2023-1 Multicore Computing, Project #3

Problem 1

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Environment

CPU type_	Intel Core i5-8265U 1.60GHz, Hyper Threading ON
# of core_	4
Memory size_	8GB
OS type_	Window 11 Pro

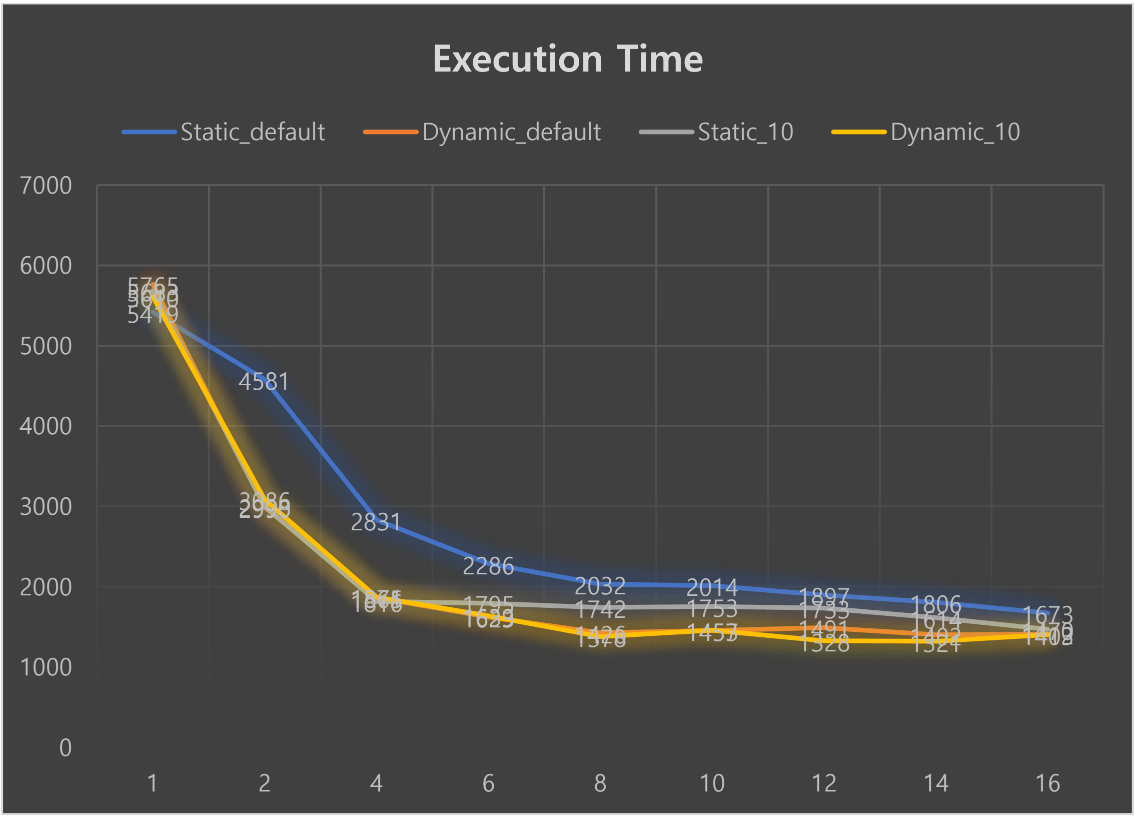
Result

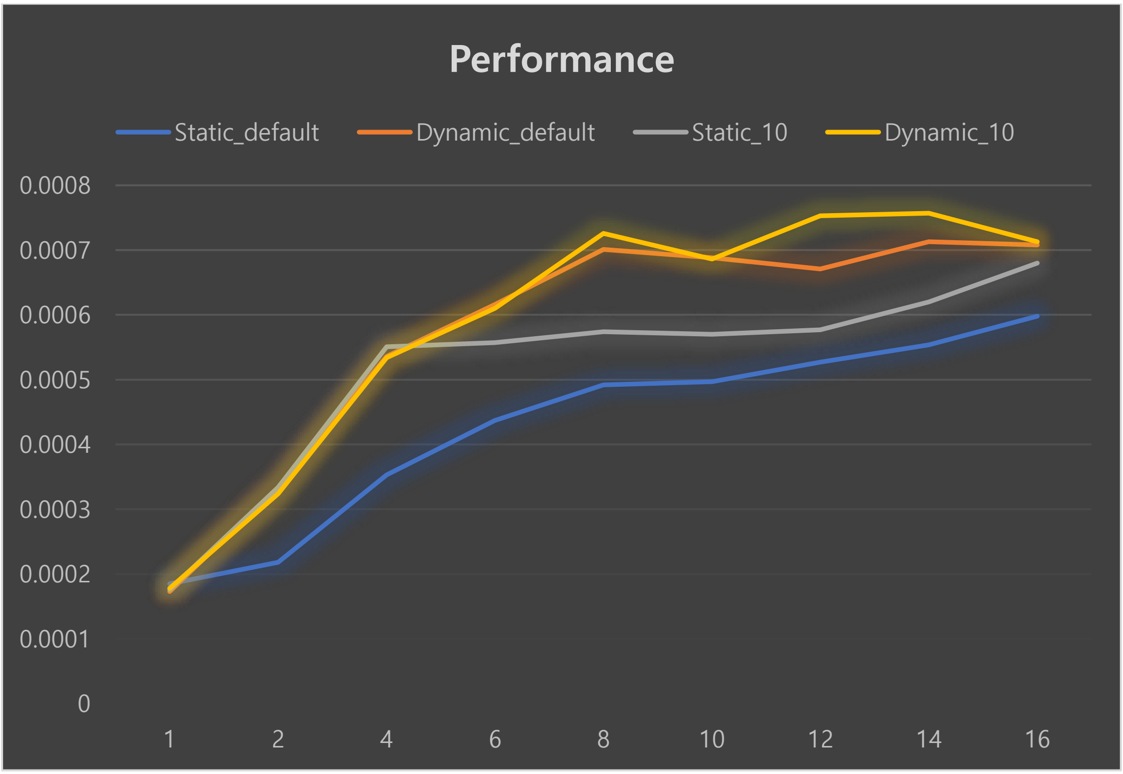
Tables_ (unit : ms)

Exec time	**Chunk size**	1	2	4	6	8	10	12	14	16
Static	Default	5419	4581	2831	2286	2032	2014	1897	1806	1673
Dynamic	Default	5765	2990	1865	1623	1426	1453	1491	1402	1412
Static	10	5683	2998	1816	1795	1742	1753	1733	1614	1470
Dynamic	10	5610	3086	1871	1639	1378	1457	1328	1321	1403

Performance	**Chunk size**	1	2	4	6	8	10	12	14	16
Static	Default	0.000185	0.000218	0.000353	0.000437	0.000492	0.000497	0.000527	0.000554	0.000598
Dynamic	Default	0.000173	0.000334	0.000536	0.000616	0.000701	0.000688	0.000671	0.000713	0.000708
Static	10	0.000176	0.000334	0.000551	0.000557	0.000574	0.00057	0.000577	0.00062	0.00068
Dynamic	10	0.000178	0.000324	0.000534	0.00061	0.000726	0.000686	0.000753	0.000757	0.000713

Graphs_


Execution Time
Static_default
Dynamic_default
Static_10
Dynamic_10
7000
6000
5000
4000
3000
2000
1000
0
5765
5419
4581
2831
2286
1795
2032
1742
2014
1753
1457
1897
1733
1491
1328
1806
1614
1324
1673
1
2
4
6
8
10
12
14
16


Performance
Static_default
Dynamic_default
Static_10
Dynamic_10
0.0008
0.0007
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0
1
2
4
6
8
10
12
14
16

Explanation / Analysis_

First, when comparing static and dynamic, in the case of static, the threads with lower numbers finished executing quickly, while the threads with higher numbers finished execution more slowly. Through this, it was clear that as the number gets larger, more calculations are required to determine whether it is a prime number or not. Also, static approach has bad work decomposition so, higher ranges have fewer primes.

Secondly, as the number of threads increased, performance increased in all cases. Particularly noteworthy is that when one thread became two, there was a very high increase in performance, with almost a 2x decrease in execution time for 1-4 threads. However, as the number of threads increased to 4-16, the efficiency of the increase was not as significant. This may be due to Amdahl's law, which states that a computer program is composed of parallelizable and non-parallelizable parts, so there is a limit to the improvement in performance unless further parallelization is possible.