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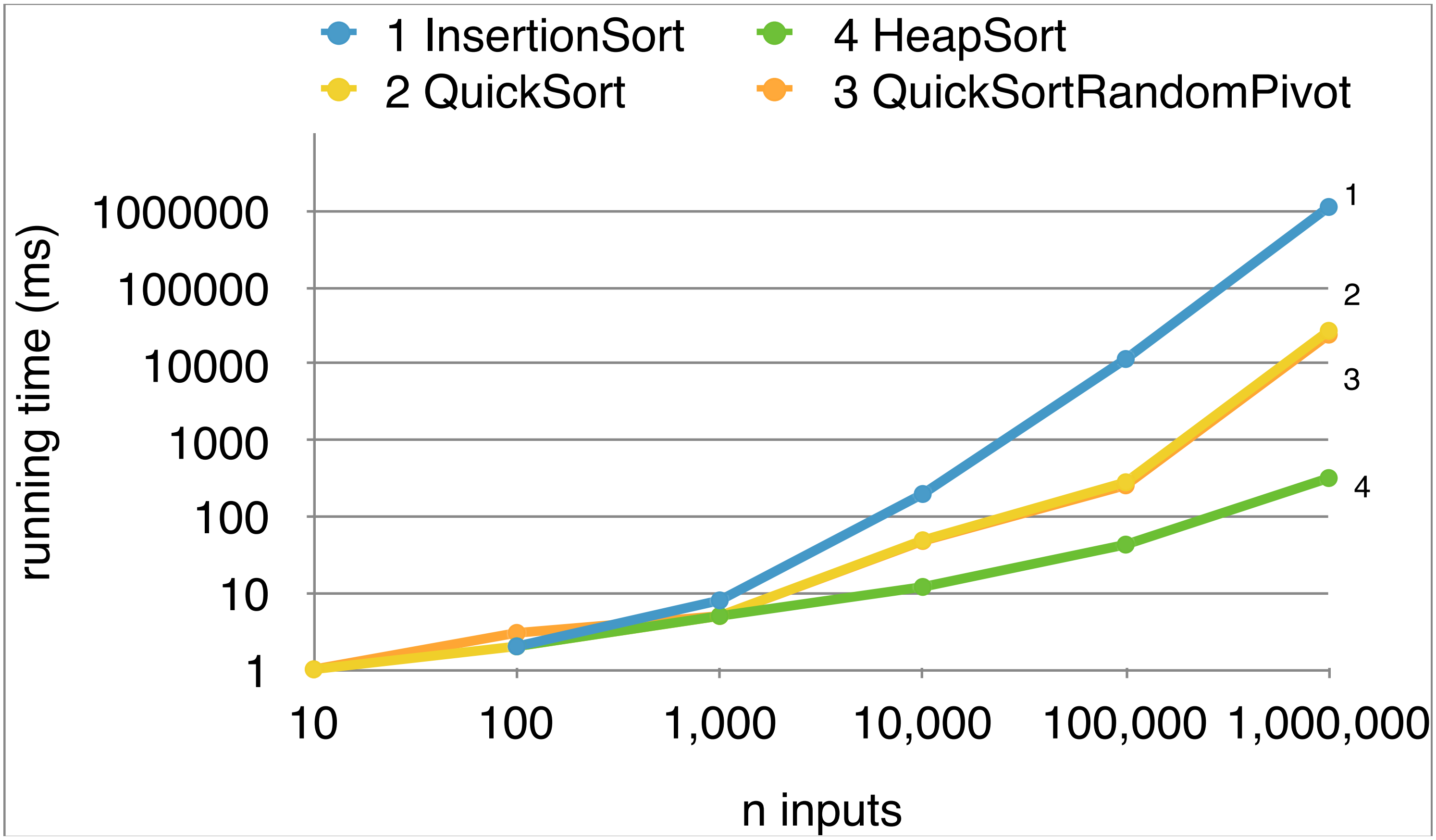
CS146-section 3

Assignment 2 Report

Sorting algorithms: Insertion Sort, Heap sort

Bonus problem: Quick Sort (fixed pivot and random pivot).

	InsertionSort $\Theta(n^2)$	HeapSort Θ(n lgn)	QuickSort Fixed Pivot O(nlgn)	QuickSort RandomPivot O(nlgn)
n = 10	< 1 milliseconds	< 1 milliseconds	1 milliseconds	1 milliseconds
n = 100	2 milliseconds	2 milliseconds	2 milliseconds	3 milliseconds
n = 1,000	8 milliseconds	5 milliseconds	5 milliseconds	5 milliseconds
n = 10,000	198 milliseconds	12 milliseconds	49 milliseconds	48 milliseconds
n = 100,000	11,606 milliseconds	43 milliseconds	282 milliseconds	257 milliseconds
n = 1,000,000	1,137,415 milliseconds ~ 19 minutes	320 milliseconds	27,138 milliseconds	24,190 milliseconds



Comparing

1. All 4 sorting algorithms have almost the same running time with small inputs (n <= 100).
2. InsertionSort Θ(n^2)
    1. Effective for small inputs and almost sorted array
    2. the running time escalates quickly. So, in general, insertion sort is not effective.

3. HeapSort Θ(n lgn)

    1. The running time slowly increase

    2. Heapsort is the most effective algorithm among 4 chosen sorting algorithm since even in the worst case, the running time still Θ(n lgn)

4. QuickSort

    1. quick sort running time is O(n lgn) for average case and O(n^2) on the worst case. Therefore, quick sort take more time than heap sort

    2. In the worst case, every element is smaller than or greater than the pivot. So, by choosing random pivot results in slightly better running times than choosing a fixed pivot position.

Conclusion

1. Sorting almost sorted array or array with small size
    - Effective Algorithm: InsertionSort
2. Sorting large array
    - Effective Algorithm: HeapSort, QuickSort
    - Ineffective Algorithm: InsertionSort, QuickSort may be an ineffective algorithm in the case of almost sorted or sorted array