

Homework 5 Report

Team Members:

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System Specification Details:

1. OS: CentOS Linux Release 7.7.1908
2. Processor: 24 Cores
3. Memory: 96 GB

Part 1:

Single Processor Execution Time

Size of the matrix (n)	Execution Time
8	0.00001
100	0.0007
1000	0.0193
10000	1.3143

Analysis: The increase in execution time is due to the increase in the size of the matrix.

Part 2:

Fine Grain Execution Time

Num of Threads/ Size of Matrix ->	8	100	1,000	10,000
2	0.0005	0.0026	0.1856	20.9588
4	0.0008	0.0028	0.3108	28.6542
8	0.0017	0.0038	0.3934	35.2886
16	0.0031	0.0045	0.4128	34.9846
32	0.0031	0.0066	0.4246	40.4357
64	0.0053	0.0078	0.4299	39.5124

Analysis:

1. It is observed that execution time increases with an increase in the number of threads. This is because as the number of threads increases, the accumulated time to switch between the threads also increases.
 2. Additionally, we observe that the execution time increases with the increase in size of the matrix. This is because each thread is responsible for the exchange of one element and as size increases, the number of elements increases which leads to more switching between threads.
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Part 3:

Coarse Grain Execution ; Size of the matrix = 10000

Delta/ Num of Threads ->	2	4	8	16	32	64
10	6.1348	6.3388	6.7070	6.5807	7.3150	7.1625
20	3.3231	4.1300	4.0570	4.0453	4.4753	4.4126
30	3.6449	2.8499	3.1588	3.138	3.3680	3.3336
40	3.2316	2.5533	2.6751	2.6945	2.7387	2.6973
50	3.0617	2.3162	2.3103	2.3969	2.3366	2.3192
60	2.6269	2.0953	2.0501	2.0339	2.1960	2.1090
70	2.5555	1.9739	1.9016	1.8957	1.9816	1.9618
80	2.5432	1.9068	1.7432	1.7962	1.8094	1.7794
90	2.4389	1.8411	1.6588	1.7289	1.6884	1.6755
100	2.4675	1.7670	1.5997	1.5533	1.5882	1.5702
110	1.9105	1.7055	1.5635	1.5454	1.5802	1.5469
120	2.3256	1.7301	1.4895	1.4679	1.4915	1.5001
130	2.2893	1.7040	1.4448	1.3574	1.3804	1.4050
140	1.9144	1.5746	1.3619	1.2931	1.3367	1.3920
150	2.3732	1.6083	1.3411	1.2927	1.3503	1.2621

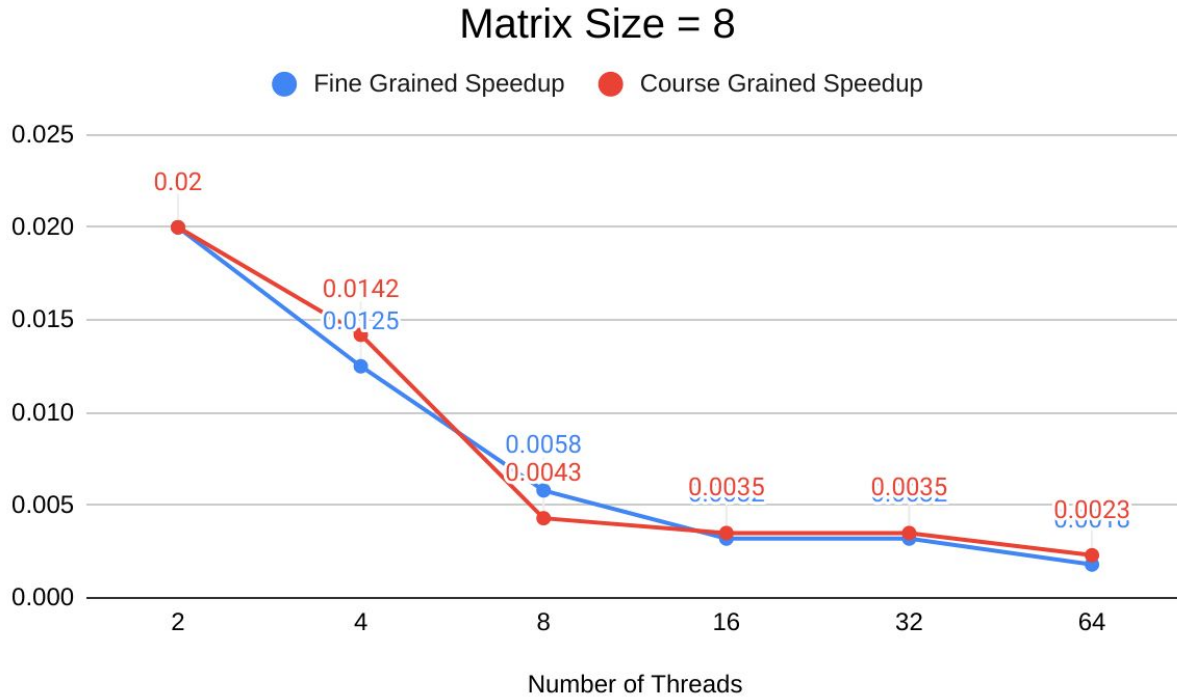
Analysis:

1. It is observed that there is a decrease in the execution time of the program with the increase in the value of delta. Here, delta value is proportional to number of elements being handled by each thread. As delta value increases, the number of elements being handled by a single thread increases. Hence, accumulated time to switch between the threads decreases which in turn reduces the execution time of the program.
 2. For the later number of threads, no significant change in the execution time is observed.
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Part 4:

Speedup = Single Processor Execution Time / Execution Time for each thread iteration in both versions

1. Size of the matrix = 8



Analysis:

- Delta value = 150
 - As observed, there is no speedup in either of the fine grained or the coarse grained versions. The only trend observed is that the speedup decreases even further with the increase in the number of threads. This is mainly because of the smaller matrix size, which takes less time in executing as opposed to overhead of creation of threads and the time taken for switching of threads.
 - In comparison to each other as well, both these versions perform almost similar to each other.
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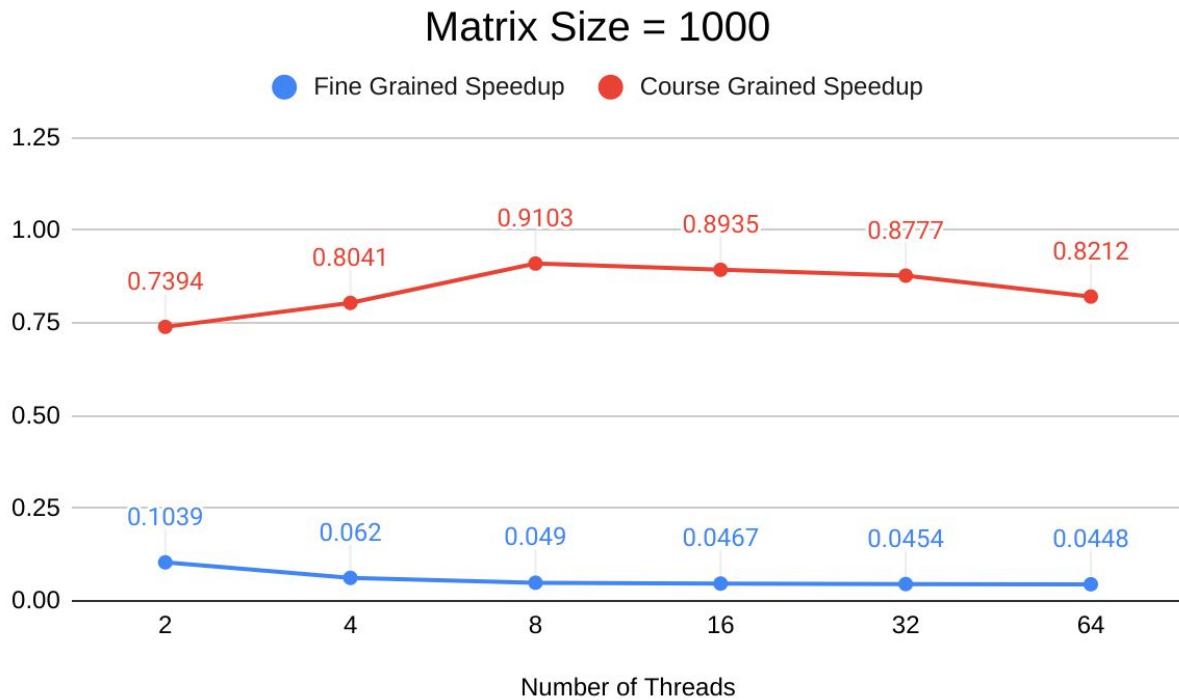
2. Size of the matrix = 100



Analysis:

- Delta value = 150
 - As observed, there is no speedup in either of the fine grained or the coarse grained versions. The only trend observed is that the speedup decreases even further with the increase in the number of threads. This is mainly because of the smaller matrix size, which takes less time in executing as opposed to overhead of creation of threads and the time taken for switching of threads.
 - In comparison to each other, the coarse grained version performs slightly better than the fine grained version for each iteration of the threads.
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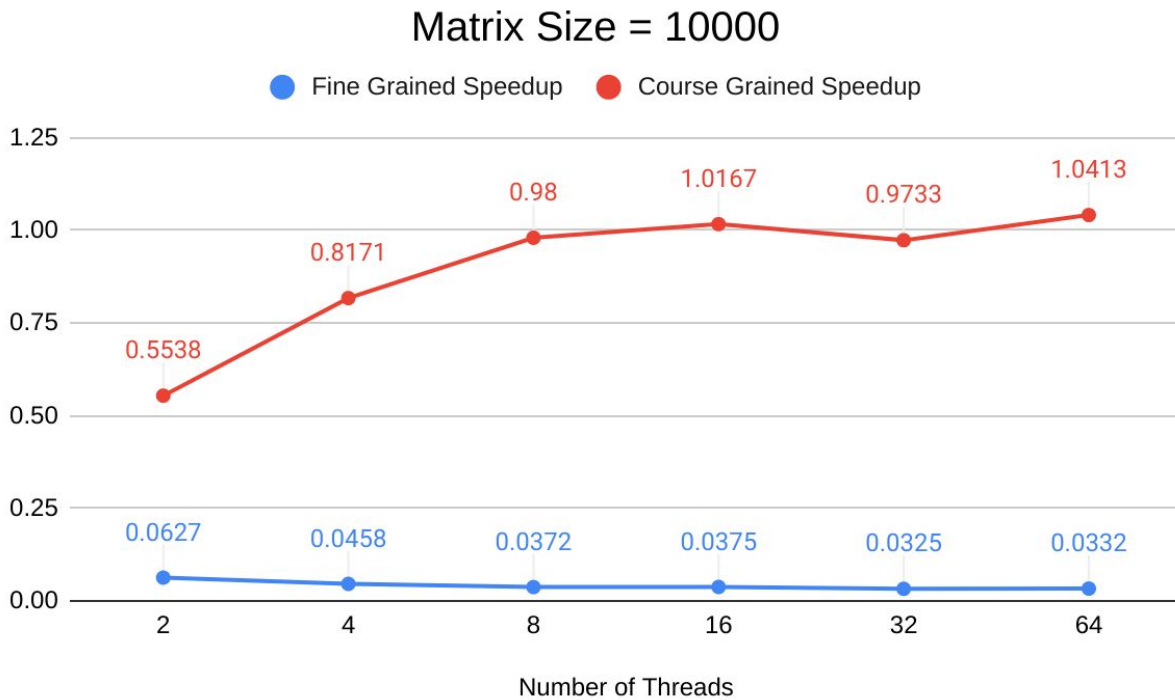
3. Size of the matrix = 1000



Analysis:

- Delta value = 150
 - Here, it is observed that the speedup for the coarse grained version is substantially higher than the fine grained version. This can be attributed to more elements being handled by each iteration of the threads which reduces execution time and in-turn increases speedup.
 - For each version independently, there is not much change in the values. There is a slight increase for the coarse grained version in the earlier threads. The range of the speedup values is quite small in both cases.
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4. Size of the matrix = 10000



Analysis:

- Delta value = 150
 - Initially, the speedup increases with the increase in the number of threads but achieves almost a constant state for the later threads for the coarse grained version.
 - Since, the delta value is large, the number of elements handled for each thread is also more, which leads to less switching and hence, reduces execution time which in-turn increases the speedup.
 - In comparison to each other, the coarse grained version performs a lot better as compared to the fine grained version.
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