

Solved Problem - Prime Factorization

In this lesson, we'll discuss how to find the prime factorization of a number.

We'll cover the following



- Problem statement
- Sample
- Explanation
- Solution
- Time Complexity

Problem statement

Given an integer, N , print all the prime factors of N .

Input format

A single line of input contains an integer N ($1 \leq N \leq 10^{10}$).

Output format

Print all the prime factors of N .

Sample

Input 1: `

```
24
```

Output 1:

```
2 3
```

Input 2:

Output 2:

3 23

Explanation

$24 = 2^3 \times 3$, prime factors are 2 and 3





$207 = 3^2 \times 23$, prime factors are 3 and 23

Solution

Starting from $i = 2$ and going up to \sqrt{N} ; if i divides N , add this to the list of prime factors and remove all occurrences of i by repetitively dividing N by i .

In the end, if the number is completely factored, we are left with 1, in which case we are done.

If we do not end up with 1, that means N has a prime factor $> \sqrt{N}$. This prime factor is the number we are left with since it's power will be 1 (*as discussed earlier*).

<div>main.cpp</div> <div>input.txt</div>	All code files are copied to end of the page...
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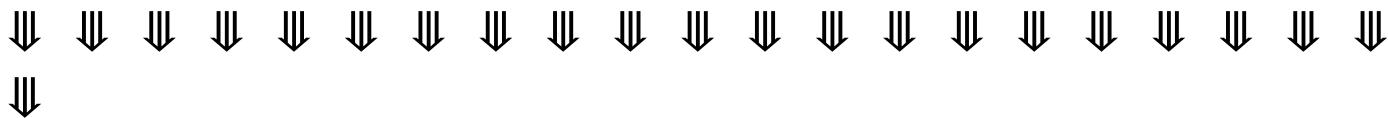
Time Complexity

At any step, if i divides the remaining N , then i is a prime factor. Because if it wasn't, say $i = 6$, then all powers of 2 and 3 would have already been taken out and it won't be divisible by 6 afterward.

Time Complexity - $O(\sqrt{N})$.

In the next chapter, we'll start with arrays and vectors

Code Files Content !!!



```
-----  
|  main.cpp [1]  
-----
```

```
#include  
#include  
using namespace std;  
  
void print_prime_factors(int N){  
    for (int i = 2; i * i <= N; i++) {  
        if (N%i == 0){  
            cout << i << " ";  
            while (N%i == 0)  
                N /= i;  
        }  
    }  
    if (N > 1)  
        cout << N << " ";  
    cout << "\n";  
}  
  
int main() {  
    ifstream cin("input.txt");  
  
    int N;  
    cin >> N;  
    print_prime_factors(N);  
    return 0;  
}
```

```
-----  
|  input.txt [1]  
-----
```

