

Programming Assignment 1

Results:

Shell Sort with Insertion Sort

Test Case	Comparisons	Moves	Total Time (I/O+Sorting)
1,000	4.903000e+03	5.792700e+04	~0
10,000	7.371800e+04	9.452980e+05	1.000000e-02 + ~0
100,000	1.000706e+06	1.393920e+07	4.000000e-02 + 1.400000e-01
1,000,000	1.328190e+07	1.929070e+08	4.600000e-01 + 2.120000e+00

Shell Sort with Selection Sort

Test Case	Comparisons	Moves	Total Time (I/O+Sorting)
1,000	3.088500e+04	7.953600e+04	~0 + 9.000000e-02
10,000	6.120440e+05	1.307370e+06	~0 + 1.584000e+01
100,000	N/A	N/A	N/A
1,000,000	N/A	N/A	N/A

Based off my four test cases and the pattern of increase with the sorting time, I conclude that my insertion sort has a time complexity of $O(n^2)$ while selection sort also has a time complexity of $O(n^2)$. Despite the same representation for complexity, it is worth noting that selection sort is less efficient, which is particularly noticeable with the larger test cases. This inefficiency is due to the lack of optimization and the larger amount of comparisons and moves that have to be done compared to insertion sort. In the end, I was not even able to obtain results for my selection sort for the largest test case.

For space complexity, the linear nature of the pattern between test cases indicated to me that insertion sort has a space complexity of $O(n)$ while selection sort has a space complexity of $O(1)$.

As for my generate sequence algorithm, my time complexity is $O(n)$ while my space complexity $O(n)$.