資工三 B00902064 宋昊恩

Matrix multiplication, matrix size = **5000** x **5000**, **double** value, from **DBL_MIN** to **DBL_MAX**.

```
hogan@hogan-Aspire-5830TG:~/Dropbox/Courses/Junior_2/NumericalAnalysis/hw4$ vim normal_matrix.cpp
hogan@hogan-Aspire-5830TG:~/Dropbox/Courses/Junior_2/NumericalAnalysis/hw4$ g++ normal_matrix.cpp -o normal_matrix
hogan@hogan-Aspire-5830TG:~/Dropbox/Courses/Junior_2/NumericalAnalysis/hw4$ time ./normal_matrix
Total time spent: 1854640000.000000

real    30m57.183s
user    30m54.368s
sys     0m1.428s
```

Illustration 1: Naive triple nested for loop matrix multiplication

```
hogan@hogan-Aspire-5830TG:~/Dropbox/Courses/Junior_2/NumericalAnalysis/hw4$ vim blas_matrix.cpp
hogan@hogan-Aspire-5830TG:~/Dropbox/Courses/Junior_2/NumericalAnalysis/hw4$ gcc -c -I /home/hogan/Tools/CBLAS/src/ blas_matrix.cpp
hogan@hogan-Aspire-5830TG:~/Dropbox/Courses/Junior_2/NumericalAnalysis/hw4$ gfortran -o blas_matrix blas_matrix.o /home/hogan/Tools/CBLAS/lib/c
blas_LINUX.a /usr/lib/libblas.a
hogan@hogan-Aspire-5830TG:~/Dropbox/Courses/Junior_2/NumericalAnalysis/hw4$ time ./blas_matrix
Total time spent: 119834000.000000

real    10m0.882s
user    9m59.737s
sys     0m0.600s
```

Illustration 2: Directly using source of blas

```
hogan@hogan-Aspire-5830TG:~/Dropbox/Courses/Junior_2/NumericalAnalysis/hw4$ vim intel_matrix.cpp
hogan@hogan-Aspire-5830TG:~/Dropbox/Courses/Junior_2/NumericalAnalysis/hw4$ g++ intel_matrix.cpp -o intel_matrix -Wl,--start-group ${MKLROOT}/l
ib/intel64/libmkl_intel_lp64.a ${MKLROOT}/lib/intel64/libmkl_core.a ${MKLROOT}/lib/intel64/libmkl_sequential.a -Wl,--end-group -lpthread -lm
hogan@hogan-Aspire-5830TG:~/Dropbox/Courses/Junior_2/NumericalAnalysis/hw4$ time ./intel_matrix
Total time spent: 11744000.000000

real    1m11.654s
user    1m11.388s
sys     0m0.228s
```

Illustration 3: Pre-built optimized blas

```
hogan@hogan-Aspire-5830TG:~/Dropbox/Courses/Junior_2/NumericalAnalysis/hw4$ vim atlas_matrix.cpp
hogan@hogan-Aspire-5830TG:~/Dropbox/Courses/Junior_2/NumericalAnalysis/hw4$ g++ atlas_matrix.cpp -o atlas_matrix -I /usr/local/atlas/include/ -
L /usr/local/atlas/lib -lcblas -latlas
hogan@hogan-Aspire-5830TG:~/Dropbox/Courses/Junior_2/NumericalAnalysis/hw4$ time ./atlas_matrix
Total time spent: 15008000.000000

real    1m16.250s
user    1m15.701s
sys     0m0.468s
```

Illustration 4: ATLAS

```
hogan@hogan-Aspire-5830TG:~/Dropbox/Courses/Junior_2/NumericalAnalysis/hw4$ vim openBlas_matrix.cpp
hogan@hogan-Aspire-5830TG:~/Dropbox/Courses/Junior_2/NumericalAnalysis/hw4$ g++ openBlas_matrix.cpp -o openBlas_matrix -lopenblas
hogan@hogan-Aspire-5830TG:~/Dropbox/Courses/Junior_2/NumericalAnalysis/hw4$ time ./openBlas_matrix
Total time spent: 11910000.000000

real    1m1.739s
user    1m1.356s
sys     0m0.584s
```

Illustration 5: BLAS by Kazushige Goto (later is branched as openBlas)