CompSci231P
Homework 2

Printing Prime Numbers - single thread vs multiple threads

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System Description:

CPU: 2.3 GHz Intel Core i5
Memory: 8 GB 2133 MHz LPDDR3
Operating System: macOS Mojave, version-10.14.3 (18D42)

Execution times :

Number of Threads	Time
single_prime_print	14.450296
1	14.566503
2	7.220406
4	4.279919
8	3.507156
16	3.619516
32	3.434672
64	3.248481
128	3.330641

Analysis & Observation :

According to the table above the time execution time for single_prime_print is 14.450296 in contrast to which the time required to execute multi_prime_print with one thread is 14.566503. The difference between them rests on the fact that multi_prime has an overhead of creating a thread, locking and unlocking of the required variable using mutex, all of these combined together add a little extra execution time to it.
As we observe that till 4 threads(my system has 4 cores) the execution time reduced linearly with the number of threads, as we can see for 2 threads the execution was half of the 1 thread. This continues till 4 cores, after which till 8 threads we see that it further decreases. The reason behind this is that the threads work parallelly, utilizing the multicores of the system to make the program run faster.

We see an irregularity at 16th thread because of the threshold of 4 core system, implying that when the number of threads is more than the number of cores/processors it loads the processor as all threads try to use the processors to complete their task. While doing so since threads>cores, there is a slight difference in access times making the execution time a little greater than previous. Consecutively, the execution time does not decrease by substantially due to the overhead of context-switching.

Elaborating the same my mac system uses hyper-threading which makes my 4 core system work as 8 core, aligning to which we see that the run/execution time decreases without any irregularity but as soon as it hits 16 threads the overhead of context switching occurs which brings in irregularities.