Primitive Problem

HackerRank

We define a *primitive root* of prime number p to be some integer $g \in [1, p-1]$ satisfying the property that all values of $g^x \bmod p$ where $x \in [0, p-2]$ are different.

For example: if $p = 7$, we want to look at all values of g in the inclusive range from 1 to $p - 1 = 6$. For $g = 3$, the powers of $g^x \bmod p$ (where x is in the inclusive range from 0 to $p - 2 = 5$) are as follows:

- $3^0 = 1 \pmod 7$
- $3^1 = 3 \pmod 7$
- $3^2 = 2 \pmod 7$
- $3^3 = 6 \pmod 7$
- $3^4 = 4 \pmod 7$
- $3^5 = 5 \pmod 7$

Note that each of these evaluates to one of the six distinct integers in the range $[1, p-1]$.

Given prime p, find and print the following values as two space-separated integers on a new line:

1. The smallest primitive root of prime p.
2. The total number of primitive roots of prime p.

Need Help? Check out a breakdown of this process at Math Stack Exchange.

Input Format

A single prime integer denoting p.

Constraints

- $2 < p < 10^9$

Output Format

Print two space-separated integers on a new line, where the first value is the smallest primitive root of p and the second value is the total number of primitive roots of p.

Sample Input 0

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7
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Sample Output 0

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3 2
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Explanation 0

The primitive roots of $p = 7$ are 3 and 5, and no other numbers in $[1, 6]$ satisfy our definition of a primitive root. We then print the smallest primitive root (3) followed by the total number of primitive roots (2).