
COMPILANDO CONOCIMIENTO

Refence

COMPETITIVE PROGRAMMING

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Part I

Number Theory

Chapter 1

Primes

1.1 Sieve of Eratosthenes

1.1.1 Get the Boolean Version

```
1 // ***** ERATOSTHENES SIEVE / IS PRIME IN O(1) *****
2 std::vector<bool> EratosthenesSieveIsPrime(ull n) { //To check if i is prime: Vector[i]
3     std::vector<bool> isPrime(n + 1, true); //Ok, first, allocate space
4     isPrime[0] = isPrime[1] = false; //Now, 0 & 1(maybe) are not prime
5
6     for (ull i = 4; i <= n; i += 2) isPrime[i] = false; //Eliminate all the evens numbers
7
8     for (ull i = 3, limit = std::sqrt(n); i <= limit; i += 2) //For every odd number < n
9         if (isPrime[i]) //If we found a prime :0
10             for (ull j = i * i; j <= n; j += 2 * i) //ForEach multiple we have'nt check
11                 isPrime[j] = false; //Each multiple is not prime
12
13     return isPrime; //Return the complete sieve
14 }
```

1.1.2 Get the Vector of Primes

```
1 // ***** ERATOSTHENES SIEVE / VECTOR OF PRIMES *****
2 std::vector<ull> EratosthenesSievePrimes(ull n) { //Return a vector of only primes
3     std::vector<bool> isPrime(n + 1, true); //Create the origianl Sieve
4     std::vector<ull> Primes(1, 2); //2 is a prime, dahhhhh!
5
6     isPrime[0] = isPrime[1] = false; //Now, 0 & 1(maybe) are not prime
7
8     for (ull i = 4; i <= n; i += 2) isPrime[i] = false; //Eliminate all the evens numbers
9
10    for (ull i = 3, limit = std::sqrt(n); i <= n; i += 2) { //Check for every odd number
11        if (isPrime[i]) { //If we still believe it's a prime
12            Primes.push_back(i); //Add it to the vector, it's a prime
13
14            if (i <= limit) //It make sense to delete multiples?
15                for (ull j = i * i; j <= n; j += 2 * i) //ForEach multiple we have'nt check
16                    isPrime[j] = false; //Each multiple is not prime
17        }
18    }
19
20    return Primes; //Return the vector of only primes
21 }
```