Codeforces Round #499 (Div. 2)

A. Stages

1 second, 256 megabytes

Natasha is going to fly to Mars. She needs to build a rocket, which consists of several stages in some order. Each of the stages is defined by a lowercase Latin letter. This way, the rocket can be described by the string — concatenation of letters, which correspond to the stages.

There are n stages available. The rocket must contain exactly k of them. Stages in the rocket should be ordered by their weight. So, after the stage with some letter can go only stage with a letter, which is at least two positions after in the alphabet (skipping one letter in between, or even more). For example, after letter 'c' can't go letters 'a', 'b', 'c' and 'd', but can go letters 'e', 'f', ..., 'z'.

For the rocket to fly as far as possible, its weight should be minimal. The weight of the rocket is equal to the sum of the weights of its stages. The weight of the stage is the number of its letter in the alphabet. For example, the stage 'a 'weighs one ton,' b 'weighs two tons, and' z' — 26 tons.

Build the rocket with the minimal weight or determine, that it is impossible to build a rocket at all. Each stage can be used at most once.

Input

The first line of input contains two integers — n and k ($1 \le k \le n \le 50$) – the number of available stages and the number of stages to use in the rocket.

The second line contains string s, which consists of exactly n lowercase Latin letters. Each letter defines a new stage, which can be used to build the rocket. Each stage can be used at most once.

Output

Print a single integer — the minimal total weight of the rocket or -1, if it is impossible to build the rocket at all.

input
```
5 3
xyabd
```
output
```
29
```

input
```
7 4
problem
```
output
```
34
```

input
```
2 2
ab
```
output
```
-1
```

input
```
12 1
abaabbaaabbb
```
output
```
1
```

In the first example, the following rocket satisfy the condition:

- "adx" (weight is $1+4+24=29$);
- "ady" (weight is $1+4+25=30$);
- "bdx" (weight is $2+4+24=30$);
- "bdy" (weight is $2+4+25=31$).

Rocket "adx" has the minimal weight, so the answer is 29.

In the second example, target rocket is "belo". Its weight is $2+5+12+15=34$.

In the third example, $n=k=2$, so the rocket must have both stages: 'a' and 'b'. This rocket doesn't satisfy the condition, because these letters are adjacent in the alphabet. Answer is -1.

B. Planning The Expedition

1 second, 256 megabytes

Natasha is planning an expedition to Mars for n people. One of the important tasks is to provide food for each participant.

The warehouse has m daily food packages. Each package has some food type a_i.

Each participant must eat exactly one food package each day. Due to extreme loads, each participant must eat the same food type throughout the expedition. Different participants may eat different (or the same) types of food.

Formally, for each participant j Natasha should select his food type b_j and each day j-th participant will eat one food package of type b_j. The values b_j for different participants may be different.

What is the maximum possible number of days the expedition can last, following the requirements above?

Input

The first line contains two integers n and m ($1 \le n \le 100$, $1 \le m \le 100$) — the number of the expedition participants and the number of the daily food packages available.

The second line contains sequence of integers $a_1, a_2, \dots, a_m$ ($1 \le a_i \le 100$), where a_i is the type of i-th food package.

Output

Print the single integer — the number of days the expedition can last. If it is not possible to plan the expedition for even one day, print 0.

input
```
4 10
1 5 2 1 1 1 2 5 7 2
```
output
```
2
```

input
```
100 1
1
```
output
```
0
```

input
```
2 5
5 4 3 2 1
```

output

```
1
```

input

```
3 9
42 42 42 42 42 42 42 42 42
```

output

```
3
```

In the first example, Natasha can assign type 1 food to the first participant, the same type 1 to the second, type 5 to the third and type 2 to the fourth. In this case, the expedition can last for 2 days, since each participant can get two food packages of his food type (there will be used 4 packages of type 1, two packages of type 2 and two packages of type 5).

In the second example, there are 100 participants and only 1 food package. In this case, the expedition can't last even 1 day.

C. Fly

1 second, 256 megabytes

Natasha is going to fly on a rocket to Mars and return to Earth. Also, on the way to Mars, she will land on $n-2$ intermediate planets. Formally: we number all the planets from 1 to n. 1 is Earth, n is Mars. Natasha will make exactly n flights: $1 \to 2 \to \ldots n \to 1$.

Flight from x to y consists of two phases: take-off from planet x and landing to planet y. This way, the overall itinerary of the trip will be: the 1-st planet $\to$ take-off from the 1-st planet $\to$ landing to the 2-nd planet $\to$ 2-nd planet $\to$ take-off from the 2-nd planet $\to \ldots \to$ landing to the n-th planet $\to$ the n-th planet $\to$ take-off from the n-th planet $\to$ landing to the 1-st planet $\to$ the 1-st planet.

The mass of the rocket together with all the useful cargo (but without fuel) is m tons. However, Natasha does not know how much fuel to load into the rocket. Unfortunately, fuel can only be loaded on Earth, so if the rocket runs out of fuel on some other planet, Natasha will not be able to return home. Fuel is needed to take-off from each planet and to land to each planet. It is known that 1 ton of fuel can lift off a_i tons of rocket from the i-th planet or to land b_i tons of rocket onto the i-th planet.

For example, if the weight of rocket is 9 tons, weight of fuel is 3 tons and take-off coefficient is 8 ($a_i = 8$), then 1.5 tons of fuel will be burnt (since $1.5 \cdot 8 = 9 + 3$). The new weight of fuel after take-off will be 1.5 tons.

Please note, that it is allowed to burn non-integral amount of fuel during take-off or landing, and the amount of initial fuel can be non-integral as well.

Help Natasha to calculate the minimum mass of fuel to load into the rocket. Note, that the rocket must spend fuel to carry both useful cargo and the fuel itself. However, it doesn't need to carry the fuel which has already been burnt. Assume, that the rocket takes off and lands instantly.

Input

The first line contains a single integer n ($2 \le n \le 1000$) — number of planets.

The second line contains the only integer m ($1 \le m \le 1000$) — weight of the payload.

The third line contains n integers $a_1, a_2, \ldots, a_n$ ($1 \le a_i \le 1000$), where a_i is the number of tons, which can be lifted off by one ton of fuel.

The fourth line contains n integers $b_1, b_2, \ldots, b_n$ ($1 \le b_i \le 1000$), where b_i is the number of tons, which can be landed by one ton of fuel.

It is guaranteed, that if Natasha can make a flight, then it takes no more than 10^9 tons of fuel.

Output

If Natasha can fly to Mars through $(n-2)$ planets and return to Earth, print the minimum mass of fuel (in tons) that Natasha should take. Otherwise, print a single number -1.

It is guaranteed, that if Natasha can make a flight, then it takes no more than 10^9 tons of fuel.

The answer will be considered correct if its absolute or relative error doesn't exceed 10^{-6}. Formally, let your answer be p, and the jury's answer be q. Your answer is considered correct if $\frac{|p-q|}{\max(1,|q|)} \le 10^{-6}$.

input

```
2
12
11 8
7 5
```

output

```
10.0000000000
```

input

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

output

```
-1
```

input

```
6
2
4 6 3 3 5 6
2 6 3 6 5 3
```

output

```
85.4800000000
```

Let's consider the first example.

Initially, the mass of a rocket with fuel is 22 tons.

- At take-off from Earth one ton of fuel can lift off 11 tons of cargo, so to lift off 22 tons you need to burn 2 tons of fuel. Remaining weight of the rocket with fuel is 20 tons.
- During landing on Mars, one ton of fuel can land 5 tons of cargo, so for landing 20 tons you will need to burn 4 tons of fuel. There will be 16 tons of the rocket with fuel remaining.
- While taking off from Mars, one ton of fuel can raise 8 tons of cargo, so to lift off 16 tons you will need to burn 2 tons of fuel. There will be 14 tons of rocket with fuel after that.
- During landing on Earth, one ton of fuel can land 7 tons of cargo, so for landing 14 tons you will need to burn 2 tons of fuel. Remaining weight is 12 tons, that is, a rocket without any fuel.

In the second case, the rocket will not be able even to take off from Earth.

D. Rocket

1 second, 256 megabytes

This is an interactive problem.

Natasha is going to fly to Mars. Finally, Natasha sat in the rocket. She flies, flies... but gets bored. She wishes to arrive to Mars already! So she decides to find something to occupy herself. She couldn't think of anything better to do than to calculate the distance to the red planet.

Let's define x as the distance to Mars. Unfortunately, Natasha does not know x. But it is known that $1 \le x \le m$, where Natasha knows the number m. Besides, x and m are positive integers.

Natasha can ask the rocket questions. Every question is an integer y ($1 \le y \le m$). The correct answer to the question is -1, if $x < y$, 0, if $x = y$, and 1, if $x > y$. But the rocket is broken — it does not always answer correctly. Precisely: let the correct answer to the current question be equal to t, then, if the rocket answers this question correctly, then it will answer t, otherwise it will answer $-t$.

In addition, the rocket has a sequence p of length n. Each element of the sequence is either 0 or 1. The rocket processes this sequence in the cyclic order, that is 1-st element, 2-nd, 3-rd, $\ldots$, $(n-1)$-th, n-th, 1-st, 2-nd, 3-rd, $\ldots$, $(n-1)$-th, n-th, $\ldots$. If the current element is 1, the rocket answers correctly, if 0 — lies. Natasha doesn't know the sequence p, but she knows its length — n.

You can ask the rocket no more than 60 questions.

Help Natasha find the distance to Mars. Assume, that the distance to Mars does not change while Natasha is asking questions.

Your solution will not be accepted, if it does not receive an answer 0 from the rocket (even if the distance to Mars is uniquely determined by the already received rocket's answers).

Input

The first line contains two integers m and n ($1 \le m \le 10^9$, $1 \le n \le 30$) — the maximum distance to Mars and the number of elements in the sequence p.

Interaction

You can ask the rocket no more than 60 questions.

To ask a question, print a number y ($1 \le y \le m$) and an end-of-line character, then do the operation `flush` and read the answer to the question.

If the program reads 0, then the distance is correct and you must immediately terminate the program (for example, by calling `exit(0)`). If you ignore this, you can get any verdict, since your program will continue to read from the closed input stream.

If at some point your program reads -2 as an answer, it must immediately end (for example, by calling `exit(0)`). You will receive the "Wrong answer" verdict, and this will mean that the request is incorrect or the number of requests exceeds 60. If you ignore this, you can get any verdict, since your program will continue to read from the closed input stream.

If your program's request is not a valid integer between -2^{31} and $2^{31}-1$ (inclusive) without leading zeros, then you can get any verdict.

You can get "Idleness limit exceeded" if you don't print anything or if you forget to flush the output.

To flush the output buffer you can use (after printing a query and end-of-line):

- `fflush(stdout)` in C++;
- `System.out.flush()` in Java;
- `stdout.flush()` in Python;
- `flush(output)` in Pascal;
- See the documentation for other languages.

Hacking

Use the following format for hacking:

In the first line, print 3 integers m, n, x ($1 \le x \le m \le 10^9$, $1 \le n \le 30$) — the maximum distance to Mars, the number of elements in the sequence p and the current distance to Mars.

In the second line, enter n numbers, each of which is equal to 0 or 1 — sequence p.

The hacked solution will not have access to the number x and sequence p.

input

```
5 2
1
-1
-1
1
0
```

output

```
1
2
4
5
3
```

In the example, hacking would look like this:

```
5 2 3

1 0
```

This means that the current distance to Mars is equal to 3, Natasha knows that it does not exceed 5, and the rocket answers in order: correctly, incorrectly, correctly, incorrectly ...

Really:

on the first query (1) the correct answer is 1, the rocket answered correctly: 1;

on the second query (2) the correct answer is 1, the rocket answered incorrectly: -1;

on the third query (4) the correct answer is -1, the rocket answered correctly: -1;

on the fourth query (5) the correct answer is -1, the rocket answered incorrectly: 1;

on the fifth query (3) the correct and incorrect answer is 0.

E. Border

1 second, 256 megabytes

Astronaut Natasha arrived on Mars. She knows that the Martians are very poor aliens. To ensure a better life for the Mars citizens, their emperor decided to take tax from every tourist who visited the planet. Natasha is the inhabitant of Earth, therefore she had to pay the tax to enter the territory of Mars.

There are n banknote denominations on Mars: the value of i-th banknote is a_i. Natasha has an infinite number of banknotes of each denomination.

Martians have k fingers on their hands, so they use a number system with base k. In addition, the Martians consider the digit d (in the number system with base k) divine. Thus, if the last digit in Natasha's tax amount written in the number system with the base k is d, the Martians will be happy. Unfortunately, Natasha does not know the Martians' divine digit yet.

Determine for which values d Natasha can make the Martians happy.

Natasha can use only her banknotes. Martians don't give her change.

Input

The first line contains two integers n and k ($1 \le n \le 100\,000$, $2 \le k \le 100\,000$) — the number of denominations of banknotes and the base of the number system on Mars.

The second line contains n integers $a_1, a_2, \ldots, a_n$ ($1 \le a_i \le 10^9$) — denominations of banknotes on Mars.

All numbers are given in decimal notation.

Output

On the first line output the number of values d for which Natasha can make the Martians happy.

In the second line, output all these values in increasing order.

Print all numbers in decimal notation.

input

```
2 8
12 20
```

output

```
2
0 4
```

input

```
3 10
10 20 30
```

output

```
1
0
```

Consider the first test case. It uses the octal number system.

If you take one banknote with the value of 12, you will get 14_8 in octal system. The last digit is 4_8.

If you take one banknote with the value of 12 and one banknote with the value of 20, the total value will be 32. In the octal system, it is 40_8. The last digit is 0_8.

If you take two banknotes with the value of 20, the total value will be 40, this is 50_8 in the octal system. The last digit is 0_8.

No other digits other than 0_8 and 4_8 can be obtained. Digits 0_8 and 4_8 could also be obtained in other ways.

The second test case uses the decimal number system. The nominals of all banknotes end with zero, so Natasha can give the Martians only the amount whose decimal notation also ends with zero.

F. Mars rover

5 seconds, 256 megabytes

Natasha travels around Mars in the Mars rover. But suddenly it broke down, namely — the logical scheme inside it. The scheme is an undirected tree (connected acyclic graph) with a root in the vertex 1, in which every leaf (excluding root) is an input, and all other vertices are logical elements, including the root, which is output. One bit is fed to each input. One bit is returned at the output.

There are four types of logical elements: AND (2 inputs), OR (2 inputs), XOR (2 inputs), NOT (1 input). Logical elements take values from their direct descendants (inputs) and return the result of the function they perform. Natasha knows the logical scheme of the Mars rover, as well as the fact that only one input is broken. In order to fix the Mars rover, she needs to change the value on this input.

For each input, determine what the output will be if Natasha changes this input.

Input

The first line contains a single integer n ($2 \le n \le 10^6$) — the number of vertices in the graph (both inputs and elements).

The i-th of the next n lines contains a description of i-th vertex: the first word "AND", "OR", "XOR", "NOT" or "IN" (means the input of the scheme) is the vertex type. If this vertex is "IN", then the value of this input follows (0 or 1), otherwise follow the indices of input vertices of this element: "AND", "OR", "XOR" have 2 inputs, whereas "NOT" has 1 input. The vertices are numbered from one.

It is guaranteed that input data contains a correct logical scheme with an output produced by the vertex 1.

Output

Print a string of characters '0' and '1' (without quotes) — answers to the problem for each input in the ascending order of their vertex indices.

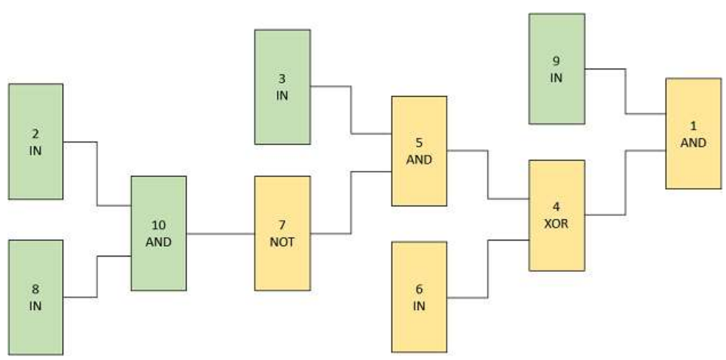
input

```
10
AND 9 4
IN 1
IN 1
XOR 6 5
AND 3 7
IN 0
NOT 10
IN 1
IN 1
AND 2 8
```

output

```
10110
```

The original scheme from the example (before the input is changed):



Green indicates bits '1', yellow indicates bits '0'.

If Natasha changes the input bit 2 to 0, then the output will be 1.

If Natasha changes the input bit 3 to 0, then the output will be 0.

If Natasha changes the input bit 6 to 1, then the output will be 1.

If Natasha changes the input bit 8 to 0, then the output will be 1.

If Natasha changes the input bit 9 to 0, then the output will be 0.