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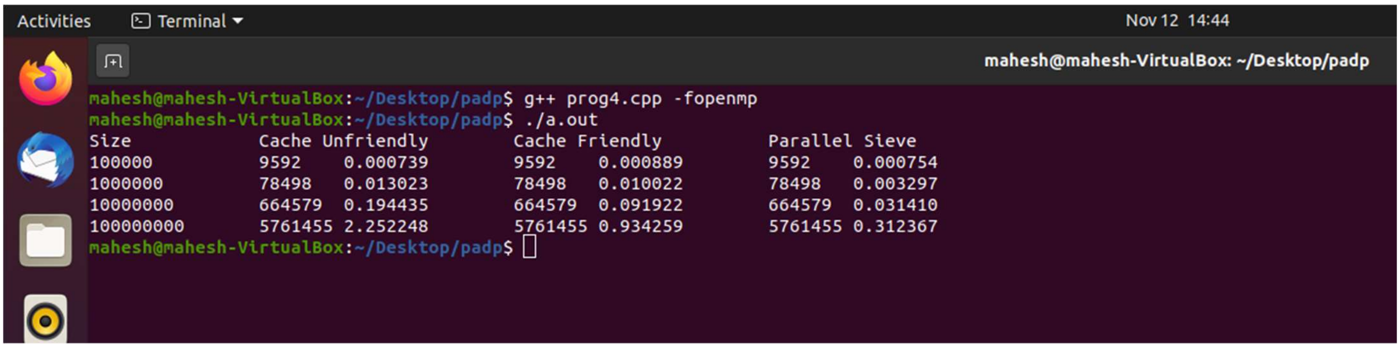
PADP lab Program 4

Code:

```
#include<math.h>
#include<string.h>
#include<omp.h>
#include<iostream>
using namespace std;
double t=0.0;
inline long Strike(bool composite[], long i, long stride, long limit) {
	for (; i <= limit; i += stride)
		composite[i] = true;
	return i;
}

long min(long a, long b){
	return a > b ? b : a;
}

long CacheUnfriendlySieve(long n)
{
	long count = 0;
	long m = (long)sqrt((double)n);
	bool* composite = new bool[n + 1];
	memset(composite, 0, n);
	t = omp_get_wtime();
	for (long i = 2; i <= m; ++i)
		if (!composite[i]) {
			++count;
```

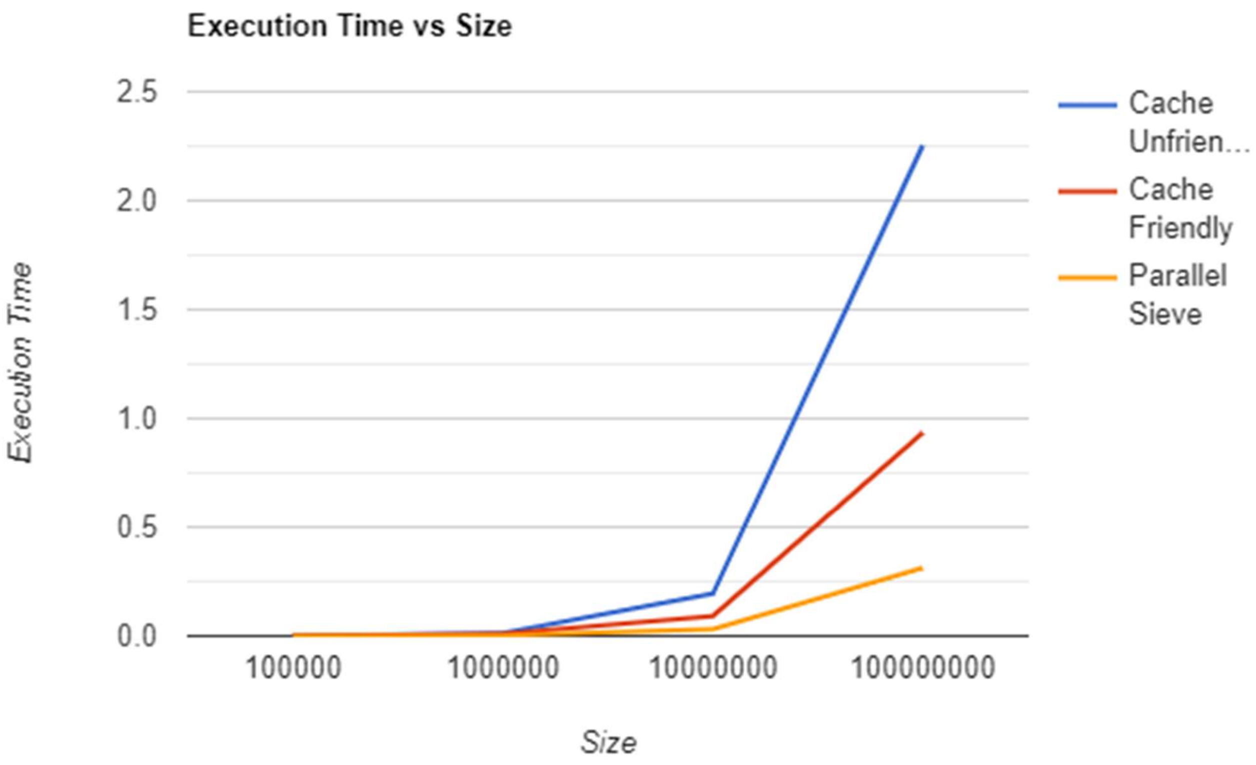
```
            // Strike walks array of size n here.
            Strike(composite, 2 * i, i, n);
        }
    for (long i = m + 1; i <= n; ++i)
        if (!composite[i]) {
            ++count;
        }
    t = omp_get_wtime() - t;
    delete[] composite;
    return count;
}
long CacheFriendlySieve(long n)
{
    long count = 0;
    long m = (long)sqrt((double)n);
    bool* composite = new bool[n + 1];
    memset(composite, 0, n);
    long* factor = new long[m];
    long* striker = new long[m];
    long n_factor = 0;
    t = omp_get_wtime();
    for (long i = 2; i <= m; ++i)
        if (!composite[i])
        {
            ++count;
            striker[n_factor] = Strike(composite, 2 * i, i, m);
            factor[n_factor++] = i;
        }

    for (long window = m + 1; window <= n; window += m)
    {
        long limit = min(window + m - 1, n);
        for (long k = 0; k < n_factor; ++k)
            // Strike walks window of size sqrt(n) here.
            striker[k] = Strike(composite, striker[k], factor[k], limit);
        for (long i = window; i <= limit; ++i)
            if (!composite[i])
                ++count;
    }
    t = omp_get_wtime() - t;
    delete[] striker;
    delete[] factor;
    delete[] composite;
    return count;
}

long ParallelSieve(long n){
    long count = 0;
    long m = (long)sqrt((double)n);
    long n_factor = 0;
    long* factor = new long[m];

    t = omp_get_wtime();

#pragma omp parallel
    {
        bool* composite = new bool[m + 1];
        long* striker = new long[m];
#pragma omp single
        {
            memset(composite, 0, m);
            for (long i = 2; i <= m; ++i)
                if (!composite[i])
                {
                    ++count;
                    Strike(composite, 2 * i, i, m);
                    factor[n_factor++] = i;
                }
        }
        long base = -1;

#pragma omp for reduction (+:count)
        for (long window = m + 1; window <= n; window += m)
        {
            memset(composite, 0, m);
            if (base != window)
            {

                base = window;
                for (long k = 0; k < n_factor; ++k)
                    striker[k] = (base + factor[k] - 1) / factor[k] * factor[k] - base;

            }   long limit = min(window + m - 1, n) - base;

            for (long k = 0; k < n_factor; ++k)
                striker[k] = Strike(composite, striker[k], factor[k], limit) - m;

            for (long i = 0; i <= limit; ++i)
                if (!composite[i])
                    ++count;
            base += m;
        }
        delete[] striker;
        delete[] composite;
    }

    t = omp_get_wtime() - t;

    delete[] factor;
    return count;
}

int main(){

    printf("Size\t\tCache Unfriendly\tCache Friendly\t\tParallel Sieve\n");
    for(int i=1; i<=4; i++ ){
        size = size*10;
        printf("%ld\t",size);
        if(i<3)
            printf("\t");
        count = CacheUnfriendlySieve(size);
        printf("%ld\t%f\t",count,t);
        count = CacheFriendlySieve(size);
        printf("%ld\t%f\t",count,t);
        count = ParallelSieve(size);
        printf("%ld\t%f\n",count,t);
    }
    return 0;
}
```

Output:



```
mahesh@mahesh-VirtualBox:~/Desktop/padp$ g++ prog4.cpp -fopenmp
mahesh@mahesh-VirtualBox:~/Desktop/padp$ ./a.out
Size            Cache Unfriendly        Cache Friendly          Parallel Sieve
100000          9592    0.000739        9592    0.000889        9592    0.000754
1000000         78498   0.013023        78498   0.010022        78498   0.003297
10000000        664579  0.194435        664579  0.091922        664579  0.031410
100000000       5761455 2.252248        5761455 0.934259        5761455 0.312367
mahesh@mahesh-VirtualBox:~/Desktop/padp$ 
```

Graphs:


Execution Time vs Size
Execution Time
Size
Cache Unfrien…
Cache Friendly
Parallel Sieve