CS201 Homework 2 Report

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CS201 - 01

2.) Tables and plots for functions

Algorithm 1: I appended items of arr1 in the same order to arr3 then for items of arr2, I found the right place to insert in arr3 from the beginning and shifting the items in arr3 when needed.

Algorithm 2: Compare pairs of numbers across arr1 and arr2 and insert the smallest to arr3. In this algorithm you are allowed to visit every item only once.

Table 1
Case 1

N	Algorithm 1	Algorithm 2
10	0	0,0001
100	0,1	0,0006
1000	4,7	0,0049
10000	364,7	0,0444
100000	364334,5	0,3972

Table 2
Case 2

N	Algorithm 1	Algorithm 2
10	0	0,0002
100	0,1	0,0008
1000	4	0,0059
10000	376,9	0,0496
100000	36712,3	0,3936

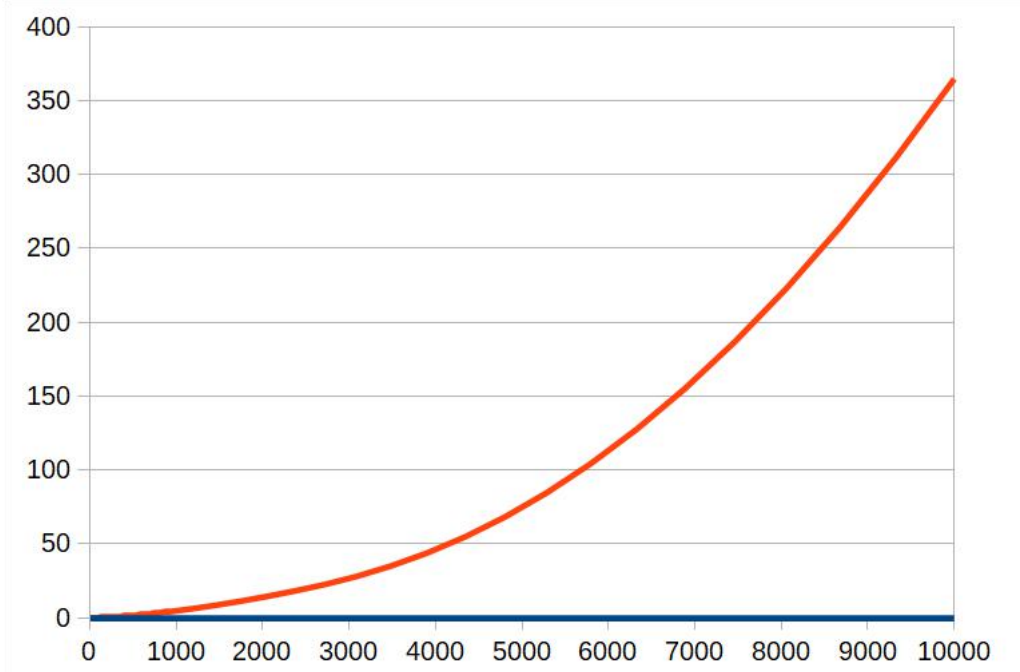
Table 3
Case 3

N	Algorithm 1	Algorithm 2
10	0	0,0001
100	0,1	0,0006
1000	3,9	0,006
10000	381	0,1235
100000	36804,8	0,9471

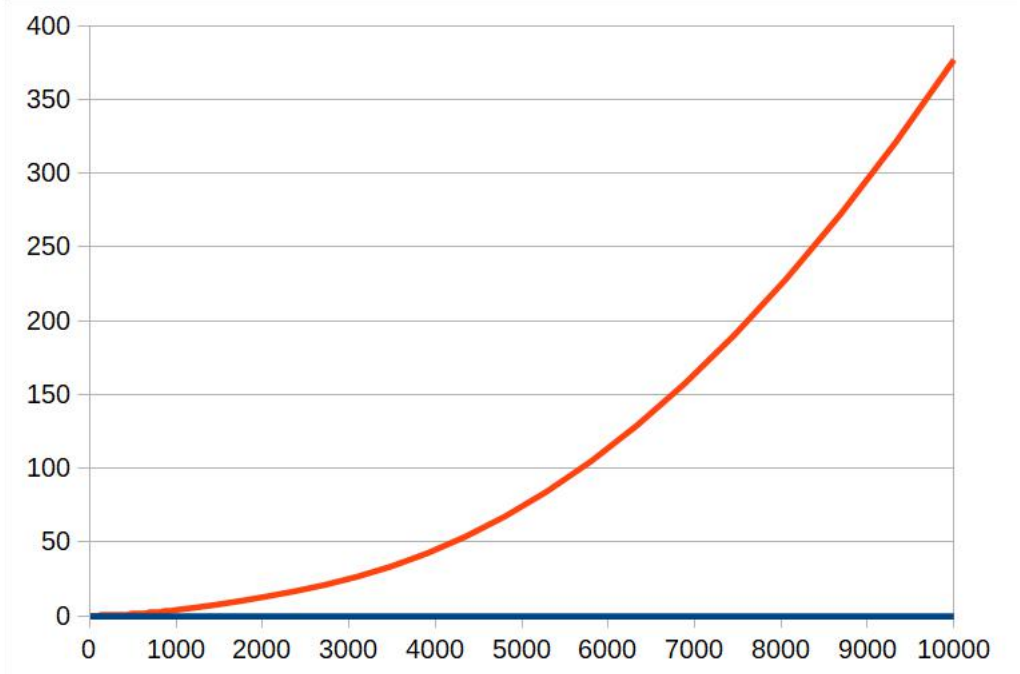
Case 1 is the case that all numbers in arr1 are smaller than arr2.
Case 2 is the case that all numbers in arr2 are smaller than arr3.
Case 3 is the case that there is no such ordering between arrays items.

I simulated the functions with each three cases, took the results and put them in table 1, table 2, and table 3.

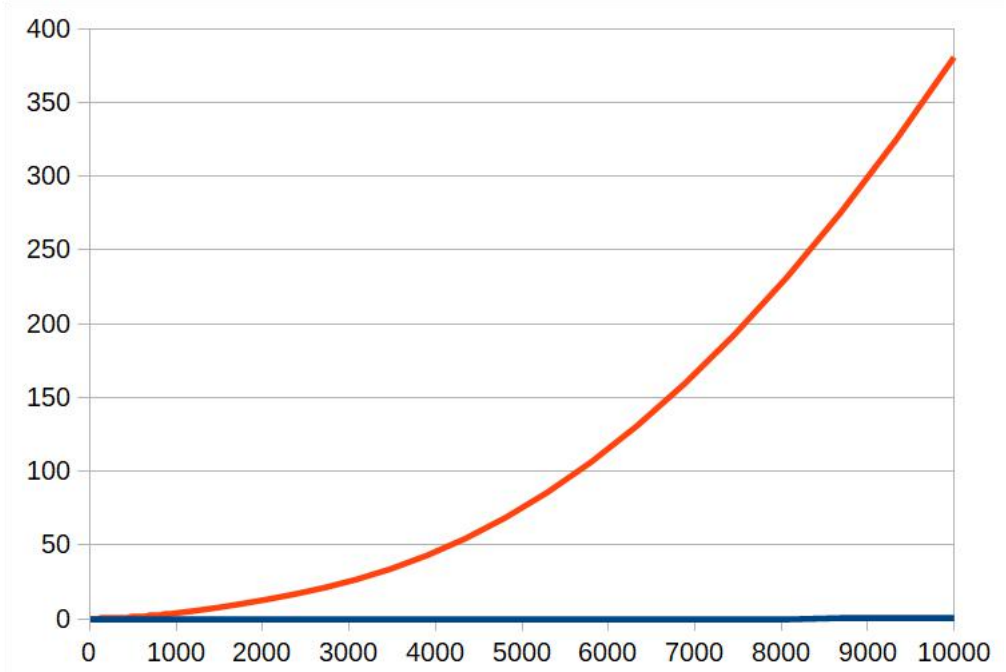
Table 1 is for algorithms I run with case 1, table 2 is for algorithms I run with case 2 and table 3 is for algorithms I run with case 3.



Plot 1: case (1) for algorithm 1 in orange line and algorithm 2 in blue line.
(Case 1 is the case that all numbers in arr1 are smaller than arr2)



Plot 2: case (2) for algorithm 1 in orange line and algorithm 2 in blue line.
(Case 2 is the case that all numbers in arr2 are smaller than arr3)



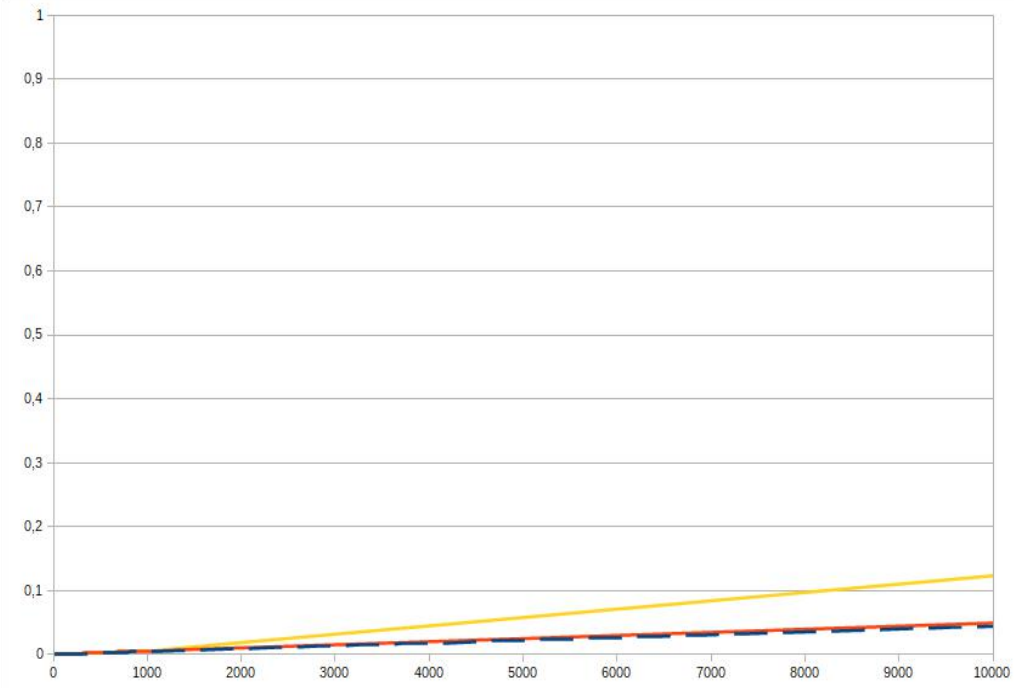
Plot 3: case (3) for algorithm 1 in orange line and algorithm 2 in blue line. (Case 3 is the case that there is no such ordering between arrays items)

3. Best case, average case and worst cases for algorithm

For Algorithm 1

Best case => Case 1 (in Plot 1)
Average case => Case 2 (in Plot 2)
Worst case => Case 3 (in Plot 3)

To compare plots for algorithm 2, I re-scaled them to see the difference.



Plot 4: For algorithm 2. Yellow line is for case 1, orange line is for case 2 and blue line if for case 3.

For Algorithm 2
    Best case => Case 1 (in Plot 1)
    Average case => Case 2 (in Plot 2)
    Worst case => Case 3 (in Plot 3)

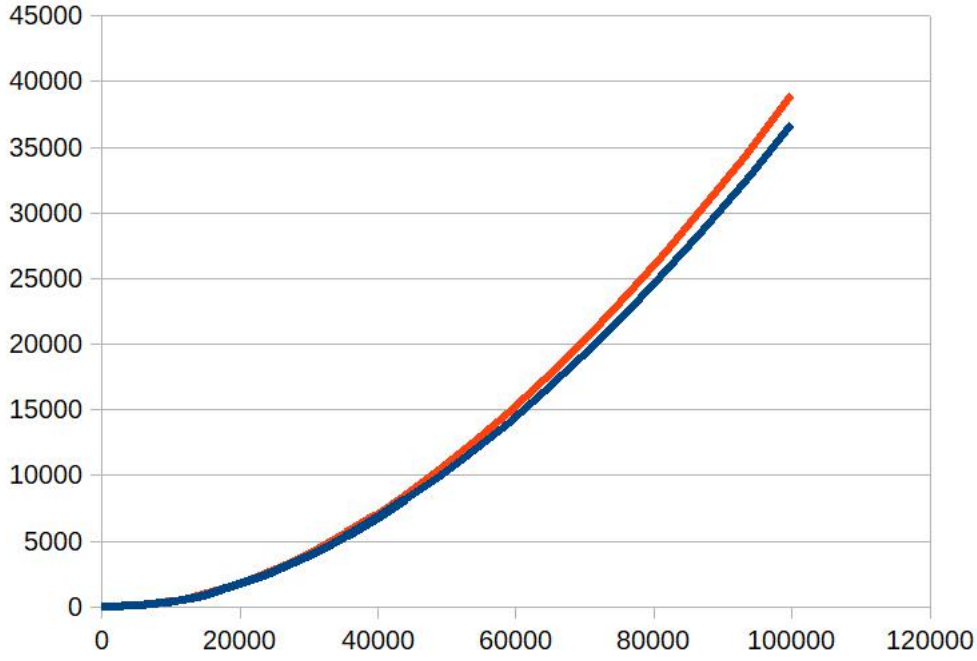
Worst case time complexity
    For Algorithm 1 => O(n^2)
    For Algorithm 2 => O(n)

4.) Computer Specifications

CPU: Intel(R) Core(TM) i7-8550U CPU @ 1.80GH 1.99 Hz
RAM: 8.00 GB

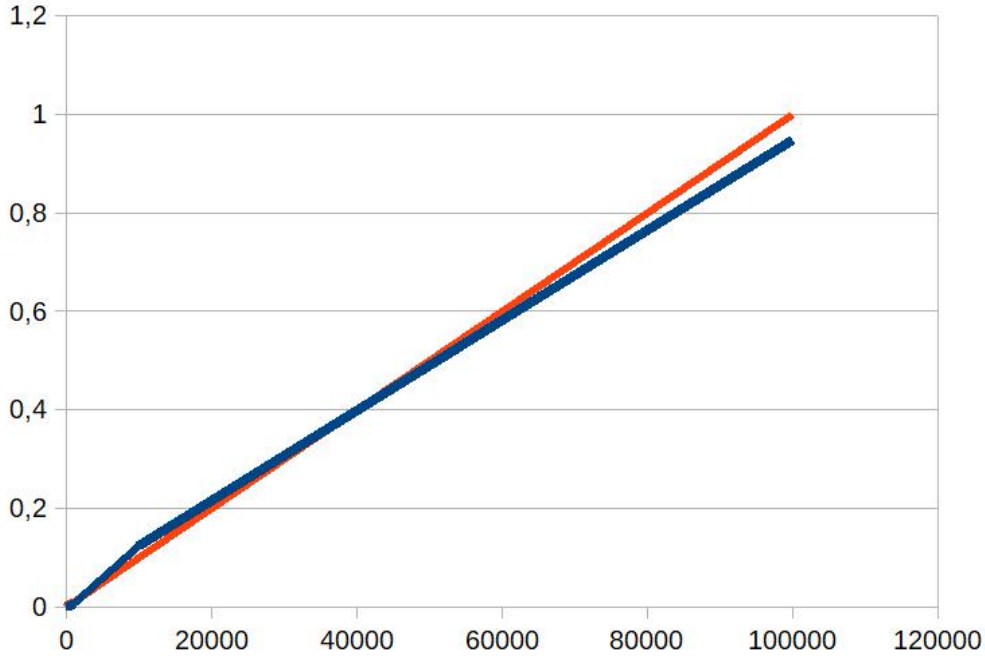
5. , 6.) Expected worst case growth rates from theoretical analysis and comparison of them

I plotted the expected worst case growth rate (O(n^2) and the growth rate I found from simulation for algorithm 1.



Plot 5: For algorithm 1. Orange line is the expected worst case growth rate (O(n^2)) and blue line is the growth rate I found from simulation.

I plotted the expected worst case growth rate (O(n)) and the growth rate I found from simulation for algorithm 2.



Plot 6: For algorithm 2. Orange line is the expected worst case growth rate (O(n)) and blue line is the growth rate I found from simulation.

Discussion:

To compare expected growth rates I obtained from step 5 and the growth rates which I obtained from simulation, I see that expected growth rates and the values which I have found from the simulation are similar with each other. For algorithm 1, I expected O(n^2) growth rate from theory, and I saw that it is similar to the growth rate of the simulation and for algorithm 2, I expected O(n) growth rate from theory and it is similar to the growth rate of the simulation so I may say that theoretical and experimental results are matching.