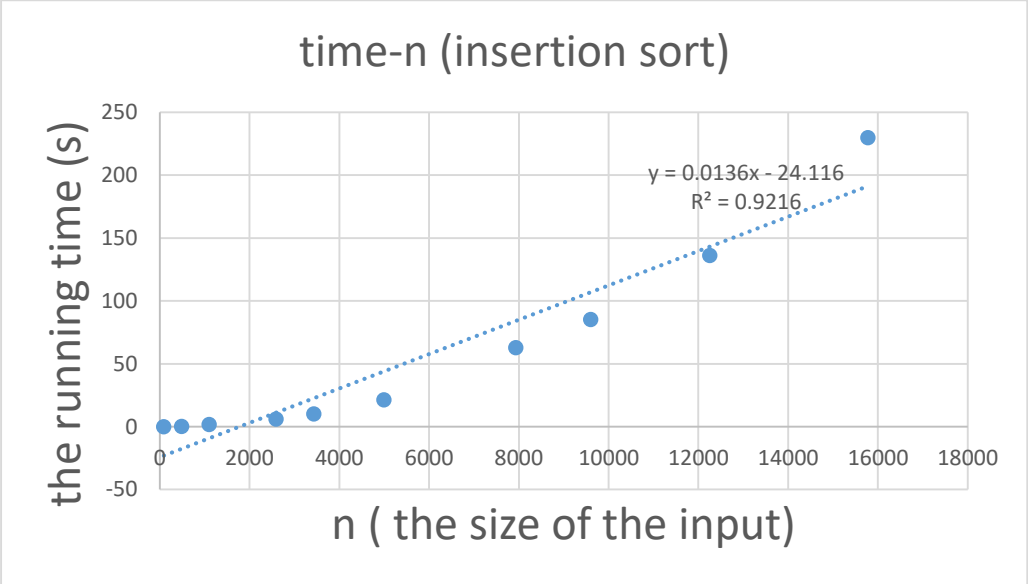
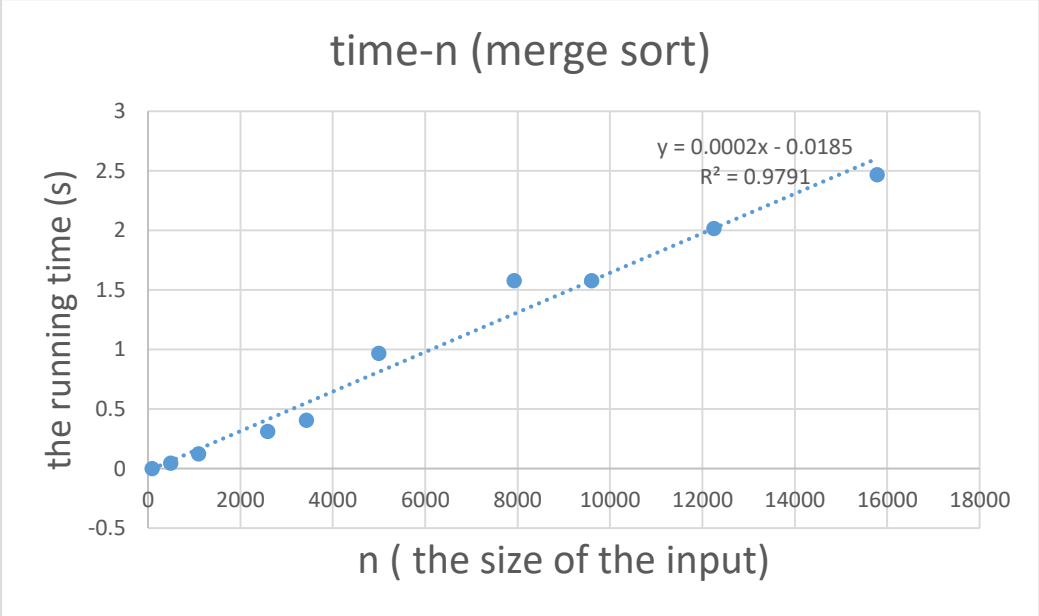
Problem 3-(c)

insertion sort	n(words)	t(s)	nlgn	n**2
1	87	0.01562	560.536	7569
2	489	0.3281	4368.57	239121
3	1097	1.84362	11079	1203409
4	2589	5.99958	29354.5	6702921
5	3432	10.2337	40308.3	11778624
6	4997	21.3266	61397.4	24970009
7	7929	62.9019	102704	62869041
8	9604	85.4003	127055	92236816
9	12252	136.1	166391	150111504
10	15780	229.842	220065	249008400

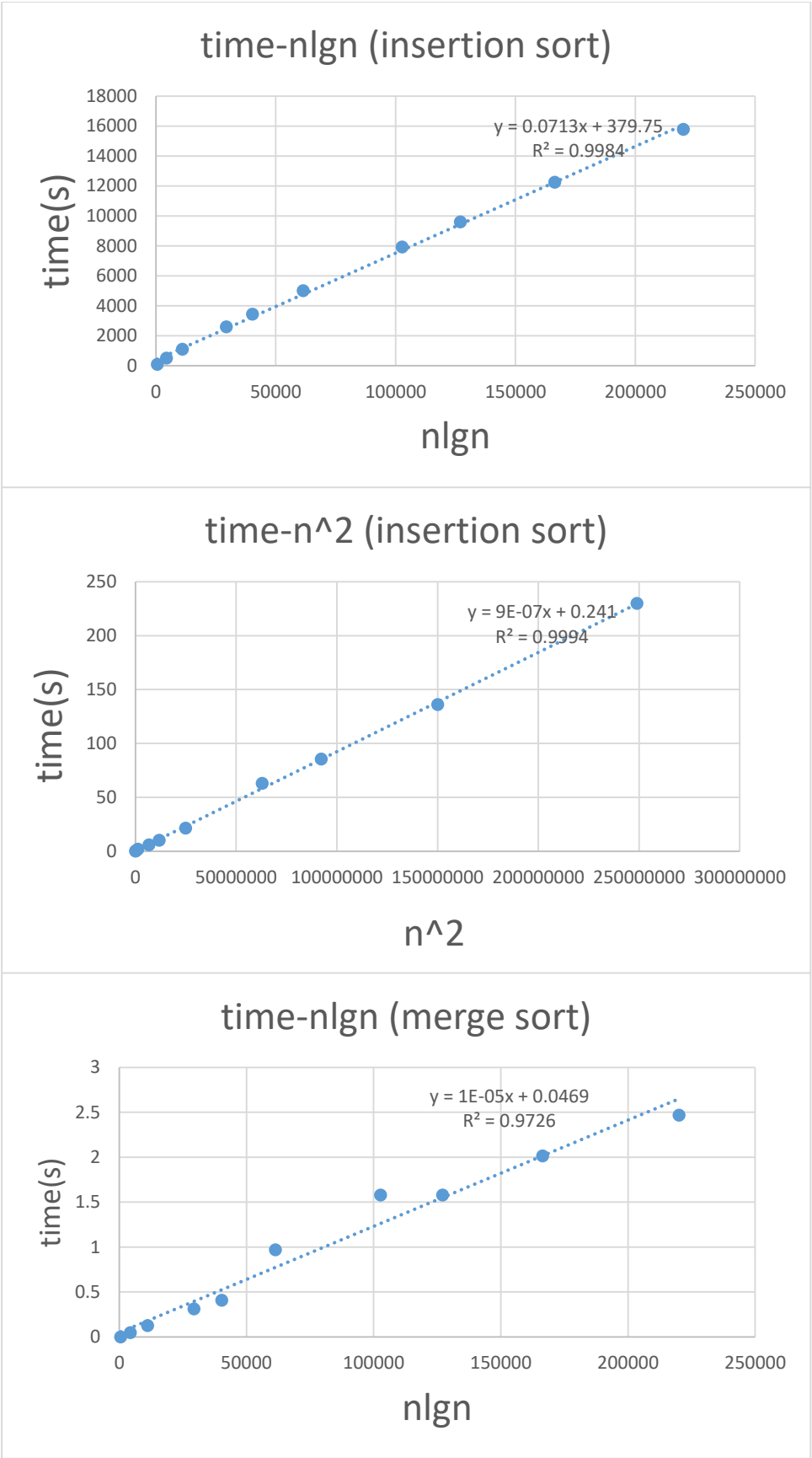


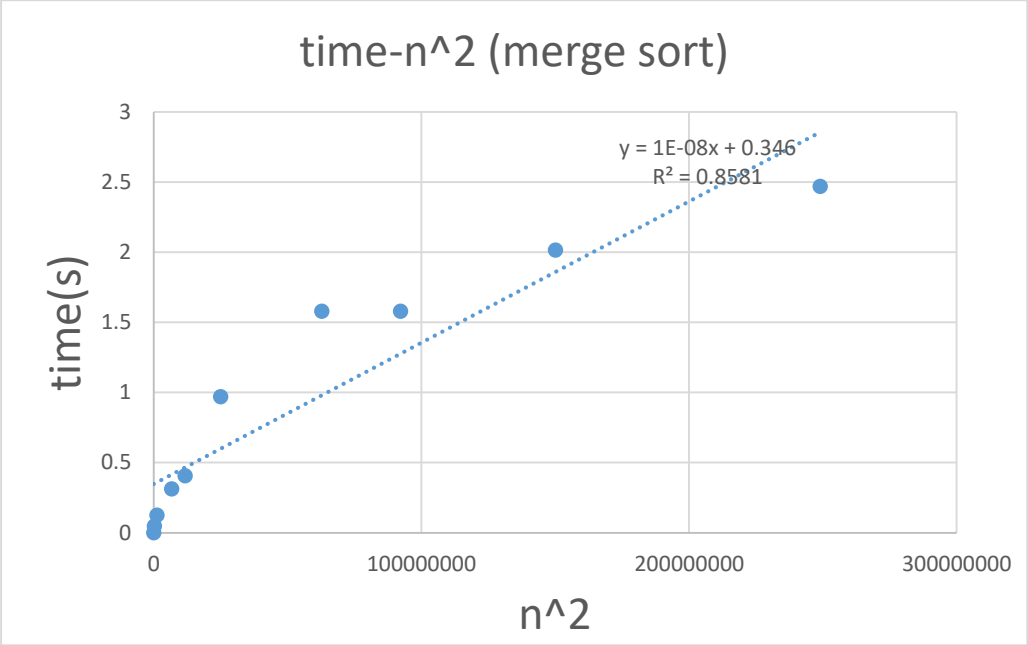
merge sort	n(words)	t(s)	nlgn	n**2
0	87	0	560.5361	7569
1	489	0.046873	4368.575	239121
2	1097	0.124992	11078.98	1203409
3	2589	0.312476	29354.55	6702921
4	3432	0.406222	40308.27	11778624
5	4997	0.968683	61397.37	24970009
6	7929	1.578016	102703.7	62869041
7	9604	1.578014	127055.3	92236816
8	12252	2.015486	166391.1	1.5E+08
9	15780	2.468597	220064.9	2.49E+08



Problem 3-(d)

I also plot time-n^2 and time-nlgn for the insertion sort and merge sort as below.


time-nlgn (insertion sort)
time(s)
nlgn
y = 0.0713x + 379.75
R² = 0.9984
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
50000
100000
150000
200000
250000
time-n^2 (insertion sort)
time(s)
n^2
y = 9E-07x + 0.241
R² = 0.9994
250
200
150
100
50
0
0
50000000
100000000
150000000
200000000
250000000
300000000
time-nlgn (merge sort)
time(s)
nlgn
y = 1E-05x + 0.0469
R² = 0.9726
3
2.5
2
1.5
1
0.5
0
0
50000
100000
150000
200000
250000



By comparison with the time-n, time-nlgn, time-n^2 plot and their least squares. I organize them into a table:

R^2	time-n	time-nlgn	time-n^2
insertion sort	0.9216	0.9984	0.9994
merge sort	0.9791	0.9726	0.8581

As a result, the best fitting model for insertion sort is Θ(n^2) and its fitting equation is T(n)= 9E-07*n^2 + 0.241.

The best fitting model for merge sort is Θ(n) and its fitting equation is T(n)= 0.0002n - 0.0185.

But the theoretical model for merge sort is Θ(nlgn) and its fitting equation is T(n)= 1E-05*nlgn + 0.0469.

In merge sort, I think the reason why nlgn's R^2 is a liitle smaller than n's R^2 is that the program records running time=0 when dealing with input01.txt, but it actually takes time, so the error is from the round-off error.