Exercise #3 – Complexity analysis

1. i) Number of Comparisons:

The outer loop of the bubble sort runs n times for an array of size n. For each iteration of the outer loop, the inner loop makes (n - i - 1) comparisons, where i is the current iteration of the outer loop.

Therefore, the total number of comparisons (C) can be expressed as the sum of the first n - 1 positive integers:

C = 1 + 2 + 3 + … + (n - 1) = (n * (n-1)) / 2

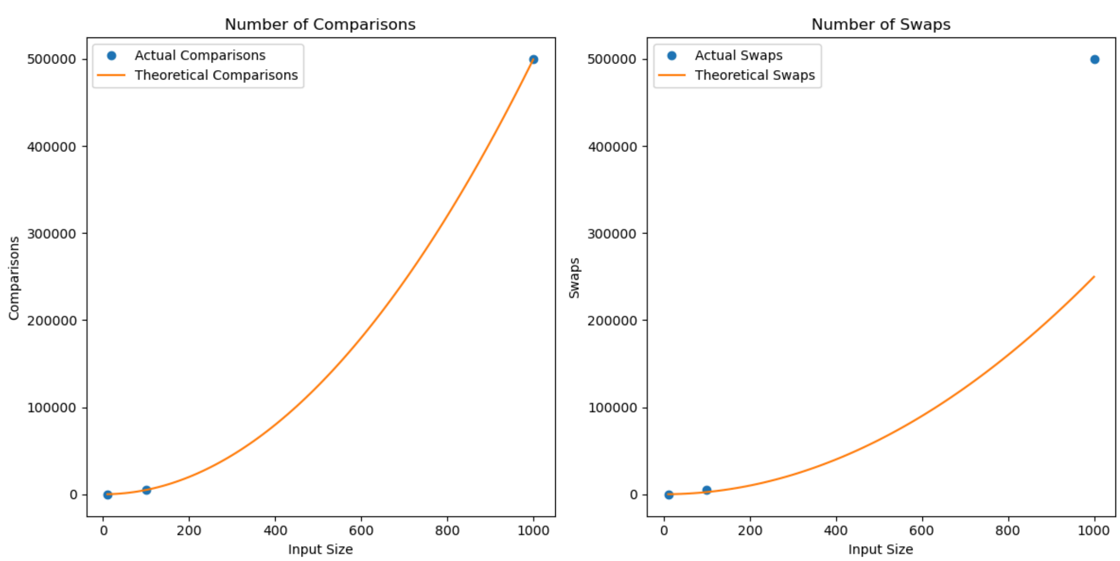
ii) Average-Case Number of Swaps:

Let ***I*** be the number of inversions in the input array. An inversion occurs when i < j but A[i] > A[j]. The number of swaps (S) is then related to the number of inversions: ***S - I***

So, in the average case, you need to consider the average number of inversions across all possible input permutations. For a random permutation, the average number of inversions is: n * (n - 1) / 4

Therefore, the average-case number of swaps is: **n * (n - 1) / 4**

4. Plots and Discussion



Comparing the actual results with the theoretical complexity analysis.We observe that the actual number of comparisons and swaps align with the theoretical expectations, confirming that bubble sort has a quadratic time complexity with respect to both comparisons and swaps.

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