Matrix Calculus

1. Introduction

The aim of the project was to write a program that allows for matrix multiplication using two methods - the traditional algorithm for matrices up to a certain limit in size, and the Strassen recursive algorithm for matrices above that limit. For both methods, the execution time of the program and the number of floating-point operations were measured, which allowed for the comparison of the results presented in graphs in the further part of the report.

2. Chart of the dependence of multiplication execution time on the size of the matrix

The charts below show the dependence of multiplication execution time on the size of the multiplied matrices. The charts were prepared for three limit values of l - i.e., the matrix size at which the multiplication method was changed from the traditional method to the Strassen recursive algorithm. The charts include l=3, l=5, and l=7 corresponding to matrices of sizes 8x8, 32x32, and 128x128. These sizes are marked on the chart by a vertical dashed line in red.

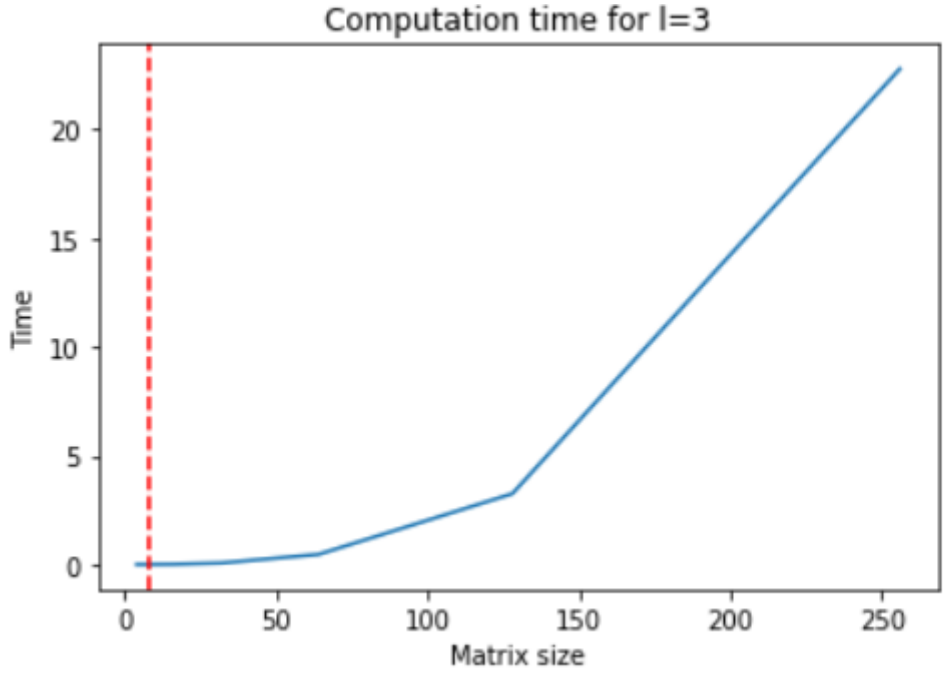

Figure 3.1: Chart of the dependence of time on matrix size for l=3

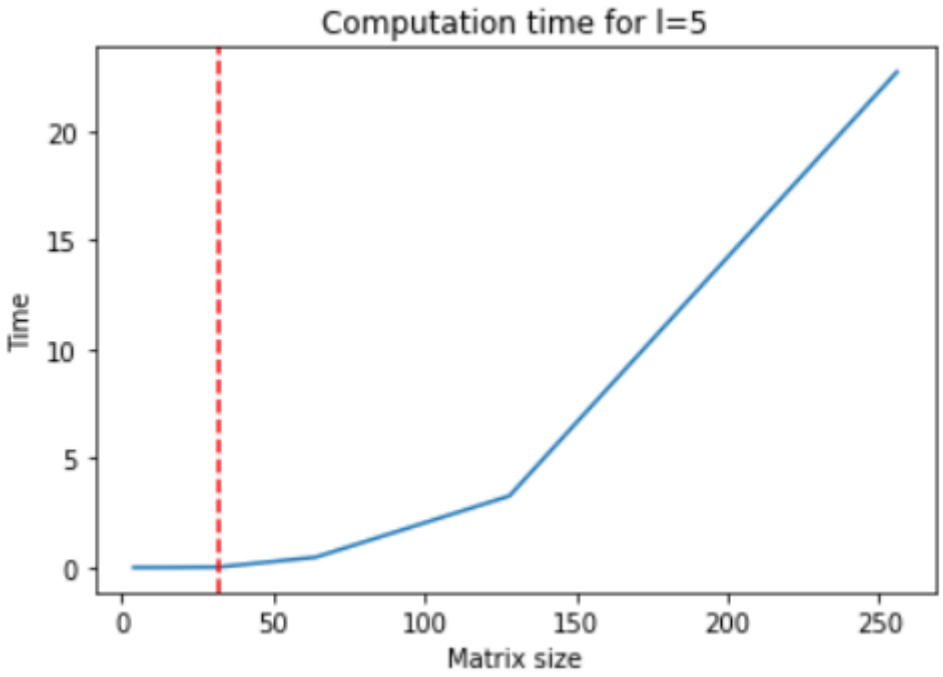

Figure 3.1: Chart of the dependence of time on matrix size for l=5

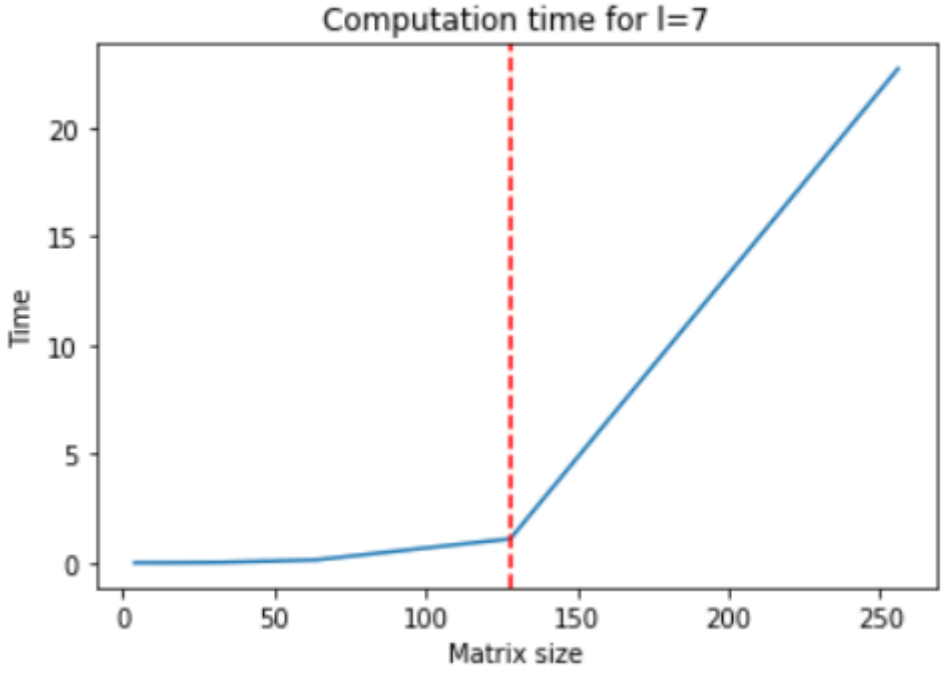

Figure 3.1: Chart of the dependence of time on matrix size for l=7

The computation time noticeably increases with the size of the matrix. Comparing the above charts, it can be observed that the traditional multiplication algorithm performs better in terms of computation time than the Strassen algorithm for matrices with a size not exceeding 128x128.

3. Chart of the dependence of the number of floating-point operations on the size of the multiplied matrices

The dependence of the number of floating-point operations on the size of the matrices is presented in analogous charts, which also include three sizes of l=3, l=5, and l=7.

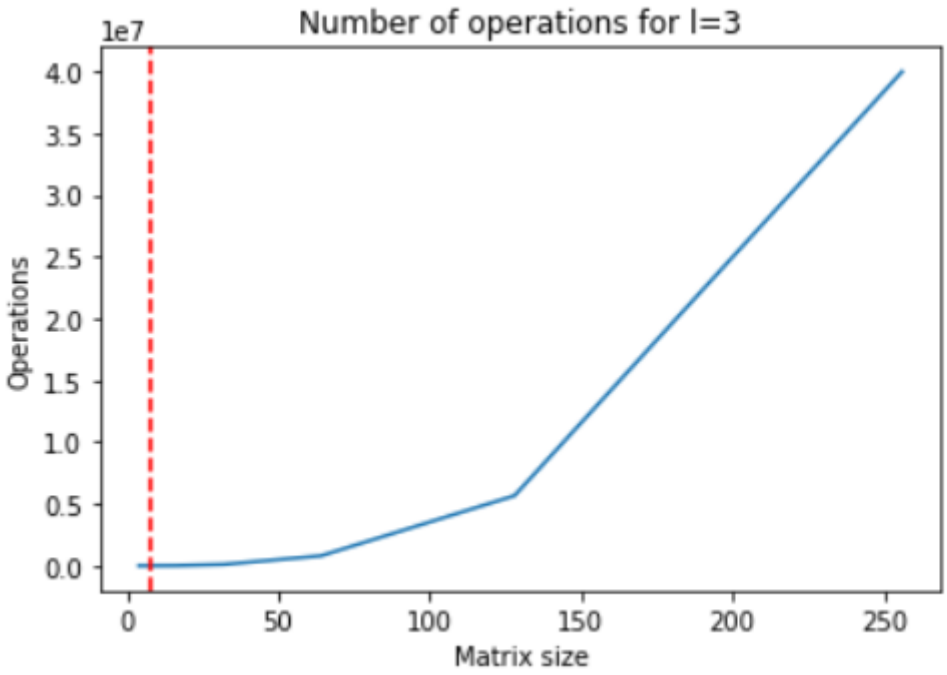

Figure 4.1: Chart of the dependence of the number of operations on the size of the matrices for l=3

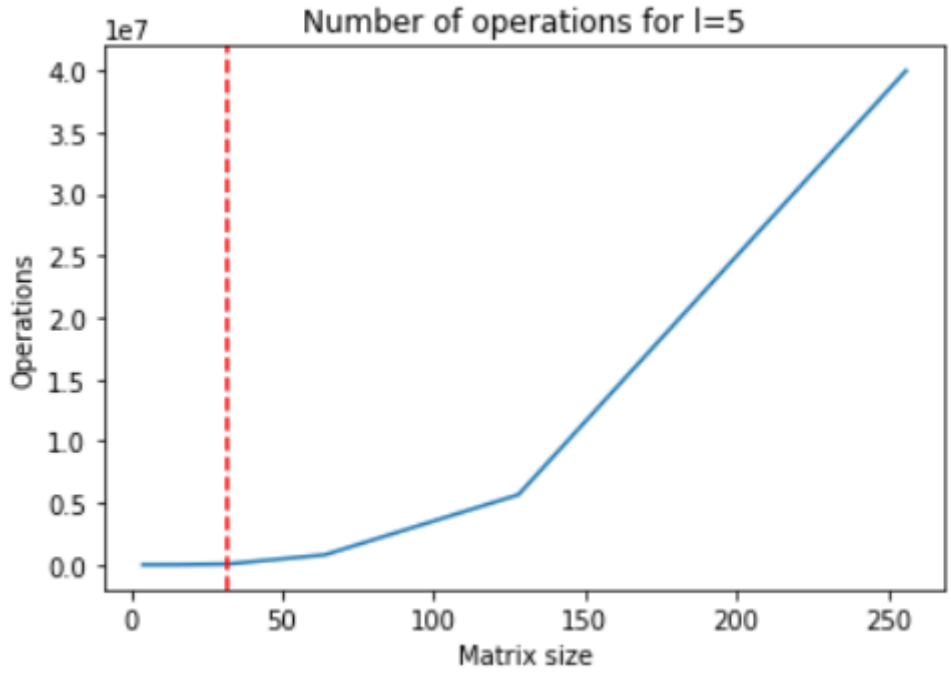

Figure 4.1: Chart of the dependence of the number of operations on the size of the matrices for l=5

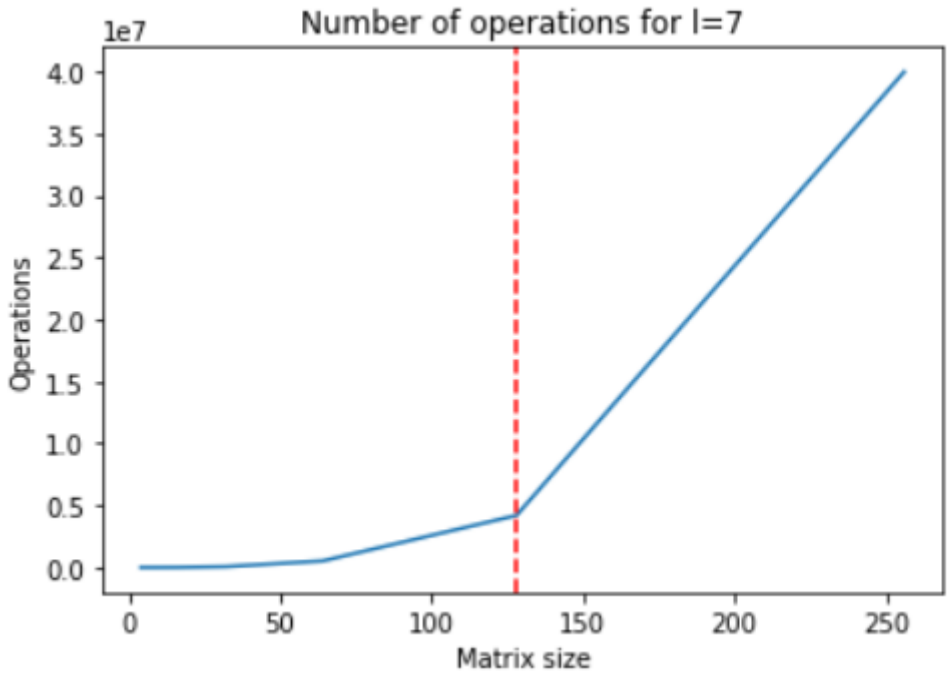

Figure 4.1: Chart of the dependence of the number of operations on the size of the matrices for l=7

The number of floating-point operations increases with the size of the matrix. Comparing the above charts, no differences in the efficiency between the traditional multiplication algorithm and the Strassen algorithm were observed in this case.