Algorithm 2022 Spring

PA1-Report

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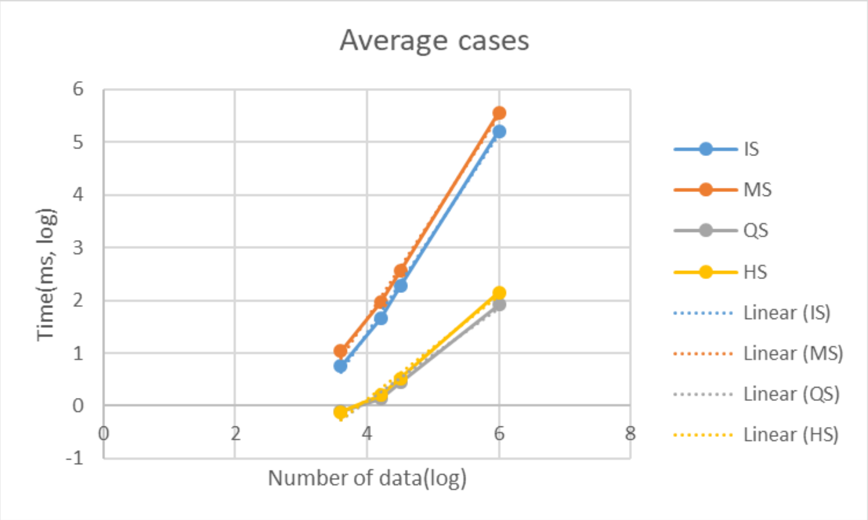
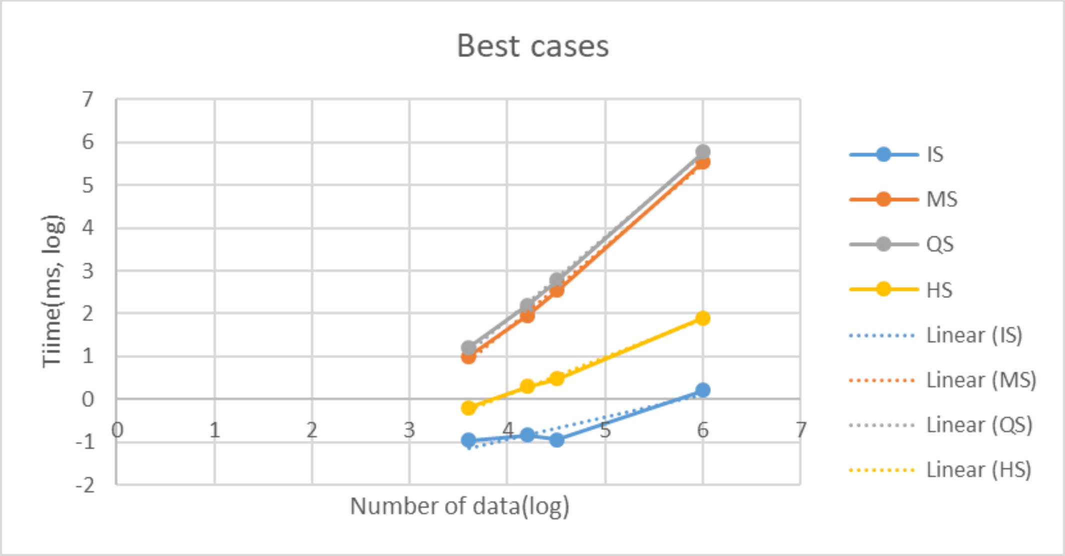
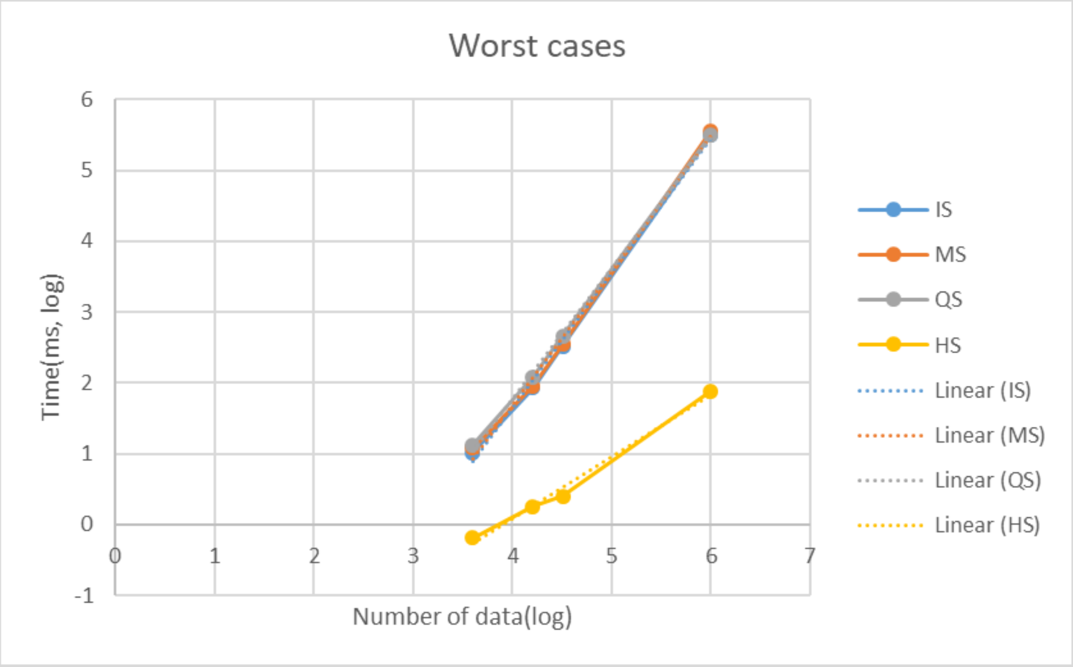
Input size	IS		MS		QS		HS	
	CPU time (ms)	Memory (KB)	CPU time (ms)	Memory (KB)	CPU time (ms)	Memory (KB)	CPU time (ms)	Memory (KB)
4000.case1	5.708	5904	10.882	6040	0.78	5904	0.756	5904
4000.case2	0.111	5904	10.167	6040	16.206	5968	0.646	5904
4000.case3	10.471	5904	11.99	6040	13.245	5904	0.645	5904
16000.case1	44.699	6056	92.227	6050	1.369	6056	1.599	6056
16000.case2	0.144	6056	90.953	6056	156.628	6684	1.987	6056
16000.case3	84.389	6056	90.438	6056	120.287	6304	1.804	6056
32000.case1	188.242	6188	357.362	6188	2.751	6188	3.292	6188
32000.case2	0.114	6188	349.958	6188	610.355	7504	2.991	6188
32000.case3	327.947	6188	348.961	6188	463.85	6740	2.5	6188
1000000.case1	159848	12144	362753	14000	82.608	12144	142.415	12144
1000000.case2	1.623	12144	361656	14000	594457	56844	78.675	12144
1000000.case3	320657	12144	361383	14000	320114	27248	76.176	12144

Table1, results

Comparison Chart





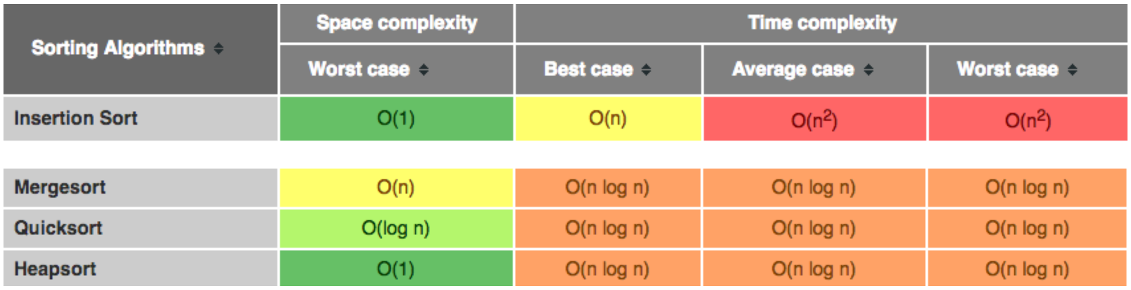


	average	best	worst
IS	1.8849	0.5173	1.9017
MS	1.9154	1.9249	1.9027
QS	0.8811	1.9261	1.8475
HS	0.9833	0.8768	0.8775

Table2, slopes

Discussion

We can find that for average cases, IS does slightly better than MS, but they are in the same scale. QS, HS do much better than the two others. For the best cases, MS does slightly better than QS, and IS does much better than all the other methods. For the worst cases, IS, MS, and QS have same performance, however HS does much better than all the other cases. We can also find that for MS, there aren't difference in performance within each cases. IS does the best in best case. In average, HS has the best performance. We can also compare the slopes in table2 with picture below. We can see that there is a little difference between experiment and 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