

Parallel Homework #4

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图 1: Here is the hardware's information

```
CPU: Intel i7-8565U (8) @ 4.600GHz
GPU: Intel UHD Graphics 620
GPU: NVIDIA GeForce MX250
Memory: 2936MiB / 7708MiB
```

图 2: About the GPU and CUDA

```
→ Latex git:(master) ✖ nvidia-smi
Mon May 24 21:02:59 2021

+-----+
| NVIDIA-SMI 465.31                 Driver Version: 465.31    CUDA Version: 11.3     |
+-----+-----+
| GPU Name      Persistence-M| Bus-Id        Disp.A | Volatile Uncorr. ECC | |
| Fan  Temp  Perf  Pwr:Usage/Cap|  Memory-Usage | GPU-Util  Compute M. |
|               |              |            |     MIG M.     |
+-----+-----+
| 0  NVIDIA GeForce ...  Off  | 00000000:02:00:00 Off |                  N/A |
| N/A   48C    P0      N/A /  N/A | 0MiB / 2002MiB |      0%    Default  |
+-----+-----+
|                          |                      |                      |
+-----+-----+
| Processes:                                                       GPU Memory |
|  GPU   GI    CI          PID    Type   Process name                  Usage    |
|-----+-----+
| No running processes found                                     |
+-----+-----+
```

图 3: Here is the test runnig

```
→ homework4-cuda_spmv git:(master) ✖ ./gemm_test 1000 32
Matrix A is 1000 x 1000, matrix B is 1000 x 32
Matrix A has a sparsity of 10.192%

((a) GEMM_OpenMP)(row-col, A and B are in row-major) used 0.40963 ms, 0.15624 gflops
((a) GEMM_OpenMP)(row-col, A and B are in row-major) PASS!

((b) GEMM_OpenBLAS)(row-col, A and B are in row-major) used 0.01651 ms, 3.87573 gflops
((b) GEMM_OpenBLAS)(row-col, A and B are in row-major) PASS!

((c) GEMM_CUDA_global_memory)(row-col, A and B are in row-major) used 0.01913 ms, 3.34606 gflops
((c) GEMM_CUDA_global_memory)(row-col, A and B are in row-major) PASS!

((d) GEMM_CUDA_shared_memory)(row-col, A and B are in row-major) used 0.02847 ms, 2.24782 gflops
((d) GEMM_CUDA_shared_memory)(row-col, A and B are in row-major) PASS!

((e) GEMM_cuBLAS)(row-col, A and B are in row-major) used 0.03768 ms, 1.69833 gflops
((e) GEMM_cuBLAS)(row-col, A and B are in row-major) PASS!

((f) csrSpMM_serial)(row-col, A and B are in row-major) used 0.00118 ms, 5.52032 gflops
((f) csrSpMM_serial)(row-col, A and B are in row-major) PASS!

((g) csrSpMM_OpenMP)(row-col, A and B are in row-major) used 0.00126 ms, 5.17725 gflops
((g) csrSpMM_OpenMP)(row-col, A and B are in row-major) PASS!

((h) csrSpMM_CUDA_scalar)(row-col, A and B are in row-major) used 0.00569 ms, 1.14671 gflops
((h) csrSpMM_CUDA_scalar)(row-col, A and B are in row-major) PASS!

((i) csrSpMM_CUDA_vector)(row-col, A and B are in row-major) used 0.00098 ms, 6.64509 gflops
((i) csrSpMM_CUDA_vector)(row-col, A and B are in row-major) PASS!

((j) csrSpMM_cuSPARSE)(row-col, A and B are in row-major) used 0.00064 ms, 10.17600 gflops
((j) csrSpMM_cuSPARSE)(row-col, A and B are in row-major) PASS!
```



