PRIMETIME

Sean Blanchard & Ferid Ruano

Overview

- We chose to develop our program in C using OpenMP
- The program's objective is to find two prime factors of a given composite
- The given composite is required to be a multiple of two primes
- Using 'unsigned long long int' we can compute at least a 2^{64} composite
- The master thread determines whether the composite itself is 4, 6, 9 or a multiple of 2 or 3. The remaining threads utilize a base 6 matrix to determine the prime factors, if needed.

Base 6 Prime Pattern

- A prime number is divisible by 1 and itself.
- A pattern can be found using a Base 6 matrix
- With the exception of 2 and 3 every prime number exists within column 1 and 5.
- The pattern for column 1 is ‘6n + 1’
- The pattern for column 5 is ‘6n - 1’

Source: Prime forms

~~1~~	2	3	~~4~~	5	~~6~~
7	~~8~~	~~9~~	~~10~~	11	~~12~~
13	~~14~~	~~15~~	~~16~~	17	~~18~~
19	~~20~~	~~21~~	~~22~~	23	~~24~~
~~25~~	~~26~~	~~27~~	~~28~~	29	~~30~~
31	~~32~~	~~33~~	~~34~~	~~35~~	~~36~~
37	~~38~~	~~39~~	~~40~~	41	~~42~~

Our Code

- The for loop acts as a Base 6 matrix iterator
- One loop checks two rows for prime factors
  - i, i + 2, i + 6, i + 8
- There is a check for a composite of a squared prime factor
- When two primes factors are found the for loop terminates by making i > limit

```
#pragma omp for
// For loop acts as a base 6 grid and checks two rows per
// loop for prime factors
for (unsigned long long int i = 5; i <= limit; i += 12)
{
    // Check column 5 on base 6 grid
    if (composite % i == 0)
    {
        primesFound++; // One prime factor found
        // Check if prime factor squared is composite
        if (i * i == composite)
        {
            printf("The prime factors are both: %'llu \n", i);
            primesFound++; // Increment primesFound to terminate loop
        }
        else
            printf("A prime factor is: %'llu \n", i);
    }

    // Check column 1 on base 6 grid
    if ((composite % (i + 2)) == 0)
    {
        primesFound++; // One prime factor found
        // Check if prime factor squared is composite
        if ((i + 2) * (i + 2) == composite)
        {
            printf("The prime factors are both: %'llu \n", i + 2);
            primesFound++; // Increment primesFound to terminate loop
        }
        else
            printf("A prime factor is: %'llu \n", i + 2);
    }
```