HW4 Ray Tracing Write up

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1 Problem 1

I create the Plane which will mimic the wall. I create 6 Wall to encapsulate the 3 balls.

2 Problem 2

Add phong shading

3 Problem 3

Casting shadow

In the above image, I create several Wall to encapsulate the balls. And for each ball, it has its own color. And based on the light position, there is some shadow casted in the image.

4 Reflective surface

The left top ball is of reflective material. It has the red from the left Wall, blue from the right Wall and grey from the top Wall and some white from the ball.

5 Distribution ray tracing

The snippet of code is here: For each pixel, sample N*N rays from the N*N sub-regions. For each ray, will sample randomly in the small subregion.

```
for(int z = 0; z < N * N; z++) {
    Ray curRay;
    curRay.origin[0] = curRay.origin[1] = curRay.origin[2] = 0;
    int j = z / N;
    int i = z % N;
    float delta = 1.0 / N;
    float rx = ((float)rand() / RAND_MAX) - 0.5; // -0.5 to 0.5
    rx = rx * delta;
    float ry = ((float)rand() / RAND_MAX) - 0.5; // -0.5 to 0.5
    ry = ry * delta;

    float xoffset = delta/2.0 + i * delta + rx;
    float yoffset = delta/2.0 + j * delta + ry;


    curRay.direction[0] = (x + xoffset) * pixelSize - 1;
    curRay.direction[1] = 1 - (y + yoffset) * pixelSize;
    curRay.direction[2] = 1;
```

```
        color += trace(curRay, 0);
    }
```

6 Refractive surfaces

The middle big Sphere has both reflective and refractive effect. Most of the color is coming back the back Wall, which is green and is caused by refractive. And if we take close look, we can see some red in the left sphere and blue in the right sphere, which is caused by reflection.