Exercises - Shaders

From exercises14.pdf

Along with this exercise you are provided with a program to test your shaders. The program takes vertex shader as a first and fragment shader as the second command line parameter. Simple rotation mechanism is available using keys 'w', 's', 'a' and 'd'. Different models are available using keys '1', '2', '3'. Filename - ex14-1_shaders.cpp.

PS: I made some modifications to the handout used last year, so remember to use the one from this git repo, not the one from last years semester page.

Lighting equations

- Ambient light $I_{amb} = M_{amb} L_{amb}$
- Diffuse light $I_{diff} = M_{diff} L_{diff} (\hat{n} \cdot \hat{l})$
- Specular light $I_{spec} = M_{spec} L_{spec} (\hat{n} \cdot \hat{h}), \hat{h} = \frac{l+v}{||l+v||}$

Built-in GLSL variables reference:
http://mew.cx/glsl_quickref.pdf

Exercises - Shaders

From exercises14.pdf cont.

1. Write a vertex and fragment shader that will assign a $(1, 0, 0)$ color to each fragment.
2. Write a vertex and fragment shader that will replicate a GL_FLAT behavior of the fixed pipeline.
3. Write a vertex and fragment shader that will replicate a GL_SMOOTH behavior of the fixed pipeline - i.e. Gouard shading.
4. Write a vertex and fragment shader that will perform Phong shading.

Exercises - Shaders

Extra, Hard

Use what you learned about refractions/reflections, and try to implement Fresnel shading.

1. Compute reflection and refraction vector using snell's law (GLSL already has functions for this, you just need to provide a η value)
2. Use the vectors as texture coordinates to fetch a reflected and refracted color value from a cube map (environment mapping)
   vec3 refl_uv = reflect(-v, n);
   vec3 refr_uv = refract(-v, n, eta);
   vec4 refl = textureCube(cube_tex, -refl_uv);
   vec4 refr = textureCube(cube_tex, -refr_uv);
3. Compute ratio of reflectance using Schlick's approximation

$$R_F(\theta_i) \approx R_F(\theta^0) + (1 - R_F(\theta^0))(1 - \cos_{\theta_i})^5$$

$$R_F(\theta^0) = \left(\frac{\eta_2 - \eta_1}{\eta_2 + \eta_1}\right)^2, \quad \cos_{\theta_i} = (v \cdot n)$$