AIPO 2022
Preliminary Round

January 7, 2022

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 Within Range

Calum Watt is a newly hired engineer at a factory. His job is to watch the production line and ensure that all products are within an allowed range of error.

You have to help Calum decide if a measurement from the production line falls within the acceptable range or not.

Input/Output

The first line consists of two numbers L and U representing the lower and upper values of the acceptable range.

The second line contains a measurement M taken by Calum.

You must output a single word, True or False - True only if the measurement M is both $\geq$ the lower value L, and $\leq$ the upper value U. Output False otherwise.

Examples

Sample Input 1

```
5 9
6
```

Sample Output 1

```
True
```

Sample Input 2

```
10 20
21
```

Sample Output 2

```
False
```

2 Prime Numbers

John Primes has just learned about prime numbers at school. He learned that a number is prime if it is divisible only by both 1 and by itself (1 is not considered a prime number). He learned that there are very efficient algorithms that can determine whether a number is prime or not. Unfortunately, these algorithms are very complicated, so John has come up with a simpler approximate solution. His idea is to consider a number prime if it is not divisible by the first K prime numbers.

You have to prove that John's idea is just an approximation, and that it incorrectly identifies some non-prime numbers as prime. Given a number K, find the smallest number x greater than 1 that is not divisible by the first K prime numbers, but is not prime itself.

Input/Output

The first line contains the number K

You must output a single line containing the number N that is not divisible by the first K prime numbers, but is not prime itself.

Examples

Sample Input 1

```
2
```

Sample Output 1

```
25
```

Explanation The first 2 prime numbers are 2, 3. The numbers that are not divisible by 2, 3 are: 5, 7, 11, 13, 17, 19, 23, 25

Sample Input 2

```
3
```

Sample Output 2

```
49
```

Explanation The first 3 prime numbers are 2, 3, 5. The numbers that are not divisible by 2, 3 or 5 are: 7, 11, 13, 17, 19, 23, 31, 37, 41, 47, 49

3 Efficient Weighting

Tara Newton received a gift for her birthday. In order to guess what's inside the gift she wants to measure its exact weight. Fortunately she has a balance and a set of K weights she can use in her quest. Because the weights are in the basement Tara doesn't want to carry more weights than are needed to find the gifts weight.

Your task is to help Tara find out the minimum number of weights she needs to carry out of the basement in order to match the weight of her gift

Input/Output

The first line contains the number of K weights The second line contains the values for each of the K weights separated by space. It can be assumed that there is an infinite amount of each of the weights available. The third (final) line contains the weight of the gift

You must output a single value - the minimum numbers of weights needed to match the gifts weight.

If it is impossible to match the exact weight of the gift using the weights available to Tara, you should output -1

Examples

Sample Input 1

```
3
1 2 5
11
```

Sample Output 1

```
3
```

Explanation 11 can be achieved with two weights of 5 and one of 1

Sample Input 2

```
1
2
5
```

Sample Output 2

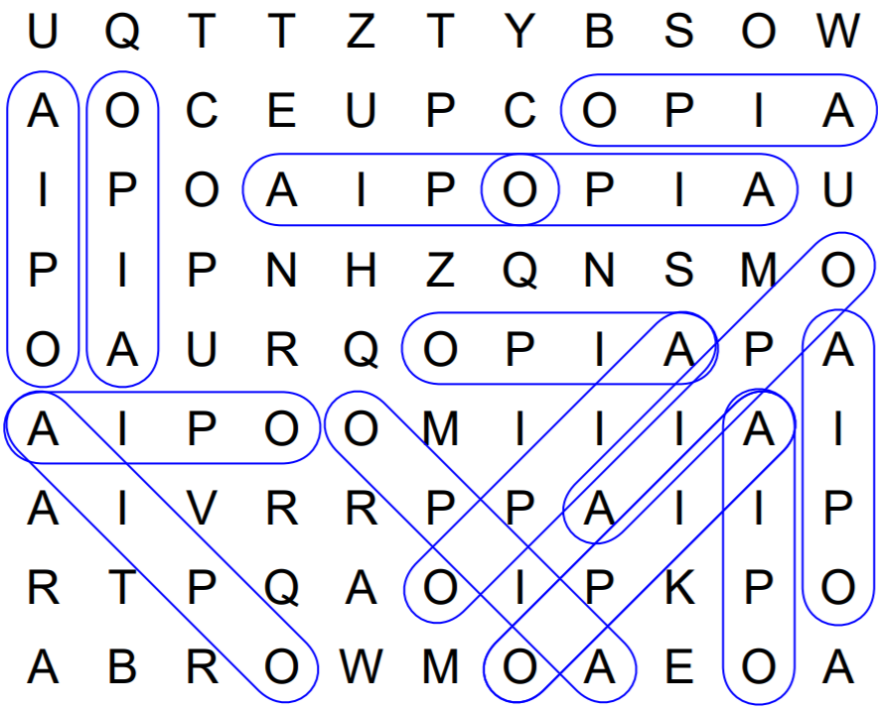
```
-1
```

Explanation There is no way to match 5 only using weights of 2

4 Wordsearch

We are given a simple word search to solve, where there is only one word we are looking to find -"AIPO"

The grid we are searching in is not necessarily square, and you can find the word "AIPO" in 8 possible directions - vertically, horizontally, and diagonally.



Input/Output

The first line consists of two numbers N and M representing the width and height of the grid to search

N lines follow, each containing M characters. This forms the grid to search.

Examples

Sample Input 1

```
9 11
UQTTZTYBSOW
AOCEUPCOPIA
IPOAIPOPIAU
PIPNHZQNSMO
OAURQOPIAPA
AIPOOMIIIAI
AIVRRPPAIIP
RTPQAOIPKPO
ABROWMOAEOA
```

Sample Output 1

```
14
```

Sample Input 2

```
4 4
aipo
iiii
pppp
oooo
```

Sample Output 2

```
3
```

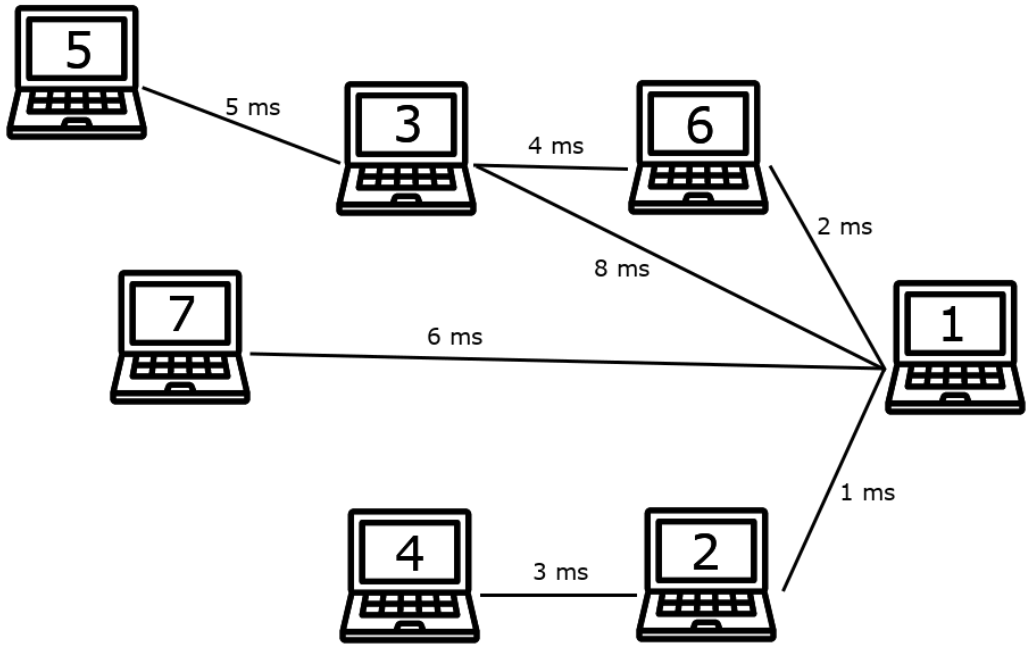
Sample Input/Output 1 corresponds to the example described in the question

5 Routing

You have been tasked with managing a network of N computers. Every computer on the network is numbered between 1 and N and is connected with cables to some other computer on the same network - each computer is guaranteed to be connected to one or more other computers.

When a computer wants to communicate with another computer, the message may have to travel through other computers in the network to reach its destination. Every cable between computers has a unique *latency* - a time delay between the computers at each end. When a message leaves one computer, it takes this time to reach the other computer at the other end of the cable. Assume all messages between computers travel with the minimum possible latency, if there are multiple possible routes.

For the example below, if a message needs to travel from computer 2 to computer 5, the minimum latency is $1 + 2 + 4 + 5 = 12$ ms following route 2,1,6,3,5.



Your task is, given a network of computers and cables, find the two computers on the network, which have the largest latency between them, even when the lowest latency route between them is taken. For the above example, the answer is computers 4 and 5, which have latency 15ms between them.

Input/Output

The first two lines contain two integers, N and M, corresponding to the number of computers, and number of cables in the network respectively.

The following M lines describe cables joining pairs of computers on the network. Each contain three values a, b and l - the numbers of the computers connected by the cable, and the latency of the cable in milliseconds.

You must output a single line containing three values - the numbers of the computers that have the maximum latency (in increasing order), and their latency

Examples

Sample Input 1

```
7 7
5 3 5
3 6 4
6 1 2
3 1 8
1 7 6
2 1 1
2 4 3
```

Sample Output 1

```
5 7 17
```

Sample Input 2

```
7 9
5 3 5
3 6 4
6 1 2
3 1 8
1 7 18
2 1 1
2 4 3
4 7 100
7 5 27
```

Sample Output 2

```
1 7 18
```

Sample Input/Output 1 corresponds to the example described in the question