PA#1 Report

B06703025 劉致豪

ALL DATA RUNNING ON **edaU6**

Input size	IS		MS		QS(with RP)		HS	
	CPU time (ms)	Memory (KB)	CPU time (ms)	Memory (KB)	CPU time (ms)	Memory (KB)	CPU time (ms)	Memory (KB)
4000.case2	0.134	5904	11.726	6040	2.690	5904	0.838	5904
4000.case3	9.328	5904	11.493	6040	3.697	5904	0.863	5904
4000.case1	6.962	5904	11.990	6040	2.733	5904	0.961	5904
16000.case2	0.198	6056	90.498	6056	7.387	6056	1.599	6056
16000.case3	73.293	6056	97.778	6056	7.664	6056	1.742	6056
16000.case1	39.355	6056	91.806	6056	8.566	6056	1.820	6056
32000.case2	0.116	6188	357.483	6188	13.260	6188	3.355	6188
32000.case3	281.168	6188	361.095	6188	14.397	6188	2.633	6188
32000.case1	140.338	6188	355.798	6188	13.857	6188	3.671	6188
1000000.case2	1.485	12144	372444	14000	423.858	12144	82.69	12144
1000000.case3	301548	12144	366693	14000	443.793	12144	81.797	12144
1000000.case1	304134	12144	381283	14000	480.659	12144	139.192	12144

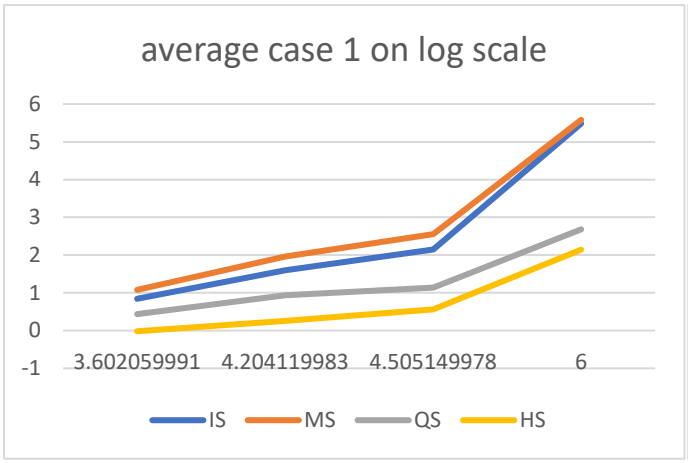
OPTIMIZING QUICKSORT BY CHOOSING **RANDOM PIVOT**

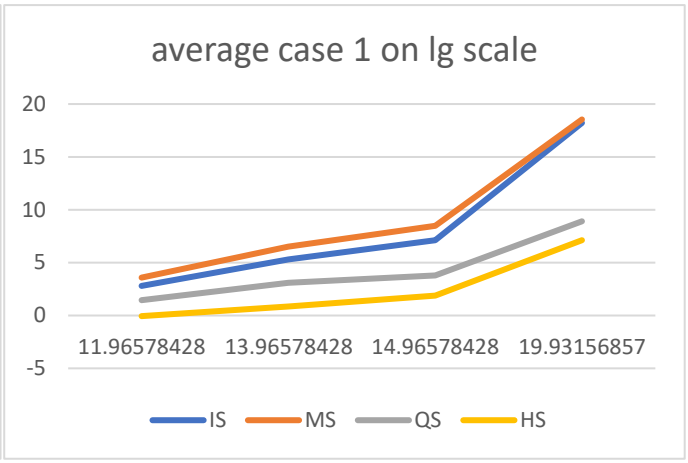
Input size	QS		QS(Random pivot)	
	CPU time (ms)	Memory (KB)	CPU time (ms)	Memory (KB)
4000.case2	15.726	5968	2.690	5904
4000.case3	16.298	5904	3.697	5904
4000.case1	0.786	5904	2.733	5904
16000.case2	164.979	6680	7.387	6056
16000.case3	121.063	6304	7.664	6056
16000.case1	1.706	6056	8.566	6056
32000.case2	617.425	7500	13.260	6188
32000.case3	468.357	6744	14.397	6188
32000.case1	2.219	6188	13.857	6188
1000000.case2	X	X	423.858	12144
1000000.case3	X	X	443.793	12144
1000000.case1	X	X	480.659	12144

QS is better than others in average input case, but becoming the worst when the input size grows.
With random pivot, the average performance improves when the average case gets a little bit worse.

Average case: **HS < QS < IS < MS**

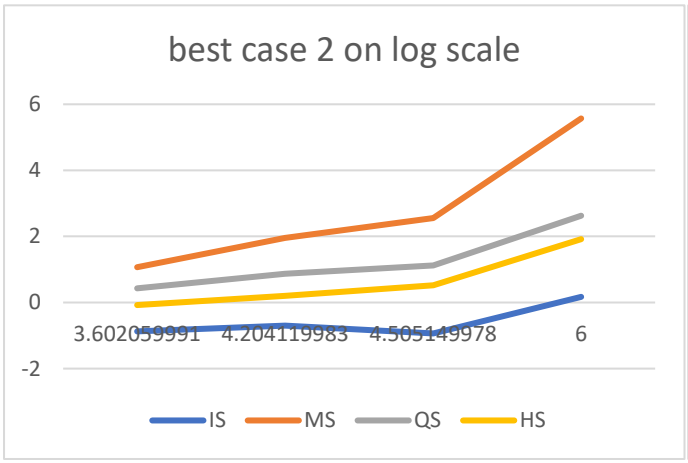
IS = $O(n^2)$, MS = $\Theta(n \log n)$, MS(size>10^6) = $O(n^2)$, QS = $\Theta(n \log n)$, QS(w/RP)= $\Theta(n \log n)$, HS = $\Theta(n \log n)$

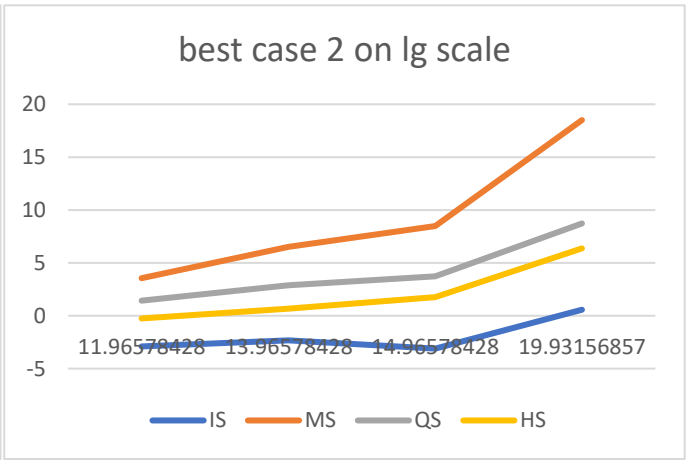




Best case: **IS < HS < QS < MS**

IS = $O(n)$, MS = $\Theta(n \log n)$, MS(size>10^6) = $O(n^2)$, QS = $\Theta(n \log n)$, QS(w/RP)= $\Theta(n \log n)$, HS = $O(n \log n)$





Worst case: **HS < QS < IS < MS**

IS = $O(n^2)$, MS = $\Theta(n \log n)$, MS(size>10^6) = $O(n^2)$, QS = $\Theta(n^2)$, QS(w/RP)= $\Theta(n \log n)$, HS = $O(n \log n)$