Lab 6: Advanced Topic in CUDA

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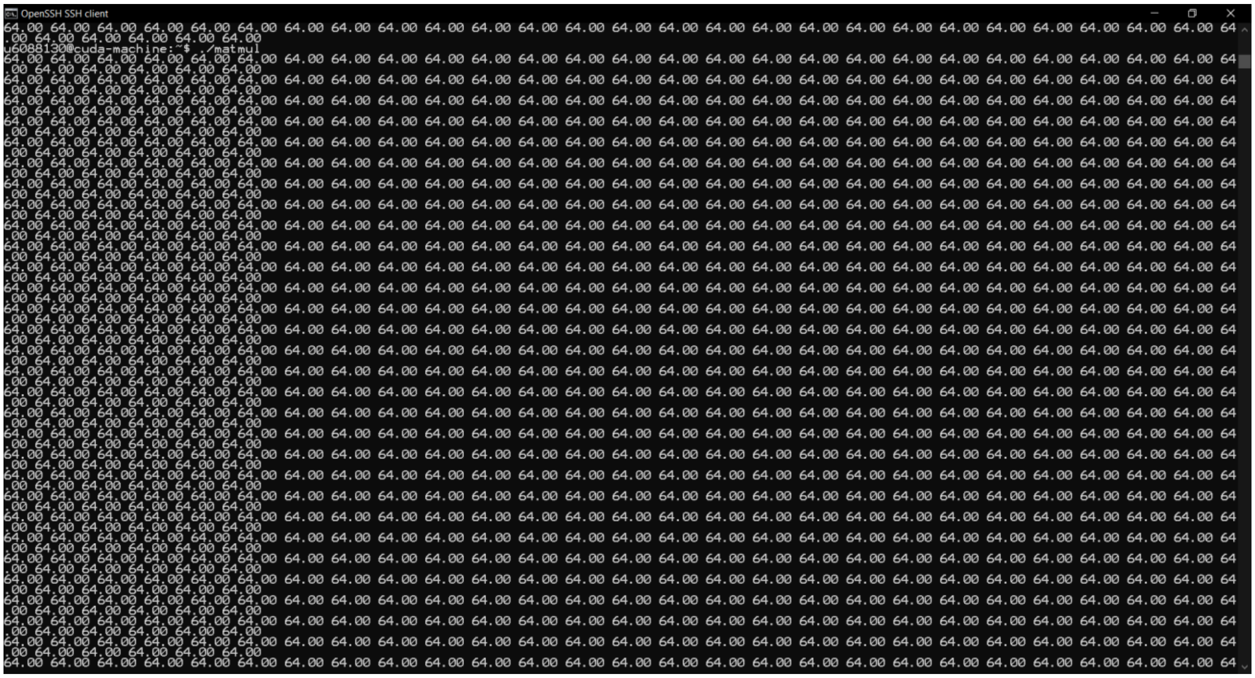
Save your file to “lab6_60xxxxxx.pdf”, ZIP the pdf file and source code files, and upload it to MyCourses website.

Lab: 1. Result from “matmul.cu”



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u6088130@cuda-machine:~$ ./matmul
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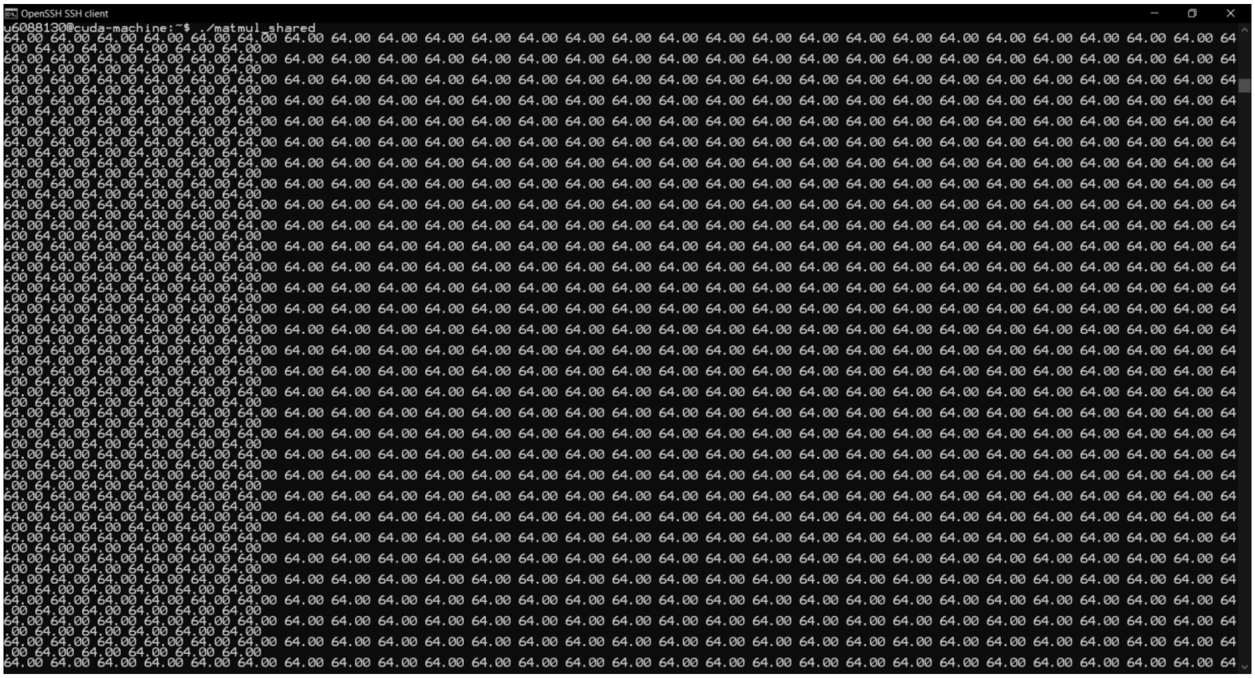
Lab: 2. Result from “matmul_shared.cu”



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u6088130@cuda-machine:~$ ./matmul_shared
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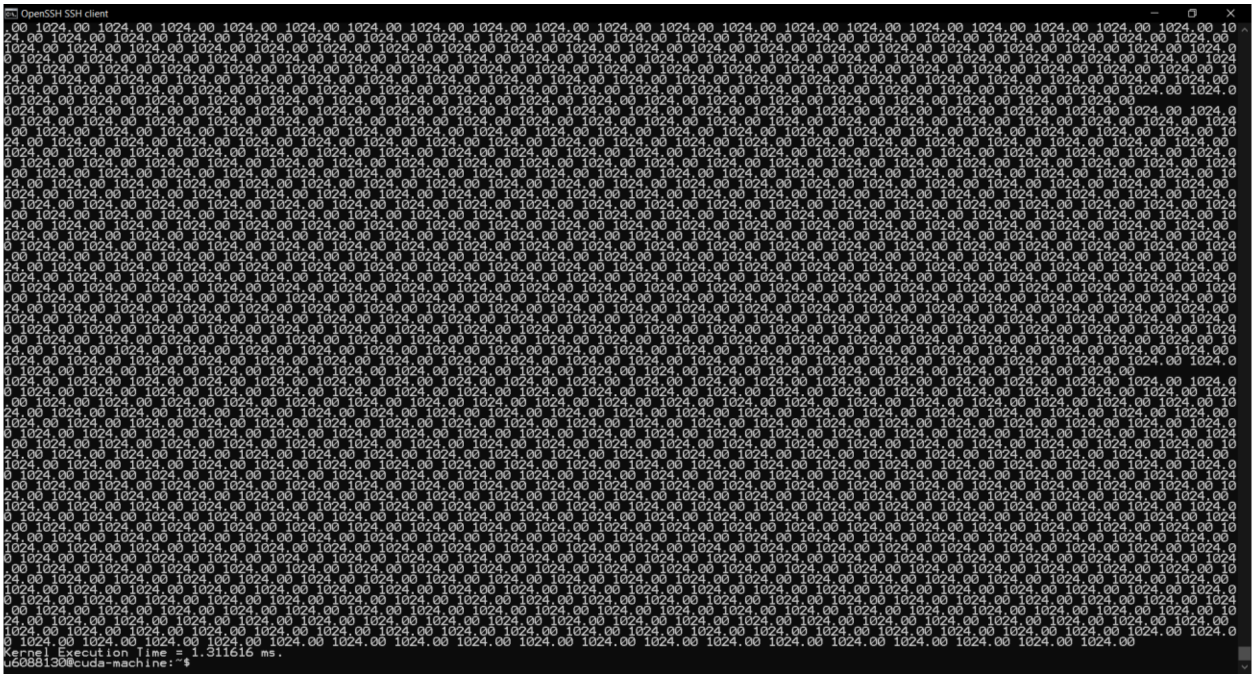
Lab: 3. Result from measuring performance of both “matmul.cu” and “matmul_shared.cu”, with Width is set to 512



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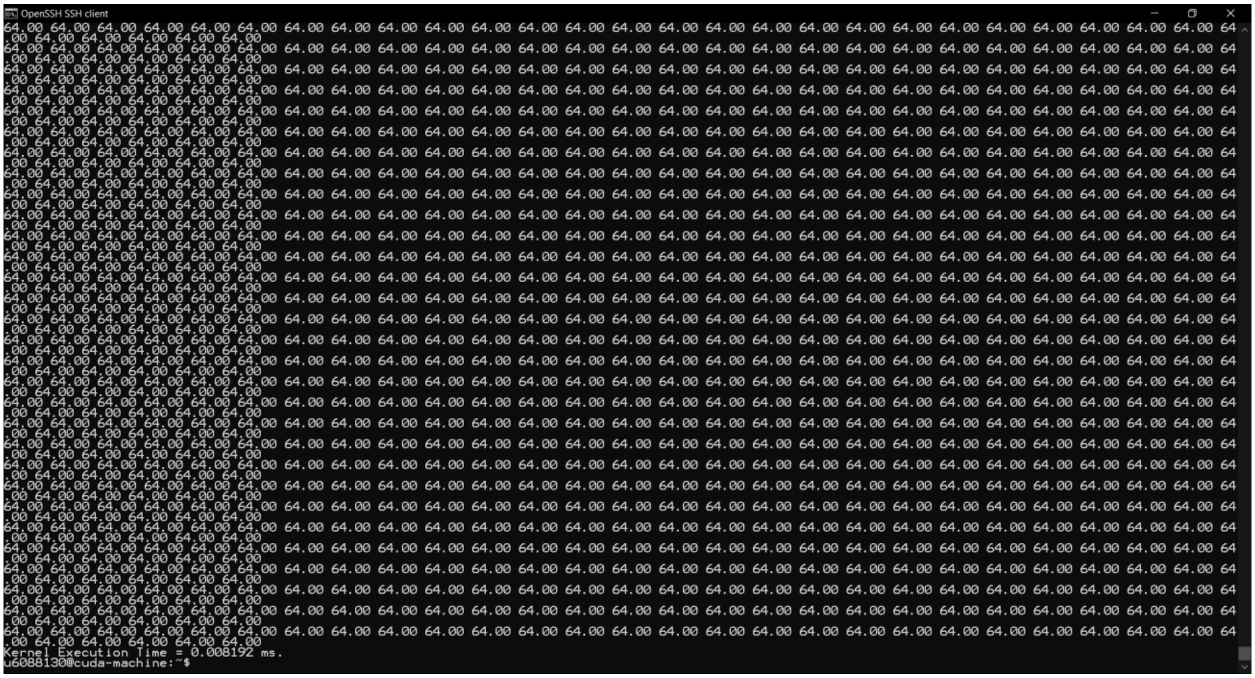
Kernel Execution Time = 1.311616 ms.
u6088130@cuda-machine:~$
```



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Kernel Execution Time = 0.008192 ms.
u6088130@cuda-machine:~$
```

Lab: 4. CUDA Occupancy calculation for “matmul.cu” and “matmul_shared.cu”

Download CUDA Occupancy Calculator from https://docs.nvidia.com/cuda/cuda-occupancy-calculator/CUDA_Occupancy_Calculator.xls

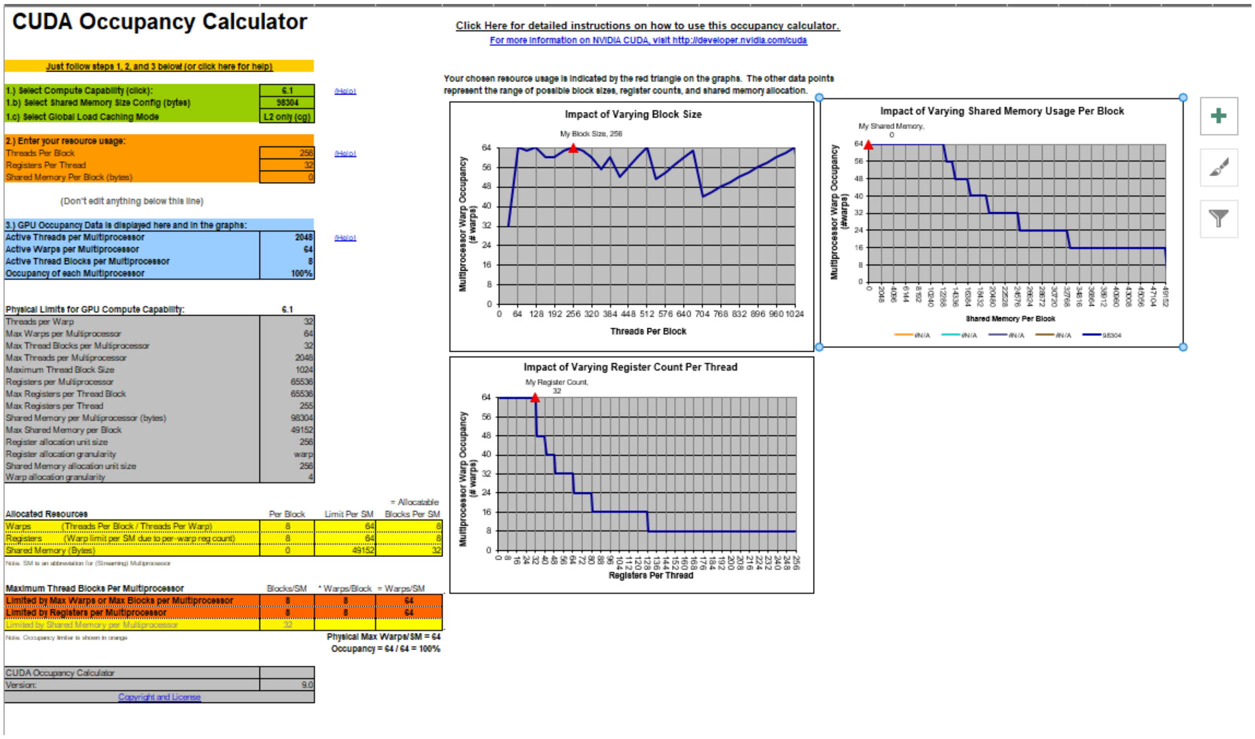
4.1 “matmul.cu”

Threads per block = ___256___________

Registers used per thread = _____32__________________

Shared memory used per thread block = __0___________

Screenshot of the result from NVIDIA Occupancy Calculator:



CUDA Occupancy Calculator

Click Here for detailed instructions on how to use this occupancy calculator.

For more information on NVIDIA CUDA, visit http://developer.nvidia.com/cuda

Your chosen resource usage is indicated by the red triangle on the graphs. The other data points represent the range of possible block sizes, register counts, and shared memory allocation.

Just follow steps 1, 2, and 3 below! (or click here for help)

1.) Select Compute Capability (click):	6.1	(Help)
1.b) Select Shared Memory Size Config (bytes)	98304	
1.c) Select Global Load Caching Mode	L2 only (cg)	

2.) Enter your resource usage:		
Threads Per Block	256	(Help)
Registers Per Thread	32	
Shared Memory Per Block (bytes)	0	

(Don't edit anything below this line)

3.) GPU Occupancy Data is displayed here and in the graphs:		
Active Threads per Multiprocessor	2048	(Help)
Active Warps per Multiprocessor	64	
Active Thread Blocks per Multiprocessor	8	
Occupancy of each Multiprocessor	100%	

Physical Limits for GPU Compute Capability:	6.1
Threads per Warp	32
Max Warps per Multiprocessor	64
Max Thread Blocks per Multiprocessor	32
Max Threads per Multiprocessor	2048
Maximum Thread Block Size	1024
Registers per Multiprocessor	65536
Max Registers per Thread Block	65536
Max Registers per Thread	255
Shared Memory per Multiprocessor (bytes)	98304
Max Shared Memory per Block	49152
Register allocation unit size	256
Register allocation granularity	warp
Shared Memory allocation unit size	256
Warp allocation granularity	4

Allocated Resources	Per Block	Limit Per SM	= Allocatable Blocks Per SM
Warps (Threads Per Block / Threads Per Warp)	8	64	8
Registers (Warp limit per SM due to per-warp reg count)	8	64	8
Shared Memory (Bytes)	0	49152	32

Note: SM is an abbreviation for (Streaming) Multiprocessor

Maximum Thread Blocks Per Multiprocessor	Blocks/SM	* Warps/Block	= Warps/SM
Limited by Max Warps or Max Blocks per Multiprocessor	8	8	64
Limited by Registers per Multiprocessor	8	8	64
Limited by Shared Memory per Multiprocessor	32		

Note: Occupancy limiter is shown in orange

Physical Max Warps/SM = 64
Occupancy = 64 / 64 = 100%

CUDA Occupancy Calculator	
Version:	9.0
Copyright and License	

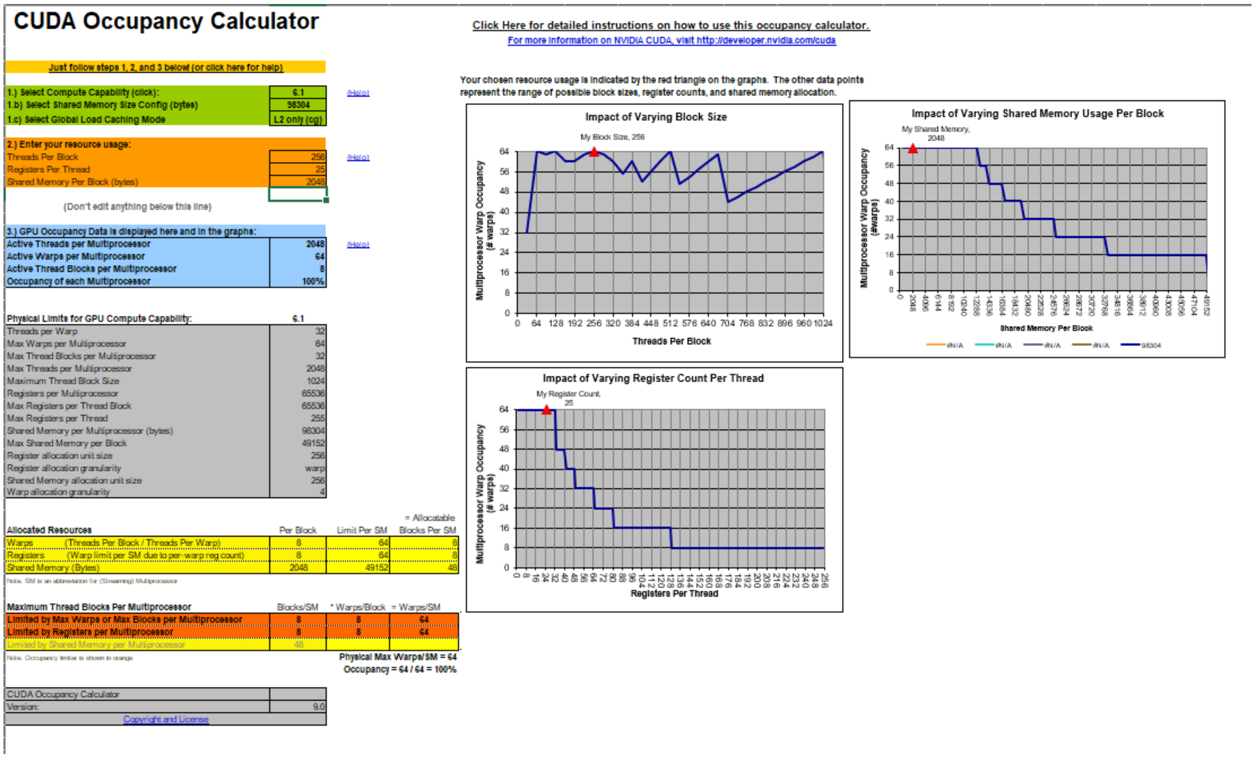
4.2 “matmul_shared.cu”

Threads per block = ___256__________

Registers used per thread = ___________25___________

Shared memory used per thread block = _2048__

Screenshot of the result from NVIDIA Occupancy Calculator:



CUDA Occupancy Calculator

Click Here for detailed instructions on how to use this occupancy calculator.

For more information on NVIDIA CUDA, visit http://developer.nvidia.com/cuda

Just follow steps 1, 2, and 3 below! (or click here for help)

1.) Select Compute Capability (click):	6.1	(Help)
1.b) Select Shared Memory Size Config (bytes)	98304	
1.c) Select Global Load Caching Mode	L2 only (cg)	

2.) Enter your resource usage:		
Threads Per Block	256	(Help)
Registers Per Thread	25	
Shared Memory Per Block (bytes)	2048	

(Don't edit anything below this line)

3.) GPU Occupancy Data is displayed here and in the graphs:		
Active Threads per Multiprocessor	2048	(Help)
Active Warps per Multiprocessor	64	
Active Thread Blocks per Multiprocessor	8	
Occupancy of each Multiprocessor	100%	

Your chosen resource usage is indicated by the red triangle on the graphs. The other data points represent the range of possible block sizes, register counts, and shared memory allocation.

Physical Limits for GPU Compute Capability:	6.1
Threads per Warp	32
Max Warps per Multiprocessor	64
Max Thread Blocks per Multiprocessor	32
Max Threads per Multiprocessor	2048
Maximum Thread Block Size	1024
Registers per Multiprocessor	65536
Max Registers per Thread Block	65536
Max Registers per Thread	255
Shared Memory per Multiprocessor (bytes)	98304
Max Shared Memory per Block	49152
Register allocation unit size	256
Register allocation granularity	warp
Shared Memory allocation unit size	256
Warp allocation granularity	4

Allocated Resources	Per Block	Limit Per SM	= Allocatable Blocks Per SM
Warps (Threads Per Block / Threads Per Warp)	8	64	8
Registers (Warp limit per SM due to per-warp reg count)	8	64	8
Shared Memory (Bytes)	2048	49152	48

Note: SM is an abbreviation for (Streaming) Multiprocessor

Maximum Thread Blocks Per Multiprocessor	Blocks/SM	* Warps/Block	= Warps/SM
Limited by Max Warps or Max Blocks per Multiprocessor	8	8	64
Limited by Registers per Multiprocessor	8	8	64
Limited by Shared Memory per Multiprocessor	48		

Note: Occupancy limiter is shown in orange

Physical Max Warps/SM = 64
Occupancy = 64 / 64 = 100%

CUDA Occupancy Calculator	
Version:	9.0
Copyright and License	

Do not forget to include the source files into the zip file before submission.