

CPSC 478/578

HW #5

Due October 23, 2017, 11:59pm

Note that the requirements for each question may vary depending on whether you are registered for 478 or for 578. The areas addressed in this assignment are lights, reflectance and tone mapping.

Turn-- in Procedure

You should submit your work as a zip file using the classesv2 server. Please name your file as LastNameFirstName--Assignment5.zip

When your file is unzipped there should be subdirectories for each question named q1, q2, etc. Name your files as directed in each question. In each directory you should have:

1. The HTML and Javascript programs you have written, or pdf's of your written response (either typed directly or scanned in). For code, you should use files in the form of the samples given, rather than producing files from scratch. This will help us follow your code.
2. If the question asks you to write code to make images, provide sample images created by your program. You can save these by clicking and saving results in your browser, or by taking a screenshot.
3. A readme.{txt, doc} that lists the input used to create the images you include, as well as answering any questions posed in the problem. You should also list the operating system (e.g. Linux, Windows 7, 8.1, 10, Mac OS 10.4.4) and browser (e.g. Firefox 40.0.2, Safari, Explorer, Edge) that you used. If your programs fail on the machines used for grading, you may be asked to bring in your system to demonstrate that the files you submitted functioned in the environment you worked in.

This assignment comes with a version of the literate ray tracer that has been modified to include an object type "spheretex" that uses the same intersection routine as the sphere type, but which has procedurally defined normals that make horizontal ridges on the sphere. Each of these problems can be done starting with the given code, that is you don't have to use the code you wrote for question 1 to answer question 2 etc. For each question, your directory should have all the js and html needed to run the solution for that question.

Each question is worth 25 pts.

1. a. **(478 and 578)** Write code to add a spot light type to the lights section. A spot light should have a direction indicated by a "to" point, and light will only be received by surface points P if the direction from P to the light is within "angle" (in degrees) of the direction of the light. The input for the reddish light at the upper left should be changed to:

```
// front and in the upper left
// bright, reddish
{
  type: 'spot',
  point: {
    x: 5, y: 95, z: 100
  },
  topoint: {
    x: 70 y: 25, z: 50 },
```

```

    angle: 30,
    color: {
      x: 255, y: 220, z: 200
    },
  },
},

```

b. **(578 only)** Write code for a spherical light source that makes “fuzzy” shadows by sampling many points within the sphere centered on the central light point. The gray light source in the ceiling should be changed to:

```

{
  type: 'spherical',
  point: {
    x: 50,
    y: 95,
    z: 50
  },
  radius: 5
  // gray, not very bright
  color: {
    x: 155,
    y: 155,
    z: 155
  },
},

```

2. **(478 and 578)** Write code to create a Phong reflectance type. The reflectance should take an exponent n , and true/false parameter “metal”. If metal is “true”, then the specular component of the reflection of the light source should be multiplied by the object color, if it is “false” it should not. Create a new material 5 in the format below, and assign it to the test objects:

```

{
  type: 'phong',
  n: 2,
  metal: 0,
  color: {
    x: 200,
    y: 170,
    z: 60
  },
  specular: 0.9,
  lambert: 0.1,
  ambient: 0.0
}

```

Provide examples of images with four different examples of Phong reflectance (different settings of n , metal, specular and lambert.)

3. a.) **(478 and 578)** Write another geometry type like spheretex called spherealong that makes apparent ridges in spheres that follow lines of longitude on the sphere. Give two example images with the test spheres with ridges of different widths.

b.) **(578 only)** Write another geometry type to define another type of ridges or bumps on spheres. Give two example images of your result.

4. **(478 and 578)** Write a paragraph or two (i.e. about half a page of text) describing an idea for your final project, a game. The game should be based on the Envy My Car code, but should be a totally different game. Your game can have the same type of interaction as Envy My Car (starting and turning using the mouse and keyboard input). It should have a different geometry though from Envy My Car. You should design a new simple 3D scene, and new objects or characters. Your game should have two particularly challenging aspects (three for 578 students). Challenging aspects include (but are not restricted to) a complex character that has appendages (i.e. arms and/or legs) that move relative to the character as the character moves, a group of objects or characters that move along pre-computed spline paths during the game, collision detection, novel textures and/or lighting effects.

If you have a data visualization or ray-tracing project that you want to do instead of the game design, describe the project you have in mind. Explain how it will use methods we have gone over in this course.