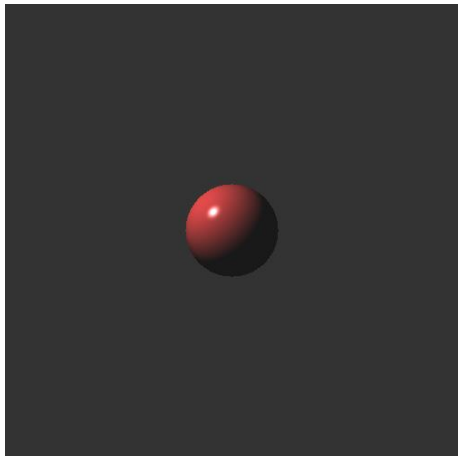
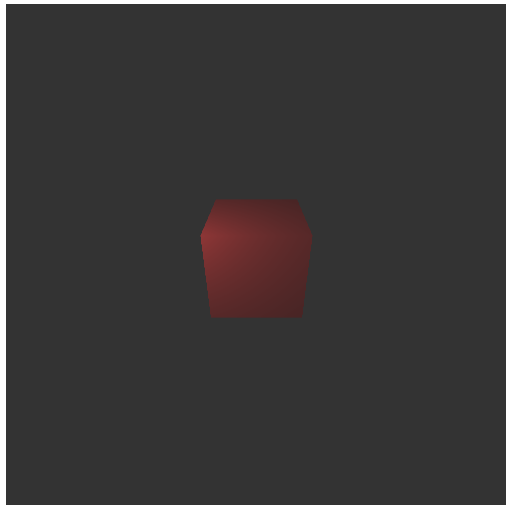
Assignment 2 | Ray Tracing

Overview of the assignment

Surfaces

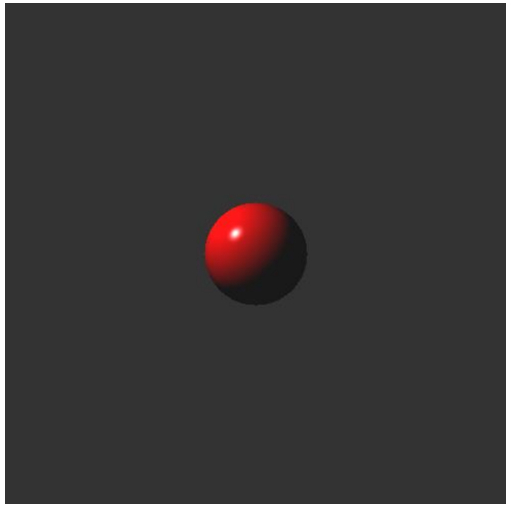
- Spheres
- Infinite planes
- Cubes



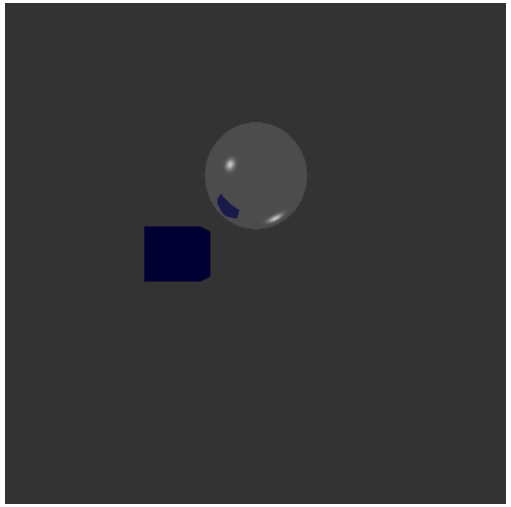


Materials

- Diffuse color
- Specular color
- Phong specularity coefficient
- Reflection color
- Transparency



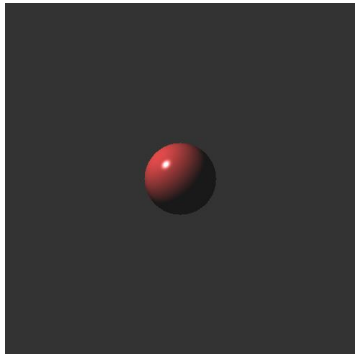
Red diffuse color



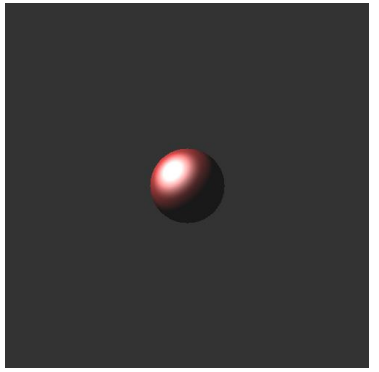
Reflection

Phong coefficient

- **High value** - renders small and sharp specular reflections, for shiny surfaces such as metal.



- **Low value** - renders wide and soft specular reflections



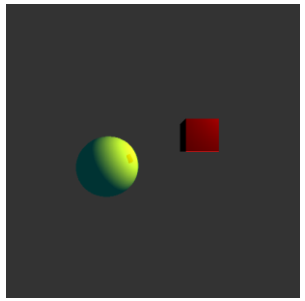
In the example – red diffuse color with white specular color

Lights

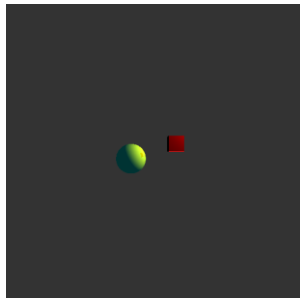
- Position
- Color
- Specular intensity
- Shadow intensity

Camera

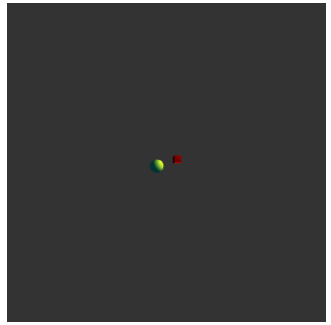
- Position
- Look-at point
- Up vector
- Screen distance
- Screen width



base



Larger screen distance



Larger screen width

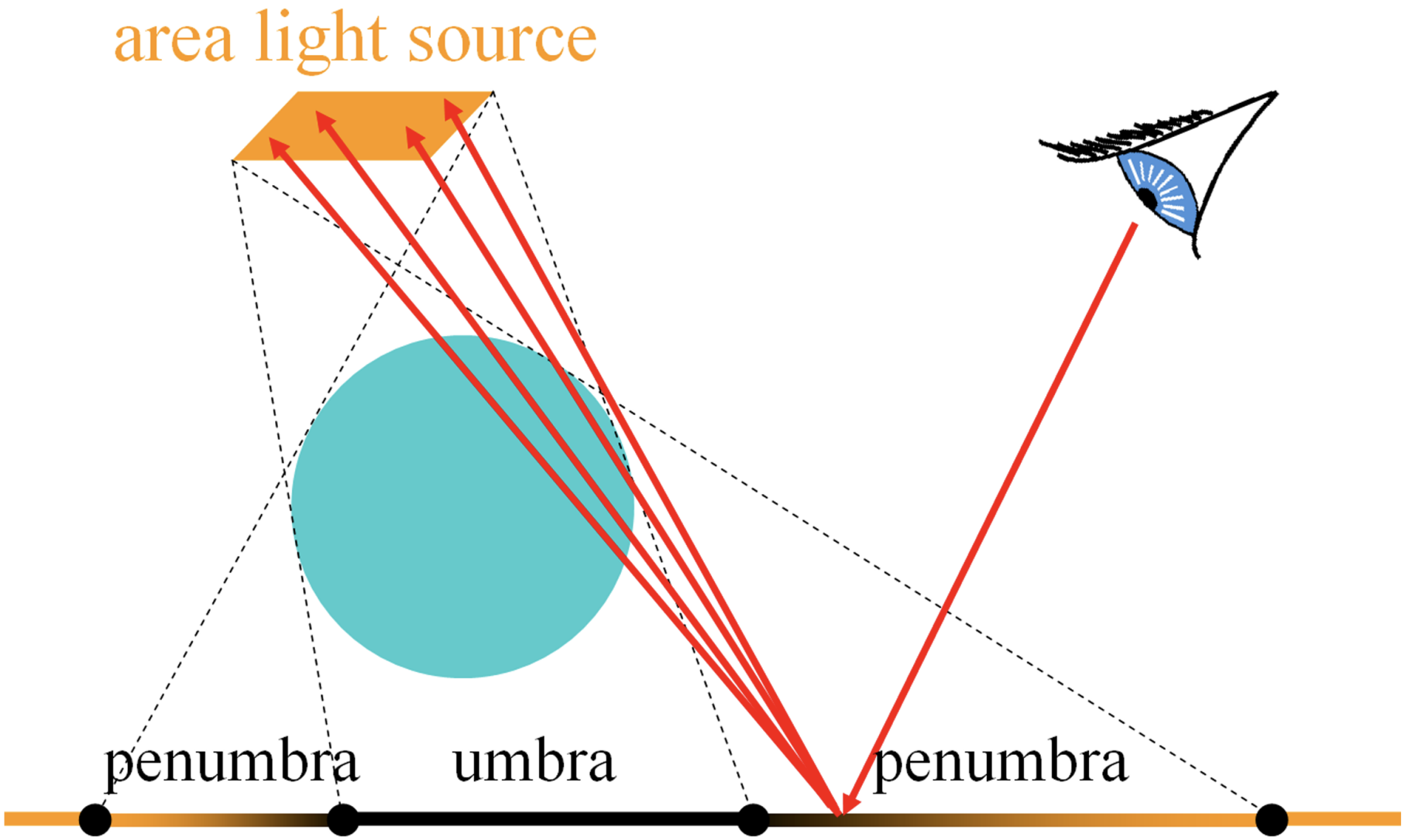
General

- Background color
- Number of shadow rays

Ray Tracing Logic

- For each pixel:
  1. Calculate the location of the pixel on the camera's screen (using camera parameters).
  2. Construct a ray from the camera through that pixel.
  3. Check the intersection of the ray with all surfaces in the scene.
     - The first intersecting surface will be the one shown in the image.
  4. Compute the color of the surface by iterating over all the light sources.
  5. Produce soft shadows.
  6. Construct reflections from transparency rays.
     1. Go to step 3.
     2. Repeat until reach max recursion level or ray reached to background.

Soft Shadows



Tips

- Start with a simple scene, that contains only one or two objects.
- Start with low resolution screen.
- Feel free to add methods to the classes in the code.
- Create a ray class.