Report of assignment 6

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The project includes the following main files and directories: linear_equation_system_solver.cpp, matrix.cpp, matrix.h, smatrix.cpp, smatrix.h, vector.cpp, and vector.h.

In this project, we designed three main classes. First is the Matrix class, which represents a general matrix. It includes a constructor for initializing matrix dimensions, methods for setting and getting matrix elements, and overloaded operators for matrix arithmetic. Next is the Vector class, which inherits from the Matrix class and represents a mathematical vector. In addition to having the functionalities of the Matrix class, it provides methods and overloaded operators for vector arithmetic. Finally, there is the SMatrix class, which also inherits from the Matrix class and represents a square matrix. It includes methods and overloaded operators specific to square matrices.

During implementation, we first need to input n, the rank of the linear equation system, which ranges from 0 to 10. Then, we randomly generate elements for the coefficient matrix A and the constant vector C, with values between 0 and 1.0. Subsequently, we output the coefficient matrix A, the constant vector C, and the system of linear equations. Next, we solve the linear equation system using matrix inversion or other suitable methods and output the solution vector X. Finally, we verify the correctness of the solution by computing AX - C and checking if it approximates the zero vector, with an error tolerance of six decimal places.

In this project, we implemented some complex operations, including matrix inversion and precision management. Matrix inversion is a crucial step in solving the linear equation system. We implemented a reliable method for matrix inversion. Additionally, when dealing with floating-point operations, we need to manage precision to ensure the accuracy of the solution verification.