Assignment 6 – Ray Tracing

(Note that there is 55% of the grade in programming projects. This assignment will be weighted to be 10 of those 55 points, so 10% of your total class grade)

Notes for CSE 470/598
Instructor: Ross Maciejewski

1 Project Guidelines

- Have fun, learn, be creative, and create something you are proud to show-off!
- No teamwork allowed! It is ok to discuss the projects with other students. You can use the discussion board on myASU (The TA will also try to answer your questions posted at myASU, but only sporadically); however your code must be your own. (You would be surprised how easy it is to detect copied code!). You cannot post code on the discussion board! (only very small code sections)
- Comment your code - you will be glad you did. You will be reusing code throughout the semester.
- You will upload your projects on myASU.
- If you have **good reasons** that you cannot complete a project on time **and** you have written documentation, then we can make adjustments to due dates. However, you must notify us before the due date that you would like to discuss such an arrangement. Good reasons would be illness, family emergency, visiting a conference to present a paper, …

2 Getting Started

The projects assume that you are using: Microsoft Windows, Firefox 40.0, WebGL

3 Javascript and WebGL

We will be using web based scripting and programming in this class. As this is a senior level computer science class it is expected that you are capable of learning and using new languages and libraries. For this class you must:

1) Download and install Firefox on your computer (it is free)
2) Enable WebGL settings on Firefox (see the Enabling-Web-GL-Firefox image file)

4 Upload your projects

How to upload a Project
This is a short guide for the successful upload of a project:

- Check the due date of the project on myASU
- Use Blackboard to upload your project. (E-mailed assignments are not accepted!)
- Your project should be packed in a zip file and named with the following naming convention: PX.Lastname.V1.zip (where V1 is the version so if you upload updates you increment the version number.
- If there is someone with the same last name in the course you can add your first name after the last name in the filename.

- The zip file should include all the source code and should be ready to load in Firefox.
- A short text file called “instructions.txt” – this text file should include the following:
    - a) instructions about how to navigate in your program, including the function of special keys (e.g. x exits the program)
    - b) special functions that you implemented
    - c) changes from the original specification that you negotiated with the instructor or TA to the original specification
    - d) other things you consider important
    - e) specify the libraries or code that you used and did not write yourself. You do not need to specify code that we provide on myASU.

5 Project 6 – Ray Tracing

5.1 Purpose

This project has been designed for an introduction to ray-tracing. You will see that I have an entire extra GLSL file (separating some shader stuff out). In this assignment you will edit ***only*** the raytrace.glsl file. No other file needs to be modified.

5.2 Overview

You will create a ray-tracer that enables phong shading, shadows and reflections. You will explore and understand the code delivered and work to modify this to create your own unique scene.

5.3 Required Functionality

Here are the elements that your program must have. Despite this "laundry list" of requirements, there is some room for creativity! Note: If the text suggests a menu item "Sound - Off" that would mean that "Off" is an entry in the submenu "Sound".

- **(15p) Create a unique scene** – You will design a unique scene with multiple pieces of geometry that you need to instantiate in the program. Minimally you will render 4 spheres, the ground plane and one other 3D geometric object of your choice. Other geometry could be a capsule, torus, box, etc. You will need to make a new function similar to the dSphere function in the program for your new geometry and update the closer function (as well as others potentially).

- **(10p) Set up Phong Shading -** Objects will be colored using the Phong shading model using ray tracing.

- **(10p) Shadows** – You will set up a scene and the lights to create shadows on the ground plane and render the shadows correctly using ray tracing.

- **(15p) Reflection** – At least one sphere in your scene should have a reflection property and it should be set up in such a manner as to reflect at least two other

objects in the scene. You will render this object to demonstrate your implementation of reflection using ray tracing.

- **(10p) Graduate Student Only Requirements:** You will add refraction to at least one object in your scene and set up the scene in such a manner as to demonstrate both reflection and refraction. You will render this object to demonstrate your implementation of refraction using ray tracing.

5.4 Grading

Note that there are 50 points available to undergraduates, 60 to graduate students. All assignments will be graded out of 45 where undergrads get a scaled grade, if they get 50/50, then their final score will show as 60/60. Undergraduates are allowed to complete the graduate portion for 5% extra credit on the assignment.

These points represent an initial weighting of the functionality. **Important:** You get full points for a *good* implementation of the required functionality. In principle you will get full points if you implement the requirements correctly, but there are many ways to do things according to specification that we might consider *unreasonable* or *undesired*. Especially we will deduct points if the design choices make it difficult to judge the program (E.g. you choose materials that are so dark that it hard to see anything, the objects move too slowly or too fast, the control of the program is extremely difficult.)

Note: we might change the weights slightly if a requirement is misunderstood by a majority of the class or some other special circumstance. I do not expect that to happen though.