AIPO 2024
Preliminary Round

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Contributors

The AIPO organisers would like to thank the following people.

For leading the question writing:

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Time limits and input/output bounds will become available when the submission system opens.

1 Add Two Numbers

You are given 2 integers a, b as standard inputs to your program. Print the sum a+b on a single line. A tutorial for this problem will be available on our website https://aipo.ucc.ie. This problem is intended to be a simple test to make sure you are able to understand the operations of the submission server.

Input/Output

Input

Two space-separated integers a, b on a single line.

Output

A single integer on a single line

Constraints

$-1,000,000 \leq a, b \leq 1,000,000$

Examples

Sample Input 1

```
3 2
```

Sample Output 1

```
5
```

Sample Input 2

```
-5 5
```

Sample Output 2

```
0
```

Sample Input 3

```
1000 -54391
```

Sample Output 3

```
53391
```

2 Grid Sums

Given as input the integers N and M, and an NxM grid, print the sum of each row of the grid on a separate line.

Input/Output

Input

Two space-separated integers N, M on a single line. These define the dimensions of the grid. N lines follow, each containing M space integers, corresponding to the values of a row in the grid

Output

N lines, each containing the sum of its respective row in the grid.

Constraints

$1 \leq N, M \leq 10\,000$

$-1,000 \leq \text{grid}[i][j] \leq 1,000$

Examples

Sample Input

```
4 5
1 1 1 1 1
0 0 0 0 1
2 3 -2 3 10
-100 -5 -1 -1 -1
```

Sample Output 1

```
5
1
16
-108
```

Sample Input 2

```
1 1
10
```

Sample Output 2

```
10
```

3 Prime Numbers

Jo Prime learned about prime numbers at school. He learned that a number is prime if it is only divisible by 1 and itself (1 is not considered prime). He found out that there are very efficient algorithms that can determine if a number is prime or not, 'in time even below the polynomial'. Unfortunately, these algorithms are very complicated, and Jo thought of an approximation. The idea is to consider a prime number if it is not divisible by the first k prime numbers.

It proves that Jo's idea is only an approximation. Given a number k, find the smallest number n greater than 1 that is not divisible by the first k prime numbers, but is not prime.

Input/Output

Input

One line containing the number k

Output

One line containing the number n satisfying the condition

Constraints

- $1 \leq k \leq 100,000$

Examples

Sample Input

```
3
```

Sample Output

```
49
```

Explanation The first 3 primes are 2,3 and 5. The numbers that are not divisible by 2,3,5 are 7, 11, 13, 17, 19, 23, 31, 37, 41, 47, 49, ... 49 is the smallest with this property.

4 The Euclidean Algorithm

The greatest common divisor of two positive integer numbers a,b, is calculated efficiently using the Euclidean algorithm. Two numbers a, b are relative prime if their greatest common divisor is 1 e.g.. $gcd(a, b) = 1$; same three numbers are relative primes if $gcd(a, b, c) = 1$. This problem requires you to learn this Euclidean algorithm and apply it to the following problem.

Given 3 positive integers $a, bandc$ you must determine if these numbers are relative prime.

Input/Output

Input

One line containing the integers a, b and c separated by spaces

Output

One line containing either YES if the numbers are relative primes or NO otherwise.

Constraints

- $0 \leq a, b, c \leq 1,000,000,000$

Examples

Sample Input 1

```
22 126 123456
```

Sample Output 1

```
NO
```

Explanation 1 The numbers are not relative primes as all are even

Sample Input 2

```
17 31 97
```

Sample Output 2

```
YES
```

Explanation 2 The numbers are relative primes as $gcd(17, 31, 97) = 1$

5 String Transformations

Samuel String loves to play with strings and their intricate structures. In his latest challenge, Samuel is experimenting with a unique, 3 stepped strategy for transforming the sentences:

1. Reverse the order of words in the string.
2. For each word, reverse the characters within the word if the word starts with a consonant and contains an odd number of characters.
3. Remove any duplicate words from the transformed string.

Help Samuel find out the result of applying his strategy on different strings.

Input/Output

Input

One line containing the string s is composed of alphabetical characters, spaces and punctuation.

Output

One line containing the string s after Samuel's strategy has been applied.

Constraints

- $1 \leq length(s) \leq 10,000$
- words can contain alphabetical characters and punctuation

Examples

Sample Input 1

```
Space After Space
```

Sample Output 1

```
ecapS After
```

Sample Input 2

```
Hello World! Python is awesome. Hello Python.
```

Sample Output 2

```
.nohtyP olleH awesome. is Python World!
```

6 Positronic Dillema

In an intriguing fusion of technology and science fiction, Grey, an ambitious computer scientist, has embarked on creating a positronic brain, a concept borrowed from his favourite sci-fi narratives. These advanced artificial brains operate based on deterministically sequenced thought chains. However, Grey encountered a critical issue during his experimental trials: some positronic brains entered an unresponsive state, freezing indefinitely. Upon thorough investigation, Grey uncovered that these freezes were caused by the brains getting trapped in infinite thought cycles. This poses a significant risk to the functionality and reliability of these advanced artificial intelligence systems.

Grey seeks your expertise in analyzing the new designs of positronic brains. He has provided a map detailing all the possible thought connections in his designs. Your task is to analyze these newly designed architectures and determine if such loops are still possible.

Input/Output

Input

On the first line, an integer n counting the number of connections in the design On each subsequent line, a pair of integers a, b separated by commas with the meaning of thought a leads to thought b. A thought can be self-referencing, meaning that a thought can lead to itself

Output

One capitalised word $SAFE$ if the design contains no cycles, $UNSAFE$ otherwise

Constraints

- $1 \leq$ nr of thoughts $\leq 1,000$
- $1 \leq n \leq 100,000$

Examples

Sample Input 1

```
2
1,3
3,5
```

Sample Output 1

```
SAFE
```

Explanation 1 The thought chain contains no cycles. One leads to three, and three leads to 5.

Sample Input 2

```
3
1,3
3,5
5,3
```

Sample Output 2

```
UNSAFE
```

Explanation 2 The thought chain contains the cycle 3, 5