

Programming Assignment #4

Ray Casting and Ray Tracing

Due Tuesday, November 20 by 11:59pm

(The grade for this assignment is out of 100 points, but you can obtain up to a maximum of 125 points by doing more optional components. Additional points beyond 100 will be applied to your final score for all programming assignments.)

Required Components: (80 pts)

- (1) Demonstrate the ability to write out to an FSF file. You can do this by just drawing a test pattern (such as a checkerboard image), or with the images from your ray caster/ray tracer (10 pts)
- (2) Generate a ray casted image (stored out as an FSF file) from a .ray specification. You can use the examples from the website. Your ray caster must be able to handle at least sphere and plane primitives (40 pts)

Note that your .ray parser must handle at least the following commands:

- **eye** x y z
- **lookat** x y z
- **up** x y z
- **fov** theta
- **background** r g b
- **sphere**
- **plane**
- **material** r g b ambientMix diffuseMix specularMix phongCoefficient reflectivity
- **light** r g b **ambient**
- **light** r g b **point** x y z
- **translate** x y z
- **rotateX** theta
- **rotateY** theta
- **rotateZ** theta
- **scale** x y z
- **reset**

- (3) Generate a ray traced image (stored out as an FSF file) from a .ray specification. You can use the examples from the website. This image must include, at least, shadows and reflections. You should include the ability to vary the maximum level of recursion, either as a command line argument or by prompting for user input. (30 pts)

Optional Components: (20-45 pts)

- (1) Add one or more additional primitive types (discs, rectangles, cylinders, cones, ellipses, etc.). Generate a test image to demonstrate this. (5 - 30pts)
- (2) Add refraction to your ray tracer. Demonstrate by generating an image for a scene that contains at least one transparent and refractive object. (20 pts)
- (3) Add spot lights to your ray tracer. Demonstrate by generating an image for a scene that contains at least one spot light. (10 pts)
- (4) Add directional lights to your ray tracer. Demonstrate by generating an image for a scene that contains at least one directional light. (10 pts)
- (5) Add texturing to your ray tracer. Demonstrate by generating an image for a scene that contains at least one directional light. (25 pts)
- (6) Generate a complex/artistic scene, and display it with your ray tracer (5 - 20 pts)