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Lab 7 Report
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CSC-150
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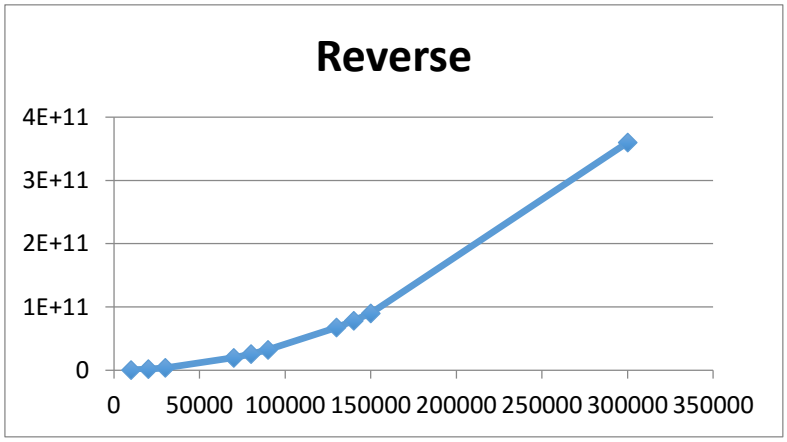
In this lab, we analyzed the runtime of six different sorting methods as they sorted five different arrays of integers. Our five array types were random, mostly sorted, reverse sorted, sorted, and constant (all the same integers). We tested each method with varying array sizes, sizing them so the largest number is close to producing a stack or memory error, or running for longer than five minutes. Here are the worst case runtime scenarios for each of the sorting methods:

Method 1:

Worst case runtime comes from inputting a reverse sorted array. The worst case runtime is $O(n^2)$ because a doubling of input values equals a quadrupling of operations needed to sort the array, and this is maintained for both small values and large values, ruling out the possibility of it being O(n log(n)).

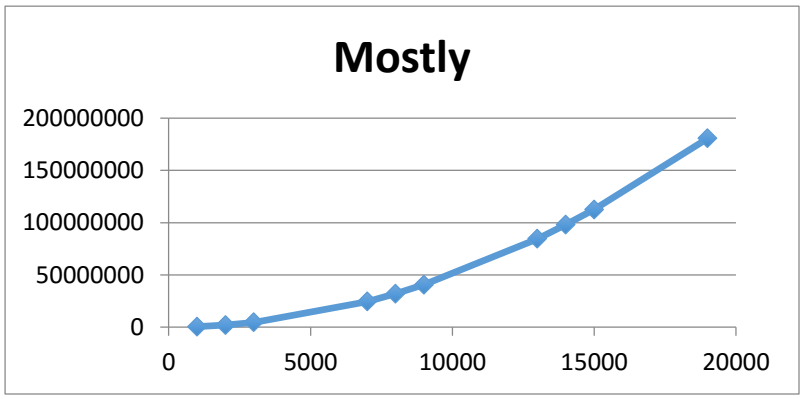
n	opCount
10000	399980000
20000	1599960000
30000	3599940000
70000	19599860000
80000	25599840000
90000	32399820000
130000	67599740000
140000	78399720000
150000	89999700000
300000	3.59999E+11



Method 2:

Worst case runtime comes from inputting a mostly sorted array and a sorted array. The worst case runtime is O(n log(n)) because at smaller values it appears to be $O(n^2)$, but with larger input that ratio approached O(n).

n	opCount
1000	506494
2000	2012994
3000	4519494
7000	24545494
8000	32051994
9000	40558494
13000	84584494

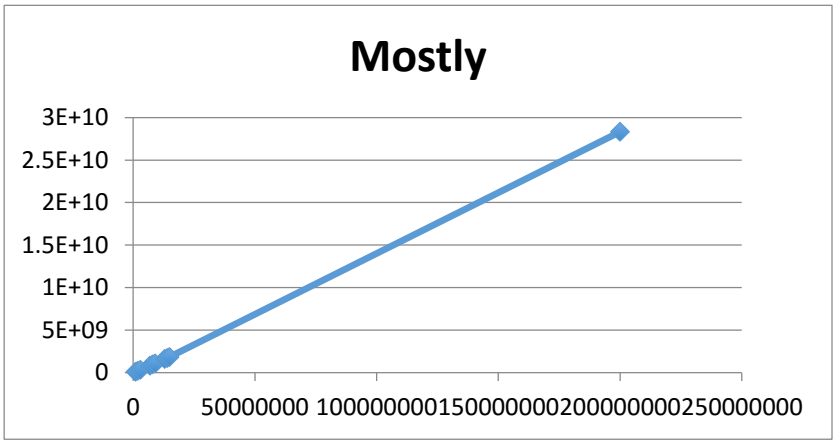


14000	98090994
15000	112597494
19000	180623494

Method 3:

Worst case runtime comes from inputting a mostly sorted or sorted array. The runtime is O(n), as every array sorted returned a linear plot. If the input values were doubled, so were the operations needed to sort the array.

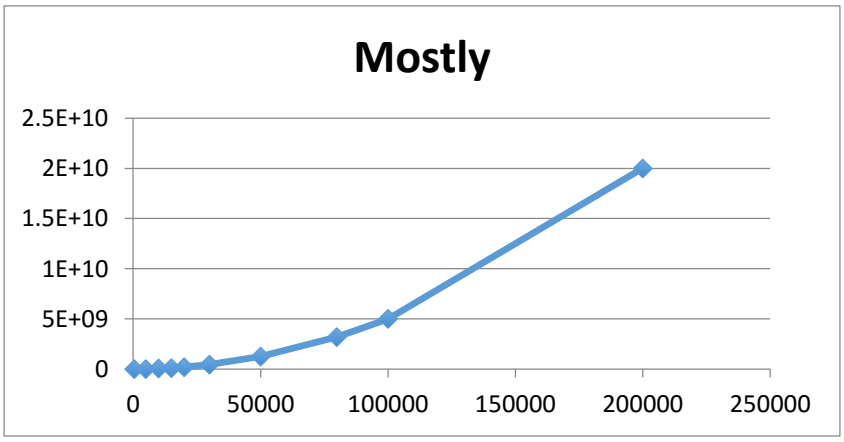
n	opCount
1000000	102938550
2000000	215877110
3000000	334389304
7000000	821842614
8000000	943508470
9000000	1070646712
13000000	1585423670
14000000	1713685238
15000000	1840653366
2E+08	2.8332E+10



Method 4:

Worst case runtime was the same for all array types with a runtime of $O(n^2)$. The runtime is $O(n^2)$ because a doubling of input values equals a quadrupling of operations needed to sort the array. Again this is maintained for both small and large values.

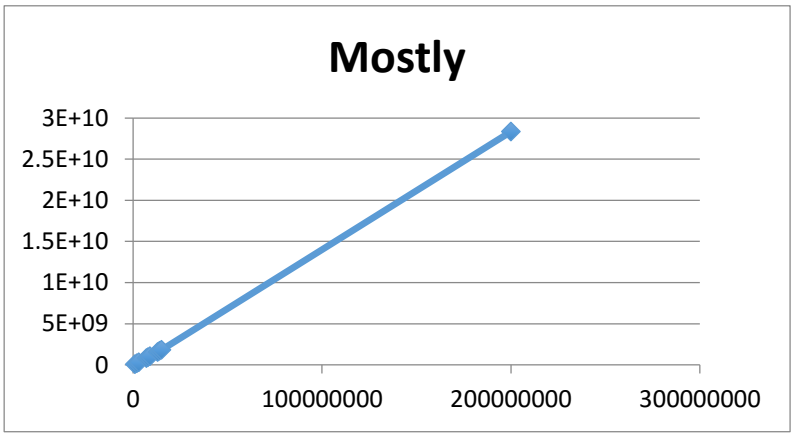
n	opCount
500	127746
5000	12527496
10000	50054996
15000	112582496
20000	200109996
30000	450164996
50000	1250274996
80000	3200439996
100000	5000549996
200000	20001099996



Method 5:

Worst case runtime comes from inputting a mostly sorted or sorted array. The runtime is O(n) as every array sorted returned a linear plot. If the input values were doubled, so were the operations needed to sort the array.

n	opCount
1000000	102938550
2000000	215877110
3000000	334389304
7000000	821842614
8000000	943508470
9000000	1070646712
13000000	1585423670
14000000	1713685238
15000000	1840653366
200000000	2.8332E+10



Method 6:

Worst case runtime comes from inputting a reverse sorted array. The runtime is $O(n^2)$ because a doubling of input values equals a quadrupling of operations needed to sort the array. Again this is maintained for both small and large values.

n	opCount
500	376747
5000	37517497
10000	150034997
15000	337552497
20000	600069997
30000	1350104997
50000	3750174997
80000	9600279997
100000	15000349997
200000	60000699997