CS 491/591: High Performance Computing Project 3

Parallel Sieve of Eratosthenes for Finding All Prime Numbers within 10^{10}

Due date: 11:59 pm, March 8th, 2019

Part 1 (20 points): Simply modify the parallel Sieve of Eratosthenes program in class so that the program can find all prime members within 10^{10} (hint: 10^{10} is larger than value range of int type).

Part 2 (40 points): Modify the parallel Sieve of Eratosthenes program in **Part 1** so that the program does **NOT** set aside memory for even integers.

Part 2 (30 points): Modify the parallel Sieve of Eratosthenes program in **Part 2** so that each process of the program finds its own sieving primes via local computations instead of broadcasts.

Part 4 (10 points): Modify the parallel Sieve of Eratosthenes program in **Part 3** so that the program can have a more effective use of caches.

Use your program to find all prime numbers within 10^{10}. **Output the total number of prime numbers within 10^{10} and the program execution time (i.e., maximum time of all processes used in the MPI program).** Benchmark your program on PantaRhei with 32 (1 node), 64 (2 nodes), 128 (4 nodes) processes to see whether your execution time is reduced by half or not when double the number of computing cores. Compare the execution time of each version (i.e., sieve1, sieve2, sieve3, sieve4) of your program to see how different designs affect the execution time of your program. Note that, in syllabus, we emphasize for **ALL** homework assignments: "Please make sure that your programs are properly documented and indented. Provide instructions on how to run your programs, give example runs, **and analyze your results.**"