CMPM 163 Notes

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Winter 2019 — April 17, 2019

Intro to Textures and Lighting

- On the GPU, vertex positions are converted to texture coordinates in **UV Space**.
- **UV Space** is a coordinate system of floating-point values ranging between 0 and 1.
- The basic lighting model is `surfaceColor = emissive + ambient + diffuse + specular`. In short, just add all the values together.
  - **Ambient Light** is the natural light inside a scene. This can be thought of as the "sun" - a strong, distant light source.
  - **Diffuse Light** is the light that is reflected by the object in all directions. This typically only relies on the surface normal and light vector. Typically this is calculated by the expression $D = K_d \times C \times \texttt{max}(N \cdot L, 0)$, where N is the surface normal, L is the light vector, C is the incoming light color, and K_d is the diffuse color.
  - **Emissive Light** is the light that the object itself.
  - **Specular Light** is the light reflected by the "shiny bits" of the object. This is typically calculated by the expression $S = K_s \times C \times f \times \texttt{max}(N \cdot H, 0)^s$ where K_s is the specular color, C is the incoming light color, f is 1 or 0 depending on whether the polygon is facing the camera, N is the surface normal, and H is the normalized vector halfway between the normalized viewpoint vector and L.
- **Flat Shading** is a shading method such that the shading is not interpolated in the raster process, but is constant per polygon normal.
- **Gouraud Shading** is a method of shading in which the lighting calculation is performed in the vertex shader rather than in the fragment shader.

A Closer Look at Lighting

- Table of Component Expressions:

Component	Expression	Legend
Ambient	$K_a \times C$	K_a = Material Ambient Reflectance; C = Incoming Light Color
Diffuse	$K_d \times C \times \max(N \cdot L, 0)$	K_d = Material diffuse color; C = Incoming diffuse light color; N = Normalized surface normal; L = Normalized vector facing light source
Specular		