Project 6: Threads

CS 2370

Background

The purpose of this assignment is to learn about multithreading and writing concurrent programs.

Requirements

Write a program that finds all the prime numbers from 2 to 1 million (inclusive).

Create 4 threads to do the work.

Do the following:
1. As you find a prime number, write it to a file called "primes.dat".
2. After all the work is done, report the total number of primes found.
3. Each thread should also keep track of the number of primes it finds. After printing the total number of primes found, print the number of primes each thread found.

Implementation Notes

1. How do you determine if a number is prime? While there are more efficient ways, just take the simple approach:
   a. For 2, and then all the odd numbers greater than 2, if that number divides the candidate number, then the candidate number isn't prime.
   b. Stop when you get to the candidate number/2.
2. You will need to test every number from 2 to 1,000,000. If you had a single thread, you would just have a simple loop. But now you must coordinate which thread works on which number. So you need a shared counter. Of course, to avoid race conditions, you must protect its usage with a mutex.
3. You also have a shared file. So you have to protect writes to it with a mutex.
4. You also have a shared counter of the number of primes found. It needs to be protected as well. However, since locking is actually expensive, and the counter updates at the same time you write a prime to the file, it's probably best to put it in the same critical section as the file write (sharing the same mutex.)
5. Shared resources must be accessible to all threads and to the main program. Yes, make them global variables. Make the output file stream a global variable also.
6. How does a thread know when it is done? Think about it.
7. You want to always make sure to lock where needed, but only where needed. Think carefully about exactly what needs to be locked.
8. Note that the numbers in primes.dat are not necessarily in order. That's fine.

This is a short program. My program is 73 lines long.