Ethan Tran
Project4-Analysis.pdf
Dr. Mishra
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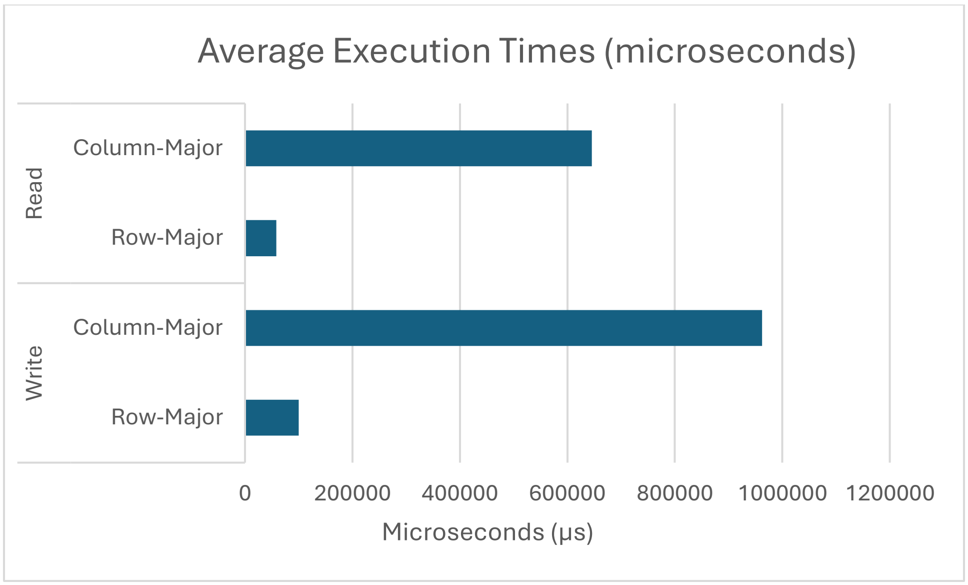
Analysis of Matrix Memory Access Patterns

Objective

The primary objective of this experiment was to analyze the execution time of matrix operations when accessing a large 2D matrix in different memory access patterns—row-major and column-major order. The goal was to measure the impact of these patterns on performance and gain insights into their influence on memory management, such as cache utilization and page-fault frequency.

Averaged Execution Times

The following table summarizes the average time (in microseconds) for each operation, averaged over 10 repetitions:



As seen above the row-major access pattern showed faster execution time when compared to column-major access. Also, as seen above, reading data from the matrix was much faster than writing data to the matrix. In column-major access there is a big difference in reading data than writing data.

Implications on System Performance

The implications on system performance is definitely more aligned to row-major access. Since computing data is defaulted to row-major access memory, it runs much faster and allows it to cache locally. With this it reduces memory access time with having not as much memory pages needing to be fetched. Another implication is page faults. Since reading and writing memory in such a large dataset, the inevitability to have page faults is higher. Since column-major access memory isn’t the typically used way to look at data it causes more problems and takes longer to compute.

Issue Encountered

Some issues I encountered while creating this project was issues with the compiler in regards to optimization. When using g++ it would optimize the project costing execution time. To fix this I had to use the -O0 flag to disable optimizations to run the program without any excess execution time. When measuring the timing of reading and writing data I had to implement it with little to none I/O disrupting to accurate readings. Also using the chrono library for precise microseconds measurements.