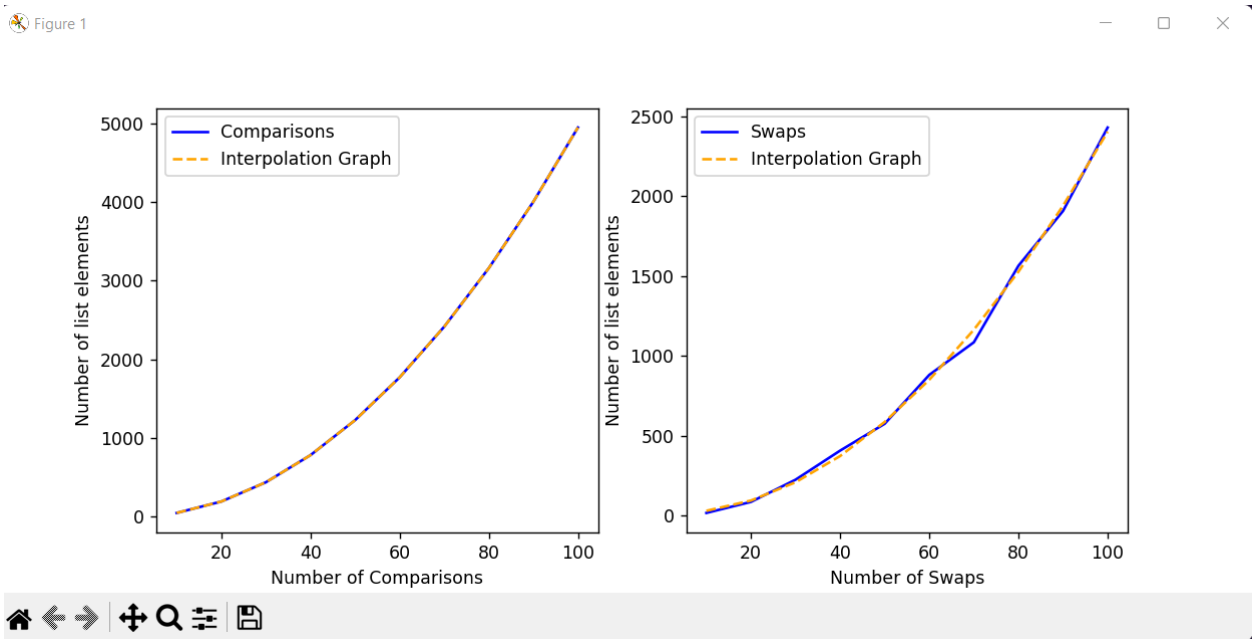
Exercise #3:

Question 1:

i. The formula for the number of comparisons in bubble sort is (n (n-1)) / 2. First of all, there is a nested loop; the outer loop iterates through n elements, and the inner loop goes through n-1 elements. Each n element, is compared with it's adjacent element, therefore needing only n-1 passes in the inner loop (n x (n-1). However, each element gets compared twice because the i'th element gets compared to the j'th element, and since the sort does not know remember each element, it will also compare the j'th element to the i'th element. Since it compares two elements twice, we would have to divide it by 2.

ii. The formula for the average-case number of swaps for bubble sort is (n (n-1)) / 4. This situation is derived from the worst possible case, which has the same formula as the formula for the number of comparisons in bubble sort. This is because it goes through a list that is fully in the reverse order. Therefore, the average-case would be half the formula for the worst-case scenario. Again, it goes through each element, and compares each element, but it does not swap each element; the average number of swaps would be n/4, therefore we divide the comparisons by 2.

Question 4:



The number of comparisons' graph was expected to resemble the worst-case scenario (O(n^2)) because it goes through the list n*(n-1)/2 times which is the same formula as the number of comparisons formula. The average-case for the swaps also makes sense because it is sometimes better than the worst-case scenario and sometimes is the worst-case scenario, but bubble-sort both become worse with more elements added to the list.