Problem 3. The prime factors of 13195 are 5, 7, 13 and 29. What is the largest prime factor of the number 600851475143?

Programming Knowledge required: How to compute prime factors in $O(\sqrt{n})$ time complexity.

Solution Outline: This is a classic implementation of prime factorization algorithm which factorizes the number in $O(\sqrt{n})$ time complexity. This algorithm can be easily found on the internet or any university level algorithms textbook.

We start by initializing a variable `max_prime_factor` to 0. Then we implement the prime factor algorithm. At each step we update the `max_prime_factor` if we encounter a bigger prime factor. Finally, `max_prime_factor` will contain the final answer.

Python Solution

```python
def get_max_prime_factor(n):
    max_prime_factor = 0
    i = 2
    while i * i <= n:
        if n % i == 0:
            max_prime_factor = max(max_prime_factor, i)
            while n % i == 0:
                n //= i
        i += 1

    if n > 1:
        max_prime_factor = max(max_prime_factor, n)

    return max_prime_factor

N = 600851475143
print(get_max_prime_factor(N))
```