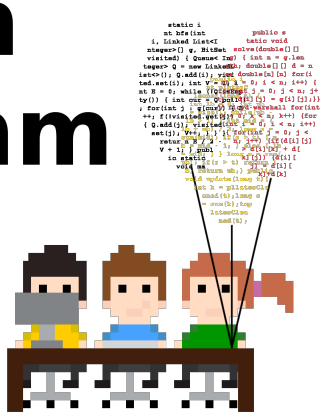
Belgium Algorithm Contest



Belgium Algorithm Contest
Round 3 - 2017

Do not open before the start of the contest.

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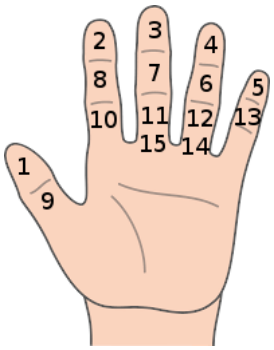
Belgium Algorithm Contest

Problem A
Finger Counting
Time limit: 2s

Alice just had a class where she learned to count on her fingers. To count up to m she starts on the thumb at 1 and goes left until the pinky finger and then back to the thumb and so on until she reaches m. The following picture shows the finger in which each number is counted when counting until $m = 15$.



After telling her older brother Craig, he really thought this was a useless thing to learn because this does not really help to count at all. To make sure his sister would still learn something from this, he asked her the following question:

If you count up to m, how many numbers will you count on each of your fingers? And what if intead of 5 fingers, you have n?

In the example with $n = 5$ and $m = 15$, she counted two numbers (1 and 9) on the first finger, 3 on the second finger, 4 on the third and forth fingers and 2 numbers on the pinky finger.

Input

A single line with two integers n and m as described above.

Constraints

1. $1 \leq n \leq 50000$
2. $1 \leq m < 2^{31}$

Output

A single line with n integers $c_1, \ldots, c_n$ separated by single spaces such that c_i is the amount of numbers that are counted on the i-th finger.

Example

Input 1

```
5 15
```

Output 1

```
2 3 4 4 2
```

Input 2

```
7 21
```

Output 2

```
2 3 3 3 4 4 2
```

Input 3

```
4 2147483647
```

Output 3

```
357913942 715827882 715827882 357913941
```

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Problem B
Friendless
Time limit: 2s

Bob, Alice and Craig are going on a school field trip. There are a total of n students that will travel on two buses. Both buses have capacity n and the kids can be assigned to the buses in any way the teachers want. The teachers have noticed that the kids are troublesome when they travel with their friends.

The teachers know that gossip ends friendships. Obviously two people will not gossip about a third one if the three of them are on the same bus. Since everyone loves gossip, the kids in one bus will always gossip about everyone that is on the other bus.

Therefore the teachers would like to split the kids between the buses so that after the trip, no two kids are friends because of gossip.

It is very evil but such a relief for them. Could you help them know whether their evil plan is achievable?

Input

The first line of the input contains two integers n and m giving the number of kids in the class and the number of friendships (pairs of kids that are friends with each other).

Then follow m lines each with two integers x and y meaning that kid x is friends with kid y. For simplicity, the kids are numbered from 0 to $n-1$. Assume that friendships are symmetric, meaning that is x is friends with y then y is friends with x.

Constraints

1. $1 \leq n \leq 10000$
2. $0 \leq m \leq min(50000, n(n-1)/2)$
3. $0 \leq x, y < n$
4. $x \neq y$

Output

A single line with `yes` if the teachers can split the kids so that all friendships are destroyed by gossip or `no` otherwise.

Example

Input 1

```
4 4
3 0
0 1
2 3
1 2
```

Output 1

```
yes
```

Input 2

```
6 8
0 1
1 2
2 3
3 4
4 5
5 0
0 3
4 2
```

Output 2

```
no
```

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● Problem C
Mokey Kong
Time limit: 2s

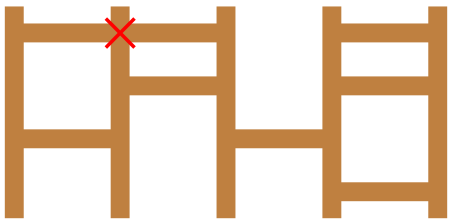
Alice just bought the latest and best game in the world: `Monkey Kong`. In this game, a monkey is on the top of a ladder and throws barrels and the player is at the bottom and has to reach the top while avoiding the barrels. The barrels fall down and whenever they come across an horizontal crossing, it will follow it. If a barrel hits the player, the player will loose.

The following figure shows the paths that the barrels will take when thrown from each of the possible positions on a particular level.

She has already mastered the game and is now playing with the level editor. In this editor she can set the number of vertical sections and then add horizontal sections connecting them. A valid level can never contain two horizontal sections next to each other horizontally.

Otherwise a barrel coming from above would not know whether to go left or right and the game would crash.

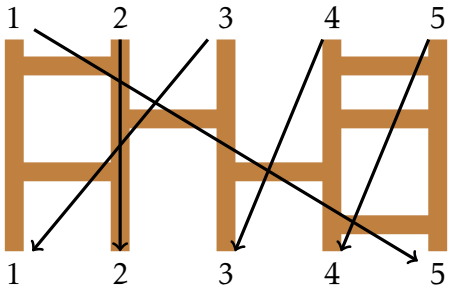
The following figure shows such an **invalid** example:



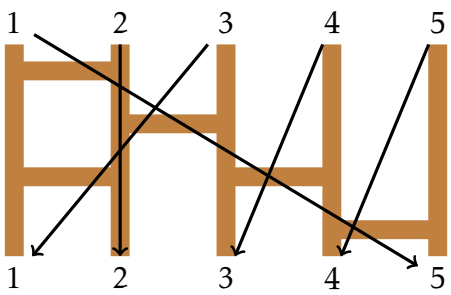
Each position where the monkey can throw a barrel from, corresponds to a position at the bottom where the barrel path with end. She has designed the best level ever. But when she tried to save it, the game said it did not fit in memory as it used too many horizontal crossings. She wonders if it is possible to maintain the same correspondence between initial and final positions of the barrels but using less horizontal crossings.

Your task is to help her compute the minimum number of horizontal crossings she has to use in order to maintain this correspondence (while maintain the number of vertical sections).

For instance, the level shown in the example above uses 7 horizontal crossings. It has 5 vertical sections. Barrels thrown from postion 1 fall in position 5, from position 2 to position 2, position 3 to position 1, position 4 to position 3 and postion 5 to postion 4.



It is possible to create a level using only 5 horizontal crossings that achieves the same:



Input

The input will be given as an ASCII representation of the level she designed. The caracter | will represent the vertical sections and the character - will represent the horizontal ones. positions without horizontal sections will be represented by a white space. For instance the first level shown above is represented as follows:

```
|-|  |  |-|
|  |-|  |-|
|-|  |-|  |
|  |  |  |-|
```

The first line of the input contains two integers n and m separated by single spaces giving the height (number of lines in the ascii representation) and m will give the number of columns in the ascii representation.

The will follow n lines each with m characters giving the representation of the level as described above.

Constraints

1. $n \geq 1$
2. $m \geq 3$
3. $n \cdot m \leq 50000$
4. **The are never two horizontal sections that are adjacent.**

Output

A single line with the minimum number of horizontal sections of a level with the same correspondence between inital and final positions in the barrel paths.

Example

Input 1

```
4 9
|-|  |  |-|
|  |-|  |-|
|-|  |-|  |
|  |  |  |-|
```

Output 1

```
5
```

Input 2

```
4 7
|-|  |  |
|  |-|  |
|-|  |  |
|  |  |-|
```

Output 2

```
4
```

Input 3

```
4 17
|-|  |-|  |-|  |  |-|
|  |-|  |-|  |-|  |-|
|-|  |  |-|  |  |-|  |
|  |  |-|  |-|  |  |-|
```

Output 3

```
10
```

Problem D
YUNOAC
Time limit: 2s

Craig left his number theory class with a strange problem. Given six integers y, u, n, o, a and c, decide whether

$$y^u \cdot n^o = a^c.$$

It seemed to him that it was more of a problem for his Java programming class where he just learned big integers. However the weekend is almost over and he still does not have an answer.

Can you help him?

Input

A single line with six integers y, u, n, o, a and c separated by single spaces.

Constraints

1. $1 \leq y, n, a < 2^{127}$
2. $1 \leq u, o, c < 2^{63}$

Note that some of these values do not fit into `long` so make sure you don't read them as such.

Output

A single line with `yes` if $y^u \cdot n^o = a^c$ and `no` otherwise.

Example

Input 1

```
12 5 18 3 6 13
```

Output 1

```
no
```

Input 2

```
105 3 143 3 15015 3
```

Output 2

```
yes
```

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Problem E
Infinite drive
Time limit: 2s

In a far away land there is an infinitely long road. Unfortunately the road has a single lane. Therefore it is impossible for cars to overtake each other. This means that if car A is behind car B but A is faster than B, when A meets B, it will run just behind B at the same speed as B forever.

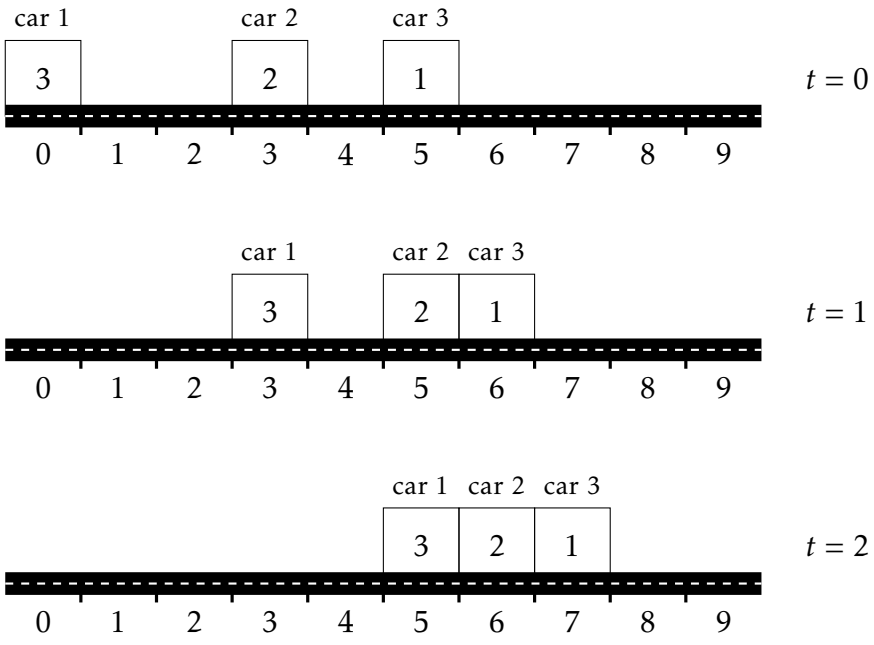
There are n cars and the i-th car has initial position $x(i,0)$ with

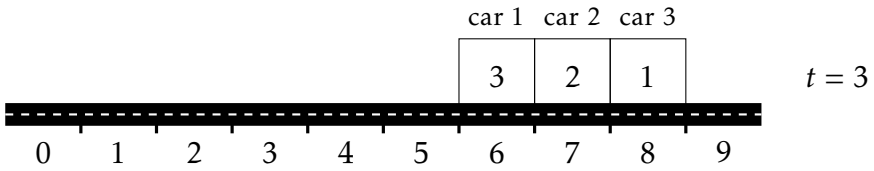
$$x(1,0) < x(2,0) < \ldots < x(n,0).$$

Each car also has an initial speed $s(i)$ and unit length. The cars move in a discrete way, meaning that if $x(i,t)$ is the position of car i at time t then,

$$x(i,t+1) = \begin{cases} x(i,t) + s(i) & \text{if } i = n \\ \min\left(x(i,t) + s(i), x(i+1,t+1) - 1\right) & \text{otherwise} \end{cases}$$

For instance, consider three cars with $x(1,0) = 0$, $x(2,0) = 3$, $x(3,0) = 5$, $s(1) = 3$, $s(2) = 2$ and $s(3) = 1$. The following figure illustrates the positions of the cars for $t = 0, 1, 2, 3$.





Cars i and j (with $i < j$) belong to the same group at time t if there is no empty space between them at time t. This means that $x(k,t)+1 = x(k+1,t)$ for all $k = i, i+1, \ldots, j-1$. In the previous example at time $t = 0$ there are 3 groups, at time $t = 1$ there are 2 groups and for any $t \geq 2$ there is only one group.

Your task is to, given the initial positions, speeds of the cars and t, compute how many groups there are at time t.

Input

The first line of the input contains a single integer n, giving the number of cars.

The next n lines each contain two integers $x(i,0)$ and $s(i)$ giving the initial position and speed of each of the cars.

After follows a line with a single integer q representing the number of times for which you have to compute the groups.

Finally, the last q lines each contain an integer t_i giving a query time.

Constraints

1. $1 \leq n \leq 100000$
2. $0 \leq x(i,0) < 2^{31}$
3. $x(1,0) < x(2,0) < \ldots < x(n,0)$
4. $1 \leq s(i) \leq 100000$
5. $1 \leq q \leq 50000$
6. $0 \leq t_i \leq 10^7$

Output

q lines each with a single integer giving the number of groups at times $t_1, t_2 \ldots, t_q$.

Example

Input 1

```
3
0 3
3 2
5 1
4
0
1
2
3
```

Output 1

```
3
2
1
1
```

Input 2

```
3
0 1
2 1
4 1
3
1
100
10000000
```

Output 2

```
3
3
3
```

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