

# CS6230: Parallel Programming & HPC

Fall 2023

Prof. P. (Saday) Sadayappan

## *GEMM*: GEneral Matrix Multiplication

## 1. CPU - Openmp Results

### 1.1 CADE Lab Performance

Test Case 1:  $N_i = 8,192$ ,  $N_j = 8,192$ ,  $N_k = 16$   
Test Case 2:  $N_i = 4096$ ,  $N_j = 4096$ ,  $N_k = 64$   
Test Case 3:  $N_i = 2048$ ,  $N_j = 2048$ ,  $N_k = 256$   
Test Case 4:  $N_i = 1024$ ,  $N_j = 1024$ ,  $N_k = 1024$   
Test Case 5:  $N_i = 256$ ,  $N_j = 256$ ,  $N_k = 16,384$   
Test Case 6:  $N_i = 64$ ,  $N_j = 64$ ,  $N_k = 262,144$   
Test Case 7:  $N_i = 16$ ,  $N_j = 16$ ,  $N_k = 4,194,304$   
Test Case 8:  $N_i = 8,991$ ,  $N_j = 8,991$ ,  $N_k = 37$   
Test Case 9:  $N_i = 2,997$ ,  $N_j = 2,997$ ,  $N_k = 11$   
Test Case 10:  $N_i = 999$ ,  $N_j = 999$ ,  $N_k = 999$   
Test Case 11:  $N_i = 333$ ,  $N_j = 333$ ,  $N_k = 8,991$   
Test Case 12:  $N_i = 111$ ,  $N_j = 111$ ,  $N_k = 80,919$   
Test Case 13:  $N_i = 37$ ,  $N_j = 37$ ,  $N_k = 728,271$

### 1.2 Lonepeak Performance - TODO Awaiting JOB Results

Test Case 1:  $N_i = 8,192$ ,  $N_j = 8,192$ ,  $N_k = 16$   
Test Case 2:  $N_i = 4096$ ,  $N_j = 4096$ ,  $N_k = 64$   
Test Case 3:  $N_i = 2048$ ,  $N_j = 2048$ ,  $N_k = 256$   
Test Case 4:  $N_i = 1024$ ,  $N_j = 1024$ ,  $N_k = 1024$   
Test Case 5:  $N_i = 256$ ,  $N_j = 256$ ,  $N_k = 16,384$   
Test Case 6:  $N_i = 64$ ,  $N_j = 64$ ,  $N_k = 262,144$   
Test Case 7:  $N_i = 16$ ,  $N_j = 16$ ,  $N_k = 4,194,304$   
Test Case 8:  $N_i = 8,991$ ,  $N_j = 8,991$ ,  $N_k = 37$   
Test Case 9:  $N_i = 2,997$ ,  $N_j = 2,997$ ,  $N_k = 11$   
Test Case 10:  $N_i = 999$ ,  $N_j = 999$ ,  $N_k = 999$   
Test Case 11:  $N_i = 333$ ,  $N_j = 333$ ,  $N_k = 8,991$   
Test Case 12:  $N_i = 111$ ,  $N_j = 111$ ,  $N_k = 80,919$   
Test Case 13:  $N_i = 37$ ,  $N_j = 37$ ,  $N_k = 728,271$

## 2. GPU - CUDA Results

### 2.1 CADE Lab Performance

Test Case 1:  $N_i = 8,192$ ,  $N_j = 8,192$ ,  $N_k = 16$   
Test Case 2:  $N_i = 4096$ ,  $N_j = 4096$ ,  $N_k = 64$   
Test Case 3:  $N_i = 2048$ ,  $N_j = 2048$ ,  $N_k = 256$   
Test Case 4:  $N_i = 1024$ ,  $N_j = 1024$ ,  $N_k = 1024$   
Test Case 5:  $N_i = 256$ ,  $N_j = 256$ ,  $N_k = 16,384$   
Test Case 6:  $N_i = 64$ ,  $N_j = 64$ ,  $N_k = 262,144$   
Test Case 7:  $N_i = 16$ ,  $N_j = 16$ ,  $N_k = 4,194,304$   
Test Case 8:  $N_i = 8,991$ ,  $N_j = 8,991$ ,  $N_k = 37$   
Test Case 9:  $N_i = 2,997$ ,  $N_j = 2,997$ ,  $N_k = 11$   
Test Case 10:  $N_i = 999$ ,  $N_j = 999$ ,  $N_k = 999$   
Test Case 11:  $N_i = 333$ ,  $N_j = 333$ ,  $N_k = 8,991$   
Test Case 12:  $N_i = 111$ ,  $N_j = 111$ ,  $N_k = 80,919$   
Test Case 13:  $N_i = 37$ ,  $N_j = 37$ ,  $N_k = 728,271$

## 2.2 Lonepeak Performance

Test Case 1:  $N_i = 8,192$ ,  $N_j = 8,192$ ,  $N_k = 16$

Test Case 2:  $N_i = 4096$ ,  $N_j = 4096$ ,  $N_k = 64$

Test Case 3:  $N_i = 2048$ ,  $N_j = 2048$ ,  $N_k = 256$

Test Case 4:  $N_i = 1024$ ,  $N_j = 1024$ ,  $N_k = 1024$

Test Case 5:  $N_i = 256$ ,  $N_j = 256$ ,  $N_k = 16,384$

Test Case 6:  $N_i = 64$ ,  $N_j = 64$ ,  $N_k = 262,144$

Test Case 7:  $N_i = 16$ ,  $N_j = 16$ ,  $N_k = 4,194,304$

Test Case 8:  $N_i = 8,991$ ,  $N_j = 8,991$ ,  $N_k = 37$

Test Case 9:  $N_i = 2,997$ ,  $N_j = 2,997$ ,  $N_k = 11$

Test Case 10:  $N_i = 999$ ,  $N_j = 999$ ,  $N_k = 999$

Test Case 11:  $N_i = 333$ ,  $N_j = 333$ ,  $N_k = 8,991$

Test Case 12:  $N_i = 111$ ,  $N_j = 111$ ,  $N_k = 80,919$

Test Case 13:  $N_i = 37$ ,  $N_j = 37$ ,  $N_k = 728,271$

## Appendix

I. OpenMP CADE Lab Output

II. OpenMP CADE Lonepeak Output Pending

III. CUDA CADE Lab Output

IV. CUDA Lonepeak Output

# 1. CPU - Openmp Results

## 1.1 CADE Lab Performance

Test Case 1:  $N_i = 8,192$ ,  $N_j = 8,192$ ,  $N_k = 16$

Variants	Performance (GFLOPs)
A x B	115.82
At x B	115.25
A x Bt	116.50
At x Bt	115.55

Test Case 2:  $N_i = 4096$ ,  $N_j = 4096$ ,  $N_k = 64$

Variants	Performance (GFLOPs)
A x B	151.04
At x B	149.09
A x Bt	151.06
At x Bt	148.55

Test Case 3:  $N_i = 2048$ ,  $N_j = 2048$ ,  $N_k = 256$

Variants	Performance (GFLOPs)
A x B	156.02
At x B	153.43
A x Bt	153.58
At x Bt	149.81

Test Case 4:  $N_i = 1024$ ,  $N_j = 1024$ ,  $N_k = 1024$

Variants	Performance (GFLOPs)
A x B	151.71
At x B	139.84
A x Bt	140.23
At x Bt	128.75

Test Case 5:  $N_i = 256$ ,  $N_j = 256$ ,  $N_k = 16,384$

Variants	Performance (GFLOPs)
A x B	116.80
At x B	94.12
A x Bt	99.68
At x Bt	83.24

Test Case 6:  $N_i = 64$ ,  $N_j = 64$ ,  $N_k = 262,144$

Variants	Performance (GFLOPs)
A x B	75.42
At x B	44.55
A x Bt	53.60
At x Bt	38.24

Test Case 7:  $N_i = 16$ ,  $N_j = 16$ ,  $N_k = 4,194,304$

Variants	Performance (GFLOPs)
A x B	27.61
At x B	16.79
A x Bt	20.25
At x Bt	15.54

Test Case 8:  $N_i = 8,991$ ,  $N_j = 8,991$ ,  $N_k = 37$

Variants	Performance (GFLOPs)
A x B	154.00
At x B	153.67
A x Bt	154.66
At x Bt	153.26

Test Case 9:  $N_i = 2,997$ ,  $N_j = 2,997$ ,  $N_k = 11$

Variants	Performance (GFLOPs)
A x B	162.81
At x B	162.82
A x Bt	160.02
At x Bt	156.99

Test Case 10:  $N_i = 999$ ,  $N_j = 999$ ,  $N_k = 999$

Variants	Performance (GFLOPs)
A x B	149.65
At x B	138.33
A x Bt	138.35
At x Bt	130.56

Test Case 11:  $N_i = 333$ ,  $N_j = 333$ ,  $N_k = 8,991$

Variants	Performance (GFLOPs)
A x B	127.90
At x B	108.62
A x Bt	110.52
At x Bt	93.98

Test Case 12:  $N_i = 111$ ,  $N_j = 111$ ,  $N_k = 80,919$

Variants	Performance (GFLOPs)
A x B	89.64
At x B	54.52
A x Bt	74.65
At x Bt	47.69

Test Case 13:  $N_i = 37$ ,  $N_j = 37$ ,  $N_k = 728,271$

Variants	Performance (GFLOPs)
A x B	70.45
At x B	40.67
A x Bt	46.03
At x Bt	45.77

## 1.2 Lonepeak Performance

Test Case 1:  $N_i = 8,192$ ,  $N_j = 8,192$ ,  $N_k = 16$

Variants	Performance (GFLOPs)
A x B	73.77
At x B	74.16
A x Bt	73.81
At x Bt	73.17

Test Case 2:  $N_i = 4096$ ,  $N_j = 4096$ ,  $N_k = 64$

Variants	Performance (GFLOPs)
A x B	174.80
At x B	171.63
A x Bt	174.03
At x Bt	170.32

Test Case 3:  $N_i = 2048$ ,  $N_j = 2048$ ,  $N_k = 256$

Variants	Performance (GFLOPs)
A x B	185.88
At x B	181.75
A x Bt	181.67
At x Bt	176.98



Test Case 4:  $N_i = 1024$ ,  $N_j = 1024$ ,  $N_k = 1024$

Variants	Performance (GFLOPs)
A x B	164.92
At x B	159.48
A x Bt	168.14
At x Bt	168.00

Test Case 5:  $N_i = 256$ ,  $N_j = 256$ ,  $N_k = 16,384$

Variants	Performance (GFLOPs)
A x B	177.18
At x B	143.22
A x Bt	148.24
At x Bt	129.37

Test Case 6:  $N_i = 64$ ,  $N_j = 64$ ,  $N_k = 262,144$

Variants	Performance (GFLOPs)
A x B	67.42
At x B	50.62
A x Bt	57.34
At x Bt	45.99

Test Case 7:  $N_i = 16$ ,  $N_j = 16$ ,  $N_k = 4,194,304$

Variants	Performance (GFLOPs)
A x B	11.37
At x B	8.17
A x Bt	10.21
At x Bt	7.55

Test Case 8:  $N_i = 8,991$ ,  $N_j = 8,991$ ,  $N_k = 37$

Variants	Performance (GFLOPs)
A x B	151.99
At x B	151.20
A x Bt	151.41
At x Bt	150.33

Test Case 9:  $N_i = 2,997$ ,  $N_j = 2,997$ ,  $N_k = 11$

Variants	Performance (GFLOPs)
A x B	205.53
At x B	199.92
A x Bt	198.34
At x Bt	195.74

Test Case 10:  $N_i = 999$ ,  $N_j = 999$ ,  $N_k = 999$

Variants	Performance (GFLOPs)
A x B	190.88
At x B	180.57
A x Bt	186.01
At x Bt	182.11

Test Case 11:  $N_i = 333$ ,  $N_j = 333$ ,  $N_k = 8,991$

Variants	Performance (GFLOPs)
A x B	128.32
At x B	125.36
A x Bt	134.42
At x Bt	121.04

Test Case 12:  $N_i = 111$ ,  $N_j = 111$ ,  $N_k = 80,919$

Variants	Performance (GFLOPs)
A x B	92.67
At x B	66.99
A x Bt	87.69
At x Bt	64.80

Test Case 13:  $N_i = 37$ ,  $N_j = 37$ ,  $N_k = 728,271$

Variants	Performance (GFLOPs)
A x B	18.57
At x B	16.65
A x Bt	18.42
At x Bt	15.69

## 2. GPU - CUDA Results

### 2.1 CADE Lab Performance

Test Case 1:  $N_i = 8,192$ ,  $N_j = 8,192$ ,  $N_k = 16$

Variants	Performance (GFLOPs)
A x B	798.48
At x B	801.63
A x Bt	846.51
At x Bt	840.31

Test Case 2:  $N_i = 4096$ ,  $N_j = 4096$ ,  $N_k = 64$

Variants	Performance (GFLOPs)
A x B	1750.96
At x B	1863.15
A x Bt	1788.23
At x Bt	1672.41

Test Case 3:  $N_i = 2048$ ,  $N_j = 2048$ ,  $N_k = 256$

Variants	Performance (GFLOPs)
A x B	1858.82
At x B	1918.11
A x Bt	1892.31
At x Bt	1718.58

Test Case 4:  $N_i = 1024$ ,  $N_j = 1024$ ,  $N_k = 1024$

Variants	Performance (GFLOPs)
A x B	1882.17
At x B	1939.95
A x Bt	1931.91

At x Bt	1715.02
---------	---------

Test Case 5:  $N_i = 256$ ,  $N_j = 256$ ,  $N_k = 16,384$

Variants	Performance (GFLOPs)
A x B	940.20
At x B	940.20
A x Bt	940.20
At x Bt	857.96

Test Case 6:  $N_i = 64$ ,  $N_j = 64$ ,  $N_k = 262,144$

Variants	Performance (GFLOPs)
A x B	278.30
At x B	209.01
A x Bt	226.27
At x Bt	170.28

Test Case 7:  $N_i = 16$ ,  $N_j = 16$ ,  $N_k = 4,194,304$

Variants	Performance (GFLOPs)
A x B	31.39
At x B	25.71
A x Bt	26.23
At x Bt	20.62

Test Case 8:  $N_i = 8,991$ ,  $N_j = 8,991$ ,  $N_k = 37$

Variants	Performance (GFLOPs)
A x B	366.17
At x B	371.78
A x Bt	384.09

At x Bt	384.01
---------	--------

Test Case 9:  $N_i = 2,997$ ,  $N_j = 2,997$ ,  $N_k = 11$

Variants	Performance (GFLOPs)
A x B	508.05
At x B	513.08
A x Bt	512.21
At x Bt	514.79

Test Case 10:  $N_i = 999$ ,  $N_j = 999$ ,  $N_k = 999$

Variants	Performance (GFLOPs)
A x B	495.00
At x B	502.98
A x Bt	494.56
At x Bt	510.39

Test Case 11:  $N_i = 333$ ,  $N_j = 333$ ,  $N_k = 8,991$

Variants	Performance (GFLOPs)
A x B	466.09
At x B	398.64
A x Bt	385.36
At x Bt	391.51

Test Case 12:  $N_i = 111$ ,  $N_j = 111$ ,  $N_k = 80,919$

Variants	Performance (GFLOPs)
A x B	301.18
At x B	303.00
A x Bt	312.28
At x Bt	331.36

Test Case 13:  $N_i = 37$ ,  $N_j = 37$ ,  $N_k = 728,271$

Variants	Performance (GFLOPs)
A x B	137.60
At x B	127.91
A x Bt	127.35
At x Bt	112.12

## 2.2 Lonepeak Performance

Test Case 1:  $N_i = 8,192$ ,  $N_j = 8,192$ ,  $N_k = 16$

Variants	Performance (GFLOPs)
A x B	2405.85
At x B	2390.51
A x Bt	2555.85
At x Bt	2534.80

Test Case 2:  $N_i = 4096$ ,  $N_j = 4096$ ,  $N_k = 64$

Variants	Performance (GFLOPs)
A x B	5082.08
At x B	5399.38
A x Bt	5198.21
At x Bt	4893.46

Test Case 3:  $N_i = 2048$ ,  $N_j = 2048$ ,  $N_k = 256$

Variants	Performance (GFLOPs)
A x B	5236.33
At x B	5376.45
A x Bt	5289.99
At x Bt	4690.30

Test Case 4:  $N_i = 1024$ ,  $N_j = 1024$ ,  $N_k = 1024$

Variants	Performance (GFLOPs)
A x B	5159.44
At x B	5282.08
A x Bt	4481.09
At x Bt	4693.91



Test Case 5:  $N_i = 256$ ,  $N_j = 256$ ,  $N_k = 16,384$

Variants	Performance (GFLOPs)
A x B	1662.51
At x B	1427.00
A x Bt	1403.45
At x Bt	1105.73

Test Case 6:  $N_i = 64$ ,  $N_j = 64$ ,  $N_k = 262,144$

Variants	Performance (GFLOPs)
A x B	566.97
At x B	472.26
A x Bt	488.27
At x Bt	381.78

Test Case 7:  $N_i = 16$ ,  $N_j = 16$ ,  $N_k = 4,194,304$

Variants	Performance (GFLOPs)
A x B	38.04
At x B	32.10
A x Bt	36.03
At x Bt	29.73

Test Case 8:  $N_i = 8,991$ ,  $N_j = 8,991$ ,  $N_k = 37$

Variants	Performance (GFLOPs)
A x B	1165.01
At x B	1256.35
A x Bt	1199.15
At x Bt	1000.03

Test Case 9:  $N_i = 2,997$ ,  $N_j = 2,997$ ,  $N_k = 11$

Variants	Performance (GFLOPs)
A x B	1226.92
At x B	1320.13
A x Bt	1288.01
At x Bt	1277.11

Test Case 10:  $N_i = 999$ ,  $N_j = 999$ ,  $N_k = 999$

Variants	Performance (GFLOPs)
A x B	1256.20
At x B	1299.24
A x Bt	1218.42
At x Bt	1295.29

Test Case 11:  $N_i = 333$ ,  $N_j = 333$ ,  $N_k = 8,991$

Variants	Performance (GFLOPs)
A x B	1289.40
At x B	1334.26
A x Bt	1314.53
At x Bt	1326.48

Test Case 12:  $N_i = 111$ ,  $N_j = 111$ ,  $N_k = 80,919$

Variants	Performance (GFLOPs)
A x B	519.58
At x B	527.56
A x Bt	498.67
At x Bt	514.93

Test Case 13:  $N_i = 37$ ,  $N_j = 37$ ,  $N_k = 728,271$

Variants	Performance (GFLOPs)
A x B	185.40
At x B	179.68
A x Bt	172.71
At x Bt	161.15

# Appendix

## I. OpenMP CADE Lab Output

---

Matrix dimension Ni: 8192, Nj 8192, Nk: 16  
Max Threads (from omp\_get\_max\_threads) = 16

A x B Reference sequential performance for AB (in GFLOPS) Min: 3.33; Max: 3.41  
Performance of parallel version for AB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 16.77 92.04 115.82 || 5.03 27.62 34.76  
Worst Performance (GFLOPS || Speedup): 16.74 91.14 114.46 || 4.91 26.72 33.55

At x B Reference sequential performance for ATB (in GFLOPS) Min: 2.47; Max: 2.48  
Performance of parallel version for ATB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 16.48 92.06 115.25 || 6.68 37.30 46.69  
Worst Performance (GFLOPS || Speedup): 15.77 89.89 113.99 || 6.37 36.30 46.03

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 5.90; Max: 5.90  
Performance of parallel version for ABT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 16.91 95.06 116.50 || 2.87 16.12 19.75  
Worst Performance (GFLOPS || Speedup): 16.74 89.83 114.80 || 2.84 15.22 19.45

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 3.49; Max: 3.51  
Performance of parallel version for ATBT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 16.89 84.65 115.55 || 4.84 24.25 33.10  
Worst Performance (GFLOPS || Speedup): 16.49 83.66 108.54 || 4.70 23.81 30.90

---

Matrix dimension Ni: 4096, Nj 4096, Nk: 64  
Max Threads (from omp\_get\_max\_threads) = 16

A x B Reference sequential performance for AB (in GFLOPS) Min: 1.79; Max: 1.80  
Performance of parallel version for AB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 18.04 106.60 151.04 || 10.06 59.47 84.26  
Worst Performance (GFLOPS || Speedup): 18.03 105.51 149.60 || 10.03 58.71 83.25

At x B Reference sequential performance for ATB (in GFLOPS) Min: 1.31; Max: 1.35  
Performance of parallel version for ATB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 17.99 105.46 149.09 || 13.72 80.43 113.70  
Worst Performance (GFLOPS || Speedup): 17.96 105.23 146.43 || 13.26 77.67 108.09

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 3.95; Max: 3.95  
Performance of parallel version for ABT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 18.01 106.16 150.06 || 4.56 26.87 37.97  
Worst Performance (GFLOPS || Speedup): 17.87 105.14 146.90 || 4.52 26.59 37.15

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 1.83; Max: 1.83  
Performance of parallel version for ATBT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 18.00 105.68 148.55 || 9.84 57.80 81.24  
Worst Performance (GFLOPS || Speedup): 17.77 104.40 147.13 || 9.71 57.05 80.40

---

Matrix dimension Ni: 2048, Nj 2048, Nk: 256  
Max Threads (from omp\_get\_max\_threads) = 16

A x B Reference sequential performance for AB (in GFLOPS) Min: 1.57; Max: 1.64  
Performance of parallel version for AB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 18.83 107.41 156.02 || 12.03 68.62 99.67  
Worst Performance (GFLOPS || Speedup): 18.68 105.76 154.45 || 11.41 64.57 94.30

At x B Reference sequential performance for ATB (in GFLOPS) Min: 0.85; Max: 0.92  
Performance of parallel version for ATB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 19.21 106.33 153.43 || 22.70 125.65 181.31  
Worst Performance (GFLOPS || Speedup): 18.80 105.02 149.74 || 20.38 113.83 162.29

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 2.80; Max: 2.85  
Performance of parallel version for ABT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 19.26 106.39 153.58 || 6.89 38.03 54.91  
Worst Performance (GFLOPS || Speedup): 19.17 105.88 147.04 || 6.73 37.14 51.58

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 1.60; Max: 1.60  
Performance of parallel version for ATBT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 19.04 104.71 149.81 || 11.90 65.42 93.60  
Worst Performance (GFLOPS || Speedup): 17.54 103.11 147.76 || 10.95 64.36 92.23

---

Matrix dimension Ni: 1024, Nj 1024, Nk: 1024  
Max Threads (from omp\_get\_max\_threads) = 16

A x B Reference sequential performance for AB (in GFLOPS) Min: 1.60; Max: 1.61  
Performance of parallel version for AB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 19.57 101.41 151.71 || 12.19 63.20 94.55  
Worst Performance (GFLOPS || Speedup): 19.32 100.08 146.54 || 12.02 62.24 91.13

At x B Reference sequential performance for ATB (in GFLOPS) Min: 0.88; Max: 0.89  
Performance of parallel version for ATB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 19.34 99.00 139.84 || 21.94 112.32 158.65  
Worst Performance (GFLOPS || Speedup): 18.93 97.72 134.73 || 21.35 110.18 151.92

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 2.46; Max: 2.47  
Performance of parallel version for ABT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 19.18 99.08 140.23 || 7.79 40.22 56.92  
Worst Performance (GFLOPS || Speedup): 19.03 96.27 131.52 || 7.71 39.01 53.30

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 1.46; Max: 1.57  
Performance of parallel version for ATBT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 18.97 94.12 128.75 || 13.01 64.57 88.33  
Worst Performance (GFLOPS || Speedup): 18.80 92.35 123.61 || 11.99 58.91 78.85

---

Matrix dimension Ni: 256, Nj 256, Nk: 16384  
Max Threads (from omp\_get\_max\_threads) = 16

A x B Reference sequential performance for AB (in GFLOPS) Min: 0.87; Max: 0.87  
Performance of parallel version for AB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 13.63 86.21 116.80 || 15.70 99.29 134.53  
Worst Performance (GFLOPS || Speedup): 13.37 83.48 115.48 || 15.37 95.99 132.78

At x B Reference sequential performance for ATB (in GFLOPS) Min: 0.37; Max: 0.38  
Performance of parallel version for ATB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 12.99 75.36 94.12 || 34.88 202.32 252.70  
Worst Performance (GFLOPS || Speedup): 12.89 66.79 93.27 || 33.58 173.95 242.88

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 2.32; Max: 2.34  
Performance of parallel version for ABT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 13.39 78.17 99.68 || 5.77 33.67 42.93  
Worst Performance (GFLOPS || Speedup): 12.44 77.31 99.04 || 5.33 33.11 42.41

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 1.01; Max: 1.04  
Performance of parallel version for ATBT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 12.94 68.39 83.24 || 12.80 67.66 82.35  
Worst Performance (GFLOPS || Speedup): 12.42 50.45 82.40 || 11.95 48.54 79.29

---

Matrix dimension Ni: 64, Nj 64, Nk: 262144  
Max Threads (from omp\_get\_max\_threads) = 16

A x B Reference sequential performance for AB (in GFLOPS) Min: 0.40; Max: 0.41  
Performance of parallel version for AB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 7.67 44.99 75.42 || 19.16 112.35 188.34  
Worst Performance (GFLOPS || Speedup): 7.67 44.45 74.96 || 18.63 108.05 182.20

At x B Reference sequential performance for ATB (in GFLOPS) Min: 0.16; Max: 0.16  
Performance of parallel version for ATB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 6.69 34.49 44.55 || 42.39 218.35 282.05  
Worst Performance (GFLOPS || Speedup): 6.67 33.99 44.07 || 41.90 213.61 276.94

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 2.26; Max: 2.27  
Performance of parallel version for ABT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 6.87 36.01 53.60 || 3.04 15.95 23.73  
Worst Performance (GFLOPS || Speedup): 6.81 35.72 53.15 || 3.00 15.71 23.38

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 0.43; Max: 0.43  
Performance of parallel version for ATBT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 6.24 29.03 38.24 || 14.64 68.11 89.73  
Worst Performance (GFLOPS || Speedup): 6.23 28.58 35.34 || 14.51 66.56 82.29

---

Matrix dimension Ni: 16, Nj 16, Nk: 4194304  
Max Threads (from omp\_get\_max\_threads) = 16

A x B Reference sequential performance for AB (in GFLOPS) Min: 0.70; Max: 0.72  
Performance of parallel version for AB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 8.60 28.46 27.61 || 12.28 40.64 39.41  
Worst Performance (GFLOPS || Speedup): 8.58 23.65 24.63 || 11.91 32.83 34.20

At x B Reference sequential performance for ATB (in GFLOPS) Min: 0.32; Max: 0.32  
Performance of parallel version for ATB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 6.64 16.74 16.79 || 20.78 52.43 52.59  
Worst Performance (GFLOPS || Speedup): 6.62 15.70 16.09 || 20.69 49.06 50.26

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 2.18; Max: 2.19  
Performance of parallel version for ABT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 6.27 15.53 20.25 || 2.87 7.11 9.27  
Worst Performance (GFLOPS || Speedup): 6.18 13.32 17.13 || 2.83 6.09 7.83

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 0.71; Max: 0.72  
Performance of parallel version for ATBT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 4.60 14.49 15.54 || 6.49 20.45 21.92  
Worst Performance (GFLOPS || Speedup): 4.59 13.35 13.62 || 6.37 18.53 18.89

---

Matrix dimension Ni: 8991, Nj 8991, Nk: 37  
Max Threads (from omp\_get\_max\_threads) = 16

A x B Reference sequential performance for AB (in GFLOPS) Min: 3.65; Max: 3.68  
Performance of parallel version for AB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 18.08 113.19 154.00 || 4.95 30.98 42.15  
Worst Performance (GFLOPS || Speedup): 17.94 112.69 153.58 || 4.87 30.60 41.70

At x B Reference sequential performance for ATB (in GFLOPS) Min: 3.28; Max: 3.30  
Performance of parallel version for ATB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 18.27 113.06 153.67 || 5.56 34.43 46.79  
Worst Performance (GFLOPS || Speedup): 18.24 112.23 153.04 || 5.53 34.03 46.41

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 4.79; Max: 4.80  
Performance of parallel version for ABT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 18.23 113.06 154.66 || 3.80 23.59 32.27  
Worst Performance (GFLOPS || Speedup): 18.20 112.64 152.22 || 3.79 23.47 31.72

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 3.57; Max: 3.68  
Performance of parallel version for ATBT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 17.97 112.62 153.26 || 5.04 31.59 42.99  
Worst Performance (GFLOPS || Speedup): 17.88 111.89 151.78 || 4.86 30.42 41.27

---

Matrix dimension Ni: 2997, Nj 2997, Nk: 111  
Max Threads (from omp\_get\_max\_threads) = 16

A x B Reference sequential performance for AB (in GFLOPS) Min: 2.71; Max: 2.72  
Performance of parallel version for AB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 18.72 118.48 162.81 || 6.90 43.66 60.00  
Worst Performance (GFLOPS || Speedup): 18.25 114.56 78.41 || 6.71 42.11 28.82

At x B Reference sequential performance for ATB (in GFLOPS) Min: 2.49; Max: 2.54  
Performance of parallel version for ATB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 18.70 118.43 162.82 || 7.50 47.51 65.32  
Worst Performance (GFLOPS || Speedup): 18.43 106.61 156.45 || 7.26 42.00 61.63

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 3.68; Max: 3.70  
Performance of parallel version for ABT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 18.70 118.27 161.71 || 5.09 32.18 44.00  
Worst Performance (GFLOPS || Speedup): 18.49 116.90 160.36 || 5.00 31.59 43.34

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 2.92; Max: 2.93  
Performance of parallel version for ATBT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 18.54 117.23 160.02 || 6.35 40.13 54.77  
Worst Performance (GFLOPS || Speedup): 18.29 114.75 156.99 || 6.24 39.12 53.52

---

Matrix dimension Ni: 999, Nj 999, Nk: 999  
Max Threads (from omp\_get\_max\_threads) = 16

A x B Reference sequential performance for AB (in GFLOPS) Min: 2.31; Max: 2.32  
Performance of parallel version for AB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 18.88 113.40 149.65 || 8.17 49.09 64.78  
Worst Performance (GFLOPS || Speedup): 18.86 111.59 146.67 || 8.14 48.16 63.30

At x B Reference sequential performance for ATB (in GFLOPS) Min: 1.42; Max: 1.42  
Performance of parallel version for ATB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 18.57 110.53 138.33 || 13.10 77.98 97.59

Worst Performance (GFLOPS || Speedup): 18.48 98.13 135.31 || 13.02 69.15 95.35

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 2.44; Max: 2.44  
Performance of parallel version for ABT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 18.57 110.59 138.35 || 7.61 45.31 56.69  
Worst Performance (GFLOPS || Speedup): 18.49 109.95 136.47 || 7.57 45.01 55.87

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 2.31; Max: 2.32  
Performance of parallel version for ATBT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 18.29 107.25 130.56 || 7.92 46.44 56.53  
Worst Performance (GFLOPS || Speedup): 17.99 105.78 124.50 || 7.74 45.50 53.56

---

Matrix dimension Ni: 333, Nj 333, Nk: 8991  
Max Threads (from omp\_get\_max\_threads) = 16

A x B Reference sequential performance for AB (in GFLOPS) Min: 1.47; Max: 1.51  
Performance of parallel version for AB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 17.39 90.10 127.90 || 11.83 61.28 86.99  
Worst Performance (GFLOPS || Speedup): 17.37 88.90 124.20 || 11.47 58.70 82.00

At x B Reference sequential performance for ATB (in GFLOPS) Min: 0.78; Max: 0.79  
Performance of parallel version for ATB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 16.58 81.56 108.62 || 21.30 104.81 139.59  
Worst Performance (GFLOPS || Speedup): 16.50 80.56 104.45 || 21.01 102.57 132.97

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 2.30; Max: 2.35  
Performance of parallel version for ABT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 16.84 83.56 110.52 || 7.33 36.40 48.14  
Worst Performance (GFLOPS || Speedup): 16.31 81.70 106.11 || 6.94 34.75 45.13

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 1.44; Max: 1.44  
Performance of parallel version for ATBT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 16.08 76.57 93.98 || 11.16 53.14 65.22  
Worst Performance (GFLOPS || Speedup): 15.83 75.42 88.41 || 10.96 52.21 61.20

---

Matrix dimension Ni: 111, Nj 111, Nk: 80919  
Max Threads (from omp\_get\_max\_threads) = 16

A x B Reference sequential performance for AB (in GFLOPS) Min: 1.04; Max: 1.04  
Performance of parallel version for AB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 8.13 50.81 89.64 || 7.82 48.87 86.21  
Worst Performance (GFLOPS || Speedup): 7.99 50.53 88.94 || 7.66 48.47 85.32

At x B Reference sequential performance for ATB (in GFLOPS) Min: 0.55; Max: 0.55  
Performance of parallel version for ATB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 6.90 34.63 54.52 || 12.53 62.90 99.02  
Worst Performance (GFLOPS || Speedup): 6.87 34.45 52.60 || 12.39 62.16 94.90

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 2.28; Max: 2.28  
Performance of parallel version for ABT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 7.86 46.22 74.65 || 3.45 20.30 32.79  
Worst Performance (GFLOPS || Speedup): 7.83 45.64 74.01 || 3.43 20.03 32.48

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 0.99; Max: 1.05  
Performance of parallel version for ATBT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 7.02 32.41 47.69 || 7.06 32.58 47.94  
Worst Performance (GFLOPS || Speedup): 6.79 32.17 46.39 || 6.49 30.75 44.34



---

Matrix dimension Ni: 37, Nj 37, Nk: 728271  
Max Threads (from omp\_get\_max\_threads) = 16

A x B Reference sequential performance for AB (in GFLOPS) Min: 0.43; Max: 0.44  
Performance of parallel version for AB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 7.77 41.92 70.45 || 17.95 96.82 162.74  
Worst Performance (GFLOPS || Speedup): 7.74 38.62 66.22 || 17.69 88.27 151.34

At x B Reference sequential performance for ATB (in GFLOPS) Min: 0.20; Max: 0.20  
Performance of parallel version for ATB (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 5.03 25.86 40.67 || 25.12 129.24 203.26  
Worst Performance (GFLOPS || Speedup): 4.92 25.71 36.71 || 24.34 127.31 181.74

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 2.25; Max: 2.29  
Performance of parallel version for ABT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 7.28 33.68 46.03 || 3.23 14.95 20.43  
Worst Performance (GFLOPS || Speedup): 7.19 33.29 45.77 || 3.14 14.52 19.96

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 0.45; Max: 0.46  
Performance of parallel version for ATBT (in GFLOPS) 1/7/15 using threads  
Best Performance (GFLOPS || Speedup): 4.93 22.43 30.92 || 11.01 50.11 69.08  
Worst Performance (GFLOPS || Speedup): 4.91 22.35 30.77 || 10.68 48.59 66.90

## II. OpenMP Lonepeak Output

\*\*\* Assigned Lonepeak Node: lp113

---

Matrix dimension Ni: 8192, Nj 8192, Nk: 16  
Max Threads (from omp\_get\_max\_threads) = 40

A x B Reference sequential performance for AB (in GFLOPS) Min: 1.77; Max: 1.77  
Performance of parallel version for AB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 8.88 74.88 73.77 || 5.02 42.30 41.67  
Worst Performance (GFLOPS || Speedup): 8.87 70.77 70.48 || 5.01 39.97 39.80

At x B Reference sequential performance for ATB (in GFLOPS) Min: 1.29; Max: 1.29  
Performance of parallel version for ATB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 8.87 74.48 74.16 || 6.88 57.81 57.57  
Worst Performance (GFLOPS || Speedup): 8.86 73.14 63.71 || 6.87 56.75 49.43

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 3.54; Max: 3.55  
Performance of parallel version for ABT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 8.90 74.39 73.81 || 2.51 21.02 20.85  
Worst Performance (GFLOPS || Speedup): 8.85 72.96 68.45 || 2.49 20.53 19.26

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 1.82; Max: 1.82  
Performance of parallel version for ATBT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 8.98 74.69 73.17 || 4.93 41.02 40.18  
Worst Performance (GFLOPS || Speedup): 8.88 74.10 66.96 || 4.87 40.68 36.75

---

Matrix dimension Ni: 4096, Nj 4096, Nk: 64  
Max Threads (from omp\_get\_max\_threads) = 40

A x B Reference sequential performance for AB (in GFLOPS) Min: 1.14; Max: 1.14  
Performance of parallel version for AB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 9.87 165.41 174.80 || 8.63 144.73 152.94  
Worst Performance (GFLOPS || Speedup): 9.86 155.57 141.11 || 8.63 136.08 123.44

At x B Reference sequential performance for ATB (in GFLOPS) Min: 0.70; Max: 0.70  
Performance of parallel version for ATB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 9.82 140.78 171.63 || 14.00 200.68 244.66  
Worst Performance (GFLOPS || Speedup): 9.82 137.54 143.19 || 13.99 196.01 204.07

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 2.68; Max: 2.68  
Performance of parallel version for ABT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 9.85 149.13 174.03 || 3.68 55.66 64.96  
Worst Performance (GFLOPS || Speedup): 9.82 142.30 127.06 || 3.66 53.04 47.36

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 1.23; Max: 1.23  
Performance of parallel version for ATBT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 9.83 150.02 170.32 || 7.99 121.95 138.45  
Worst Performance (GFLOPS || Speedup): 9.81 136.81 161.55 || 7.97 111.15 131.26

---

Matrix dimension Ni: 2048, Nj 2048, Nk: 256  
Max Threads (from omp\_get\_max\_threads) = 40

A x B Reference sequential performance for AB (in GFLOPS) Min: 0.92; Max: 0.92  
Performance of parallel version for AB (in GFLOPS) 1/19/39 using threads

Best Performance (GFLOPS || Speedup): 10.31 171.88 185.88 || 11.18 186.33 201.51  
Worst Performance (GFLOPS || Speedup): 10.31 161.15 158.47 || 11.17 174.59 171.68

A x B Reference sequential performance for ATB (in GFLOPS) Min: 0.47; Max: 0.47  
Performance of parallel version for ATB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 10.24 168.57 181.75 || 21.63 356.16 384.02  
Worst Performance (GFLOPS || Speedup): 10.23 146.58 168.90 || 21.62 309.68 356.84

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 1.97; Max: 1.97  
Performance of parallel version for ABT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 10.38 167.56 181.67 || 5.27 85.14 92.31  
Worst Performance (GFLOPS || Speedup): 10.37 145.69 164.33 || 5.27 74.01 83.47

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 0.85; Max: 0.85  
Performance of parallel version for ATBT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 10.30 164.22 176.98 || 12.07 192.30 207.24  
Worst Performance (GFLOPS || Speedup): 10.28 145.54 150.41 || 12.04 170.40 176.10

---

Matrix dimension Ni: 1024, Nj 1024, Nk: 1024  
Max Threads (from omp\_get\_max\_threads) = 40

A x B Reference sequential performance for AB (in GFLOPS) Min: 0.90; Max: 0.90  
Performance of parallel version for AB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 10.09 133.56 164.92 || 11.19 148.16 182.95  
Worst Performance (GFLOPS || Speedup): 10.09 121.37 134.52 || 11.18 134.57 149.15

At x B Reference sequential performance for ATB (in GFLOPS) Min: 0.34; Max: 0.34  
Performance of parallel version for ATB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 9.96 121.31 159.48 || 29.25 356.08 468.10  
Worst Performance (GFLOPS || Speedup): 9.96 106.86 133.98 || 29.18 313.04 392.47

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 1.78; Max: 1.78  
Performance of parallel version for ABT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 10.32 125.28 168.14 || 5.80 70.45 94.55  
Worst Performance (GFLOPS || Speedup): 9.95 119.65 159.88 || 5.59 67.27 89.88

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 0.86; Max: 0.86  
Performance of parallel version for ATBT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 9.84 128.35 168.00 || 11.50 149.97 196.30  
Worst Performance (GFLOPS || Speedup): 9.80 117.17 132.83 || 11.44 136.81 155.10

---

Matrix dimension Ni: 256, Nj 256, Nk: 16384  
Max Threads (from omp\_get\_max\_threads) = 40

A x B Reference sequential performance for AB (in GFLOPS) Min: 0.75; Max: 0.75  
Performance of parallel version for AB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 8.87 145.89 177.18 || 11.83 194.61 236.35  
Worst Performance (GFLOPS || Speedup): 8.87 118.32 165.00 || 11.75 156.75 218.60

At x B Reference sequential performance for ATB (in GFLOPS) Min: 0.38; Max: 0.38  
Performance of parallel version for ATB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 8.05 116.45 143.22 || 21.33 308.43 379.33  
Worst Performance (GFLOPS || Speedup): 8.05 112.80 137.23 || 21.29 298.41 363.05

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 1.72; Max: 1.72  
Performance of parallel version for ABT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 8.72 130.16 148.24 || 5.06 75.49 85.98

Worst Performance (GFLOPS || Speedup): 8.34 111.66 139.68 || 4.84 64.75 81.00

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 0.72; Max: 0.72  
Performance of parallel version for ATBT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 8.21 114.57 129.37 || 11.41 159.22 179.80  
Worst Performance (GFLOPS || Speedup): 7.98 108.54 121.02 || 11.07 150.45 167.75

---

Matrix dimension Ni: 64, Nj 64, Nk: 262144  
Max Threads (from omp\_get\_max\_threads) = 40

A x B Reference sequential performance for AB (in GFLOPS) Min: 0.22; Max: 0.22  
Performance of parallel version for AB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 4.33 41.01 67.42 || 19.31 182.99 300.85  
Worst Performance (GFLOPS || Speedup): 4.32 40.86 60.66 || 19.27 182.23 270.51

At x B Reference sequential performance for ATB (in GFLOPS) Min: 0.10; Max: 0.10  
Performance of parallel version for ATB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 3.12 35.12 50.62 || 32.82 369.49 532.56  
Worst Performance (GFLOPS || Speedup): 3.12 32.99 48.67 || 32.77 347.03 511.94

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 1.63; Max: 1.63  
Performance of parallel version for ABT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 3.89 40.00 57.34 || 2.38 24.53 35.15  
Worst Performance (GFLOPS || Speedup): 3.88 39.87 56.29 || 2.38 24.42 34.48

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 0.18; Max: 0.18  
Performance of parallel version for ATBT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 3.37 34.20 45.99 || 18.21 185.04 248.77  
Worst Performance (GFLOPS || Speedup): 3.36 33.68 44.87 || 18.15 182.17 242.72

---

Matrix dimension Ni: 16, Nj 16, Nk: 4194304  
Max Threads (from omp\_get\_max\_threads) = 40

A x B Reference sequential performance for AB (in GFLOPS) Min: 0.37; Max: 0.37  
Performance of parallel version for AB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 5.35 11.41 11.37 || 14.32 30.56 30.45  
Worst Performance (GFLOPS || Speedup): 5.35 10.87 11.18 || 14.31 29.09 29.93

At x B Reference sequential performance for ATB (in GFLOPS) Min: 0.18; Max: 0.18  
Performance of parallel version for ATB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 3.10 8.31 8.17 || 17.45 46.73 45.93  
Worst Performance (GFLOPS || Speedup): 3.05 8.10 8.13 || 17.16 45.55 45.67

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 1.59; Max: 1.59  
Performance of parallel version for ABT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 3.31 10.07 10.21 || 2.08 6.32 6.41  
Worst Performance (GFLOPS || Speedup): 3.30 10.06 10.17 || 2.07 6.31 6.38

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 0.31; Max: 0.31  
Performance of parallel version for ATBT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 2.60 7.48 7.55 || 8.41 24.25 24.49  
Worst Performance (GFLOPS || Speedup): 2.59 7.47 7.51 || 8.40 24.20 24.33

---

Matrix dimension Ni: 8991, Nj 8991, Nk: 37  
Max Threads (from omp\_get\_max\_threads) = 40

A x B Reference sequential performance for AB (in GFLOPS) Min: 2.01; Max: 2.01  
Performance of parallel version for AB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 9.79 142.99 151.99 || 4.87 71.18 75.66  
Worst Performance (GFLOPS || Speedup): 9.79 139.39 149.04 || 4.87 69.32 74.13

At x B Reference sequential performance for ATB (in GFLOPS) Min: 1.71; Max: 1.71  
Performance of parallel version for ATB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 9.77 140.15 151.20 || 5.72 82.12 88.59  
Worst Performance (GFLOPS || Speedup): 9.77 138.24 145.32 || 5.71 80.78 84.92

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 2.86; Max: 2.86  
Performance of parallel version for ABT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 9.74 139.97 151.41 || 3.40 48.92 52.93  
Worst Performance (GFLOPS || Speedup): 9.74 138.58 147.78 || 3.40 48.39 51.60

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 2.30; Max: 2.30  
Performance of parallel version for ATBT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 9.72 139.38 150.33 || 4.23 60.68 65.45  
Worst Performance (GFLOPS || Speedup): 9.71 136.71 138.86 || 4.22 59.48 60.41

---

Matrix dimension Ni: 2997, Nj 2997, Nk: 111  
Max Threads (from omp\_get\_max\_threads) = 40

A x B Reference sequential performance for AB (in GFLOPS) Min: 1.74; Max: 1.74  
Performance of parallel version for AB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 9.99 170.47 205.53 || 5.75 98.19 118.39  
Worst Performance (GFLOPS || Speedup): 9.98 160.23 162.77 || 5.75 92.28 93.74

At x B Reference sequential performance for ATB (in GFLOPS) Min: 1.59; Max: 1.59  
Performance of parallel version for ATB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 9.94 167.24 199.92 || 6.27 105.47 126.09  
Worst Performance (GFLOPS || Speedup): 9.94 164.55 163.18 || 6.25 103.52 102.66

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 2.31; Max: 2.31  
Performance of parallel version for ABT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 9.94 167.32 198.34 || 4.30 72.39 85.81  
Worst Performance (GFLOPS || Speedup): 9.93 162.69 133.66 || 4.29 70.38 57.82

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 1.91; Max: 1.92  
Performance of parallel version for ATBT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 9.88 136.68 195.74 || 5.17 71.49 102.39  
Worst Performance (GFLOPS || Speedup): 9.88 128.76 134.13 || 5.16 67.22 70.02

---

Matrix dimension Ni: 999, Nj 999, Nk: 999  
Max Threads (from omp\_get\_max\_threads) = 40

A x B Reference sequential performance for AB (in GFLOPS) Min: 1.62; Max: 1.62  
Performance of parallel version for AB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 9.86 151.74 190.88 || 6.08 93.62 117.77  
Worst Performance (GFLOPS || Speedup): 9.86 134.60 153.53 || 6.08 83.01 94.69

At x B Reference sequential performance for ATB (in GFLOPS) Min: 0.50; Max: 0.50  
Performance of parallel version for ATB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 9.70 138.60 180.57 || 19.30 275.69 359.16  
Worst Performance (GFLOPS || Speedup): 9.67 136.63 151.44 || 19.24 271.70 301.16

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 1.75; Max: 1.75

Performance of parallel version for ABT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 9.70 136.61 186.01 || 5.55 78.19 106.46  
Worst Performance (GFLOPS || Speedup): 9.67 135.92 171.05 || 5.53 77.78 97.88

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 1.70; Max: 1.71  
Performance of parallel version for ATBT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 9.56 140.00 182.11 || 5.61 82.17 106.88  
Worst Performance (GFLOPS || Speedup): 9.46 133.64 167.28 || 5.55 78.37 98.10

---

Matrix dimension Ni: 333, Nj 333, Nk: 8991  
Max Threads (from omp\_get\_max\_threads) = 40

A x B Reference sequential performance for AB (in GFLOPS) Min: 0.77; Max: 0.77  
Performance of parallel version for AB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 9.17 99.82 128.32 || 11.88 129.39 166.35  
Worst Performance (GFLOPS || Speedup): 9.16 89.25 121.87 || 11.88 115.67 157.96

At x B Reference sequential performance for ATB (in GFLOPS) Min: 0.40; Max: 0.40  
Performance of parallel version for ATB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 8.50 94.82 125.36 || 21.43 238.99 315.98  
Worst Performance (GFLOPS || Speedup): 8.48 91.01 112.33 || 21.36 229.28 282.99

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 1.70; Max: 1.70  
Performance of parallel version for ABT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 8.78 90.78 134.42 || 5.16 53.32 78.95  
Worst Performance (GFLOPS || Speedup): 8.61 87.40 121.04 || 5.05 51.31 71.06

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 0.77; Max: 0.77  
Performance of parallel version for ATBT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 8.11 89.24 117.51 || 10.53 115.88 152.58  
Worst Performance (GFLOPS || Speedup): 8.04 82.03 100.04 || 10.42 106.32 129.67

---

Matrix dimension Ni: 111, Nj 111, Nk: 80919  
Max Threads (from omp\_get\_max\_threads) = 40

A x B Reference sequential performance for AB (in GFLOPS) Min: 0.66; Max: 0.66  
Performance of parallel version for AB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 4.68 54.23 92.67 || 7.06 81.77 139.73  
Worst Performance (GFLOPS || Speedup): 4.67 52.84 87.97 || 7.05 79.66 132.61

At x B Reference sequential performance for ATB (in GFLOPS) Min: 0.40; Max: 0.40  
Performance of parallel version for ATB (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 3.56 42.00 66.99 || 9.01 106.19 169.39  
Worst Performance (GFLOPS || Speedup): 3.56 40.19 65.22 || 8.98 101.53 164.76

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 1.63; Max: 1.64  
Performance of parallel version for ABT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 4.28 53.32 87.69 || 2.62 32.65 53.68  
Worst Performance (GFLOPS || Speedup): 4.25 53.08 85.14 || 2.59 32.42 52.00

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 0.69; Max: 0.69  
Performance of parallel version for ATBT (in GFLOPS) 1/19/39 using threads  
Best Performance (GFLOPS || Speedup): 3.87 42.22 64.80 || 5.58 60.85 93.40  
Worst Performance (GFLOPS || Speedup): 3.83 41.47 63.77 || 5.51 59.72 91.83

---

Matrix dimension Ni: 37, Nj 37, Nk: 728271

Max Threads (from omp\_get\_max\_threads) = 40

A x B Reference sequential performance for AB (in GFLOPS) Min: 0.25; Max: 0.25

Performance of parallel version for AB (in GFLOPS) 1/19/39 using threads

Best Performance (GFLOPS || Speedup): 4.72 44.37 18.57 || 18.95 178.30 74.64

Worst Performance (GFLOPS || Speedup): 4.71 41.45 17.28 || 18.90 166.46 69.40

At x B Reference sequential performance for ATB (in GFLOPS) Min: 0.11; Max: 0.11

Performance of parallel version for ATB (in GFLOPS) 1/19/39 using threads

Best Performance (GFLOPS || Speedup): 2.53 29.69 16.65 || 22.87 268.66 150.63

Worst Performance (GFLOPS || Speedup): 2.52 22.75 16.39 || 22.81 205.75 148.20

A x Bt Reference sequential performance for ABT (in GFLOPS) Min: 1.60; Max: 1.60

Performance of parallel version for ABT (in GFLOPS) 1/19/39 using threads

Best Performance (GFLOPS || Speedup): 3.80 41.10 18.42 || 2.38 25.76 11.54

Worst Performance (GFLOPS || Speedup): 3.79 40.95 16.76 || 2.37 25.63 10.49

At x Bt Reference sequential performance for ATBT (in GFLOPS) Min: 0.20; Max: 0.20

Performance of parallel version for ATBT (in GFLOPS) 1/19/39 using threads

Best Performance (GFLOPS || Speedup): 2.35 29.22 15.69 || 11.63 144.82 77.75

Worst Performance (GFLOPS || Speedup): 2.34 22.10 15.13 || 11.58 109.49 74.94

### III. CUDA CADE Lab Output

---

Matrix dimension Ni: 8192, Nj 8192, Nk: 16

Trial 0: AB GFLOPS: 335.41

Trial 1: AB GFLOPS: 798.12

Trial 2: AB GFLOPS: 798.48

Trial 0: ATB GFLOPS: 769.13

Trial 1: ATB GFLOPS: 791.14

Trial 2: ATB GFLOPS: 801.63

Trial 0: ABT GFLOPS: 819.16

Trial 1: ABT GFLOPS: 845.40

Trial 2: ABT GFLOPS: 846.51

Trial 0: ATBT GFLOPS: 813.59

Trial 1: ATBT GFLOPS: 840.82

Trial 2: ATBT GFLOPS: 840.31

---

Matrix dimension Ni: 4096, Nj 4096, Nk: 64

Trial 0: AB GFLOPS: 809.19

Trial 1: AB GFLOPS: 1767.98

Trial 2: AB GFLOPS: 1750.96

Trial 0: ATB GFLOPS: 1740.78

Trial 1: ATB GFLOPS: 1857.79

Trial 2: ATB GFLOPS: 1863.15

Trial 0: ABT GFLOPS: 1682.52

Trial 1: ABT GFLOPS: 1782.96

Trial 2: ABT GFLOPS: 1788.23

Trial 0: ATBT GFLOPS: 1529.30

Trial 1: ATBT GFLOPS: 1677.93

Trial 2: ATBT GFLOPS: 1672.41

---

Matrix dimension Ni: 2048, Nj 2048, Nk: 256

Trial 0: AB GFLOPS: 953.21

Trial 1: AB GFLOPS: 1867.82

Trial 2: AB GFLOPS: 1858.82

Trial 0: ATB GFLOPS: 1782.77

Trial 1: ATB GFLOPS: 1921.84

Trial 2: ATB GFLOPS: 1918.11

Trial 0: ABT GFLOPS: 1721.93

Trial 1: ABT GFLOPS: 1888.32

Trial 2: ABT GFLOPS: 1892.31

Trial 0: ATBT GFLOPS: 1554.63

Trial 1: ATBT GFLOPS: 1719.11



Trial 2: ATBT GFLOPS: 1718.58

---

Matrix dimension Ni: 1024, Nj 1024, Nk: 1024

Trial 0: AB GFLOPS: 648.77

Trial 1: AB GFLOPS: 1799.07

Trial 2: AB GFLOPS: 1882.17

Trial 0: ATB GFLOPS: 1748.40

Trial 1: ATB GFLOPS: 1934.75

Trial 2: ATB GFLOPS: 1939.95

Trial 0: ABT GFLOPS: 1742.59

Trial 1: ABT GFLOPS: 1840.16

Trial 2: ABT GFLOPS: 1931.91

Trial 0: ATBT GFLOPS: 1619.70

Trial 1: ATBT GFLOPS: 1714.72

Trial 2: ATBT GFLOPS: 1715.02

---

Matrix dimension Ni: 256, Nj 256, Nk: 16384

Trial 0: AB GFLOPS: 475.47

Trial 1: AB GFLOPS: 949.09

Trial 2: AB GFLOPS: 940.20

Trial 0: ATB GFLOPS: 909.70

Trial 1: ATB GFLOPS: 953.25

Trial 2: ATB GFLOPS: 950.71

Trial 0: ABT GFLOPS: 889.94

Trial 1: ABT GFLOPS: 930.92

Trial 2: ABT GFLOPS: 931.33

Trial 0: ATBT GFLOPS: 830.41

Trial 1: ATBT GFLOPS: 858.51

Trial 2: ATBT GFLOPS: 857.96

---

Matrix dimension Ni: 64, Nj 64, Nk: 262144

Trial 0: AB GFLOPS: 231.10

Trial 1: AB GFLOPS: 278.73

Trial 2: AB GFLOPS: 278.30

Trial 0: ATB GFLOPS: 206.43

Trial 1: ATB GFLOPS: 208.99

Trial 2: ATB GFLOPS: 209.01

Trial 0: ABT GFLOPS: 226.52

Trial 1: ABT GFLOPS: 226.00

Trial 2: ABT GFLOPS: 226.27

Trial 0: ATBT GFLOPS: 166.59

Trial 1: ATBT GFLOPS: 167.86

Trial 2: ATBT GFLOPS: 170.28

---

Matrix dimension Ni: 16, Nj 16, Nk: 4194304

Trial 0: AB GFLOPS: 28.63

Trial 1: AB GFLOPS: 30.29

Trial 2: AB GFLOPS: 31.39

Trial 0: ATB GFLOPS: 25.68

Trial 1: ATB GFLOPS: 25.72

Trial 2: ATB GFLOPS: 25.71

Trial 0: ABT GFLOPS: 26.21

Trial 1: ABT GFLOPS: 26.23

Trial 2: ABT GFLOPS: 26.23

Trial 0: ATBT GFLOPS: 20.60

Trial 1: ATBT GFLOPS: 20.62

Trial 2: ATBT GFLOPS: 20.62

---

Matrix dimension Ni: 8991, Nj 8991, Nk: 37

Trial 0: AB GFLOPS: 331.36

Trial 1: AB GFLOPS: 366.10

Trial 2: AB GFLOPS: 366.17

Trial 0: ATB GFLOPS: 369.31

Trial 1: ATB GFLOPS: 371.80

Trial 2: ATB GFLOPS: 371.78

Trial 0: ABT GFLOPS: 382.02

Trial 1: ABT GFLOPS: 383.86

Trial 2: ABT GFLOPS: 384.09

Trial 0: ATBT GFLOPS: 382.29

Trial 1: ATBT GFLOPS: 384.00

Trial 2: ATBT GFLOPS: 384.01

---

Matrix dimension Ni: 2997, Nj 2997, Nk: 111

Trial 0: AB GFLOPS: 321.33

Trial 1: AB GFLOPS: 507.61

Trial 2: AB GFLOPS: 508.05

Trial 0: ATB GFLOPS: 501.84

Trial 1: ATB GFLOPS: 513.10

Trial 2: ATB GFLOPS: 513.08

Trial 0: ABT GFLOPS: 502.10

Trial 1: ABT GFLOPS: 512.01

Trial 2: ABT GFLOPS: 512.21

Trial 0: ATBT GFLOPS: 505.61

Trial 1: ATBT GFLOPS: 514.85

Trial 2: ATBT GFLOPS: 514.79

---

Matrix dimension Ni: 999, Nj 999, Nk: 999

Trial 0: AB GFLOPS: 258.24  
Trial 1: AB GFLOPS: 496.28  
Trial 2: AB GFLOPS: 495.00

Trial 0: ATB GFLOPS: 493.68  
Trial 1: ATB GFLOPS: 503.05  
Trial 2: ATB GFLOPS: 502.98

Trial 0: ABT GFLOPS: 487.18  
Trial 1: ABT GFLOPS: 494.74  
Trial 2: ABT GFLOPS: 494.56

Trial 0: ATBT GFLOPS: 500.80  
Trial 1: ATBT GFLOPS: 508.72  
Trial 2: ATBT GFLOPS: 510.39

---

Matrix dimension Ni: 333, Nj 333, Nk: 8991

Trial 0: AB GFLOPS: 52.10  
Trial 1: AB GFLOPS: 472.88  
Trial 2: AB GFLOPS: 466.09

Trial 0: ATB GFLOPS: 391.54  
Trial 1: ATB GFLOPS: 384.30  
Trial 2: ATB GFLOPS: 398.64

Trial 0: ABT GFLOPS: 386.31  
Trial 1: ABT GFLOPS: 392.61  
Trial 2: ABT GFLOPS: 385.36

Trial 0: ATBT GFLOPS: 386.17  
Trial 1: ATBT GFLOPS: 391.95  
Trial 2: ATBT GFLOPS: 391.51

---

Matrix dimension Ni: 111, Nj 111, Nk: 80919

Trial 0: AB GFLOPS: 240.45  
Trial 1: AB GFLOPS: 298.68  
Trial 2: AB GFLOPS: 301.18

Trial 0: ATB GFLOPS: 309.02  
Trial 1: ATB GFLOPS: 311.93  
Trial 2: ATB GFLOPS: 303.00

Trial 0: ABT GFLOPS: 307.72  
Trial 1: ABT GFLOPS: 312.63  
Trial 2: ABT GFLOPS: 312.28

Trial 0: ATBT GFLOPS: 327.60  
Trial 1: ATBT GFLOPS: 331.70  
Trial 2: ATBT GFLOPS: 331.36

---

Matrix dimension Ni: 37, Nj 37, Nk: 728271

Trial 0: AB GFLOPS: 78.85

Trial 1: AB GFLOPS: 137.74  
Trial 2: AB GFLOPS: 137.60

Trial 0: ATB GFLOPS: 127.02  
Trial 1: ATB GFLOPS: 128.66  
Trial 2: ATB GFLOPS: 127.91

Trial 0: ABT GFLOPS: 126.59  
Trial 1: ABT GFLOPS: 126.68  
Trial 2: ABT GFLOPS: 127.35

Trial 0: ATBT GFLOPS: 111.51  
Trial 1: ATBT GFLOPS: 112.73  
Trial 2: ATBT GFLOPS: 112.12

## IV. CUDA Lonepeak Output

\*\*\* Assigned Lonepeak Node: lp234

---

Matrix dimension Ni: 8192, Nj 8192, Nk: 16

Trial 0: AB GFLOPS: 2354.70  
Trial 1: AB GFLOPS: 2381.35  
Trial 2: AB GFLOPS: 2405.85

Trial 0: ATB GFLOPS: 2378.06  
Trial 1: ATB GFLOPS: 2394.35  
Trial 2: ATB GFLOPS: 2390.51

Trial 0: ABT GFLOPS: 2537.10  
Trial 1: ABT GFLOPS: 2561.21  
Trial 2: ABT GFLOPS: 2555.85

Trial 0: ATBT GFLOPS: 2526.12  
Trial 1: ATBT GFLOPS: 2532.89  
Trial 2: ATBT GFLOPS: 2534.80

---

Matrix dimension Ni: 4096, Nj 4096, Nk: 64

Trial 0: AB GFLOPS: 4995.45  
Trial 1: AB GFLOPS: 5068.26  
Trial 2: AB GFLOPS: 5082.08

Trial 0: ATB GFLOPS: 5289.58  
Trial 1: ATB GFLOPS: 5362.70  
Trial 2: ATB GFLOPS: 5399.38

Trial 0: ABT GFLOPS: 5063.29  
Trial 1: ABT GFLOPS: 5191.77  
Trial 2: ABT GFLOPS: 5198.21

Trial 0: ATBT GFLOPS: 4818.96  
Trial 1: ATBT GFLOPS: 4881.00  
Trial 2: ATBT GFLOPS: 4893.46

---

Matrix dimension Ni: 2048, Nj 2048, Nk: 256

Trial 0: AB GFLOPS: 5011.86  
Trial 1: AB GFLOPS: 5265.09  
Trial 2: AB GFLOPS: 5236.33

Trial 0: ATB GFLOPS: 5200.22  
Trial 1: ATB GFLOPS: 5334.57  
Trial 2: ATB GFLOPS: 5376.45

Trial 0: ABT GFLOPS: 5087.86  
Trial 1: ABT GFLOPS: 5267.99  
Trial 2: ABT GFLOPS: 5289.99

Trial 0: ATBT GFLOPS: 4570.83  
Trial 1: ATBT GFLOPS: 4680.82  
Trial 2: ATBT GFLOPS: 4690.30

---

Matrix dimension Ni: 1024, Nj 1024, Nk: 1024

Trial 0: AB GFLOPS: 4912.44  
Trial 1: AB GFLOPS: 5149.94  
Trial 2: AB GFLOPS: 5159.44

Trial 0: ATB GFLOPS: 5180.55  
Trial 1: ATB GFLOPS: 5271.71  
Trial 2: ATB GFLOPS: 5282.08

Trial 0: ABT GFLOPS: 4418.55  
Trial 1: ABT GFLOPS: 4459.06  
Trial 2: ABT GFLOPS: 4481.09

Trial 0: ATBT GFLOPS: 4622.78  
Trial 1: ATBT GFLOPS: 4677.23  
Trial 2: ATBT GFLOPS: 4693.91

---

Matrix dimension Ni: 256, Nj 256, Nk: 16384

Trial 0: AB GFLOPS: 1642.77  
Trial 1: AB GFLOPS: 1662.63  
Trial 2: AB GFLOPS: 1662.51

Trial 0: ATB GFLOPS: 1410.06  
Trial 1: ATB GFLOPS: 1423.28  
Trial 2: ATB GFLOPS: 1427.00

Trial 0: ABT GFLOPS: 1395.63  
Trial 1: ABT GFLOPS: 1402.28  
Trial 2: ABT GFLOPS: 1403.45

Trial 0: ATBT GFLOPS: 1097.30  
Trial 1: ATBT GFLOPS: 1106.04  
Trial 2: ATBT GFLOPS: 1105.73

---

Matrix dimension Ni: 64, Nj 64, Nk: 262144

Trial 0: AB GFLOPS: 565.82  
Trial 1: AB GFLOPS: 565.14  
Trial 2: AB GFLOPS: 566.97

Trial 0: ATB GFLOPS: 470.33  
Trial 1: ATB GFLOPS: 472.19  
Trial 2: ATB GFLOPS: 472.26

Trial 0: ABT GFLOPS: 486.67  
Trial 1: ABT GFLOPS: 488.17  
Trial 2: ABT GFLOPS: 488.27

Trial 0: ATBT GFLOPS: 380.02

Trial 1: ATBT GFLOPS: 381.91  
Trial 2: ATBT GFLOPS: 381.78

---

Matrix dimension Ni: 16, Nj 16, Nk: 4194304

Trial 0: AB GFLOPS: 36.21  
Trial 1: AB GFLOPS: 36.18  
Trial 2: AB GFLOPS: 38.04

Trial 0: ATB GFLOPS: 32.09  
Trial 1: ATB GFLOPS: 32.10  
Trial 2: ATB GFLOPS: 32.10

Trial 0: ABT GFLOPS: 36.02  
Trial 1: ABT GFLOPS: 36.04  
Trial 2: ABT GFLOPS: 36.03

Trial 0: ATBT GFLOPS: 29.73  
Trial 1: ATBT GFLOPS: 29.73  
Trial 2: ATBT GFLOPS: 29.73

---

Matrix dimension Ni: 8991, Nj 8991, Nk: 37

Trial 0: AB GFLOPS: 1164.30  
Trial 1: AB GFLOPS: 1166.14  
Trial 2: AB GFLOPS: 1165.01

Trial 0: ATB GFLOPS: 1254.89  
Trial 1: ATB GFLOPS: 1255.49  
Trial 2: ATB GFLOPS: 1256.35

Trial 0: ABT GFLOPS: 1196.96  
Trial 1: ABT GFLOPS: 1198.58  
Trial 2: ABT GFLOPS: 1199.15

Trial 0: ATBT GFLOPS: 1246.46  
Trial 1: ATBT GFLOPS: 993.75  
Trial 2: ATBT GFLOPS: 1000.03

---

Matrix dimension Ni: 2997, Nj 2997, Nk: 111

Trial 0: AB GFLOPS: 1219.07  
Trial 1: AB GFLOPS: 1224.15  
Trial 2: AB GFLOPS: 1226.92

Trial 0: ATB GFLOPS: 1315.39  
Trial 1: ATB GFLOPS: 1318.95  
Trial 2: ATB GFLOPS: 1320.13

Trial 0: ABT GFLOPS: 1285.27  
Trial 1: ABT GFLOPS: 1287.85  
Trial 2: ABT GFLOPS: 1288.01

Trial 0: ATBT GFLOPS: 1273.74  
Trial 1: ATBT GFLOPS: 1278.39  
Trial 2: ATBT GFLOPS: 1277.11

---

Matrix dimension Ni: 999, Nj 999, Nk: 999

Trial 0: AB GFLOPS: 1247.48  
Trial 1: AB GFLOPS: 1259.91  
Trial 2: AB GFLOPS: 1256.20

Trial 0: ATB GFLOPS: 1291.75  
Trial 1: ATB GFLOPS: 1296.10  
Trial 2: ATB GFLOPS: 1299.24

Trial 0: ABT GFLOPS: 1218.35  
Trial 1: ABT GFLOPS: 1220.31  
Trial 2: ABT GFLOPS: 1218.42

Trial 0: ATBT GFLOPS: 1289.61  
Trial 1: ATBT GFLOPS: 1297.96  
Trial 2: ATBT GFLOPS: 1295.29

---

Matrix dimension Ni: 333, Nj 333, Nk: 8991

Trial 0: AB GFLOPS: 1273.53  
Trial 1: AB GFLOPS: 1288.04  
Trial 2: AB GFLOPS: 1289.40

Trial 0: ATB GFLOPS: 1320.21  
Trial 1: ATB GFLOPS: 1332.32  
Trial 2: ATB GFLOPS: 1334.26

Trial 0: ABT GFLOPS: 1304.49  
Trial 1: ABT GFLOPS: 1313.98  
Trial 2: ABT GFLOPS: 1314.53

Trial 0: ATBT GFLOPS: 1314.53  
Trial 1: ATBT GFLOPS: 1323.61  
Trial 2: ATBT GFLOPS: 1326.48

---

Matrix dimension Ni: 111, Nj 111, Nk: 80919

Trial 0: AB GFLOPS: 517.08  
Trial 1: AB GFLOPS: 518.80  
Trial 2: AB GFLOPS: 519.58

Trial 0: ATB GFLOPS: 520.99  
Trial 1: ATB GFLOPS: 517.62  
Trial 2: ATB GFLOPS: 527.56

Trial 0: ABT GFLOPS: 498.35  
Trial 1: ABT GFLOPS: 504.36  
Trial 2: ABT GFLOPS: 498.67

Trial 0: ATBT GFLOPS: 510.88  
Trial 1: ATBT GFLOPS: 504.42  
Trial 2: ATBT GFLOPS: 514.93

---



Matrix dimension Ni: 37, Nj 37, Nk: 728271

Trial 0: AB GFLOPS: 185.02

Trial 1: AB GFLOPS: 185.37

Trial 2: AB GFLOPS: 185.40

Trial 0: ATB GFLOPS: 179.42

Trial 1: ATB GFLOPS: 180.50

Trial 2: ATB GFLOPS: 179.68

Trial 0: ABT GFLOPS: 171.48

Trial 1: ABT GFLOPS: 172.58

Trial 2: ABT GFLOPS: 172.71

Trial 0: ATBT GFLOPS: 160.94

Trial 1: ATBT GFLOPS: 162.12

Trial 2: ATBT GFLOPS: 161.15