Codeforces Round #196 (Div. 2)

A. Puzzles

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

The end of the school year is near and Ms. Manana, the teacher, will soon have to say goodbye to a yet another class. She decided to prepare a goodbye present for her n students and give each of them a jigsaw puzzle (which, as wikipedia states, is a tiling puzzle that requires the assembly of numerous small, often oddly shaped, interlocking and tessellating pieces).

The shop assistant told the teacher that there are m puzzles in the shop, but they might differ in difficulty and size. Specifically, the first jigsaw puzzle consists of f_1 pieces, the second one consists of f_2 pieces and so on.

Ms. Manana doesn't want to upset the children, so she decided that the difference between the numbers of pieces in her presents must be as small as possible. Let A be the number of pieces in the largest puzzle that the teacher buys and B be the number of pieces in the smallest such puzzle. She wants to choose such n puzzles that $A - B$ is minimum possible. Help the teacher and find the least possible value of $A - B$.

Input

The first line contains space-separated integers n and m ($2 \leq n \leq m \leq 50$). The second line contains m space-separated integers $f_1, f_2, ..., f_m$ ($4 \leq f_i \leq 1000$) — the quantities of pieces in the puzzles sold in the shop.

Output

Print a single integer — the least possible difference the teacher can obtain.

Sample test(s)

input

```
4 6
10 12 10 7 5 22
```

output

```
5
```

Note

Sample 1. The class has 4 students. The shop sells 6 puzzles. If Ms. Manana buys the first four puzzles consisting of 10, 12, 10 and 7 pieces correspondingly, then the difference between the sizes of the largest and the smallest puzzle will be equal to 5. It is impossible to obtain a smaller difference. Note that the teacher can also buy puzzles 1, 3, 4 and 5 to obtain the difference 5.

B. Routine Problem

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

Manao has a monitor. The screen of the monitor has horizontal to vertical length ratio a:b. Now he is going to watch a movie. The movie's frame has horizontal to vertical length ratio c:d. Manao adjusts the view in such a way that the movie preserves the original frame ratio, but also occupies as much space on the screen as possible and fits within it completely. Thus, he may have to zoom the movie in or out, but Manao will always change the frame proportionally in both dimensions.

Calculate the ratio of empty screen (the part of the screen not occupied by the movie) to the total screen size. Print the answer as an irreducible fraction p / q.

Input

A single line contains four space-separated integers a, b, c, d ($1 \le a, b, c, d \le 1000$).

Output

Print the answer to the problem as "p/q", where p is a non-negative integer, q is a positive integer and numbers p and q don't have a common divisor larger than 1.

Sample test(s)

input

```
1 1 3 2
```

output

```
1/3
```

input

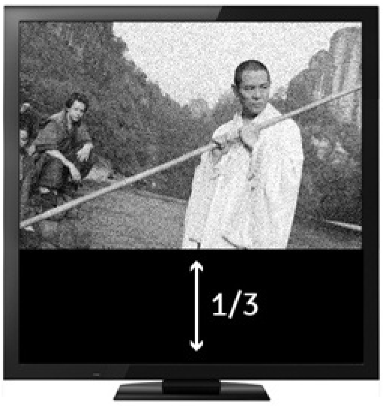
```
4 3 2 2
```

output

```
1/4
```

Note

Sample 1. Manao's monitor has a square screen. The movie has 3:2 horizontal to vertical length ratio. Obviously, the movie occupies most of the screen if the width of the picture coincides with the width of the screen. In this case, only 2/3 of the monitor will project the movie in the horizontal dimension:



Sample 2. This time the monitor's width is 4/3 times larger than its height and the movie's frame is square. In this case, the picture must take up the whole monitor in the vertical dimension and only 3/4 in the horizontal dimension:

C. Quiz

time limit per test: 1 second

memory limit per test: 256 megabytes

input: standard input

output: standard output

Manao is taking part in a quiz. The quiz consists of n consecutive questions. A correct answer gives one point to the player. The game also has a counter of consecutive correct answers. When the player answers a question correctly, the number on this counter increases by 1. If the player answers a question incorrectly, the counter is reset, that is, the number on it reduces to 0. If after an answer the counter reaches the number k, then it is reset, and the player's score is doubled. Note that in this case, first 1 point is added to the player's score, and then the total score is doubled. At the beginning of the game, both the player's score and the counter of consecutive correct answers are set to zero.

Manao remembers that he has answered exactly m questions correctly. But he does not remember the order in which the questions came. He's trying to figure out what his minimum score may be. Help him and compute the remainder of the corresponding number after division by 1000000009 $(10^9 + 9)$.

Input

The single line contains three space-separated integers n, m and k $(2 \le k \le n \le 10^9; 0 \le m \le n)$.

Output

Print a single integer — the remainder from division of Manao's minimum possible score in the quiz by 1000000009 $(10^9 + 9)$.

Sample test(s)

input

```
5 3 2
```

output

```
3
```

input

```
5 4 2
```

output

```
6
```

Note

Sample 1. Manao answered 3 questions out of 5, and his score would double for each two consecutive correct answers. If Manao had answered the first, third and fifth questions, he would have scored as much as 3 points.

Sample 2. Now Manao answered 4 questions. The minimum possible score is obtained when the only wrong answer is to the question 4.

Also note that you are asked to minimize the score and not the remainder of the score modulo 1000000009. For example, if Manao could obtain either 2000000000 or 2000000020 points, the answer is $2000000000 \mod 1000000009$, even though $2000000020 \mod 1000000009$ is a smaller number.

D. Book of Evil

time limit per test: 2 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Paladin Manao caught the trail of the ancient Book of Evil in a swampy area. This area contains n settlements numbered from 1 to n. Moving through the swamp is very difficult, so people tramped exactly $n - 1$ paths. Each of these paths connects some pair of settlements and is bidirectional. Moreover, it is possible to reach any settlement from any other one by traversing one or several paths.

The *distance* between two settlements is the minimum number of paths that have to be crossed to get from one settlement to the other one. Manao knows that the Book of Evil has got a damage range d. This means that if the Book of Evil is located in some settlement, its damage (for example, emergence of ghosts and werewolves) affects other settlements at distance d or less from the settlement where the Book resides.

Manao has heard of m settlements affected by the Book of Evil. Their numbers are $p_1, p_2, ..., p_m$. Note that the Book may be affecting other settlements as well, but this has not been detected yet. Manao wants to determine which settlements may contain the Book. Help him with this difficult task.

Input

The first line contains three space-separated integers n, m and d ($1 \le m \le n \le 100000; 0 \le d \le n - 1$). The second line contains m distinct space-separated integers $p_1, p_2, ..., p_m$ ($1 \le p_i \le n$). Then $n - 1$ lines follow, each line describes a path made in the area. A path is described by a pair of space-separated integers a_i and b_i representing the ends of this path.

Output

Print a single number — the number of settlements that may contain the Book of Evil. It is possible that Manao received some controversial information and there is no settlement that may contain the Book. In such case, print 0.

Sample test(s)

input

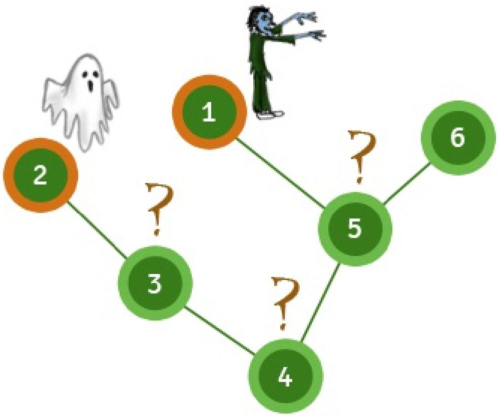
```
6 2 3
1 2
1 5
2 3
3 4
4 5
5 6
```

output

```
3
```

Note

Sample 1. The damage range of the Book of Evil equals 3 and its effects have been noticed in settlements 1 and 2. Thus, it can be in settlements 3, 4 or 5.



E. Divisor Tree

time limit per test: 0.5 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

A *divisor tree* is a rooted tree that meets the following conditions:

- Each vertex of the tree contains a positive integer number.
- The numbers written in the leaves of the tree are prime numbers.
- For any inner vertex, the number within it is equal to the product of the numbers written in its children.

Manao has n distinct integers $a_1, a_2, ..., a_n$. He tries to build a divisor tree which contains each of these numbers. That is, for each a_i, there should be at least one vertex in the tree which contains a_i. Manao loves compact style, but his trees are too large. Help Manao determine the minimum possible number of vertices in the divisor tree sought.

Input

The first line contains a single integer n $(1 \le n \le 8)$. The second line contains n distinct space-separated integers a_i $(2 \le a_i \le 10^{12})$.

Output

Print a single integer — the minimum number of vertices in the divisor tree that contains each of the numbers a_i.

Sample test(s)

input

```
2
6 10
```

output

```
7
```

input

```
4
6 72 8 4
```

output

```
12
```

input

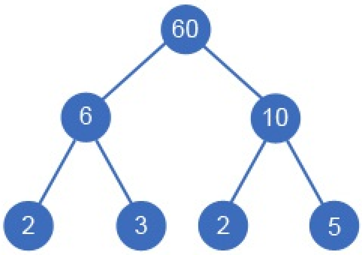
```
1
7
```

output

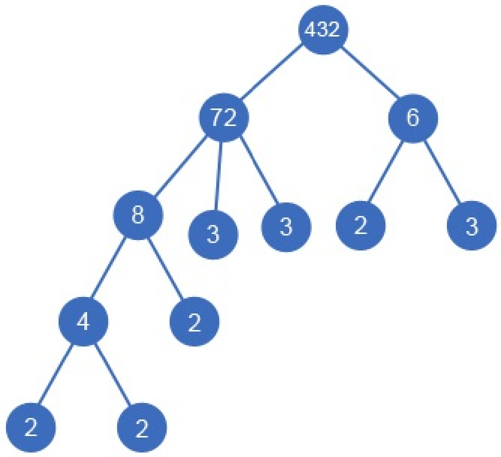
```
1
```

Note

Sample 1. The smallest divisor tree looks this way:



Sample 2. In this case you can build the following divisor tree:



Sample 3. Note that the tree can consist of a single vertex.