

Problem 47 - Distinct Primes Factors

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This document originally appeared as a blog post on my website. Find it at gautammanohar.com/euler/47.

1 Problem Statement

The first two consecutive numbers to have distinct prime factors are $14 = 2 \cdot 7$ and $15 = 3 \cdot 5$. The first three consecutive such numbers are

$$644 = 2^2 \cdot 7 \cdot 23, 645 = 3 \cdot 5 \cdot 43, 646 = 2 \cdot 17 \cdot 19$$

Given N , find all the sets of K consecutive integers that each have exactly K distinct prime factors. Print the first number of each set in ascending order.

2 My Algorithm

The mathematical notation for the number of distinct prime factors of n is $\omega(n)$ ($\Omega(n)$ denotes the total number of prime factors, counting multiplicity). We use a modified Sieve of Eratosthenes: instead of storing whether n is prime, we store $\omega(n)$. Whenever we hit an n with $\omega(n) = 0$, we find all the multiples of n less than N and add one to the associated value.

Then, we search through all sets of K consecutive elements in the array and check whether they all have exactly K distinct prime factors.