Problem 1 Written Report

By: Adam Kohl and Fei Xu

Numerous parameters affect the rendering of a computer graphics scene. Many adaptations need to me made in order to get a high-quality rendering. First things first, a light model and material model is always needed to create a colored object. There are three light sources associated with rendering.

A point light source emits light equally in all direction. For example, the sun in our galaxy is a point light source. On the other hand, a spot light source only emits light within a limited angle and decreases intensity as the light source furthers from the surface of the primitive. Finally, directed light is emitted from a distant light source. The light rays run parallel to one another and the distance between the light source and surface has no effect on the light’s intensity. Light attenuation plays a factor in the outcome of the light source. Attenuation is the loss of light intensity over a distance; therefore the intensity will decrease as the distance increases from the light source. An important note regarding performance, directional light is faster to calculate because the graphics card can pre-calculate the light vector for all vertices.

The vertex color of a model is an accumulation of specular reflection, diffuse reflection, ambient reflection, and emissive reflection. Specular reflection is the light from one particular direction being reflected into another particular direction. The specular reflection will results in spots or glares on the surface of the primitive. The intensity of the spot is dependent on the angle between the eye point and reflection vector is extremely important, while the spot size is independent of the angle. Finally, the specular reflection is dependent on the viewer because it doesn’t affect the entire 3D model.

The ambient reflection isn’t directed; rather it’s a global illumination. This type of reflection will make the model appear plain-colored and is most noticeable where the model doesn’t receive direct light. Diffuse reflection causes a consistent illumination of the model. Instead the light from one direction is scattered in all directions so it appears equally as bright in all directions, therefore the view position doesn’t affect it. Finally, diffuse reflection plays the most important role in the perception of shapes. Finally, emissive reflection is light simulated from an object. The object is in turn the light source, such as the sun is for our solar system. The material will have an RGB color value as an input as will the light.

The model’s geometry plays an important in the color outcome. The vertex colors for each primitive is first processed individually. Once processed all the vertices are processed an assembly algorithm takes place. Finally, the rasterization process occurs so the shading function can fill the primitive. In terms of geometry, there are many ways to shade an object. For example, flat shading accentuates individual polygons by assigning one color to each. There is also Gouraud shading which will smooth the edges between the polygons by linearly interpolating from vertex points.