Algorithm 2022 Spring

PA1-Report

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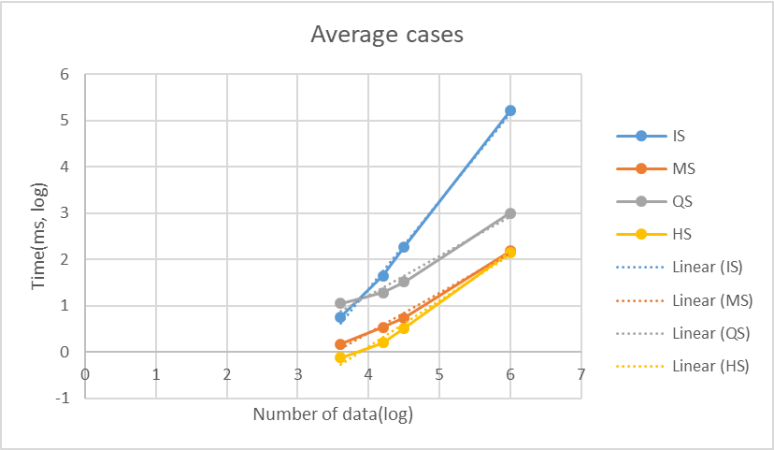
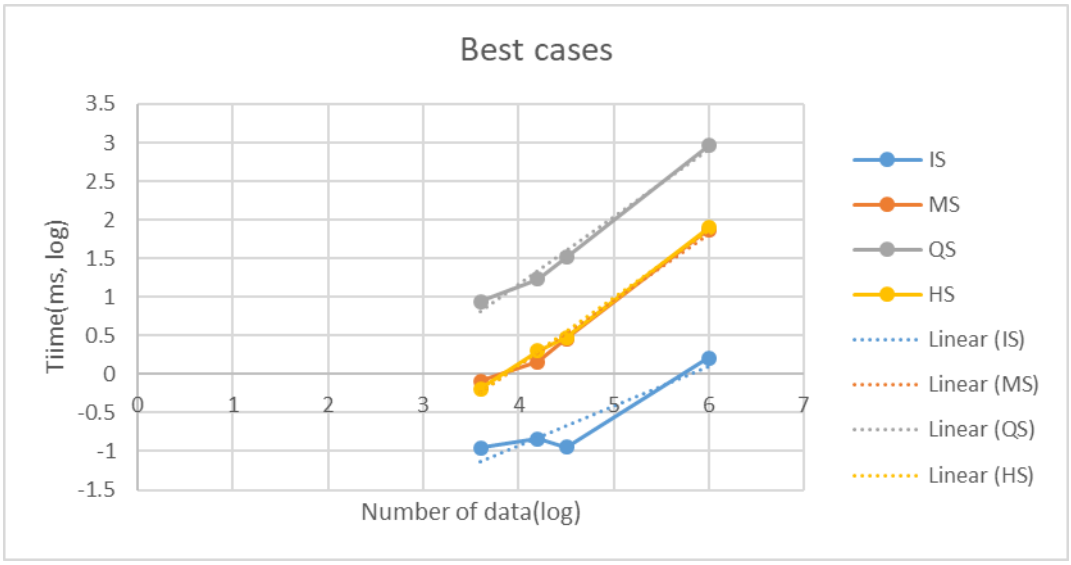
| Input size | IS | | MS | | QS | | HS | |
|---|---|---|---|---|---|---|---|---|
| | CPU time (ms) | Memory (KB) | CPU time (ms) | Memory (KB) | CPU time (ms) | Memory (KB) | CPU time (ms) | Memory (KB) |
| 4000.case1 | 5.708 | 5904 | 1.482 | 5904 | 11.176 | 5904 | 0.756 | 5904 |
| 4000.case2 | 0.111 | 5904 | 0.808 | 5904 | 8.703 | 5904 | 0.646 | 5904 |
| 4000.case3 | 10.471 | 5904 | 0.892 | 5904 | 9.463 | 5904 | 0.645 | 5904 |
| 16000.case1 | 44.699 | 6056 | 3.43 | 6056 | 19.352 | 6056 | 1.599 | 6056 |
| 16000.case2 | 0.144 | 6056 | 1.457 | 6056 | 17.043 | 6056 | 1.987 | 6056 |
| 16000.case3 | 84.389 | 6056 | 1.933 | 6056 | 19.903 | 6056 | 1.804 | 6056 |
| 32000.case1 | 188.242 | 6188 | 5.51 | 6188 | 33.057 | 6188 | 3.292 | 6188 |
| 32000.case2 | 0.114 | 6188 | 2.894 | 6188 | 32.987 | 6188 | 2.991 | 6188 |
| 32000.case3 | 327.947 | 6188 | 2.903 | 6188 | 29.432 | 6188 | 2.5 | 6188 |
| 1000000.case1 | 159848 | 12144 | 151.764 | 14004 | 998.179 | 12144 | 142.415 | 12144 |
| 1000000.case2 | 1.623 | 12144 | 74.301 | 14004 | 914.763 | 12144 | 78.675 | 12144 |
| 1000000.case3 | 320657 | 12144 | 82.397 | 14004 | 946.363 | 12144 | 76.176 | 12144 |

Table1, results

Comparison Chart







| | average | best | worst |
|---|---|---|---|
| IS | 1.8849 | 0.5173 | 1.9017 |
| MS | 0.8516 | 0.8516 | 0.8439 |
| QS | 0.8498 | 0.8732 | 0.8616 |
| HS | 0.9833 | 0.8768 | 0.8775 |

Table2, slopes

Discussion

We can find that for average cases, IS does the worse, all the others are in the same scale. For the best cases, MS, HS do better than QS, and IS does much better than all the other methods. Amount the worst cases, IS does the worst, MS, and HS have same performance, which is slightly better than QS. We can also find that for MS the average case always need more time within each cases. In average, HS has the best performance. We can also compare the slopes in table2 with picture below. The result of experiment is correspond with theory.

| Sorting Algorithms | Space complexity | Time complexity | | |
|---|---|---|---|---|
| | Worst case | Best case | Average case | Worst case |
| Insertion Sort | O(1) | O(n) | $O(n^2)$ | $O(n^2)$ |
| Mergesort | O(n) | O(n log n) | O(n log n) | O(n log n) |
| Quicksort | O(log n) | O(n log n) | O(n log n) | O(n log n) |
| Heapsort | O(1) | O(n log n) | O(n log n) | O(n log n) |

Reference:

https://medium.com/@cmlavin7/lets-sort-this-out-mergesort-algorithm-6019e570cc25