Term Project – Complexity Analysis

I have chosen to include insertion sort in my experiments because it was the other common sort method that I was introduced to while learning programming, outside of the other two methods that we were asked to compare; selection and bubble sort. To begin, the complexity equation of bubble sort, selection sort, and insertions sort are all O(n^2). Although they all share a common worse case equation for calculating their time complexity, you can see in the tests that their results for the time elapsed for the method to run differ from each other, and when using the nanosecond to compare them, they difference is notable. The graph shows that selection sort is only a little faster when using small array sizes, although it is far superior to the others when there are many more array values to be sorted. Bubble sort has proven to be the least time efficient of the three methods, in small arrays it was able to be comparable to the other methods, however it took nearly five times longer than the next slowest, insertion sort, when using an array with fifty thousand numbers in it (varying from 1-5000). Insertion sort was consistently in between both of the other methods. Although, it was on the faster side, comparing more to selection sort than bubble.

Part of the reason that bubble sort is so much slower than the other two sort methods is because bubble sort cannot return until the outer loop has finished, making it considerably slower whenever dealing with data sets with more data points. Whereas, selection sort uses if statements in both the outer and inner for loop, so that the data can be combed through more thoroughly so that the “swaps” are more effective and less iterations of the for loop are having to be run. While, insertion sort uses a while statement to cut down on it’s for loop iterations. The while loop usage in insertion sort proves to be better than the effectiveness of the nested for loop of the bubble sort, however both of these methods are put to shame by the efficiency of the if statement’s effectiveness in the selection sort.

Computer Components -

* + CPU: Intel i7-7700HQ @ 2.80Hz, 4 cores, 8 Logical Processors
  + GPU: GeForce GTX 1070
  + RAM: 16 GB ddr3 3400 mhz