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INFO 6205 Program Structures and Algorithms
Assignment 5

Task:

This task is to implement a parallel sorting algorithm such that each partition of the array is sorted in parallel. You must prepare a report that shows the results of your experiments and draws a conclusion (or more) about the efficacy of this method of parallelizing sort. Your experiments should involve sorting arrays of sufficient size for the parallel sort to make a difference. You should run with many different array sizes (they must be sufficiently large to make parallel sorting worthwhile, obviously) and different cut-off schemes.

Performance based on different cut-offs and arrays sizes (time: millisecond)

Cutt-off	20^4	40^5	80^5	20^6	40^6
10000	105	490	934	1922	2894
11000	36	316	473	1016	1975
12000	39	245	473	1014	2005
13000	34	224	419	986	1880
14000	10	231	414	962	1879
15000	9	227	456	946	2053
16000	26	234	460	808	2047
32000	23	287	533	890	2030
64000	21	192	463	725	2208
128000	12	207	345	871	2361

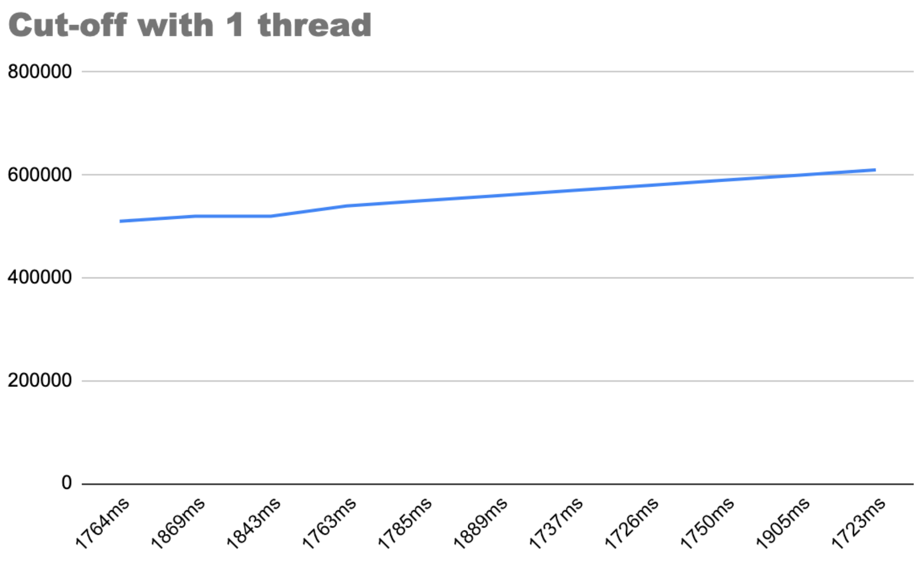
Performance based on different threads

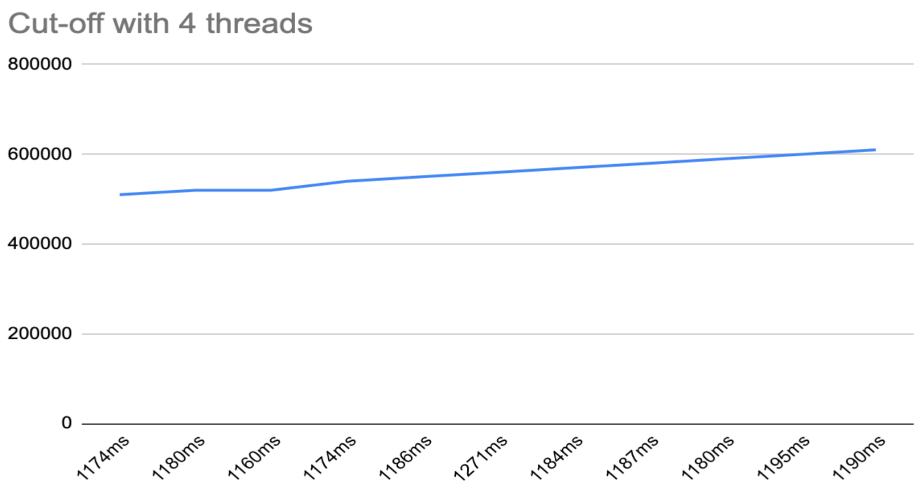
Cut-off	1 thread	2 thread	4 theads	8 threads	16 thread	32 thread	64 threads
510000	2141ms	1764ms	1174ms	788ms	778ms	769ms	811ms
520000	1779ms	1869ms	1180ms	807ms	798ms	797ms	764ms
520000	1880ms	1843ms	1160ms	805ms	769ms	758ms	759ms
540000	1913ms	1763ms	1174ms	817ms	769ms	775ms	764ms
550000	1882ms	1785ms	1186ms	821ms	770ms	779ms	786ms
560000	1785ms	1889ms	1271ms	801ms	840ms	781ms	777ms
570000	1770ms	1737ms	1184ms	816ms	770ms	760ms	776ms
580000	1831ms	1726ms	1187ms	810ms	778ms	779ms	781ms
590000	1942ms	1750ms	1180ms	825ms	769ms	777ms	776ms
600000	1947ms	1905ms	1195ms	831ms	779ms	783ms	768ms
610000	1910ms	1723ms	1190ms	794ms	775ms	762ms	767ms

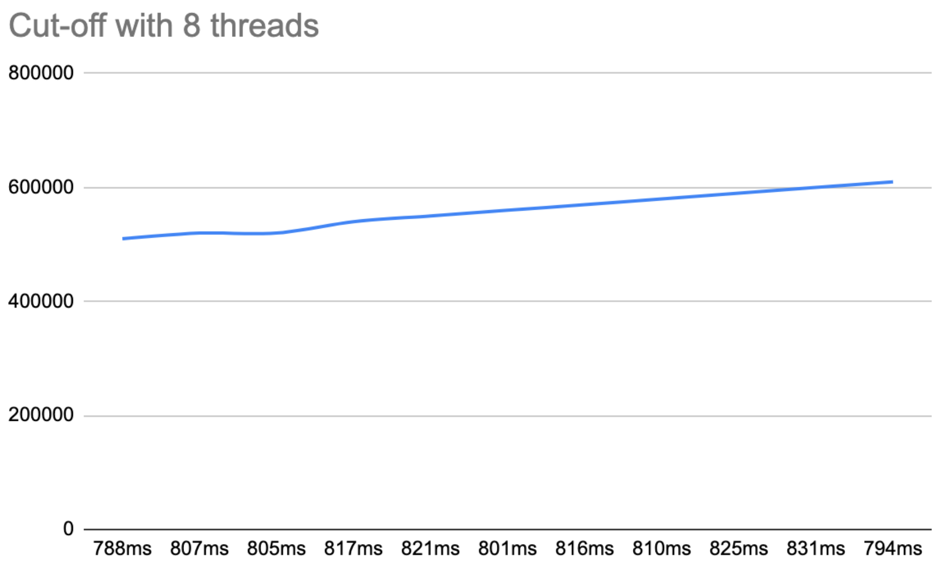
Relationship conclusion :

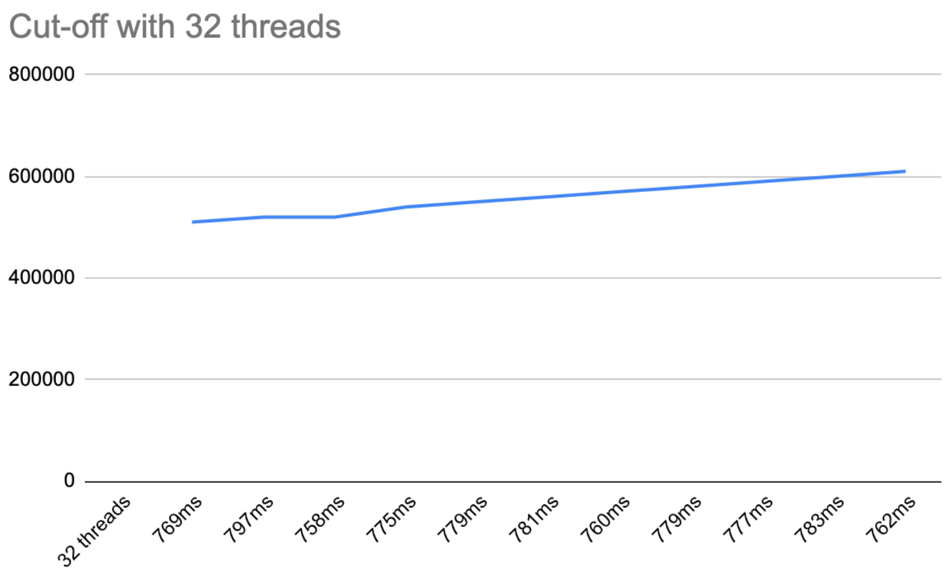
- Parallel sorting is more efficient at lower cut-off values than system sorting.
- Sorting a small array does not depend on the size of the cut-off however, when we increase the size of the random array, the larger the cut-off size, the lower the efficiency will be, which means that sorting larger data will require more time. In this case, we would split it into smaller arrays and then sort it by system sort, which is much more efficient.
- As I increased the threads from 2 to 4, the runtime significantly decreased. This indicates that having more threads brings better performance. However, as I increased threads from 8 to 16, the runtime remained the same as 4 threads. Probably because there will be a certain cost when switching execution between multiple threads.

Evidence to support relationship








Cut-off with 32 threads
800000
600000
400000
200000
0
32 threads
769ms
797ms
758ms
775ms
779ms
781ms
760ms
779ms
777ms
783ms
762ms