Assignment 2
Algorithm sand DataStructures

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1 Comparison

What are the differences between the three algorithms? For each algorithm, mention a situation where it has an advantage over the other two.

1.1 Insertion

The insertion sort is the only one who is linear with the average case $O(n^2)$ and also the fastest if all the element are the same or the list is already sorted O(n). Insertion sort is also a non recursive algorithm which means it doesnt call itself in the function, while both quicksort and heapsort do.

1.2 Quicksort

Quick sort uses the divide and conquer method unlike insertion- and heapsort. It has the average time complexity of $O(nlogn)$, same as Heapsort. However has the worst case complexity of $O(n^2)$. Both quicksort and heapsort have the same time complexity however quicksort is often faster when the list is bigger and the elements are different (explained in next section). Quicksort is also faster then insertion sort if n is big and the elements are different.

1.3 Heapsort

Heap sort is a comparison-based algorithm and have the average complexity of $O(nlogn)$. Heapsort, like insertion sort, divides the array into a sorted and an unsorted region and solves and then iteratively shrinks the unsorted region one step at a time. This makes this algorithm slightly slower than quicksort, even though they have the same average complexity. Heapsort have fixed time complexity, which means this takes the same time weather the list is sorted from the beginning or not.