**Program Four:** **The Interactive Sphere**

Jordon Paynter

Department of Computer Science, Colorado State University Global

CSC 405: Graphics and Visualization

Professor Jennifer Marquez

December 24, 2023

Contents

[**Reflection** 3](#_Toc154353873)

[**Images of the Sphere draw with lines and triangles** 5](#_Toc154353874)

[Depth of 2 for recursion draw with Triangles 5](#_Toc154353875)

[Depth of 4 for recursion draw with Triangles 6](#_Toc154353876)

[Depth of 6 for recursion draw with Triangles. 7](#_Toc154353877)

[Depth of 8 for recursion draw with Triangles 8](#_Toc154353878)

[Depth of 3 for recursion draw with lines 9](#_Toc154353879)

[Depth of 6 for recursion draw with lines 10](#_Toc154353880)

[Depth of 8 for recursion draw with lines 11](#_Toc154353881)

## **Reflection**

A sphere object is a three-dimensional geometric shape that resembles a perfectly round ball or planet. It is defined as a set of points in space equidistant from a central point, known as its center. In computer graphics and 3D rendering, a sphere is often used as an example of a curved surface to demonstrate shading calculations, including diffuse and specular reflections. These calculations involve simulating how light interacts with the sphere's surface, determining how much light is absorbed or reflected at each point, and subsequently rendering the sphere with realistic lighting effects. Spheres are particularly useful for teaching and understanding shading algorithms due to their simplicity and symmetry, making them an ideal starting point for learning computer graphics rendering techniques. In computer graphics, the key to rendering 3D scenes onto 2D screens lies predominantly in two types of projections: orthographic and perspective. Orthographic projection is characterized by its unique way of viewing objects along parallel lines, ensuring their size remains consistent irrespective of their distance from the camera. This technique is particularly favored in technical and engineering domains, such as CAD software used by engineers, where precise measurements and an undistorted view of each design component are paramount.

Creating the interactive wireframe sphere in WebGL was a challenging yet rewarding experience. One of the initial challenges was the absence of indices, which differed from previous projects involving objects like cubes. Instead, the sphere was constructed by recursively dividing triangles and pushing vertices into an array. This approach required careful consideration of the subdivision logic and normalization to maintain the sphere's shape. Debugging and troubleshooting became frequent companions as I worked through complex logical operations. Understanding and implementing these recursion-based techniques was a valuable learning experience, highlighting the importance of precise geometric calculations in 3D graphics programming.

The interactivity of the sphere, allowing users to manipulate its rotation and zoom through sliders and mouse interactions, significantly enhanced my understanding of shading and curved surfaces in 3D graphics. Observing the wireframe sphere from different angles and lighting conditions brought the concept of shading to life. Taking these steps in learning how things are done is truly inspiring. This project developed my gratitude for the intricacies involved in 3D graphics, from geometry and shading to user interaction. It has provided valuable insights into the power and potential of WebGL for creating interactive 3D web applications.

# **Images of the Sphere draw with lines and triangles**

**Figure 1a.**

Depth of 2 for recursion draw with Triangles

A screenshot of a computer

Description automatically generated

**Figure 1b.**

Depth of 4 for recursion draw with Triangles

A screenshot of a computer

Description automatically generated

**Figure 1c.**

Depth of 6 for recursion draw with Triangles.

A screenshot of a computer

Description automatically generated

**Figure 1d.**

Depth of 8 for recursion draw with Triangles

**A screenshot of a computer

Description automatically generated**

**Figure 1e.**

Depth of 3 for recursion draw with lines

A colorful sphere with lines and dots

Description automatically generated

**Figure 1f.**

## Depth of 6 for recursion draw with lines

A colorful sphere with lines and dots

Description automatically generated

**Figure 1g.**

## Depth of 8 for recursion draw with lines

**A colorful ball on a white background

Description automatically generated**