Lab 5

Multithreaded Matrix Multiplication

Operation System

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Introduction

Since day to day, CPU performance is increasing quickly. In the CPU industry engineers are trying to develop a CPU with less power consumption and high performance of processor speed. As we noted from old generation to new generation of CPU they mainly have increased the clock speed (frequency) and number of threads. It means a program which can process with multiple threads will reduce the duration time of processing.

Objective

This testing report is mainly created in order to observe the benefit of implementing threads execution in multiplication of matrices.

Implementation

This matrix multiplication program I have implemented thread execution. I have split the task into small threads. Every thread has its own specific task to calculate a row of matrix answers.

For instance, We have a x b of matrix multiple * b x c of the matrix so the number of tasks is the row number of a x b. (Number of tasks = a)

Testing And Result

I have tested with two computers. The first is the M1 cpu which has 8 cores (4 cores 3.2GHz - 4 cores 2GHz). I have tested this machine with two conditions, once single core and 7 cores. As we can see in the data sheet running in 7 threads is on average 2.8 times faster than a single core. If we take a look at 19 threads of intel core i7 we found that it is faster than a single core on average 17.3 times.

condition	M1 - (1 core 3.2GHz)	M1 - (4 cores 3.2GHz - 4 cores 2GHz)	M1 - 1thread VS 7threads	Intel i7 12700K (20 cores)	M1 - 1thread VS intel core i7 20threads
rows x columns	1 threads	7 threads	duration (1core / 7cores)	19 threads	duration (1core / 19cores)
1000 x 1000	1277	497	2.6	186	6.9
1300 x 1300	2774	953	2.9	152	18.3
1600 x 1600	5178	1712	3.0	275	18.8
1900 x 1900	8879	2998	3.0	487	18.2
2200 x 2200	14037	6390	2.2	770	18.2
2500 x 2500	20345	8251	2.5	1149	17.7
2800 x 2800	28708	10878	2.6	1578	18.2

3100 x 3100	38865	13015	3.0	2118	18.3
3400 x 3400	50613	17777	2.8	2803	18.1
3700 x 3700	65006	21946	3.0	3684	17.6
4000 x 4000	82238	28364	2.9	4597	17.9
4300 x 4300	101560	35193	2.9	5772	17.6
4600 x 4600	124524	42776	2.9	7166	17.4
4900 x 4900	150364	55035	2.7	8586	17.5
5200 x 5200	179393	64720	2.8	10345	17.3
5500 x 5500	219377	81555	2.7	12357	17.8
5800 x 5800	255045	98579	2.6	14462	17.6

X - axis is duration in millisecond

Y - axis is testing condition rows x columns
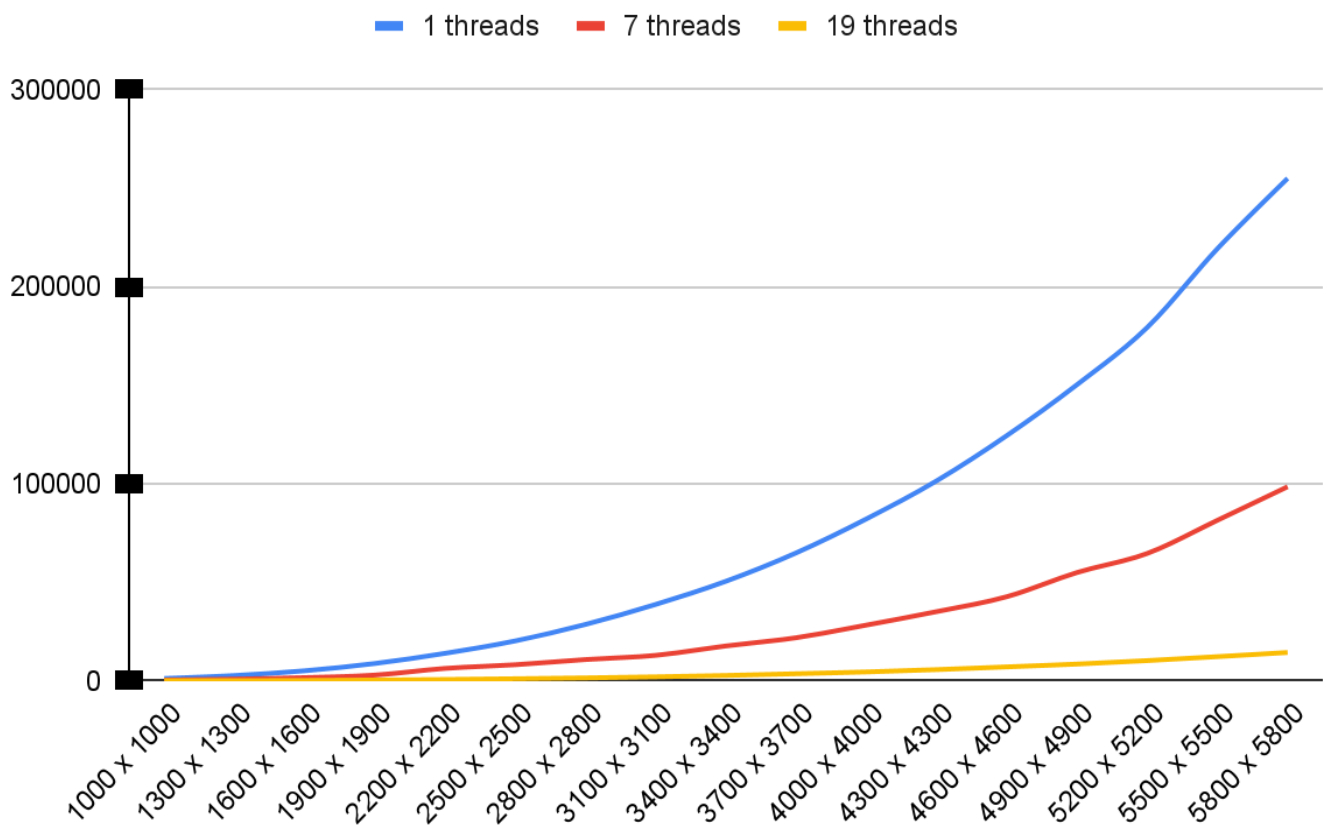
Conclusion

In conclusion I found that a process program in multiple threads can reduce time of calculation. Execution will reduce more when the CPU has more cores with high clock speed.