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Reflective essay:

Insertion Sort (green and teal):

**We only accounted for compares not swaps, however you need to look at both for InSrt.**

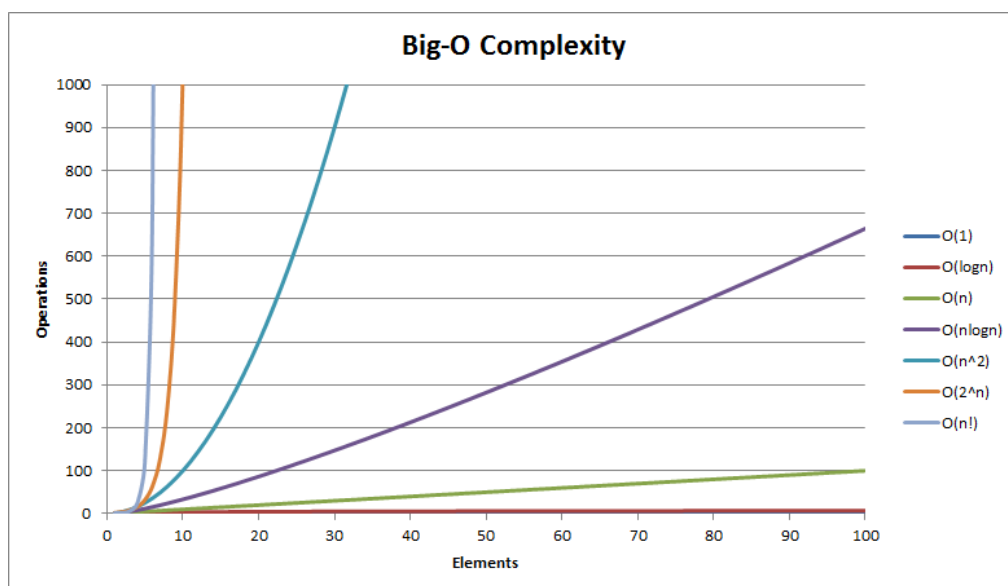
The best case input is an array that is already sorted. In this case insertion sort has a linear running time ( $O(n)$ ). During each iteration, the first remaining element of the input is only compared with the right-most element of the sorted subsection of the array.

The simplest worst case input is an array sorted in reverse order. The set of all worst case inputs consists of all arrays where each element is the smallest or second-smallest of the elements before it. In these cases every iteration of the inner loop will scan and shift the entire sorted subsection of the array before inserting the next element. This gives insertion sort a quadratic running time ( $O(n^2)$ ). The average case is also quadratic, which makes insertion sort impractical for sorting large arrays. However, insertion sort is one of the fastest algorithms for sorting very small arrays

Bubble Sort (green and teal):

Bubble sort has worst-case and average complexity both  $O(n^2)$ , where  $n$  is the number of items being sorted. There exist many sorting algorithms with substantially better worst-case or average complexity of  $O(n \log n)$ . Even other  $O(n^2)$  sorting algorithms, such as insertion sort, tend to have better performance than bubble sort. Therefore, bubble sort is not a practical sorting algorithm when  $n$  is large.

The only significant advantage that bubble sort has over most other implementations, even quicksort, but not insertion sort, is that the ability to detect that the list is sorted efficiently is built into the algorithm. When the list is already sorted (best-case), the complexity of bubble sort is only  $O(n)$ . By contrast, most other algorithms, even those with better average-case complexity, perform their entire sorting process on the set and thus are more complex.



I did not have any difficulties in this assignment. I was confused on if we were supposed to include a swaps counter for insertion sort.