Lab 8 report

6314061 – Quang Tuan Le

April 2023

Task: Biological Systems

1. The code includes 2 approaches, the GPUGameOfLife and the SerialGameOfLife to demonstrate a solution by using CUDA for parallel and using for loops to execute as usual (serial). To do GPUGameOfLife, the code first generate random matrix from CPU and copy to GPU, GPU executes in parallel to get result and copy back to matrix in CPU. To run GPU in parallel, we use __global__, __shared__, threadIdx.x, __synchthreads().
   My folder includes lab8.cu and lab8_2.cu, lab8 can receive command line arguments, lab8_2 can just run without command line arguments for convenience (default 10x10 with 2 iterations).

2. Here is my test and result: Screenshot of matrix 6x6 in 3 iterations.

```
qle010@onyx:~/Courses/COP4520/Lab8 193% ./lab8 6 6 3
INITIAL STATE:
1 1 0 0 0 0
1 0 0 1 1 1
1 0 0 1 1 1
0 0 1 1 0 0
0 0 1 1 1 0
1 0 0 1 0 0
GPU:
-------------
0 1 0 0 1 0
1 0 1 0 0 1
0 0 0 1 0 1
0 0 0 0 0 0
0 0 0 0 0 0
1 0 1 1 0 1
CPU:
-------------
1 1 1 1 1 1
1 0 1 1 0 1
0 1 0 0 0 1
0 1 0 0 0 1
0 1 0 0 1 0
0 1 1 1 1 0
CPU:
-------------
1 0 0 0 0 1
1 0 0 0 0 1
1 1 0 1 0 1
1 1 1 0 1 1
1 1 0 0 1 1
1 1 1 1 1 1
CPU:
-------------
0 1 0 0 1 0
1 0 1 0 0 1
0 0 0 1 0 1
0 0 0 0 0 0
0 0 0 0 0 0
1 0 1 1 0 1
FINAL STATE AFTER 3 ITERATIONS:
0 1 0 0 1 0
1 0 1 0 0 1
0 0 0 1 0 1
0 0 0 0 0 0
0 0 0 0 0 0
1 0 1 1 0 1
GPU execution time: 43 (ms)
Serial execution time: 46 (ms)
qle010@onyx:~/Courses/COP4520/Lab8 194%
```

3. From my result:
   I can conclude that GPU runs so much faster than Serial especially when the size of matrix is increased significantly. I use chrono library to measure time.

Here is the table for different matrix and iterations:

Matrix & Iterations	GPU (ms)	Serial (ms)
6x6 & 3	35	44
10x10 & 4	35	114
20x20 & 5	41	386
50x50 & 5	53	1676