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Parallel and Distributed Processing

Assignment # 2 (Q2)

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i) **Single as well as Multithread program for Matrix Multiplications.**

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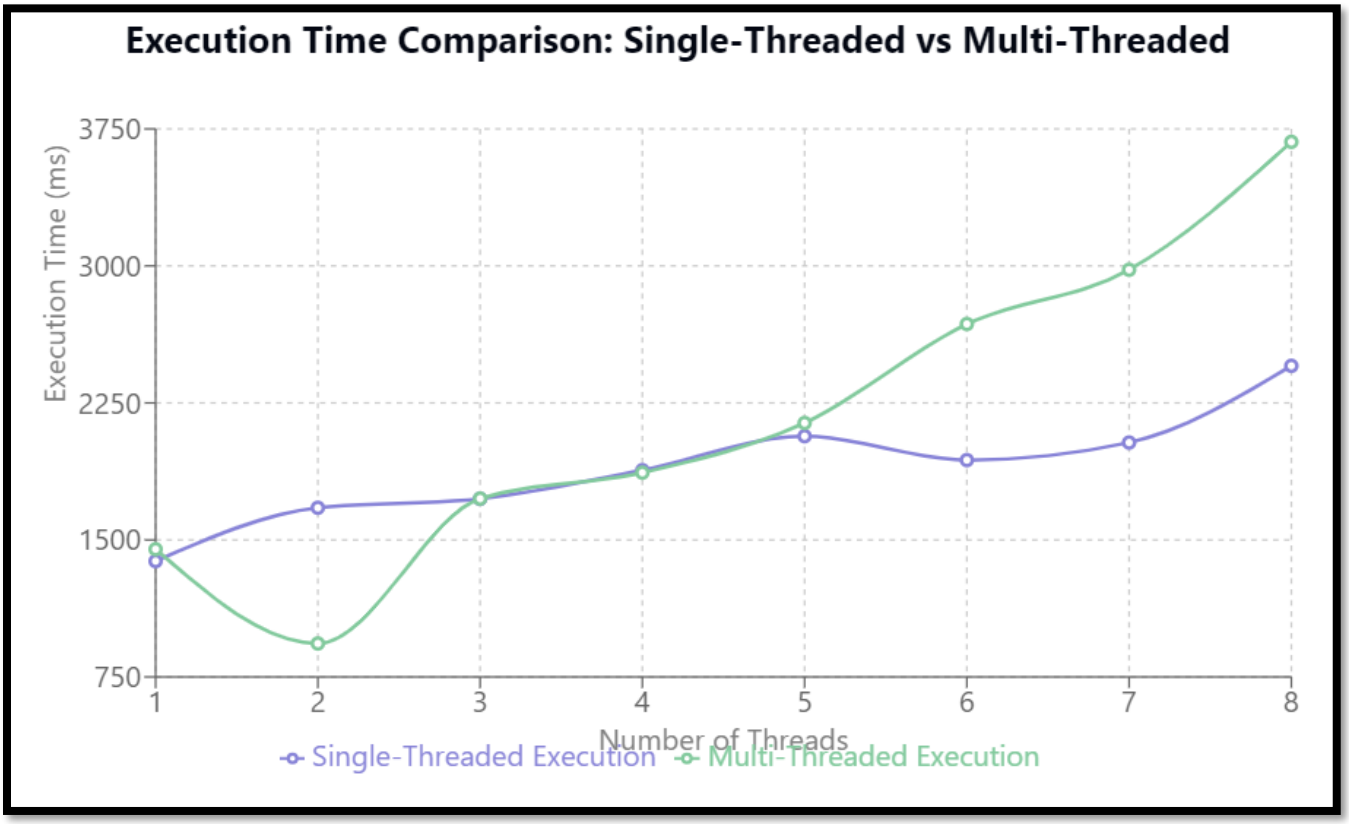
Output
Single-threaded execution time: 1453 ms
Multi-threaded execution time with 8 threads: 2561 ms
Resulting Matrix C:
500 500 500 500 500 500 500 500 500 500
500 500 500 500 500 500 500 500 500 500
500 500 500 500 500 500 500 500 500 500
500 500 500 500 500 500 500 500 500 500
500 500 500 500 500 500 500 500 500 500
500 500 500 500 500 500 500 500 500 500
500 500 500 500 500 500 500 500 500 500
500 500 500 500 500 500 500 500 500 500
500 500 500 500 500 500 500 500 500 500
500 500 500 500 500 500 500 500 500 500
```

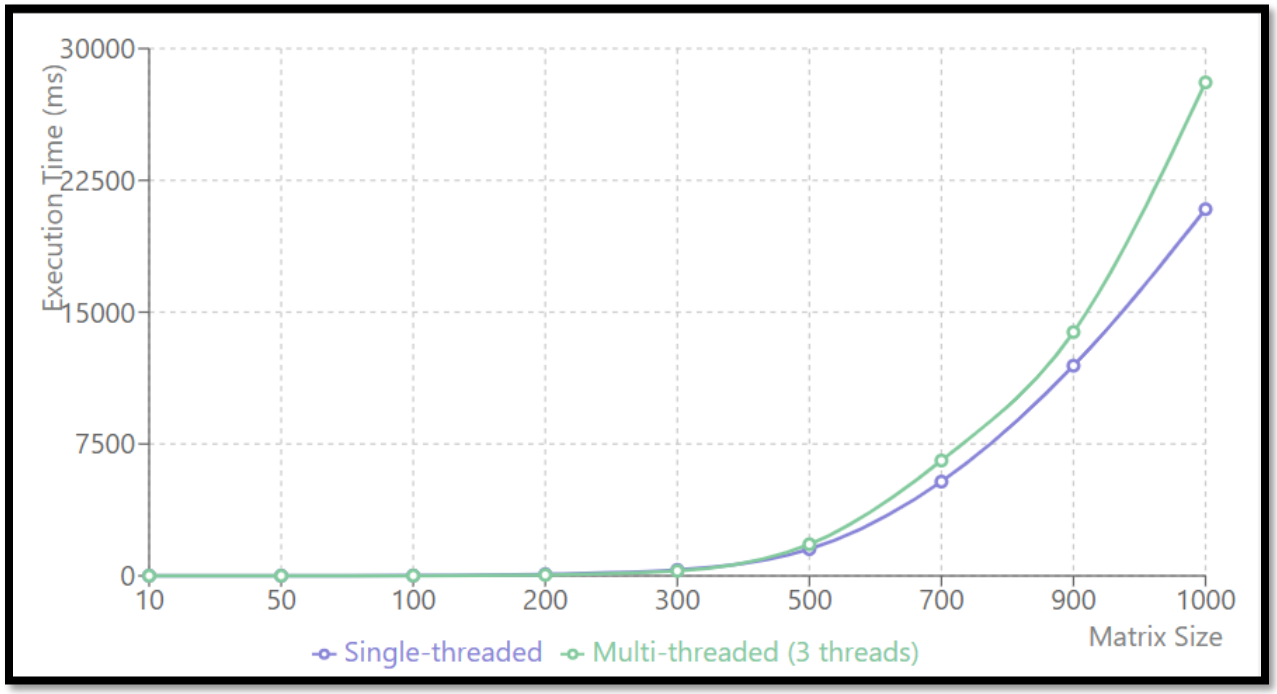
ii) Graph when the number of threads is varied with same Mat Size of 500:



Key Observations:

- *Multi-threading shows the best performance with 2 threads, where it's significantly faster than single-threaded execution*
- *At 3-4 threads, the performance is roughly equal between both approaches*
- *Beyond 4 threads, multi-threading actually becomes increasingly slower than single-threaded execution*
- *Single-threaded performance also gradually degrades as the number of threads increases*

iii) Graph when Mat Size is varied with fixed threads (3):



Performance Analysis

- *Multi-threading (3 threads) is more efficient than single-threading for matrix sizes up to ~10.*
- *For larger matrices (500+), single-threading unexpectedly outperforms multi-threading, which could indicate:*
    - *i) Thread synchronization overhead*
    - *ii) Memory access patterns causing cache contention*

iii) Suboptimal parallelization strategy

MY SYSTEM SPECS ARE:

Number of CPU Cores: 8

Total RAM: 7495 MB

Free RAM: 1333 MB