Merilyn Kuo
CSE 13S
Spring 2021

Assignment 3: Sorting
Writeup

Disclaimer: My Quicksort with Stack somehow broke the day of the due date and don't have much information on it. However, before it broke that the Quicksort with Stack has the same statistics as the Quicksort with queue. My shell sort also does not collect statistics properly so I do not have much information on it as well.

Time Complexities:

The time complexities for each of the sorting algorithms is as follows:

Bubble Sort: O(n^2)
The bubble sort is made up of two loops, one while loop with a for loop nested inside. Each loop contributes O(n) and since one loop is nested in the other, we have O(n^s)

Shell Sort: O(n^3)
The shell sort is made up of 3 loops, an outer for loop with another for loop inside and a while loop inside the inner for loop. Applying the same concept from above where each loop contributes O(n), we have O(n^3) for Shell Sort.

Quick Sort (Stack and Queue):
The quick sort is where the time complexity gets more variant. The partition function itself has a time complexity of O(n^2) at it's worst case but depending on the quick sort algorithms and what is passed through the partition function, the time complexity could get better (O(n log n)).

What I Learned From the Sorting Algorithms:

Out of the four sorting algorithms implemented, the quicksort is the quickest one, hence its name. Since the gap sequence we had was a good one, the quicksort algorithm won't have the worst case time complexity. Shell sort is the second best out of the four. The number of compares it does is somewhat close to the Quicksort (with respect to the number of elements) but the Shell Sort algorithm does a lot more moves to get the sorting done. The bubble sort is the slowest out of all of them and does a lot more moves and compares.

Max Stack/Queue Sizes:

The max size of the stack and queue increases with the number of elements being sorted. We can see this if we run the sorting with the same random seed each time. The table of values below was statistics from the Queue Quicksort but we can assume the stats for the Stack Quicksort will be the same.

elements	3	10	20	40	80	160	320	640	1280	2560	5120
max size of queue	2	8	10	24	30	50	86	182	340	588	1110