Obligatory Exercises

Evaluation Point System for Source Code

Area	Points	Explanation
Compilers	0	Does not compile because of errors
	1	Does not compile because of linking problems solvable by student
	2	Compiles with warnings OR does not compile due to linking problems not solvable by student
	3	Compiles without problems or warnings
Runs	0	Runs not at all or does not do the task
	1	Starts, but breaks after some time or after some specific action due to major error
	2	Starts, but breaks after some time or after some specific action due to minor error
	3	Runs without problem
Exercise	0	Exercise not solved or understood at all
	1	Good effort but did not get very far
	2	Main parts of exercise solved, but details are missing OR/AND insight seems to be missing
	3	Exercise solved with minor errors/problems
	4	Exercise solved
Code Quality	0	"Spaghetti code" - unreadable
	1	Poor: badly structured, no error/failure handling
	2	Acceptable: readable, sufficiently structured, most/main errors handled
	3	Good: structured, errors handled, efficient, easy readable
Comments	0	None
	1	Repeats code
	2	Bare minimum
	3	Good

Source Control

GitHub

Easy to follow tutorial for setting up git on your machine:
https://help.github.com/articles/set-up-git

Download a git client of choice if you don't like to use terminal commands

Source Control cont.

GitHub

Some useful commands

- clone - clones a remote repository from url
- pull - pull updates from remote
- push - push latest committed changes
- commit - commit changes made locally
- rm - remove a file from source control
- add - add a new file to source control
- status - prints out the current status of local repo.

Syntax:
git [command] [options]
Example:
git clone git@github.com:jkrmc12/INF3320-Group-1.git
cd INF3320-Group-1
git add doc/2oct/2oct.tex
git commit
git push

Source Control cont.

GitHub

When using source control on the obligatory assignments you are required to use private repositories.
On GitHub only public repositories are free, however you can upgrade to a students account and get five private repositories.
https://github.com/edu

Exercise 5.1

Describe the difference between flat, Gouraud, and Phong-shading.

Exercise 5.1

Solution

Solution: The main difference between shading models is the level at which lighting calculations are done (primitive, vertex or fragment). Flat shading evaluates the lighting model once for each triangle, and fills the triangle with that colour. Gouraud shading evaluates the lighting model at each of the three vertices and interpolates the colour to determine the fragment colours inside the triangle. Phong shading evaluates the lighting model per fragment. The normal vector is interpolated (and normalized) over the triangle.

Exercise 5.2

Given a point $\vec{p}$ on a surface with surface normal $\vec{n}$ and a light ray coming from a medium with refraction index η_2 and is refracted into a medium with refraction index η_2. The incoming light ray makes the angle θ with the surface normal. Make a small drawing and set up the relevant expressions for the refracted direction. When do total reflection happen?

Exercise 5.2

Solution

Total reflection happens when two conditions are fulfilled:

(a) The index of refraction of the medium the light is traveling from is greater than the index of refraction of the medium the light is traveling to $\eta_1 > \eta_2$

(b) The angle of incidence (angle between the light vector and surface normal) is grater than the critical angle given by' $\theta_c = \sin^{-1}\left(\frac{\eta_2}{\eta_1}\right)$

Exercise 5.3

Given the unit vector $\vec{i}$ that describes the direction of a light ray and a surface normal $\vec{n}$, start with Snell's law and show that the refracted light direction is

$$\vec{r} = \frac{\eta_1}{\eta_2}\vec{i} + \left(\frac{\eta_1}{\eta_2}(\vec{n} \cdot \vec{i}) - \sqrt{1 - \left(\frac{\eta_1}{\eta_2}\right)^2 (1 - (\vec{n} \cdot \vec{i})^2)} \right) \vec{n} \quad (1)$$

Exercise 5.3

Solution

$\vec{r}$: Refracted direction
$\vec{i}$: Incoming light
$\vec{n}$: Surface normal
Define $\vec{r}$ as:

$$\vec{r} = \alpha\vec{i} + \beta\vec{n} \tag{2}$$

Since be know $\vec{r}$ lies in the plane spanned by the incoming light vector $\vec{i}$ and surface $\vec{n}$.
Snell's Law

$$\eta_1 \sin\theta = \eta_2 \sin\theta_r \tag{3}$$

θ_r is an angle the refracted direction vector $\vec{r}$ makes with $-\vec{n}$

Find α and β by solving the equations Snells law and the fact that $\vec{r}$ is of unit length

$$\|\vec{r}\| = \|\alpha\vec{i} + \beta\vec{n}\| = 1 \tag{4}$$

Exercise 5.3

Solution cont.

Try to find θ_r, it can be expressed as:

$$\cos\theta_r = (-\vec{n} \cdot (\alpha\vec{i} + \beta\vec{n})) \tag{5}$$