Homework 07

Qinglei Cao

1. Environment

Cauchy 15: Westmere-EP E5606 @2.13GHz. 8 cores

2. Correctness

2.1. xGEMM

Both serial and OpenMP versions are compared to MKL dgemm_ function.

2.2. xTRSM

For both serial and OpenMP versions, compare A*X to B, Shows below (B_mul = A*X).

```
[qcao3@saturn Qinglei_Cao_hw07]$ salloc -N 1 -w c15 ./seq_dtrsm 5 L
salloc: Granted job allocation 139118
lower triangular matrix
A:
4.200939e+00  0.000000e+00  0.000000e+00  0.000000e+00  0.000000e+00
1.971915e+00  3.915496e+00  0.000000e+00  0.000000e+00  0.000000e+00
3.992200e+00  4.558237e+00  9.877568e-01  0.000000e+00  0.000000e+00
1.676114e+00  3.841148e+00  1.388874e+00  2.769850e+00  0.000000e+00
2.386985e+00  3.144355e+00  1.823922e+00  2.567005e+00  4.761149e+00

X:
1.090465e+00  7.566306e-01  8.537341e-01  1.685368e-01  7.224206e-01
-5.283623e-01  -7.089193e-02  -2.547143e-01  9.420373e-01  -1.637484e-01
6.050977e-02  -2.073918e+00  -1.724296e+00  2.810472e-02  -1.059328e+00
9.684266e-01  2.195093e+00  1.807126e+00  -8.880870e-01  1.471978e+00
-1.924850e-01  -2.031843e-01  4.480048e-01  6.860783e-02  1.681996e-01

B:
4.580975e+00  3.178559e+00  3.586485e+00  7.080128e-01  3.034844e+00
8.150286e-02  1.214434e+00  6.861579e-01  4.020884e+00  7.833954e-01
2.004722e+00  6.489522e-01  5.440440e-01  4.994623e+00  1.091285e+00
2.564662e+00  4.195561e+00  3.063199e+00  1.480158e+00  3.187761e+00
2.621436e+00  2.467915e+00  4.863875e+00  1.462584e+00  3.856788e+00

B_mul:
4.580975e+00  3.178559e+00  3.586485e+00  7.080128e-01  3.034844e+00
8.150286e-02  1.214434e+00  6.861579e-01  4.020884e+00  7.833954e-01
2.004722e+00  6.489522e-01  5.440440e-01  4.994623e+00  1.091285e+00
2.564662e+00  4.195561e+00  3.063199e+00  1.480158e+00  3.187761e+00
2.621436e+00  2.467915e+00  4.863875e+00  1.462584e+00  3.856788e+00
```

3. Performance

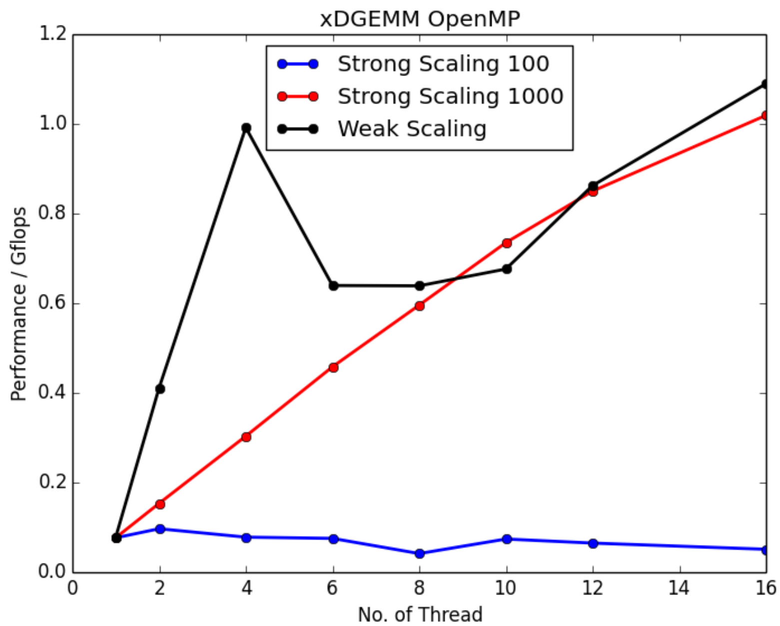

Fig.1 xGEMM, there are two experiments for strong scaling, small matrix of size 100 and big matrix of size 1000; for weak scaling, the matrix size is (No. of Thread) * 100

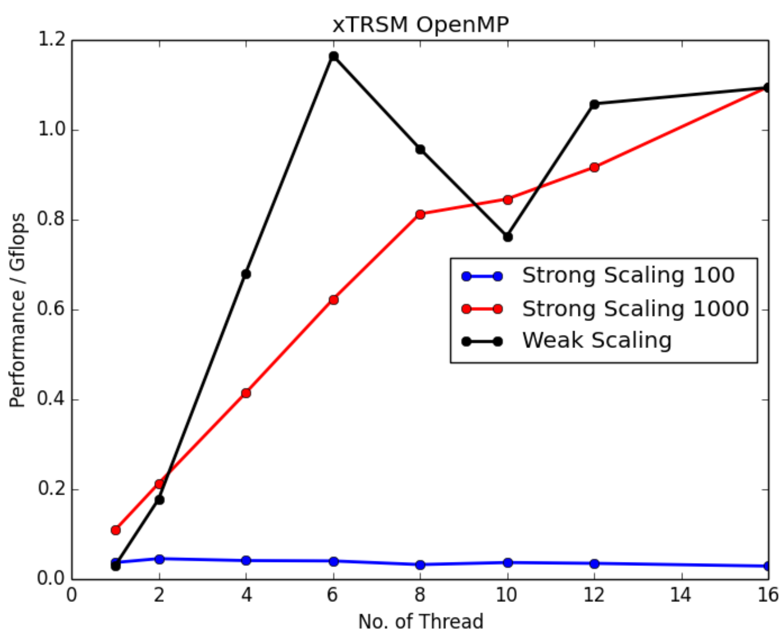

Fig.2 xTRSM, there are two experiments for strong scaling, small matrix of size 100 and big matrix of size 1000; for weak scaling, the matrix size is (No. of Thread) * 100

In both xGEMM and xTRSM:

- Strong scaling when matrix size is small, 100, performance reduces a little as number of thread increases, that maybe because the computation time reduced by increasing number of threads is less than the increased synchronizing time;
- Strong scaling when matrix size is large, 1000, performance increases almost linearly;
- Weak scaling, there is peak (xGEMM at 4 threads and xTRSM at 6 threads), maybe it is because of cache? As do not use block to fit cache size.