

CSE 204: Data Structures Sessional

Offline 7: Comparison of Merge Sort and Quick Sort

Submitted By,

Sihat Afnan

Lab Group : B2

Student Id : 1705098

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Machine Configuration:

Operating System- Windows 7 Professional

Processor- Intel(R) Core(TM) i3 CPU @2.70GHz up 3.19 GHz

Installed Memory (RAM)- 2.00 GB (1.74 GB Available)

System Type- 64-bit operating system

Data & Complexity Analysis:

Merge Sort:

The merge sort algorithm only depends on the size of the array, not on the values of the array.

An amount of similar memory required to replace the values of the array in sorted order. The algorithm follows divide and conquer rule. So in all circumstances-

Time Complexity: $O(n \log n)$

Memory Complexity: $O(n)$

The table is attached herewith.

n	Merge	Sort	Time (ms)
	Best	Average	Worst
10	0.0025	0.0034	0.0034
20	0.0066	0.0076	0.0082
50	0.019	0.0215	0.018
100	0.039	0.048	0.033
200	0.044	0.05	0.05
500	0.14	0.11	0.115
1000	0.27	0.33	0.26
2000	0.48	0.6	0.54
5000	1.45	1.7	1.25
10000	2.9	3.8	3
20000	6	7.4	7

Quick Sort:

Quick sort runs in $O(n \log n)$ time in its best and average case and runs in $O(n^2)$ in its worst and average cases.

The best case for the quick sort is the position of the pivot divides the array equally. On the contrary, the worst case is that all other elements are at one side of the pivot. Constant number of variables are required for this sorting.

Time Complexity: $O(n^2)$ for worst case (increasing or decreasing sequence) and $O(n \log n)$ for average case.

Memory Complexity: $O(1)$

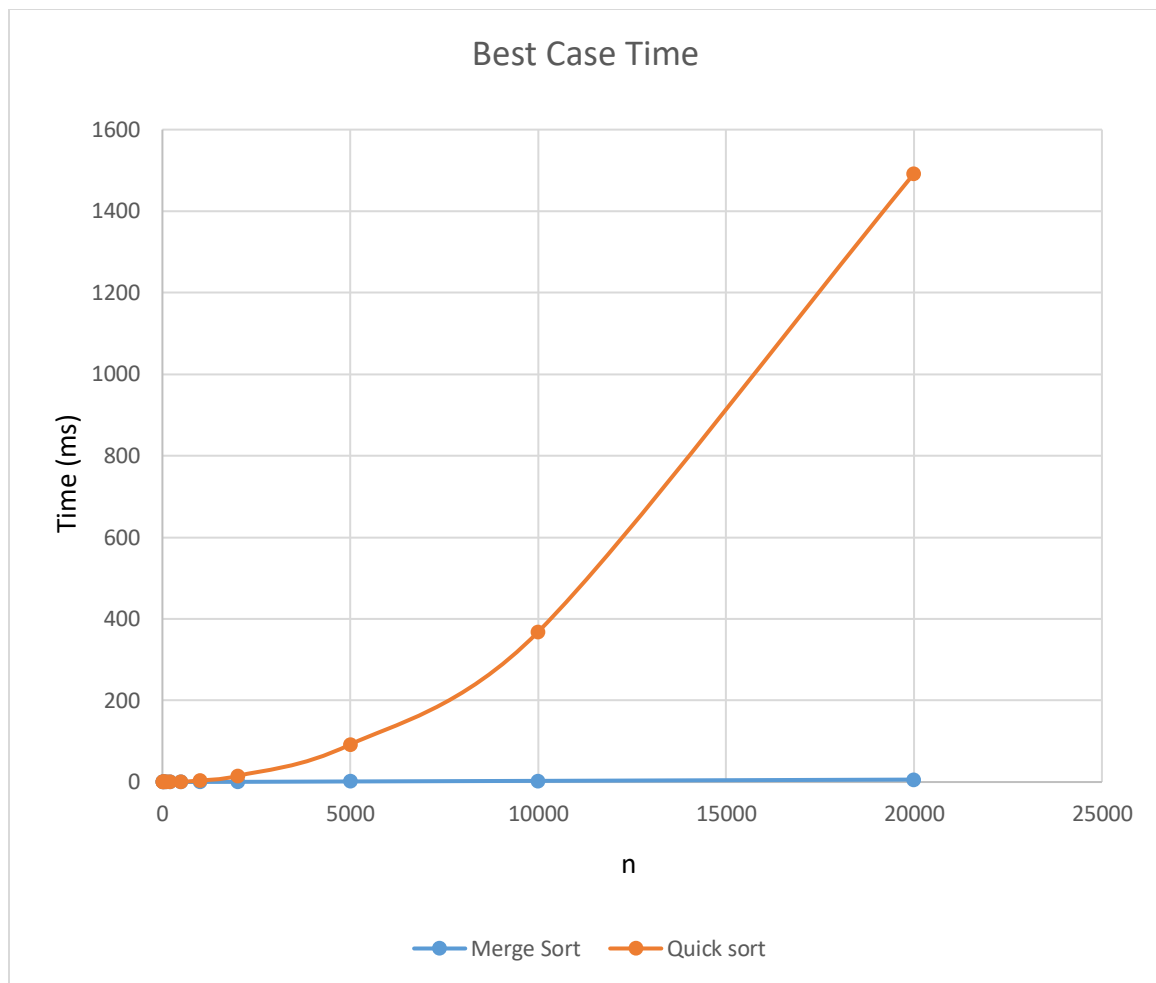
The table is attached herewith.

n	Quick	Sort	Time (ms)
	Best	Average	Worst
10	0.0006	0.0004	0.0006
20	0.0016	0.0008	0.0012
50	0.0065	0.004	0.0075
100	0.043	0.008	0.022
200	0.15	0.022	0.102
500	0.93	0.055	0.665
1000	3.78	0.07	2.52
2000	15.04	0.2	9.94
5000	92.15	0.65	58.8
10000	368.5	1.4	219.3
20000	1492.2	3	797

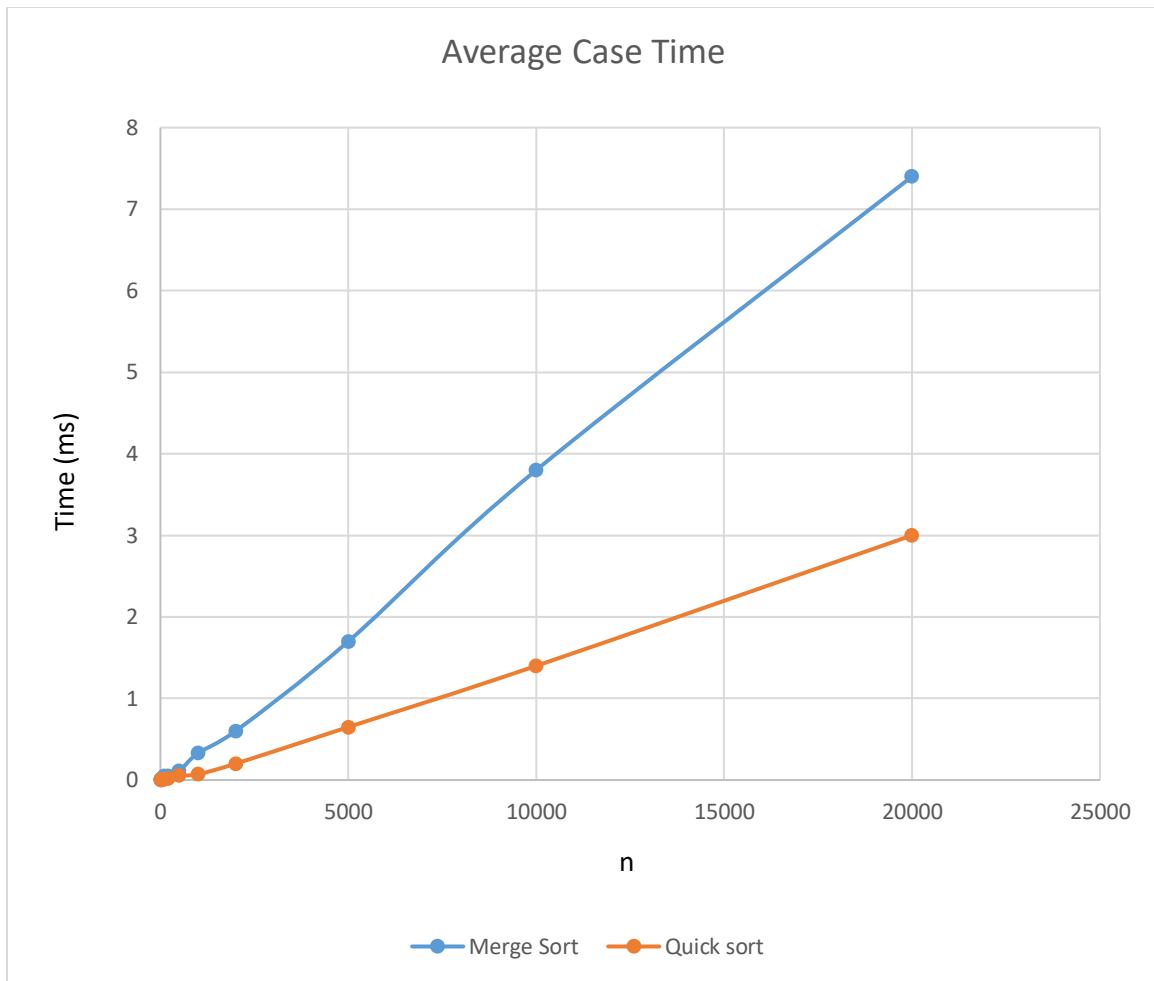
Graph Plots:

The graphs for comparison between merge sort and quick sort is attached herewith.

n	Best Case	Time (ms)
	Merge Sort	Quick sort
10	0.0025	0.0006
20	0.0066	0.0016
50	0.019	0.0065
100	0.039	0.043
200	0.044	0.15
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10	0.0034	0.0004
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50	0.0215	0.004
100	0.048	0.008
200	0.05	0.022
500	0.11	0.055
1000	0.33	0.07
2000	0.6	0.2
5000	1.7	0.65
10000	3.8	1.4
20000	7.4	3



Worst	Case	Time (ms)
n	Merge Sort	Quick sort
10	0.0034	0.0006
20	0.0082	0.0012
50	0.018	0.0075
100	0.033	0.022
200	0.05	0.102
500	0.115	0.665
1000	0.26	2.52
2000	0.54	9.94
5000	1.25	58.8
10000	3	219.3
20000	7	797

Worst Case Time

