

Module Four Milestone Three Narrative

Hector Maldonado

Southern New Hampshire University

CS-499: Computer Science Capstone

Professor Ramsey Kraya

7/25/2025

## **Artifact Narrative: Octree Spatial Partitioning and Code Quality Enhancements**

The artifact I have chosen for my ePortfolio is the enhanced version of a 3D scene management system from my CS-330 Comp Graphics and Visualization class from 2024. This artifact represents my implementation of octree based spatial partitioning for efficient object culling, along with a series of code quality improvements such as variable initialization and optimized memory management.

I included this artifact because it demonstrates my ability to apply advanced algorithms and data structures to solve real world performance challenges in computer graphics. The octree implementation showcases my understanding of hierarchical spatial partitioning, which is a key concept in optimizing rendering pipelines. Also, the refactoring work was an enormous task, such as initializing all struct members and moving large arrays to the heap, which highlights my attention to robust, maintainable, and portable code, albeit at the cost of a bit of a more congested code.

Through this enhancement, I met my planned course outcomes related to algorithms, data structures, and software engineering best practices. The process of integrating the octree required me to research heavily into spatial data structures, adapt and apply them to my project's needs, and debug (hours, and hours' worth) complex interactions between scene objects and the partitioning system. I learned the importance of both theoretical knowledge and practical debugging, especially when optimizing for performance and reliability.

One challenge I faced was ensuring that all objects were correctly managed and positioned as I originally intended them to be, within the octree without introducing memory leaks or logic errors, which I overcame by thorough testing and incremental development.

Overall, this artifact, I feel not only demonstrates my technical skills but also reflects my growth in problem solving and my commitment to producing high quality, efficient software.