

## Programming Assignment 1

Results:

**SHELL SORT WITH INSERTION SORT**

Test Case	Comparisons	Moves	Total Time
15	6	214	Approximately 0
1000	520	71548	Approximately 0
10000	5191	1226027	Approximately 0
100000	52326	18757928	0.02
1000000	545383	266532805	0.038

**SHELL SORT WITH SELECTION SORT**

Test Case	Comparisons	Moves	Total Time
15	35	312	Approximately 0
1000	33628	106542	0.01
10000	696325	1831254	2.53
100000	12386880	28058403	366.710022
1000000	N/A	N/A	N/A

From the tables, you can see that the comparisons, moves, and total time increases as the number needing to be sorted gets larger. Based off of the five test cases, if  $n$  represents the number of elements in the sequence, the space complexity is  $O(n)$  and the time complexity is  $O(n)$  ( $O(1)$  for each element). I think that something that could speed up the sorting process would be not having to find the size of the sequence at the beginning of the sorting process. I'm sure there is a better way to optimize it in that regard. Also, I think that it could be optimized by having less for loops, and having more complex algorithms, that accomplish more in a smaller amount of space and time. All in all, I think that space was fairly optimized with the algorithm used.