The report of homework 7

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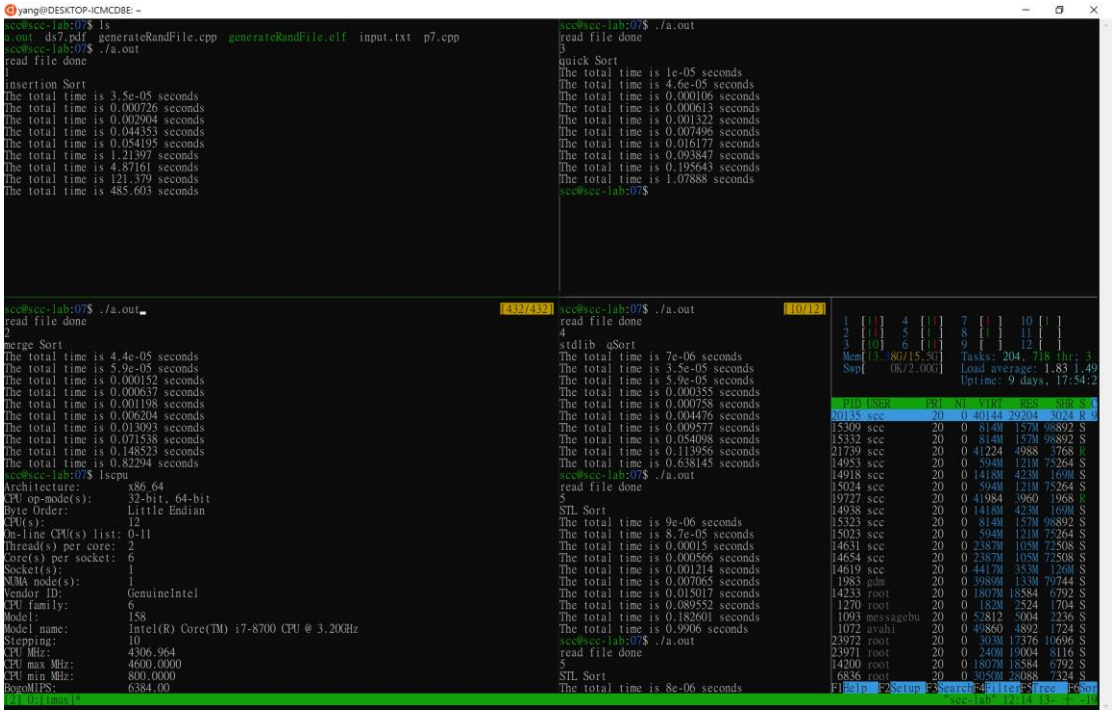
scale/algorithm (num/s)	Insertion Sort	Merge sort	Quick sort	cstdlib qsort	STL sort
100	3.5e-05	4.4e-05	1e-05	7e-06	9e-06
500	0.000726	5.9e-05	4.6e-05	3.5e-05	8.7e-05
1000	0.002904	0.000152	0.000106	5.9e-05	0.00015
5000	0.044353	0.000637	0.000613	0.000355	0.000566
10000	0.054195	0.001198	0.001322	0.000758	0.001214
50000	1.21397	0.006204	0.007496	0.004476	0.007065
100000	4.87161	0.013093	0.016177	0.009577	0.015017
500000	121.379	0.071538	0.093847	0.054098	0.089552
1000000	485.603	0.148523	0.195643	0.113956	0.182601
5000000	12140.075	0.82294	1.07888	0.638145	0.9906



The last 2 results of insertion sore are time out! Which might coast 485 seconds and 3.37 hours.

I use yellow mark to repersent TLE(Time Limit Exceed).

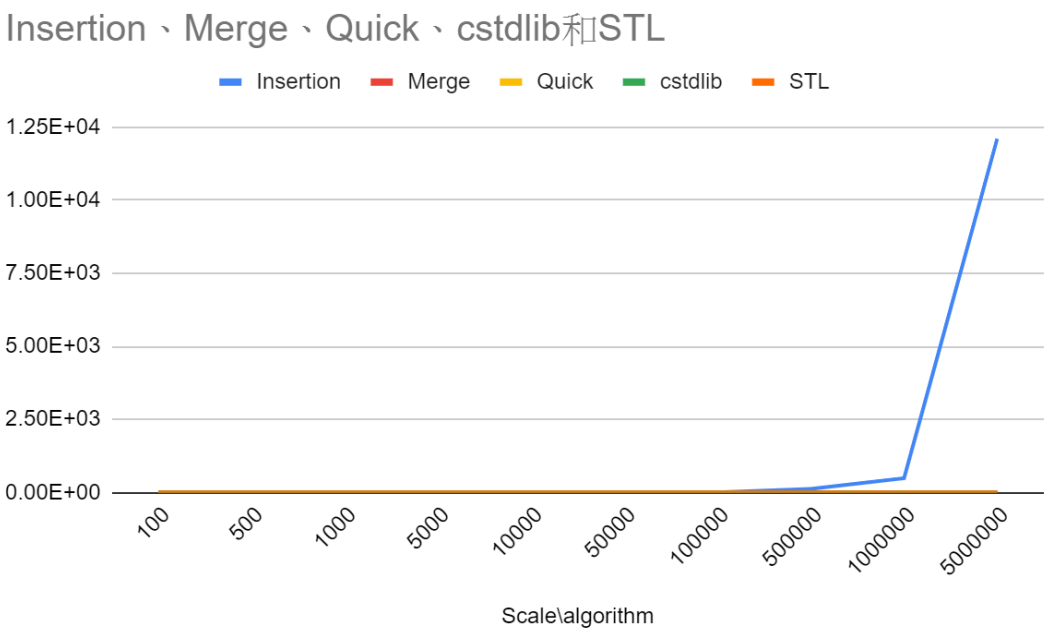
Insertion sort : $\Theta(n^2)$

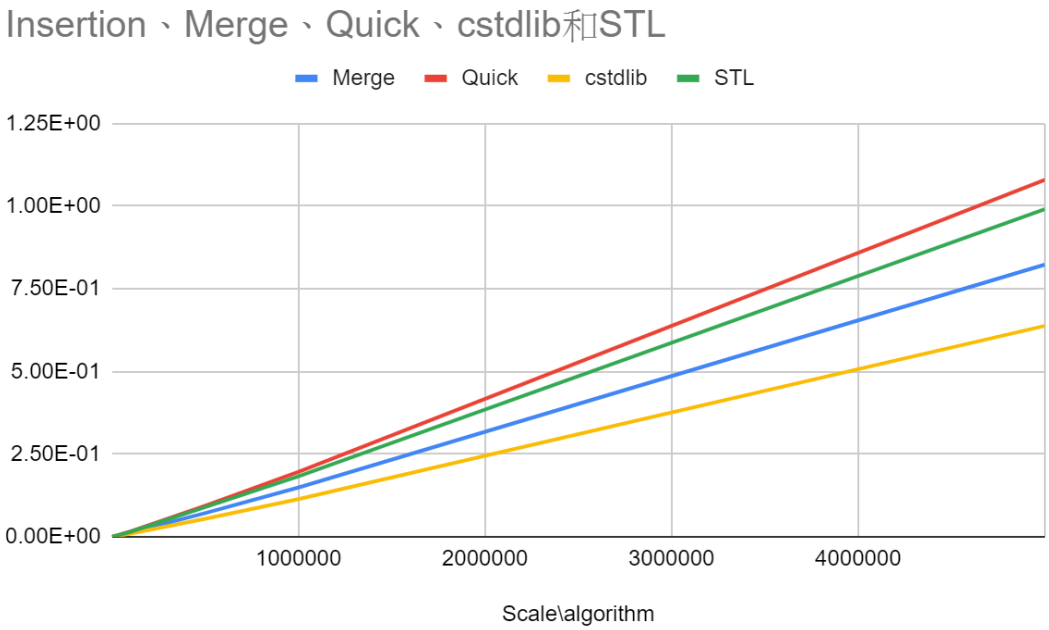
Merge sort : $\Theta(n \log n)$

Quick sort : $\Theta(n \log n)$

cstdlib qsort : $\Theta(n \log n)$

STL sort : $\Theta(n \log n)$


Insertion、Merge、Quick、cstdlib和STL
Insertion
Merge
Quick
cstdlib
STL
1.25E+04
1.00E+04
7.50E+03
5.00E+03
2.50E+03
0.00E+00
100
500
1000
5000
10000
50000
100000
500000
1000000
5000000
Scale\algorithm


Insertion、Merge、Quick、cstdlib和STL
Merge
Quick
cstdlib
STL
1.25E+00
1.00E+00
7.50E-01
5.00E-01
2.50E-01
0.00E+00
1000000
2000000
3000000
4000000
Scale\algorithm

About

My CPU: i7-8700 3.2GHz

```
scc@scc-lab:07$ lscpu
Architecture:        x86_64
CPU op-mode(s):      32-bit, 64-bit
Byte Order:          Little Endian
CPU(s):              12
On-line CPU(s) list: 0-11
Thread(s) per core:  2
Core(s) per socket:  6
Socket(s):           1
NUMA node(s):        1
Vendor ID:           GenuineIntel
CPU family:          6
Model:               158
Model name:          Intel(R) Core(TM) i7-8700 CPU @ 3.20GHz
Stepping:            10
CPU MHz:             4306.964
CPU max MHz:         4600.0000
CPU min MHz:         800.0000
BogoMIPS:            6384.00
Virtualization:      VT-x
L1d cache:           32K
L1i cache:           32K
L2 cache:            256K
L3 cache:            12288K
NUMA node0 CPU(s):   0-11
Flags:               fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36
clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpelgb rdtscp lm constant_tsc art
 arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid aperfmperf tsc_known_freq pn
i pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcid sse4_1 s
se4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm abm 3dnowprefe
tch cpuid_fault epb invpcid_single pti ssbd ibrs ibpb stibp tpr_shadow vnmi flexpriority ept
vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm mpx rdseed adx smap clflush
opt intel_pt xsaveopt xsavec xgetbv1 xsaves dtherm ida arat pln pts hwp hwp_notify hwp_act_wi
ndow hwp_epp md_clear flush_l1d
scc@scc-lab:07$
```

My RAM: (8G DDR4 2666)*2

```
Handle 0x0040, DMI type 17, 40 bytes
Memory Device
        Array Handle: 0x003F
        Error Information Handle: Not Provided
        Total Width: 64 bits
        Data Width: 64 bits
        Size: 8192 MB
        Form Factor: DIMM
        Set: None
        Locator: ChannelA-DIMM1
        Bank Locator: BANK 0
        Type: DDR4
        Type Detail: Synchronous
        Speed: 2666 MT/s
        Manufacturer: Kingston
        Serial Number: D4237674
        Asset Tag: 9876543210
        Part Number: 9905702-082.A00G
        Rank: 1
        Configured Clock Speed: 2666 MT/s
        Minimum Voltage: Unknown
        Maximum Voltage: Unknown
        Configured Voltage: 1.2 V
```

```
Handle 0x0041, DMI type 17, 40 bytes
Memory Device
        Array Handle: 0x003F
        Error Information Handle: Not Provided
        Total Width: 64 bits
        Data Width: 64 bits
        Size: 8192 MB
        Form Factor: DIMM
        Set: None
        Locator: ChannelA-DIMM2
        Bank Locator: BANK 1
        Type: DDR4
        Type Detail: Synchronous
        Speed: 2666 MT/s
        Manufacturer: SK Hynix
        Serial Number: 926D93A2
        Asset Tag: 9876543210
        Part Number: HMA81GU6CJR8N-VK
        Rank: 1
        Configured Clock Speed: 2666 MT/s
        Minimum Voltage: Unknown
        Maximum Voltage: Unknown
        Configured Voltage: 1.2 V
```

My OS: Ubuntu 18.04(Linux kernel: 4.15.0)

```
scc@scc-lab:07$ uname -a
Linux scc-lab 4.15.0-64-generic #73-Ubuntu SMP Thu Sep 12 13:16:13 UTC 2019 x86_64 x86_64 x86
_64 GNU/Linux
```

My compiler: GNU GCC 7.4.0

```
scc@scc-lab:07$ gcc -v
Using built-in specs.
COLLECT_GCC=gcc
COLLECT_LTO_WRAPPER=/usr/lib/gcc/x86_64-linux-gnu/7/lto-wrapper
OFFLOAD_TARGET_NAMES=nvptx-none
OFFLOAD_TARGET_DEFAULT=1
Target: x86_64-linux-gnu
Configured with: ../src/configure -v --with-pkgversion='Ubuntu 7.4.0-1ubuntu1~18.04.1' --with
-bugurl=file:///usr/share/doc/gcc-7/README.Bugs --enable-languages=c,ada,c++,go,brig,d,fortra
n,objc,obj-c++ --prefix=/usr --with-gcc-major-version-only --program-suffix=-7 --program-pref
ix=x86_64-linux-gnu- --enable-shared --enable-linker-build-id --libexecdir=/usr/lib --without
-included-gettext --enable-threads=posix --libdir=/usr/lib --enable-nls --with-sysroot=/ --en
able-clocale=gnu --enable-libstdcxx-debug --enable-libstdcxx-time=yes --with-default-libstdcx
x-abi=new --enable-gnu-unique-object --disable-vtable-verify --enable-libmpx --enable-plugin
--enable-default-pie --with-system-zlib --with-target-system-zlib --enable-objc-gc=auto --ena
ble-multiarch --disable-werror --with-arch-32=i686 --with-abi=m64 --with-multilib-list=m32,m6
4,mx32 --enable-multilib --with-tune=generic --enable-offload-targets=nvptx-none --without-cu
da-driver --enable-checking=release --build=x86_64-linux-gnu --host=x86_64-linux-gnu --target
=x86_64-linux-gnu
Thread model: posix
gcc version 7.4.0 (Ubuntu 7.4.0-1ubuntu1~18.04.1)
```