

## 2022 NYCU OS HW2 report

Question	Answer
<p>Q1. (5pts)</p> <p>Briefly describe your design for the add, multiple function of matrix, the thread management.</p> <p>Also, describe the number of threads in the Multi-thread program.</p>	<p>I used 10 threads in the multi-thread program, the summation and multiplication implementation are similar to that of single-thread. I made every thread in charge of a specific portion rows of the resulting matrix. For example, there are 500 rows in our resulting matrix, and we have 10 threads, then every thread will in charge of 50 rows of the calculations of resulting matrix(row0-49 &amp; row50-99...) .</p>
<p>Q2. (15pts)</p> <p>Try at least 3 kinds of number of threads, and compare the difference in time.(Take screenshots of the time of each case)</p> <p>Also, explain the results.</p>	<p>Single-thread:</p> <pre>sh-4.4\$ time ./single_thread &lt; input.txt 2248968 2528950360  real    0m0.845s user    0m0.829s sys     0m0.004s</pre> <p>2-thread:</p> <pre>sh-4.4\$ time ./two_thread &lt; input.txt 2248968 2528950360  real    0m0.451s user    0m0.706s sys     0m0.002s</pre> <p>6-thread:</p> <pre>sh-4.4\$ time ./six_thread &lt; input.txt 2248968 2528950360  real    0m0.329s user    0m0.923s sys     0m0.004s</pre> <p>As you can see, when it is single-thread, the real time is 0.845s, while in 2-thread condition, the real time is 0.451s, and the speed up is about 1.874. When it is 6-thread, the real time is 0.329s, which is about 2.568 times faster than the single-thread operation.</p> <p>The result of speed up is because we have multiple CPUs to provide multiple threads of execution concurrently. However, due to the limitation of CPUs, the speed up is not proportional to the number of threads.</p>

Q3. (10pts)

Show the best speedup between multi-thread and single-thread. (Take screenshots of the time of single-thread and multi-thread)

Also, explain why multi-thread is faster.

Single-thread operation:

```
sh-4.4$ time ./single_thread < input.txt
2248968
2528950360

real    0m0.845s
user    0m0.829s
sys     0m0.004s
```

10-thread operation:

```
sh-4.4$ time ./multi_thread < input.txt
2248968
2528950360

real    0m0.242s
user    0m0.703s
sys     0m0.004s
```

The speed up is  $0.845/0.242 = 3.492$

Multi-thread is faster because the process utilizes the advantage of multi-processor and splits the process into multiple parts for execution in threads concurrently.