up-left) =

```
glm::translate(glm::vec3(-0.5, 0.5, 0));  
glm::scale(transform, glm::vec3(0.45));  
glm::rotate(glm::radians(float glfwGetTime()) * 10), glm::vec3(1, 1, 0));
```

Donut(up-right) =

```
glm::translate(glm::vec3(glm::vec3(0.5, 0.5, 0)));  
glm::scale(transform, glm::vec3(0.45));  
glm::rotate(glm::radians(float glfwGetTime()) * 10), glm::vec3(1, 1, 0));
```

Spikes(down-left) =

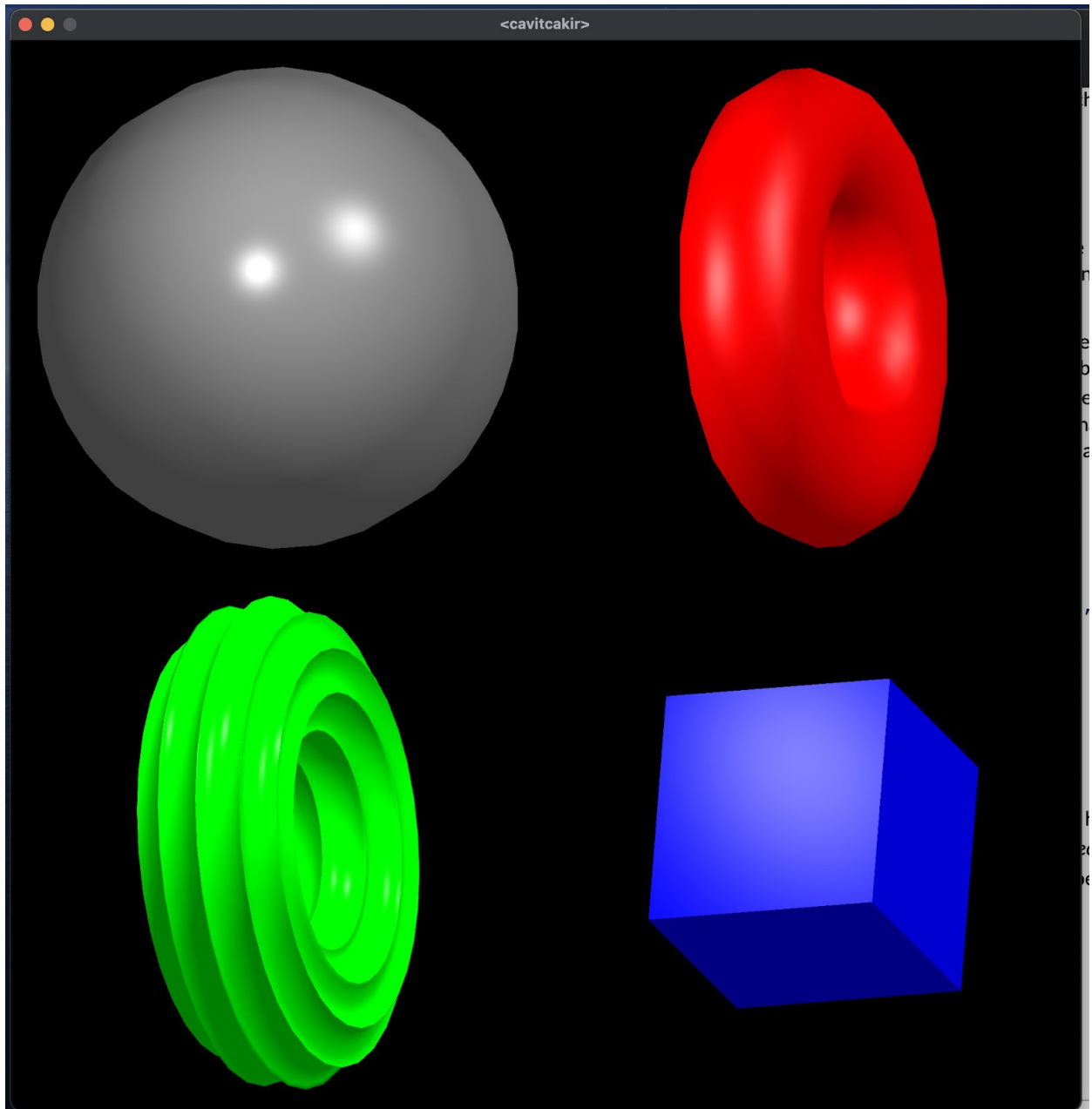
```
glm::translate(glm::vec3(-0.5, -0.5, 0));  
glm::scale(transform, glm::vec3(0.45));  
glm::rotate(glm::radians(float glfwGetTime()) * 10), glm::vec3(1, 1, 0));
```

Cube(down-right) =

```
glm::translate(glm::vec3(0.5, -0.5, 0));  
glm::scale(transform, glm::vec3(0.45));  
glm::rotate(glm::radians(float glfwGetTime()) * 10), glm::vec3(1, 1, 0));
```

Fourth Scene

Screenshots:



Fourth Scene Specs:

Sphere(up-left) =

```
glm::translate(glm::vec3(-0.5, 0.5, 0));
glm::scale(transform, glm::vec3(0.45));
glm::rotate(glm::radians(float glfwGetTime()) * 10), glm::vec3(1, 1, 0));
glUniform3fv(color_location, 1, glm::value_ptr(glm::vec3(0.5,0.5,0.5)));
glUniform1f(brightness_location, 128);
```

Donut(up-right) =

```
glm::translate(glm::vec3(glm::vec3(0.5, 0.5, 0)));
glm::scale(transform, glm::vec3(0.45));
glm::rotate(glm::radians(float glfwGetTime()) * 10), glm::vec3(1, 1, 0));
glUniform3fv(color_location, 1, glm::value_ptr(glm::vec3(1,0,0)));
glUniform1f(brightness_location, 32);
```

Spikes(down-left) =

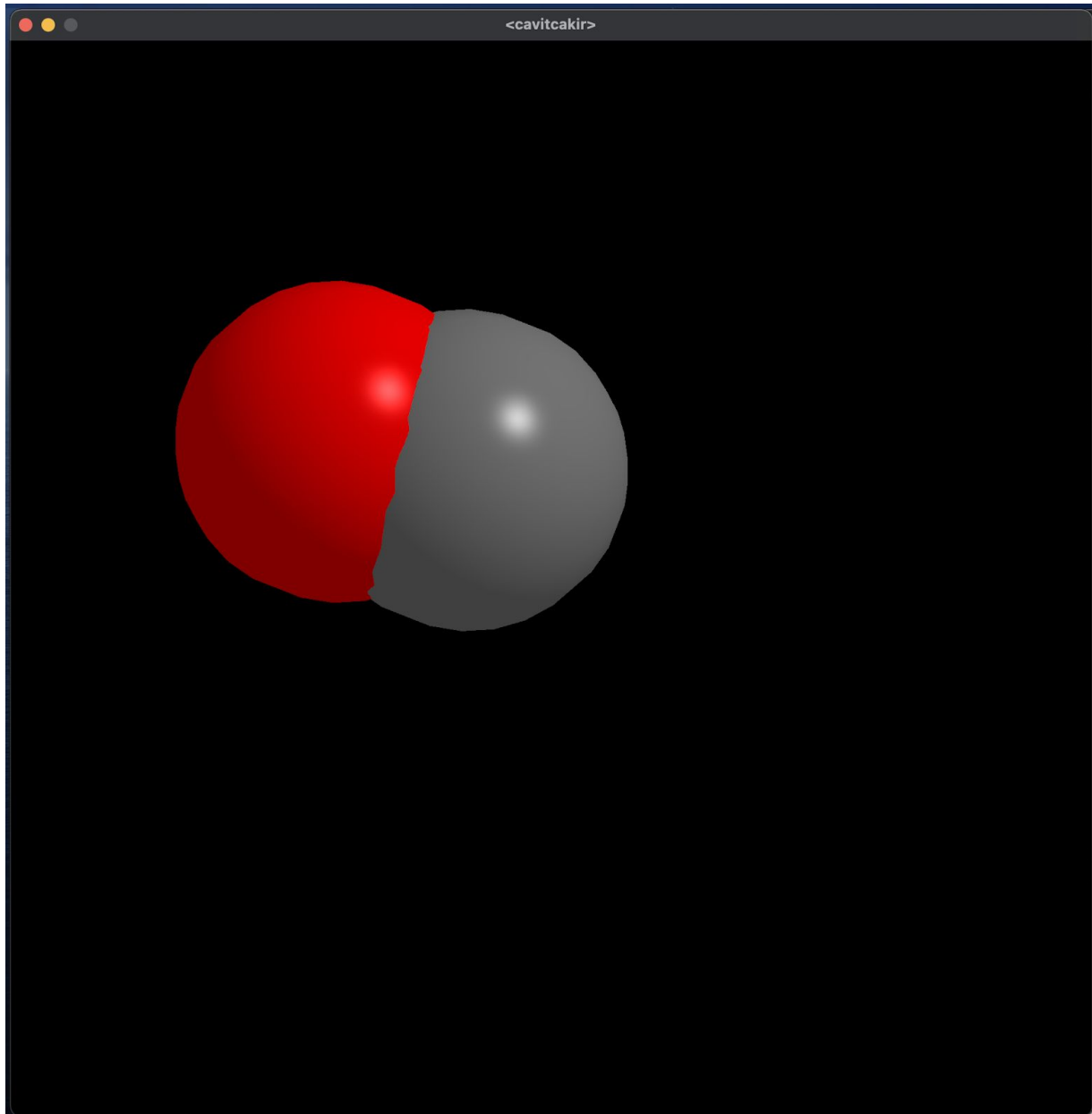
```
glm::translate(glm::vec3(-0.5, -0.5, 0));
glm::scale(transform, glm::vec3(0.45));
glm::rotate(glm::radians(float glfwGetTime()) * 10), glm::vec3(1, 1, 0));
glUniform3fv(color_location, 1, glm::value_ptr(glm::vec3(0,1,0)));
glUniform1f(brightness_location, 256);
```

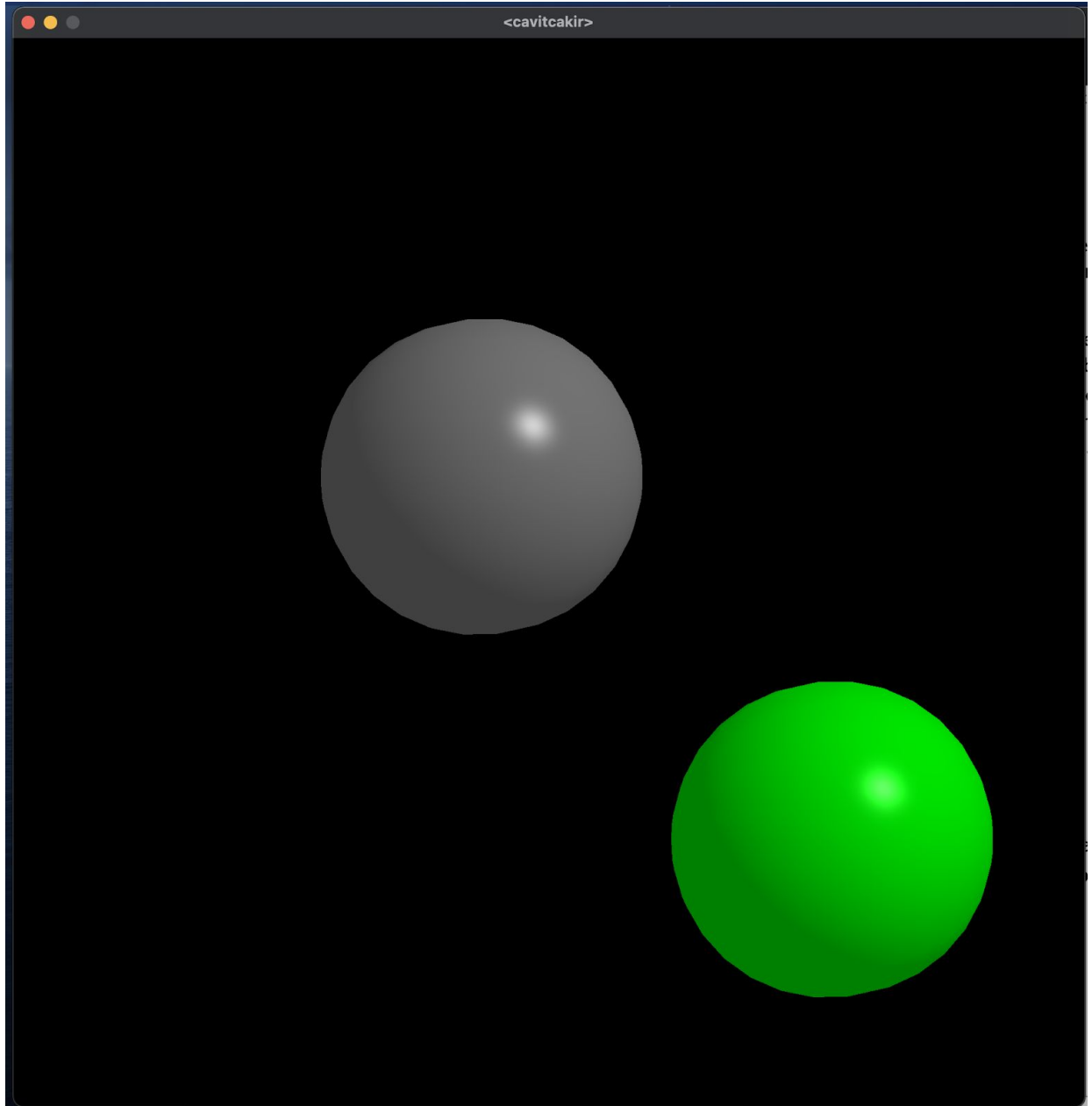
Cube(down-right) =

```
glm::translate(glm::vec3(0.5, -0.5, 0));
glm::scale(transform, glm::vec3(0.45));
glm::rotate(glm::radians(float glfwGetTime()) * 10), glm::vec3(1, 1, 0));
glUniform3fv(color_location, 1, glm::value_ptr(glm::vec3(0,0,1)));
glUniform1f(brightness_location, 256);
```

Fifth Scene

Screenshots:





Fifth Scene Specs:

Sphere(mouse) =

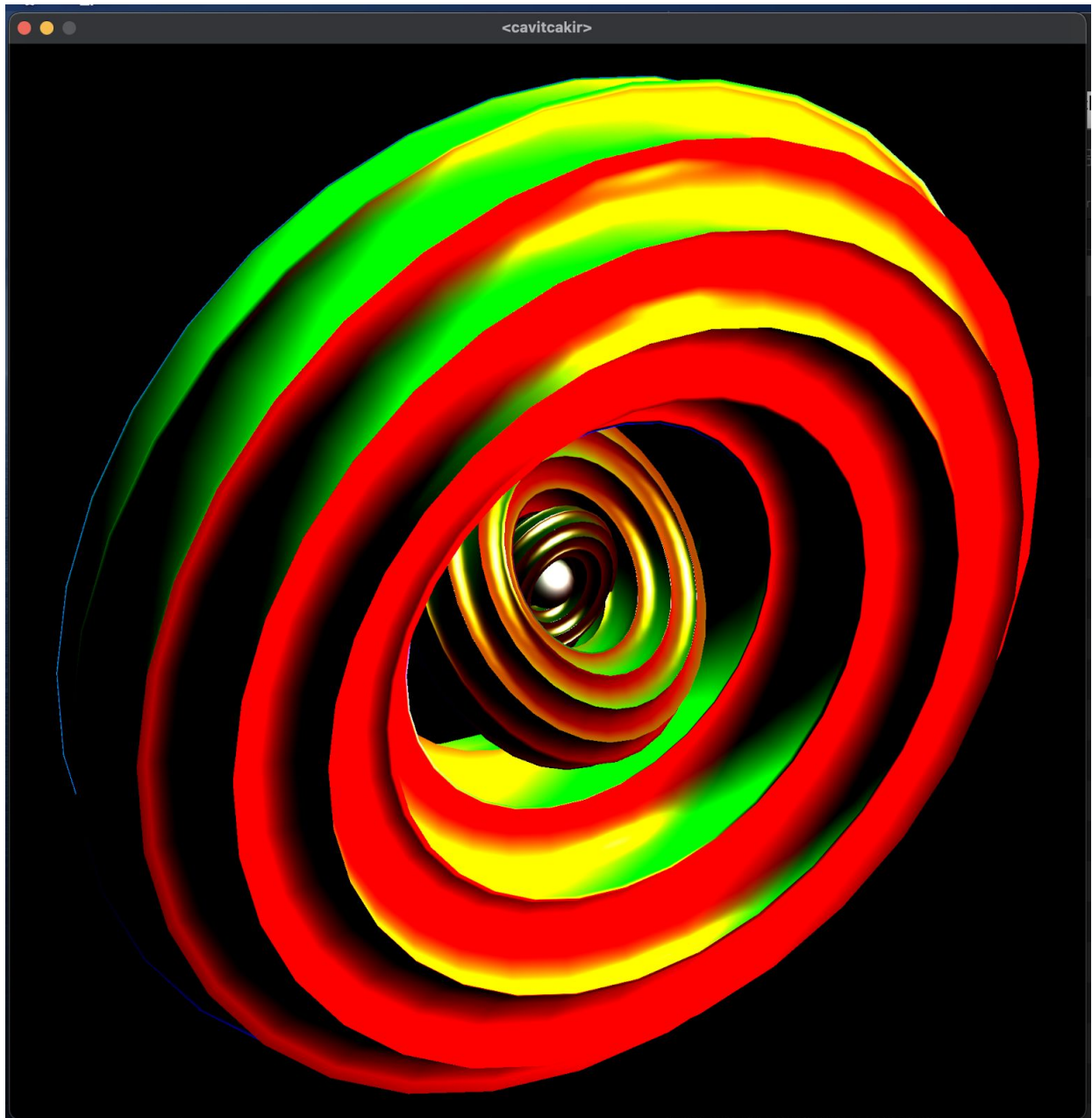
```
glm::translate(glm::vec3(mouse_position.x, mouse_position.y, 0));  
if(glm::distance(mouse_position, chasing_pos) < 0.6) {  
    glUniform3fv(color_location, 1, glm::value_ptr(glm::vec3(1, 0, 0)));  
} else  
    glUniform3fv(color_location, 1, glm::value_ptr(glm::vec3(0, 1, 0)));  
glUniform1f(brightness_location, 128);  
glm::scale(transform, glm::vec3(0.45));  
glm::rotate(glm::radians(float glfwGetTime()) * 10), glm::vec3(1, 1, 0));
```

Sphere(follower) =

```
chasing_pos = glm::mix(mouse_position, chasing_pos, 0.99);  
glm::translate(glm::vec3(chasing_pos.x, chasing_pos.y, 0));  
glm::scale(transform, glm::vec3(0.45));  
glm::rotate(glm::radians(float glfwGetTime()) * 10), glm::vec3(1, 1, 0));  
glUniform3fv(color_location, 1, glm::value_ptr(glm::vec3(0.5, 0.5, 0.5)));  
glUniform1f(brightness_location, 128);
```

Sixth Scene

Screenshots:



Sixth Scene Specs:

They are all at the center.

Their colors are from normal vectors.

Center=

```
glm::scale(transform, glm::vec3(0.05));  
glm::rotate(glm::radians(float glfwGetTime()) * 600), glm::vec3(1, 0, 0));  
glUniform1f(brightness_location, 5);
```

Closest to Center Ring =

```
glm::scale(transform, glm::vec3(0.15));  
glm::rotate(glm::radians(float glfwGetTime()) * 250), glm::vec3(1, 0, 1));  
glUniform1f(brightness_location, 32);
```

Closest to Outer Ring =

```
glm::scale(transform, glm::vec3(0.35));  
glm::rotate(glm::radians(float glfwGetTime()) * 150), glm::vec3(-1, 0, -1));  
glUniform1f(brightness_location, 64);
```

Outer Ring =

```
glm::scale(transform, glm::vec3(1));  
glm::rotate(glm::radians(float glfwGetTime()) * 50), glm::vec3(-1, 1, 0));  
glUniform1f(brightness_location, 128);
```