A. The Light Bulbs

Limits: 1 sec., 256 MiB

There are n light bulbs in a line numbered from 1 to n. Each of them can be either on or off but initially all of them are off. Also there are k switches. Each switch inverts the state of some of the light bulbs.

You are asked to find the minimal number of switches you need to flip in order to have at least m light bulbs on.

Input

First line contains three integers: n, m, k. Each of the next k lines contains informations about the switches. i-th of them starts with an integer c_i — the number of light bulbs that are inverted by this switch followed by c_i integers a_{ij} — the numbers of that light bulbs.

Output

Print one number — the answer for the problem or `-1` if the goal can not be achieved.

Constraints

$1 \leq m \leq n \leq 20$,
$1 \leq k \leq 100$,
$1 \leq a_{ij} \leq n$,
$a_{ij} \neq a_{ik}$ for $j \neq k$.

Samples

Input (*stdin*)	Output (*stdout*)
3 3 3 1 2 2 1 2 2 2 3	3

B. The Lucky Base

Limits: 1 sec., 256 MiB

You are given an integer n. Please, find the number of numerical systems in which n is a lucky number.

The number is considered to be lucky if it consists of only digits 4 and 7. For example 4, 47 and 444747 are lucky numbers nut 457, 53, 115 are not.

Input

The only line contains single integer n in base 10.

Output

Print all of the bases of numerical systems in which n is a lucky number in ascending order in a single line separated by single spaces. If there is an infinite number of bases print `INFINITY` instead. If there is no such bases print `NONE` instead.

Constraints

$1 \leq n \leq 10^9$

Samples

Input (*stdin*)	Output (*stdout*)
`39`	`8`

C. The Barrel

Limits: 1 sec., 256 MiB

There are n cities numbered from 1 to n. Some of them are connected with two-way roads. Initially each city has v_i liters of water.

The government of the country decided to redistribute water between the city. In order to do that they have to pick a volume of the barrel s and put all the water inside the identical barrels, s liters each. Please note that barrels are required to be full. If there is not enough water to completely fill a barrel then the water is considered to be wasted. Each city has as much barrels as it needs to use up the water it contains.

After that there are k days to redistribute water between cities. A barrel needs 1 day to travel between any two cities that are connected with a road. The final goal is to have at least one barrel with water in each city in k days.

Please find the maximum possible volume of the barrel s in order to be able to achieve the goal.

Input

The first line contains three integers n, m, k. The next line contains n integers v_i. The next m lines contain the description of roads: i-th of them contains two integers a_i and b_i which means that cities a_i and b_i are connected with a two-way road.

Output

Print the only number — the maximum possible volume of the barrel. The absolute or relative error should not exceed 10^{-2}.

Constraints

$1 \le n \le 100$,
$0 \le m \le 10000$,
$0 \le k \le 10^9$,
$1 \le v_i \le 10^9$,
$1 \le a_i, b_i \le n$.

Samples

Input (*stdin*)	Output (*stdout*)
2 1 1 2 5 1 2	2.50

D. The Lamps

Limits: 1 sec., 256 MiB

There are n lamps placed in a row and numbered from the left to the right. Some of the lamps are initially on, and some are off.

You goal is to either make all of them on or all of them off. In a single turn you can toggle all lamps in a range $(a \times 2^b) + 1$ to $(a + 1) \times 2^b$, inclusive. Here a and b are some non-negative integers. Note that a turn can be applied only when all lamps from the range are available.

Find the minimum number of turns you have to do to achieve your goal.

Input

The first line contains a single integer n — the number of lamps. The next line contains a string of n characters `0` and `1`. `0` indicates a lamp that is initially off, while `1` that it's on.

Output

A single integer — the minimum number of turns.

Constraints

$1 \leq n \leq 10^6$.

Samples

Input (*stdin*)	Output (*stdout*)
7 0100111	2

E. The Generator

Limits: 1 sec., 256 MiB

You have the following generator of positive integers. Each next integer is equal to such smallest integer z, such that among all previously generated integers there won't be two values x and y such that $x + x - y = z$. So, the first few generated integers look like this: 1, 2, 4, 5, 10, and so on.

You task is to find the n-th generated number.

Input

A single integer n.

Output

A single integer — the answer to the problem.

Constraints

$1 \le n \le 10^9$.

Samples

Input (*stdin*)	Output (*stdout*)
7	13

F. The Black and White Strings

Limits: 1 sec., 256 MiB

You have a black-and-white string s. The characters of string s are numbered from the left to the right from 1 to $|s|$, where $|s|$ is the length of the string. Let's denote the i-th character of string s as s_i. As the string is black-and-white, each character of the string is either letter `B`, or letter `W`. Unfortunately, the string is very old and some characters are damaged. The damaged positions are denoted as `X`.

You are determined to restore the string. For that you need to replace each character `X` by a `B` or a `W`. The string must look good, so it must be *beautiful*. You consider a string beautiful if it has two non-intersecting substrings of a given length k, such that the left one fully consists of characters `B`, and the right one fully consists of characters `W`. More formally, there are four integers a, b, c, d ($1 \le a \le b < c \le d \le |s|$; $b - a + 1 = d - c + 1 = k$) such that $s_i =$ `B` ($a \le i \le b$) and $s_j =$ `W` ($c \le j \le d$).

Find the number of different beautiful strings you can obtain from string s. Two strings are considered different if there is such position, where the character in the first string differs from the corresponding character in the second string.

Input

The first line contains two space-separated integers n and k. The second line contains string s. String s has length n and only consists of characters `W`, `B` and `X`.

Output

On a single line print an integer — the answer to the problem modulo 1000000007 ($10^9 + 7$).

Constraints

$1 \le k \le n \le 10^6$.

Samples

Input (*stdin*)	Output (*stdout*)
3 2 XXX	0
4 2 XXXX	1
10 2 XXBXXWXXXX	166

G. The Tree Painting

Limits: 1 sec., 256 MiB

You are given a rooted tree with N nodes. You would like to paint each node of the tree in one of three possible colors: red, green, and blue. The following conditions must be fulfilled:

- For each node painted red, there must be no more than R red nodes in its subtree (including this node).
- For each node painted green, there must be no more than G green nodes in its subtree (including this node).
- For each node painted blue, there must be no more than B blue nodes in it's subtree (including this node).

Find the number of ways to paint the tree and output it modulo 1000000007.

Input

The first line contains four integers N, R, G and B.

The following $N - 1$ lines contain pairs of the nodes' numbers U_i and V_i (one pair per line), describing the edges of the tree.

The nodes are numbered from 1 to N, inclusive, and the node with the index 1 is the root of the tree.

Output

Output the answer to the problem on the first line.

Constraints

$1 \leq N \leq 300$,
$0 \leq R, G, B \leq 300$.

Samples

Input (*stdin*)	Output (*stdout*)
3 1 1 1 1 2 3 1	12
8 2 1 3 1 2 1 4 5 4 7 4 3 2 4 6 8 6	613