Assignment 3 Software Design Document

CS2300 Section 1 Spring 2022

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# Project Description

The problem is divided into three different parts. The first part reads in a matrix and a vector and solves a vector using the equations Ax = b. The second part takes in a matrix and a vector and then finds eigenvalues and eigenvectors and then does eigen decomposition between all the components and compares it to the original matrix. The third part will read in a 2d or 3d file and whether it is 2d or 3d it will calculate the area of a triangle and then the distance of a point or plane to the line.

# Approach

In main, I only called functions and parsed the files so that the functions could call the individual values. In my part 1 function, it has all the calculations for finding the second vector with the matrix and the first vector. It has various if and else so that it can catch and system that is inconsistent or undetermined. The second part is like the first in that it is all in one function and that has the calculations for eigen values and eigenvectors and then eigen decomposition. I use the numpy matrix class for this. The third part is broken up into two different so that you can call the 2d version or the 3d version in main based on the input of the file.

# Detailed Design

## Programming Language

For this programming language I used Python because I wanted to try to learn more about it and it has way less syntax then when I used Java. It has various libraries such as Numpy and math that help with matrices and math calculations, and there is also file objects that help with reading and writing to files.

## Modules

Part 1: The inputs into this function were each value in the matrix and vector so that you could perform calculations on the individual elements without having to parse the matrix and vector every single time. There is also the input of a file name so that you can create an output file. The output of this function was a 2x1 vector that satisfies the equation Ax=b.

Part 2: The inputs of part2 are the exact same as part 1 this time we are trying to find the eigenvalues and the eigenvectors from the matrix and then we are going to use the vector to perform eigen decomposition and then output each of these to an output file. The final output is a comparison of the eigen decomposition to the original matrix and printing a 1 or 0.

Part 3: The third part varies on the input from the test file. If the input is a 2d triangle, then it will call the 2d calculations and print the area of the triangle and the distance of a point to a line to a file. If the input file was a 3d file, then it will calculate the area of the triangle in three dimensions and the distance from a plane to a point.

## Flowcharts

Diagram

Description automatically generated

## Key Data Structures

I used a list of output files so that you can test every possible outcome in a for loop. I also used arrays so that I could store the parsed input.

## Test Description

I used the 4 test input files for 2d calculations and 2 3d output files for the third part. We used the 4 2d test files so that it can test various situations with part 1, 2, and 3. The 2 3d output files were used only for part 3 so that the program could read which type of file was being read and then doing the calculations in the respective dimension.