CS 325

Guangyu Zhang

3.

a). collect running time

I generate the random arrays by using random function in Python

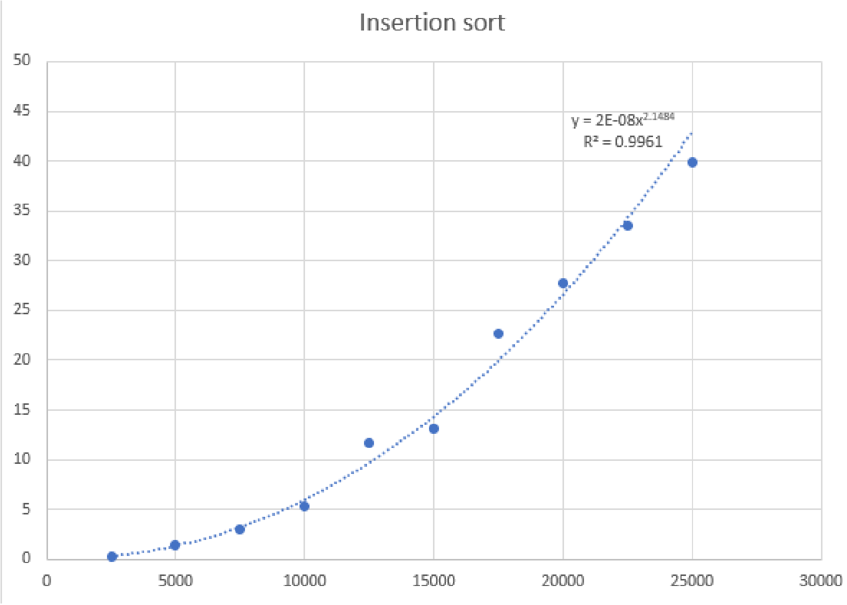
Number(n)	Insertion sort
2500	0.31410765647888184 sec
5000	1.3504152297973633 sec
7500	2.9880361557006836 sec
10000	5.380636692047119 sec
12500	11.743558645248413 sec
15000	13.124891996383667 sec
17500	22.597503900527954 sec
20000	27.65602707862854 sec
22500	33.48346185684204 sec
25000	39.86635708808899 sec

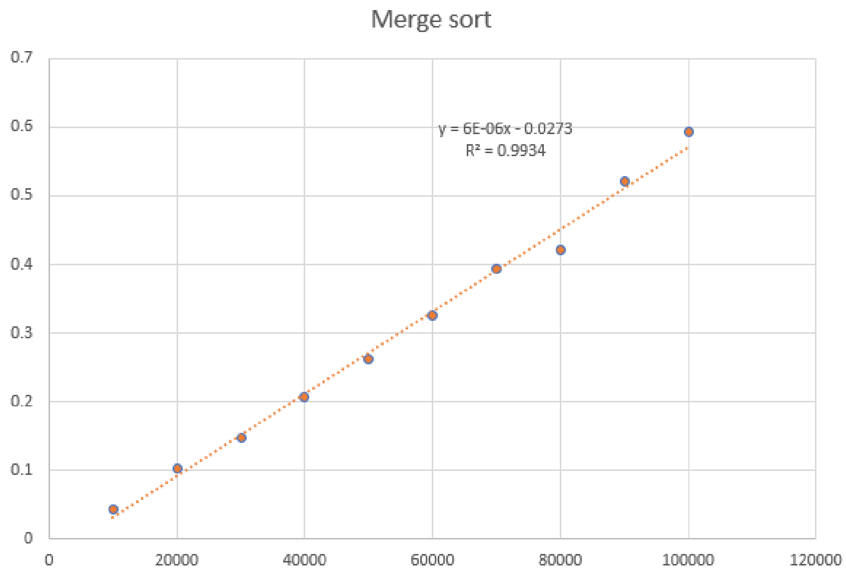
Number(n)	Merge sort
10000	0.04283332824707031 sec
20000	0.10372638702392578 sec
30000	0.14660954475402832 sec
40000	0.20744538307189941 sec
50000	0.2613043785095215 sec
60000	0.3251631259918213 sec

70000	0.39394640922546387 sec
80000	0.4208981990814209 sec
90000	0.5206441879272461 sec
100000	0.5934135913848877 sec

b). plot data and fit a curve

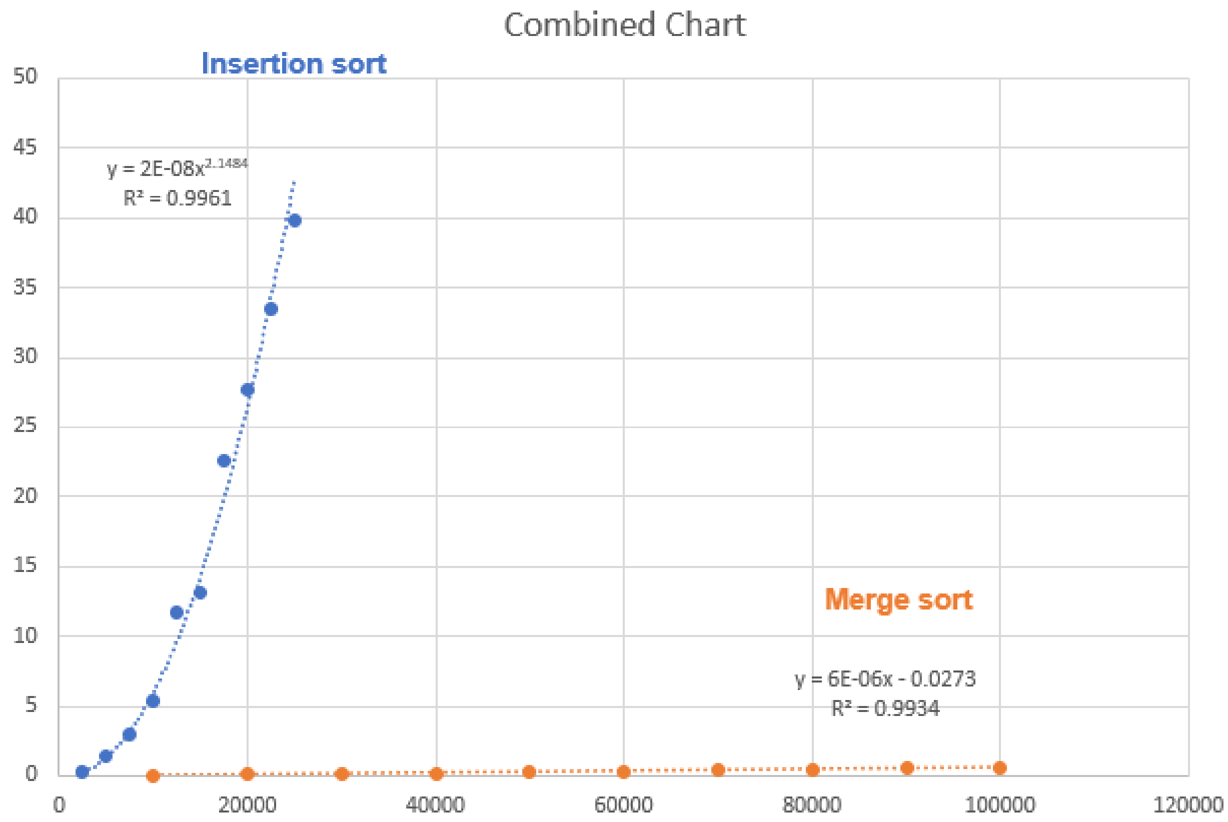
For insertion sort, the best fits curve is polynomial. For merge sort, the best fits curve is linear.





c). combine

merge sort has a lower time consumption than insertion sort



d). prediction

insertion sort: $2 \times 10^{-8} x^{2.1484}$

merge sort: $6 \times 10^{-6} x - 0.0273$

when x = 200000,

Time of insert sort will approximately be 4895 sec, and time of merge sort will approximately be 1.1727 sec.

e). comparison

My results shows that insertion sort has polynomial complexity, and merge sort has linear complexity. Similarly, the theoretical of insertion sort running time is O(n^2) which fits my results. And, the theoretical of merge sort running time is O(nlogn), in my results, the time of halving might be very short which is the logn part. Another possible reason is that the excel cannot draw a graph based on logn function. Therefore, I got the results above.