# Linear Algebra Solver Using Python

This project is a collection of Python scripts designed to solve systems of linear equations using different algebraic methods, including Cholesky Decomposition and Doolittle's LU Factorization. The solver decides on the method based on the properties of the input matrix.

## File Descriptions

- \*\*`main.py`\*\*: The main executable script that orchestrates the solving process. It uses user inputs to determine which algebraic method to apply based on the matrix's symmetry and positive definiteness.

- \*\*`CholeskyMethod.py`\*\*: Contains the implementation of the Cholesky Decomposition method, used for symmetric, positive definite matrices.

- \*\*`DoolittleMethod.py`\*\*: Implements the Doolittle's LU Factorization method, applicable for general square matrices.

- \*\*`gauss\_seidel.py`\*\*: (If applicable) Provides an implementation of the Gauss-Seidel method for iterative solving of linear equations. (Based on your files, if this method integrates with the main program.)

- \*\*`user\_input\_handler.py`\*\*: A separate script for handling user input. It prompts the user for the matrix and vector, validates them, and returns them to `main.py`.

- \*\*`Cheat Sheet Using Numpy.py`\*\*: A utility script showcasing how to use NumPy for linear algebra operations, serving as a reference for implementing manual methods.

- \*\*`Symmetry Checks Used to verify code.py`\*\*: Contains functions to check the symmetry of matrices, which is crucial for deciding whether Cholesky Decomposition can be applied.

- \*\*`Test Cholskey np vs manual.py`\*\*: A test script that compares the results of the Cholesky method implemented manually vs. using NumPy, ensuring correctness.

## Usage

Run `main.py` to start the program. You will be prompted to enter the elements of the matrix \(A\) and the vector \(b\). The program will then determine the appropriate method to solve the system \(Ax = b\) and display the solution.

## Contributions

This project was developed with assistance from ChatGPT, an AI developed by OpenAI. ChatGPT provided guidance on implementing linear algebra methods, integrating NumPy for validation, and structuring the project for clarity and efficiency.