# Assignment 4 - More in 3D

Software Design Document

CS2300 Section 1 Spring 2022

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Project Description

There are three parts to this assignment. First we are solving a shading problem by identifying whether a triangle is back facing or front facing and then determining the intensity of the light. Secondly we are doing a parallel projection and projected points onto a plane. As well as the perspective projection that projects the points into the plane. Lastly we were to find the distance from a point to a plane and then determine whether a line was intersecting a triangle.

Approach

I first read in all the inputs into various variables so that calculations could be done on each point. I then created functions for each subpart so that all the calculations would stay separate from each other. I then outputted the results of the functions to a variable which was then written to the output files.

Detailed Design

Programming Language

The programming language I used was Python. The reason I used Python was because it was able to help solve the linear systems for the last subpart and the complexity of syntax is virtually gone with this language. Python allows the user to easily read in input and output answers to files with ease.

Modules

Part 1: The inputs for part 1 were an eye location, light direction, and then vertices of multiple triangles. I read these inputs into varaibles and then passed them to a function so that I could do the calculations on each point. I also used functions because it would make looping the part easier. After the function was done I outputted the result to an output file.

Part 2: The inputs for part 2 were a point on a plane, the normal to the plane, and then a vector if it was a parallel projection. I read these inputs into varaibles and then passed them to a function so that I could do the calculations on each point. I also used functions because it would make looping the part easier. After the function was done I outputted the result to an output file. For subpart 2 there was no projection direction to read in.

Part 3: The inputs for part 3 was a point on a plane, a vector normal to the plane, and then a point that we need to calculate the distance from. I read these inputs into varaibles and then passed them to a function so that I could do the calculations on each point. I also used functions because it would make looping the part easier. After the function was done I outputted the result to an output file. For subpart 2, we had to read in two points that defined a line and then 3 points of a triangle.

Flowchart

Diagram

Description automatically generated

Key Data Structures

The key data structures that I used were lists, which are basically dynamic arrays. These are helpful when not knowing how many inputs we need and how many outputs we must export to files.

Test Description

The input files I used were used to test each function in the code. Certain files would test certain situations, in every part we would test negative numbers and various combinations so that we could step through all the branches of code.