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Report

Analysis on generating the sequences：

The sequence 1 would have O(1) complexity. The total number of sequences were generated by equation (log(Size + 1) / log(2)). Then using this constant number in one for loop to generate the sequence. There is only one for loop involved and the control value is a constant number.

The sequence 2 would have O(n^2) complexity. The total numbers of q and p were generated by equation (log(Size) / log(3)). Then using a nested for loop with p and q to generate the sequence.

Table of run-time, number pf comparisons and number of moves:

Numbers of elements	10000				100000				1000000			
	Bubble sort		Insertion sort		Bubble sort		Insertion sort		Bubble sort		Insertion sort	
Sequence	1	2	1	2	1	2	1	2	1	2	1	2
Number of comparisons	8.02e+07	1.49e+08	1.42e+05	7.02e+04	8.03e+09	1.49e+10	2.61e+06	9.72e+05	8.03e+11	1.49e+12	4.83e+07	1.27e+07
Number of moves	5.47e+07	4.56e+07	3.69e+05	9.13e+05	5.49e+9	4.57e+09	5.55e+06	1.36e+07	5.51e+11	4.58e+11	8.42e+07	1.89e+08
I/O time[second]	8.81e-03	8.77e-03	1.46e-02	1.89e-02	7.23e-02	7.52e-02	7.96e-02	6.00e-02	4.29e-01	4.79e-01	3.84e-01	4.00e-01
Sorting time[second]	2.85e-01	4.51e-01	5.84e-03	6.41e-03	2.60e+01	4.80+01	3.01e-02	3.59e-02	2.67e+03	4.94e+03	2.71e-01	3.30e-01

As we can see in the table apply shell sort using the bubble sort would take longer than apply shell sort using insertion sort. For sorting the same number of elements insertion sort will always take short time and use less number of comparisons and moves. The number of comparisons and moves of bubble are way more than insertion because there are two comparisons and one move within the inner loop of the bubble sort and the insertion sort only have comparison in the insertion sort. So the increase of running time of insertion sort is more linear and the increase of running time of bubble sort is more exponential.

The space complexity of my sorting routines would more space to calculate the sequences in the sorting function, because I'm not saving the sequences in an array after calculating it in the Print_Seq_1. I recalculated it in the loop, it will take more space to calculate the sequences.