Profiling Report

1. Profiling.exe captures

```
The minimum number of entries is set to 1000
Enter the number of max entries to sort: The maximum sample data size is 10000

  insertionsort(): sorted
         N   repetitions     sort(sec)
      1000         172775      0.000006
      2000          99668      0.000010
      3000          68421      0.000015
      4000          50531      0.000020
      5000          40201      0.000025
      6000          35096      0.000028
      7000          27874      0.000036
      8000          26184      0.000038
      9000          23986      0.000042
     10000          21725      0.000046

  insertionsort(): randomized
         N   repetitions     sort(sec)
      1000           1246      0.000803
      2000            293      0.003422
      3000            138      0.007284
      4000             76      0.013266
      5000             48      0.020939
      6000             33      0.031181
      7000             24      0.041755
      8000             19      0.053319
      9000             15      0.069302
     10000             13      0.081448

  insertionsort(): reversed
         N   repetitions     sort(sec)
      1000            588      0.001702
      2000            146      0.006856
      3000             71      0.014261
      4000             40      0.025413
      5000             24      0.042233
      6000             17      0.059179
      7000             13      0.078154
      8000             10      0.103642
      9000              8      0.136225
     10000              6      0.172497
```

```
mergesort(): sorted
       N   repetitions     sort(sec)
    1000         84945      0.000012
    2000         48003      0.000021
    3000         32438      0.000031
    4000         23369      0.000043
    5000         17636      0.000057
    6000         16113      0.000062
    7000         13145      0.000076
    8000         11567      0.000086
    9000         10553      0.000095
   10000          9026      0.000111

mergesort(): randomized
       N   repetitions     sort(sec)
    1000          7800      0.000128
    2000          3532      0.000283
    3000          2270      0.000441
    4000          1629      0.000614
    5000          1283      0.000780
    6000          1055      0.000948
    7000           876      0.001142
    8000           770      0.001299
    9000           686      0.001459
   10000           621      0.001611

mergesort(): reversed
       N   repetitions     sort(sec)
    1000         12520      0.000080
    2000          5917      0.000169
    3000          3776      0.000265
    4000          2785      0.000359
    5000          2210      0.000453
    6000          1781      0.000562
    7000          1517      0.000659
    8000          1322      0.000756
    9000          1178      0.000849
   10000           995      0.001006

quicksort(): sorted
       N   repetitions     sort(sec)
    1000           256      0.003916
    2000            68      0.014913
    3000            31      0.032897
    4000            18      0.058280
    5000            11      0.091633
    6000             8      0.132527
    7000             6      0.187148
```

```
     8000             5      0.245327
     9000             4      0.319862
    10000             3      0.364662

quicksort(): randomized
       N   repetitions     sort(sec)
    1000         10119      0.000099
    2000          4427      0.000226
    3000          2759      0.000362
    4000          2039      0.000491
    5000          1484      0.000674
    6000          1305      0.000767
    7000          1029      0.000972
    8000           942      0.001062
    9000           784      0.001276
   10000           702      0.001425

quicksort(): reversed
       N   repetitions     sort(sec)
    1000           426      0.002350
    2000           107      0.009411
    3000            48      0.020946
    4000            26      0.039398
    5000            16      0.062564
    6000            11      0.091188
    7000             9      0.116358
    8000             7      0.155676
    9000             6      0.191739
   10000             5      0.246017
```

2. 성능 분석표

Insertion - Best	**T(N) ≈ N^{b}**	
	a = 9.2 x 10^{-9}	b = 0.926
N	10,000	1,000,000
Time	0.000046	Estimated: 0.0033
N	20,000	Measured: 0.004780
Time	0.000093	

Insertion - Average	**T(N) ≈ N^b**	
	a = 6.3 x 10^{-10}	b = 2.03
N	10,000	1,000,000
Time	0.081448	Estimated: 953.54
N	20,000	Measured:
Time	0.327224	

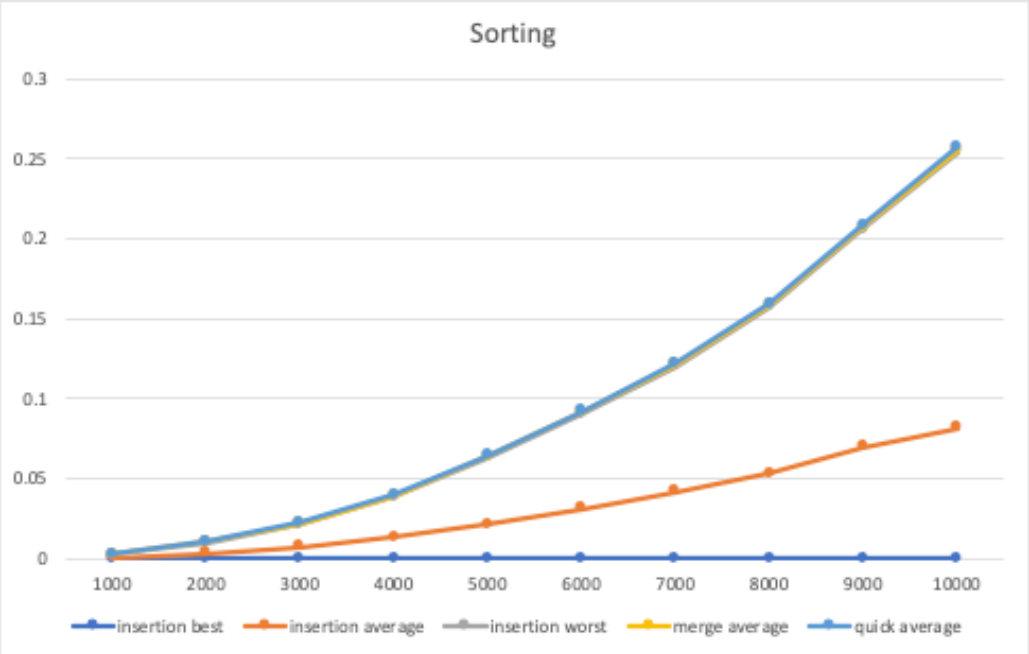
Insertion - Worst	**T(N) ≈ N^b**	
	a = 1.2 x 10^{-9}	b = 2.03
N	10,000	1,000,000
Time	0.172497	Estimated: 1816.27
N	20,000	Measured:
Time	0.672188	

Average quicksort	**T(N) ≈ N^b**	
O(NlogN): randomized	a = 4.8 x 10^{-8}	b = 1.113
N	10,000	1,000,000
Time	0.001401	Estimated: 2.96
N	20,000	Measured:
Time	0.003010	

Average mergesort	**T(N) ≈ N^{b}**	
O(NlogN): randomized	a = 7.8 x 10^{-8}	b = 1.081
N	10,000	1,000,000
Time	0.001611	Estimated: 0.23
N	20,000	Measured: 0.12
Time	0.0034	

3. 5 cases graph

	insertion bes	insertion ave	insertion wo	merge avera	quick average
1000	0.000006	0.000803	0.001702	0.000128	0.000099
2000	0.00001	0.003422	0.006856	0.000283	0.000226
3000	0.000015	0.007284	0.014261	0.000441	0.000362
4000	0.00002	0.013266	0.025413	0.000614	0.000491
5000	0.000025	0.020939	0.042233	0.00078	0.000674
6000	0.000028	0.031181	0.059179	0.000948	0.000767
7000	0.000036	0.041755	0.078154	0.001142	0.000972
8000	0.000038	0.053319	0.103642	0.001299	0.001062
9000	0.000042	0.069302	0.136225	0.001459	0.001276
10000	0.000046	0.081448	0.172497	0.001611	0.001425



4. Time complexity & description

- selection sort

: bestcase 일 때는 매우 빠르지만 일반적인 경우와 worst case인 경우에 대해서는 asymptotic time complexity가 $O(N^2)$에 근접해서 매우 느려진다.

- merge sort

: N이 100만에 근접해도 빠르게 정렬되는 모습을 볼 수 있다.

- quick sort

: 이론상 randomize 되어있을 때 가장 빨라야하는데 무엇인가 문제가 있는지 매우 느렸다.