Report on Project 4, Part 1

Parallelization of Matrix Multiplication

CS415

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Version 1.0

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Overview:

Computing matrix multiplication is known to have a long calculation time. Matrix multiplication itself is not necessarily difficult but as the size of the matrix grows, more calculations are needed. Computing matrix multiplication has a run time of n^3. The purpose of this experiment is to show the speedup achieved with parallelization.

Test Methodology:

Two different programs are written to test the matrix multiplication time, sequential and parallel. The sequential code will be used as a controlled variable. The code will be tested at various sizes starting at 360 by 360 sized matrix. For more detail of the sequential and parallel code, please see below.

Sequential

The sequential code first allocates spaces for three matrixes, 2 for multiplicand and 1 for product. The two multiplicand matrixes are filled. After being filled, the two matrixes are multiplied together and the results are stored in the product matrix. The time starts when the calculation starts and ends when the calculation ends.

Parallel

The parallel code first allocates spaces for three tiles in all the cores, 2 for multiplicand and 1 for product. The size of the tiles is determined by the size of the matrix and the number of cores. The two multiplicand matrixes are filled. After being filled, all the cores will follow Cannon's algorithm to multiple the two matrixes (spread across all the tiles) together. The time starts when the calculation starts and ends when the calculation ends.

Data Analysis:

The raw data from the tests can be found in the file project4Analysis.

Sequential

The run time of the sequential code exhibits a runtime of O(n^3) as shown in Graph 1.1. The execution time grows exponentially as the length of the matrix grows linearly.

Parallel

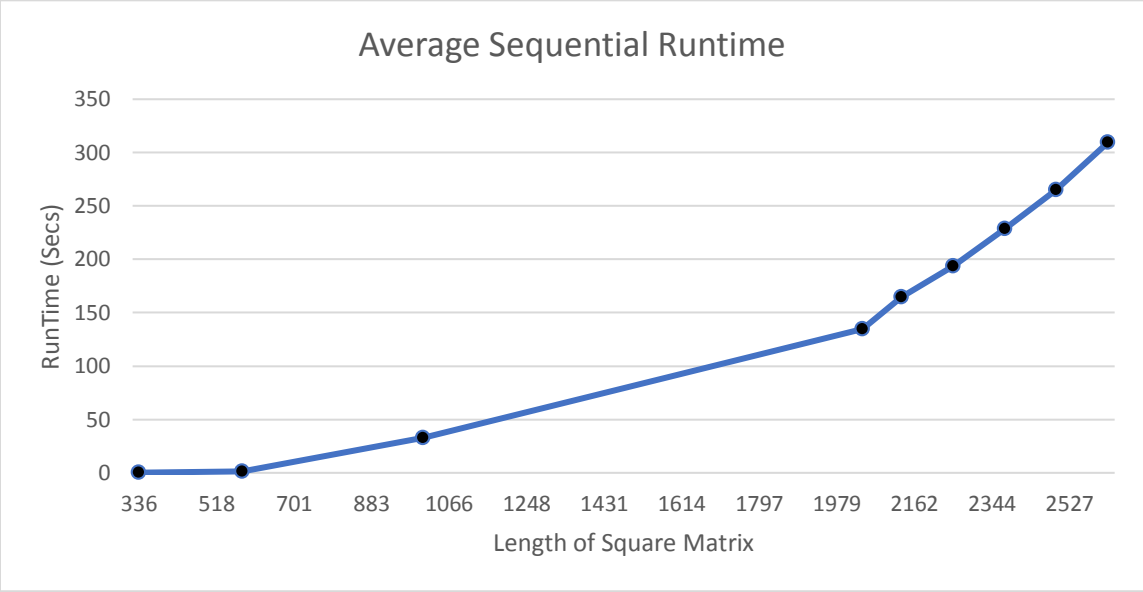
TODO

Conclusion:

TODO

Graphs and Tables

Graph 1.1



The graph shows the runtime of matrix multiplication is O(n^3).

Table 1.1

Sequential matrix runtime(Secs)									
Length of square matrix	360	600	1020	2040	2160	2280	2400	2520	2640
Average	0.178956	1.436156	33.01261	134.629	164.6035	193.7146	228.746	265.135	309.6805

The table is the average sequential runtime of matrix multiplication. The runtime is O(n^3) as the length increases, the runtime increases exponentially.