CS488 – Assignment 4

Alexander Klen

ayklen 20372654

June 27, 2014

Manual

Program Description

This command line program produces images from a scene described by a lua script. It does so by tracing rays for each pixel backwards along paths that light would travel and computing colours, shadows, and reflections along the way.

Extra Features and Optimizations

- **Reflections** – I implemented reflections by recursivly ray tracing after reflecting about the normal of intersection faces.
- I made my ray tracer run workers in **parallel** so that multi-core CPUs can render a scene much faster. Each ray is independent (all sharing a common scene graph) and computationally expensivce to compute, so parallelization is a logical optimization. You can set the number of threads it should use in the Makefile – I have provided compiled versions for 1, 8, and 40 threads ("rt" uses 8 threads). A comparison on "macho-cows.lua" shows that my ray tracer takes 1:25.54 with a single thread, and 22.642 using 8 threads (on my own quad-core i7).
- I implemented simple **anti-aliasing** by averaging the results of 4 ray traces for each pixel. This smooths the image a little bit and decreases jagged edges of shadows and edges. I have provided "data/sample_no_anti_aliasing.png" for comparison with "data/sample.png", which uses anti-aliasing. It is on by default, but a compiler flag will turn it off (see Makefile).

Scene

My scene contains a rotated 3d array of spheres with mirror surfaces, two instances of the provided small stellated dodecahedron meshes, and a scaled cube for the base (somewhat reflective). There are red, green, and blue lights positioned so that each shines on a different visible face of the array of spheres. You can see specular highlights on each sphere (up to 3 each from the lights), and also some specular highlights on the box surface at the very bottom. The meshes at the top appear illuminated by white light (they have a yellow-ish material) because they are being hit by all three lights (each being a different full colour channel). At the far end of the reflective box surface, you can see an interesting pattern of colours resulting from shadows/occlusions of each light by the spheres. You can see the main parts reflected on the box surface and also the spheres reflecting each other.