

# Computational Fabrication - 2024

## Assignment 1

Krunal Rathod

Submitted On: 22March 2024

### 1 Implementation

#### 1.1 Ray Triangle Intersection

The `rayTriangleIntersection` function is an important component for determining whether a ray intersects a triangle. This involved computing the normal vector of the current triangle, check for parallelism between ray and triangle, validate the parameter 't', and determine if the intersection point lies inside the triangle's edges.

#### 1.2 Number of Surface Intersections

The function `numSurfaceIntersections` counts the number of times a ray cast in a particular direction intersects the surface defined by the input triangles. This function is important for accurately determining if a voxel is inside or outside the mesh surface, for the correctness of the voxelization process.

#### 1.3 Iterations Over Voxels

In the main function, I iterated over all voxels in the voxel grid and tested whether they were inside or outside the surface. By casting rays from voxel centers in a specific direction and counting the number of intersections with the surface, I labeled voxels as inside or outside based on whether the number of intersections was odd or even, respectively.



Figure 1: Bunny (32x32x32)

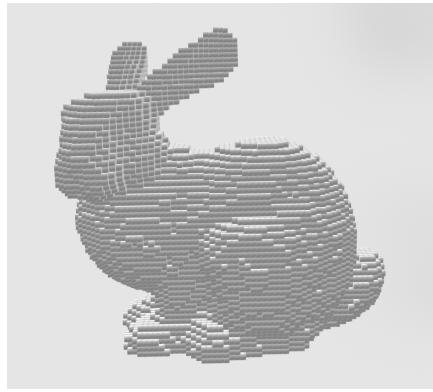


Figure 2: Bunny (64x64x64)

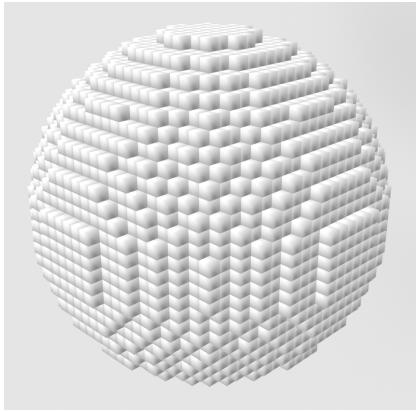


Figure 3: Sphere (32x32x32)

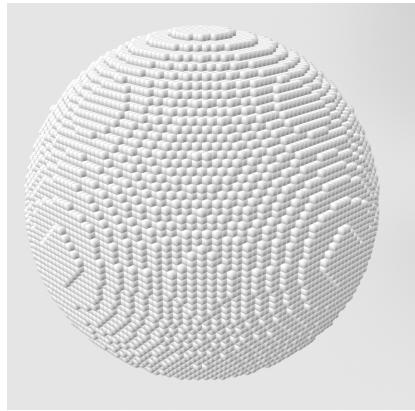


Figure 4: Sphere (64x64x64)

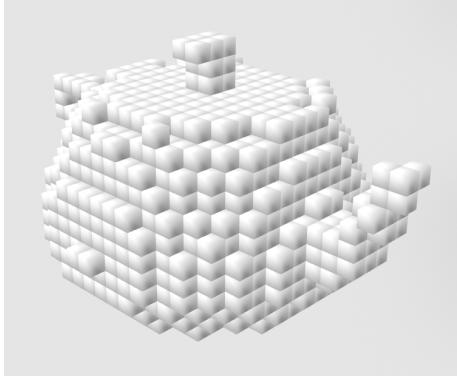


Figure 5: Teapot (32x32x32)

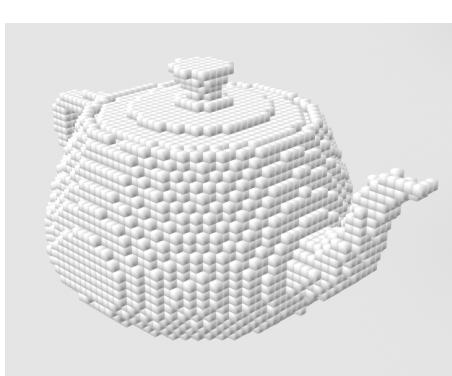


Figure 6: Teapot (64x64x64)

## 2 Additional Resources

I found the below resources particularly useful, not just only for the purpose of assignment, but also for understanding the concepts as well.

## References

<http://procworld.blogspot.com/2018/10/thinking-about-voxels.html>  
<https://gamedev.net/forums/topic/607674-voxels/>  
<https://en.wikipedia.org/wiki/Voxel>  
[https://www.reddit.com/r/VoxelGameDev/comments/q318zo/help\\_my\\_understanding\\_of\\_voxels/](https://www.reddit.com/r/VoxelGameDev/comments/q318zo/help_my_understanding_of_voxels/)  
<https://sites.google.com/site/letsmakeavoxelengine/home>  
<https://medium.com/@EightyLevel/how-voxels-became-the-next-big-thing-4eb9665cd13a>  
<http://procworld.blogspot.com/2018/10/thinking-about-voxels.html>  
<https://blog.spatial.com/the-main-benefits-and-disadvantages-of-voxel-modeling#:~:text=Voxels%20are%20essentially%203D%20pixels,modeling%20technique%20for%20replicating%20reality.>