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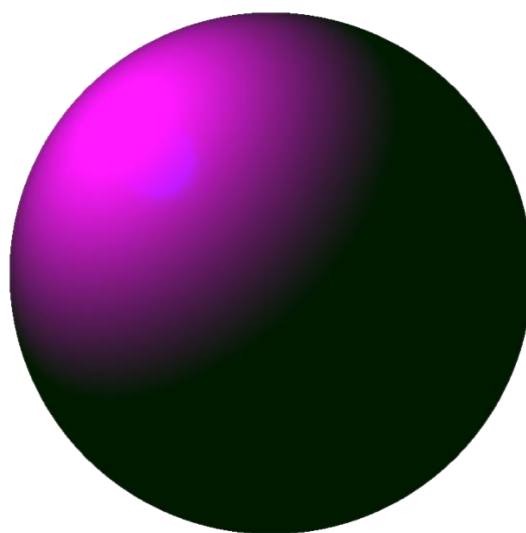
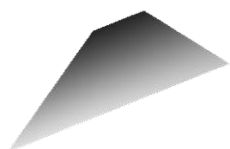
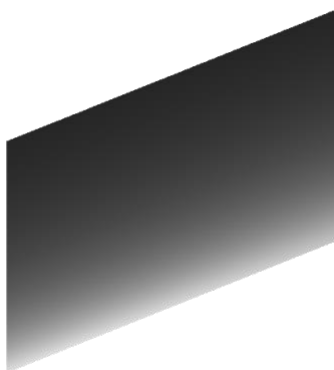
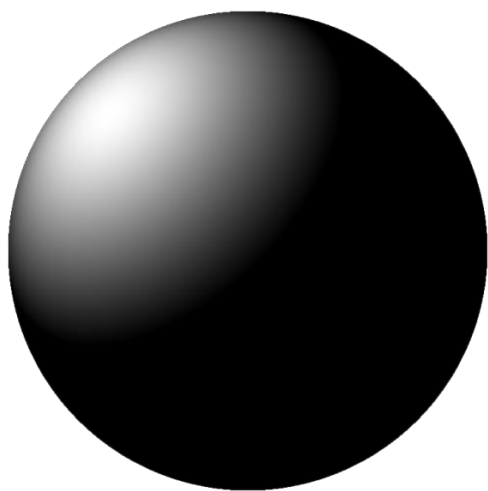
## **Assignment 2**

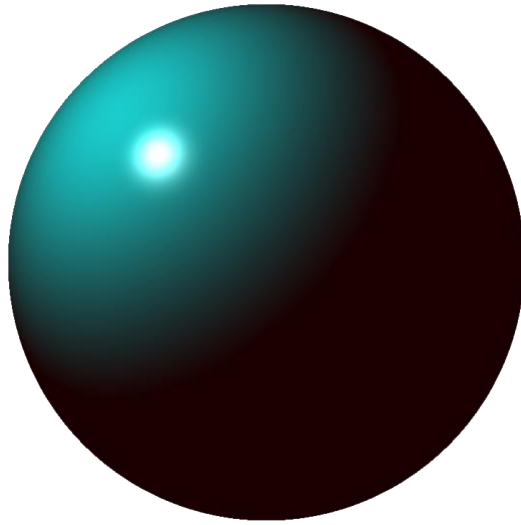
### **Environment:**

OS: Mac OS Monterey 12.5.1  
Compiler: clang-1400.0.29.202

### **Report Body:**

I believe I generated all the correct images which can be seen below.





For Part 1, I really struggled to get the orthographic projection correct. My problem was that I was assuming the vectors `pgram_u` and `pgram_v` represented the point that was the corner of the parallelogram when in fact they were the vectors themselves. So they were relative to the `pgram_origin`. After quite a lot of messing around I figured this out and it corrected my projection. Another issue I ran into was having the correct conditions in the if-block. At first I didn't have any parallelogram and it turned out that it was because my code was never entering this block when it should.

I found the perspective projection of the parallelogram to be very straight forward since only the small change of the ray direction was needed from the orthogonal projection.

In part 2 the shading was decently straight forward. I had no problem adding the different color channels in, however I had some issues with the specular shading at first. My problem was that when I calculated  $H$ , the bisecting vector of the viewing direction and the light direction, I did not initially normalize the viewing direction and the light direction. This resulted in my specular shading showing up in the wrong spot on the sphere.

In the last image you'll see I tried some other options with the shading parameters to see what might happen. Although not shown in that image, I also tried changing the Phong exponent to smaller and larger values so that the specular component appeared larger or smaller.