Coursework 1: Ray tracing

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1. The concepts used for both the ray and plane intersections are very similar. For the plane intersection, we substitute the equation of the ray into the equation of the plane to find 't'. To find the point of intersection we add 't' to the the ray's origin multiply by the direction.

   For the cylinder intersection, we use the equation of a cylinder and substitute the ray into it. This will give us values that will allow us to calculate the determinant. If our determinant is greater than zero, than we know there is an intersection. For a cylinder, there can be two intersections so we must then sort the two different 't' values and return the smaller one. Then like with the ray, we can add our 't' value to the origin of the ray and multiply by the direction, giving us the point of intersection. However, we don't know the normal of the cylinder so we have to calculate that too. Knowing the hit position, the position of the cylinder and the direction of the cylinder, we can calculate the normal using a formula. We now have all the information for the intersection of a cylinder and can return the HitInfo.

2. For the the paper material, I chose a diffuse value of 1.0 to make it completely white. I chose a low specular value (0.1) since paper does not have much (if any) specularity. It is also not very glossy (0.3) and is not reflective or refractive (0.0 for both).

   For the metallic mirror material, I gave it a diffuse value of (0.1, 0.1, 0.1) to give it a slightly grey colour, like metal. I gave it a low specularity (0.3) since some metals can have a strong specularity component while others have a weaker one. I gave it a high reflective value since I wanted this type of metal to have high reflectivity.

   I gave the glass material high specularity and no diffuse value since this is what I think represents glass most accurately. It also has a high reflective and

refractive value just like most glass in real life. I gave it a refractive index value of 1.3 which seems to be quite common.

The plastic material was given a diffuse value of (1.0, 1.0, 0.0) in order to make it yellow. It was also given a high specularity and glossiness value so that the specular light could be seen on the yellow sphere very clearly in the scene. It also should not be reflective or refractive so a value of 0.0 was given in order to reflect this.

3. For shadows, a mistake that could be easily made is using a 'tmax' value that is too large. It might be tempting to use a large value such as 10000.0 for tmax since that's what we have used for other functions, however this will give rise to unrealistic and inappropriate shadows. To avoid this, we should calculate what our tmax value should be. It would make sense to only check for shadows between where the light is and the point of intersection, and no further. To do this we simply get the length of the hitToLight vector and pass this in as our tmax for the intersectScene function.

4.

5. Schlick's approximation was used.