[Algorithms] PA1 Report

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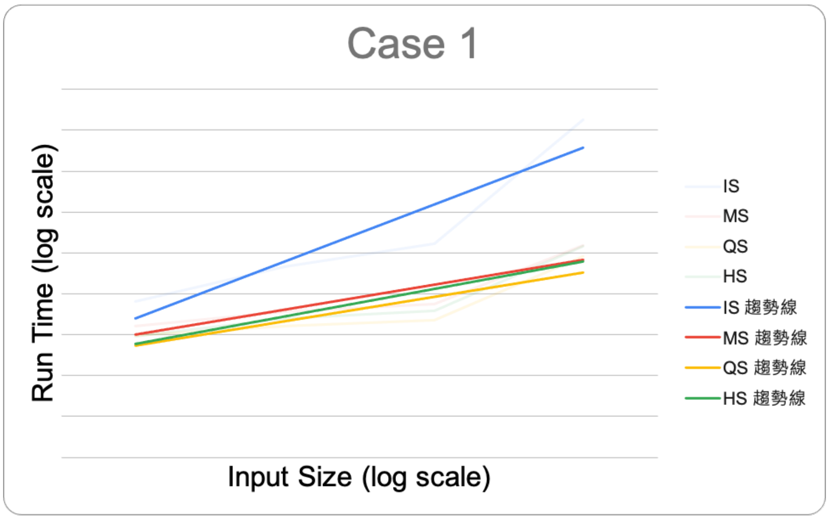
Running Time and Memory Usage Table

(Generated at EDA U6)

	IS		MS		QS		HS	
Input Size	CPU Time (ms)	Memory (kB)	CPU Time (ms)	Memory (kB)	CPU Time (ms)	Memory (kB)	CPU Time (ms)	Memory (kB)
4000.case2.in	0.105	5904	0.839	5904	0.285	5904	0.794	5904
4000.case3.in	12.097	5904	1.054	5904	0.684	5904	0.807	5904
4000.case1.in	6.426	5904	1.625	5904	0.974	5904	0.922	5904
16000.case2.in	0.115	6056	1.612	6056	1.07	6056	1.309	6056
16000.case3.in	85.996	6056	1.726	6056	1.61	6056	1.505	6056
16000.case1.in	45.697	6056	3.598	6056	1.647	6056	2.536	6056
32000.case2.in	0.135	6188	2.017	6188	1.722	6188	3.013	6188
32000.case3.in	331.835	6188	2.116	6188	2.416	6188	2.977	6188
32000.case1.in	165.135	6188	5.49	6188	2.29	6188	3.803	6188
1000000.case2.in	1.231	12144	70.57	14004	49.053	12144	96.749	12144
1000000.case3.in	N/A	N/A	76.749	14004	50.887	12144	76.06	12144
1000000.case1.in	N/A	N/A	149.559	14004	82.33	12144	142.523	12144

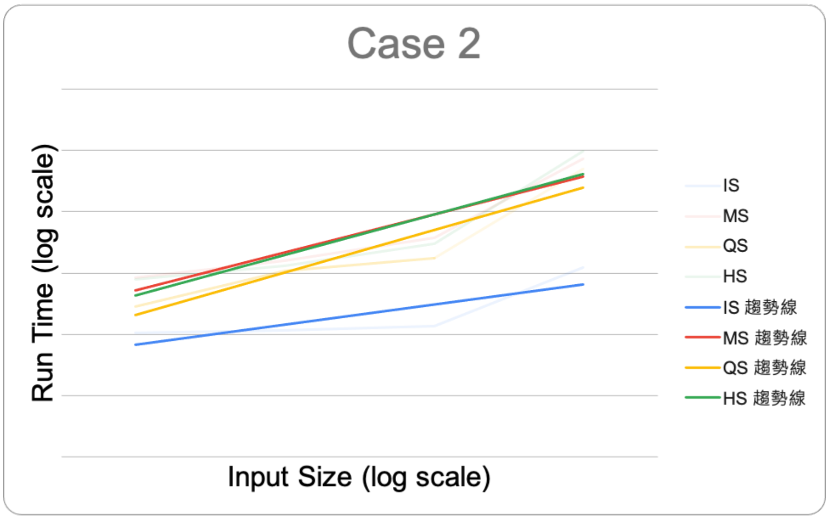
Note: N/A is for cases that run over 3 minutes.

Growth of Run Time



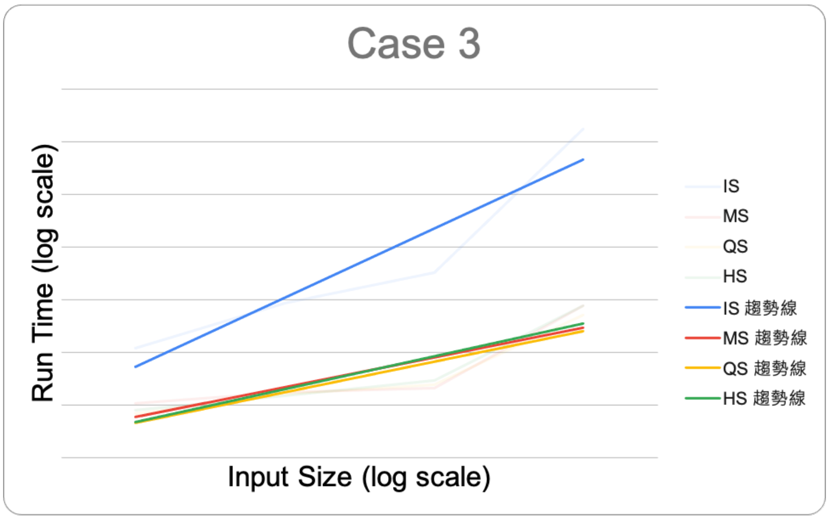
Case 1

Case 1 is the average case. Insertion sort has time complexity $\Theta(n^2)$, while the others are $\Theta(nlogn)$, ending up running faster than insertion sort.



Case 2

The input for case 2 is a sorted array. We can see that insertion sort uses the least amount of time, since it has linear complexity for best case. Since, in quick sort, I chose the pivot randomly, its time complexity is approximately same as MS and HS. All three are $\Theta(nlogn)$.



Case 3

The input for case 3 is a reversely-sorted array, which is a worst case for insertion sort with $\Theta(n^2)$ time complexity. As for other three, the time complexity is $\Theta(nlogn)$. Therefore, insertion sort is running slower than all other sorter.

Note: For the above three cases, I use random quick sort.