

# CSE 520 Computer Architecture -- Spring 2019

## Programming Assignment 4

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List of CPU/GPU models in the system in which the experiment was performed:

- Intel(R) Core™ i7-6700 CPU @ 3.40GHz
- Intel(R) Gen9 HD Graphics NEO

Output Screenshot:

```
rbhushan@en41193641: ~/Desktop/matrix_mul
rbhushan@en41193641:~/Desktop/matrix_mul$ g++ -std=c++11 -w -o main main.cpp -lOpenCL
rbhushan@en41193641:~/Desktop/matrix_mul$ ./main
Performing Matrix Multiplication for Matrix Size 512*512
.....
Reference C matrix multiplication: 0.804863 sec
Normal Kernel
OpenCL on CPU: 0.0122901 sec
Tile Size 8
OpenCL on CPU: 0.0195486 sec
Tile Size 16
OpenCL on CPU: 0.0204007 sec
Normal Kernel
OpenCL on GPU: 0.0104446 sec
Tile Size 8
OpenCL on GPU: 0.0116232 sec
Tile Size 16
OpenCL on GPU: 0.018706 sec
Performing Matrix Multiplication for Matrix Size 1024*1024
.....
Reference C matrix multiplication: 6.6319 sec
Normal Kernel
OpenCL on CPU: 0.112963 sec
Tile Size 8
OpenCL on CPU: 0.164948 sec
Tile Size 16
OpenCL on CPU: 0.149431 sec
Normal Kernel
OpenCL on GPU: 0.085382 sec
Tile Size 8
OpenCL on GPU: 0.0939795 sec
Tile Size 16
OpenCL on GPU: 0.151871 sec
Performing Matrix Multiplication for Matrix Size 2048*2048
.....
Reference C matrix multiplication: 195.998 sec
Normal Kernel
OpenCL on CPU: 3.96307 sec
Tile Size 8
OpenCL on CPU: 2.3633 sec
Tile Size 16
OpenCL on CPU: 1.42496 sec
Normal Kernel
OpenCL on GPU: 0.907214 sec
Tile Size 8
OpenCL on GPU: 0.749906 sec
Tile Size 16
OpenCL on GPU: 1.2206 sec
Press Enter to finish...
rbhushan@en41193641:~/Desktop/matrix_mul$ g++ -std=c++11 -w -o device device.cpp -lOpenCL
rbhushan@en41193641:~/Desktop/matrix_mul$ ./device
Device: Intel(R) Core(TM) i7-6700 CPU @ 3.40GHz
Device: Intel(R) Gen9 HD Graphics NEO
rbhushan@en41193641:~/Desktop/matrix_mul$
```

Table of Measured Execution Times:

Matrix Size	Reference C implementation (single thread)	OpenCL on CPU			OpenCL on GPU		
		Normal Kernel	Tiled Kernel (tile_size=8)	Tiled Kernel (tile_size=16)	Normal Kernel	Tiled Kernel (tile_size=8)	Tiled Kernel (tile_size=16)
512*512	0.804863	0.0122901	0.0195486	0.0204007	0.0104446	0.0116232	0.018706
1024*1024	6.6319	0.112963	0.164948	0.149431	0.085382	0.0939795	0.151871
2048*2048	195.998	3.96307	2.3633	1.42496	0.9072140	0.749906	1.2206