Computer Science Department
CPSC 453
Programming Assignment 4
Ray Tracing
Due Date: Monday, December 8, 2003
Total Marks: 120 with 50 bonus

Implement a ray tracer that renders triangles and spheres. Use the phong reflection model and a point light source. Implement shadows and reflections. You will not use QT or Open GL for this assignment.

The emphasis of this assignment is on raytracing, not the user interface. You do not need to create a GUI for your raytracer. You may create the scene in code and output the resulting image to a file. The type of image file you use is your choice. We recommend PPM and provide the PPM specification and source code (see bottom of assignment).

Along with your code and documentation you must submit at least two images produced by your raytracer. One of the images must be of a pre-specified scene. The specification of the scene and an example image can be found on the lab website. Also submit one or more images of scenes you create. Your submitted images must prove that each of your features (and bonuses) works. You will receive no marks for features that are not demonstrated in the images you submit.

Your documentation should include a description of the algorithms and data structures your raytracer uses. Part of your documentation grade will be based on how clean and readable your code is. You must also include a README file that describes the images you submit and which features are demonstrated in each image.

Requirements:
Basic (120 marks Total):

- 20 marks: Triangles
- 20 marks: Spheres
- 20 marks: Phong refelction model and point light source (not at eye)
- 20 marks: Shadows
- 20 marks: Reflection
- 20 marks: Code and Documentation

Bonus (50 marks Total):

- 10 marks: Refraction

- 10 marks: Simple anti-aliasing as discussed in class
- 5 marks: Dynamic light and eye position specification
- 15 marks: Additional primitives (5 marks per primitive to a maximum of 15 marks)
- 10 marks: Read scene specification from an input file

PPM format:

magic number	image width	image height	maximum color value
r g b	r g b	...	r g b
.			
.			
.			
r g b	r g b	...	r g b

Each row of the image has (image width) rgb triples and there are (image height) rows in total. The magic number for PPM is P6.

Example PPM file:

```
P6
4 4
15
0 0 0     0 0 0     0 0 0     15 0 15
0 0 0     0 15 7    0 0 0     0 0 0
0 0 0     0 0 0     0 15 7    0 0 0
15 0 15   0 0 0     0 0 0     0 0 0
```

Routines for reading and writing PPM available from http://pages.cpsc.ucalgary.ca/ jungle/src/ppm.