Algorithm PA1 Report

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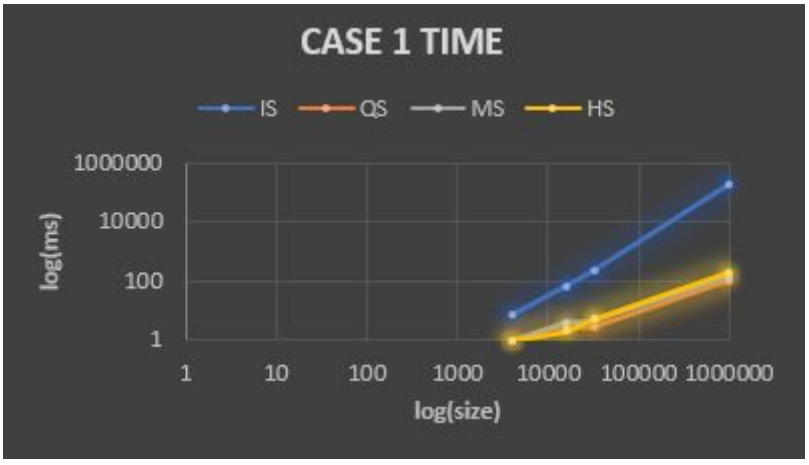
Time Complexity Analysis

演算法	時間複雜度			穩定性
	Best	Average	Worst	
Insertion	O(n)	O(n^2)	O(n^2)	stable
Quick	O(nlogn)	O(nlogn)	O(n^2)	unstable
Merge	O(nlogn)	O(nlogn)	O(nlogn)	stable
Heap	O(nlogn)	O(nlogn)	O(nlogn)	unstable

<Case 1> Random Order (Average Case)

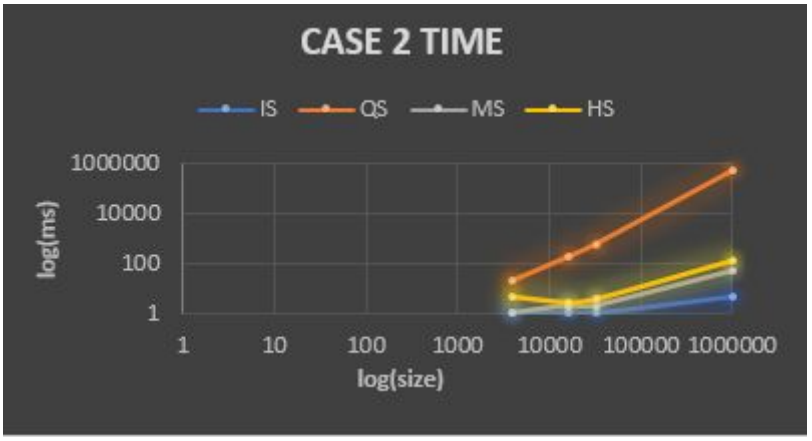
Case_1				
Input Size	IS time(ms)	QS time(ms)	MS time(ms)	HS time(ms)
4000	6.999	1	1	1
16000	68.989	3	4	1.999
32000	230.965	3	4.999	4.999
1000000	201976	99.985	146.978	185.971



1. Average case : Insertion > Heap ~ Merge ~ Quick
2. Insertion sort : O(n^2)
3. Quicksort = Merge sort = Heap sort = O(nlogn)

<Case 2> Sorted (Best Case, non-decreasing)

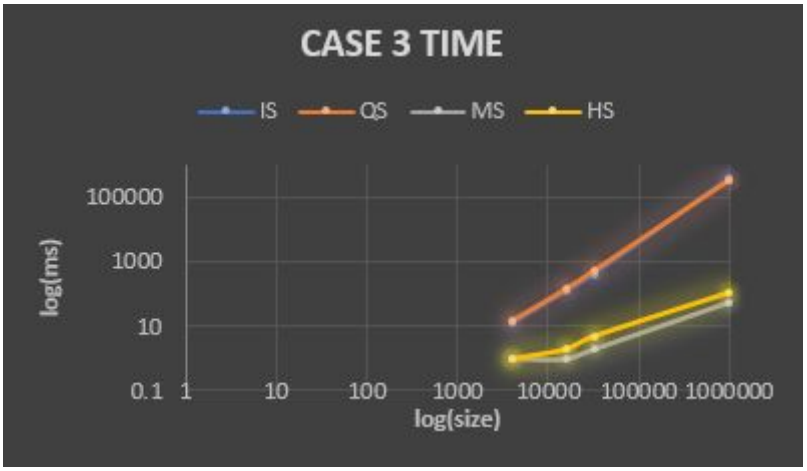
Case_2				
Input Size	IS time(ms)	QS time(ms)	MS time(ms)	HS time(ms)
4000	1	20.996	1	5
16000	1	190.971	1.999	3
32000	1	626.905	2	4
1000000	5	605011	52.991	145.978



1. Best Case : Quick > Heap ~ Merge > Insertion
2. Insertion sort : O(n), the blue line (lowest)
3. Heap sort : O(nlogn)
4. Merge sort : O(nlogn)
5. Quick sort : O(nlogn), at this sorted case, the quick sort is the slowest sort way, because I use the last element (data[-1]) to be my pivot, which is the largest number at this case.

<Case 3> Sorted (Worst Case, non-increasing)

Case_3				
Input Size	IS time(ms)	QS time(ms)	MS time(ms)	HS time(ms)
4000	12.998	15.997	1	0.999
16000	130.98	155.977	1	1.999
32000	432.934	557.915	2	4.999
1000000	404658	350380	57.99	114.983



1. Worst case : Insertion ~ Quick > Heap ~ Merge
2. Insertion sort : O(n^2)
3. Quick sort : O(n^2)
4. Heap sort : O(nlogn)
5. Merge sort : O(nlogn)