A Streets of Working Lanterns

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

Policeman Anatoliy monitors a lair of unorganized criminal group spreading prohibited Asian drawings. The lair has only one entrance, which is also an exit. When someone enters into the lair, Anatoliy writes an opening round bracket in his notepad, and when someone comes out, he writes a closing round bracket.

Long surveillance provokes an appetite, so Anatoliy has to eat donuts not to starve to death. Unfortunately, after the surveillance had ended, Anatoliy discovered a lot of greasy stains left by donuts in his notepad, and they prevent to understand which brackets are opening or closing. He doesn't want his boss to shout on him, so he must restore his records. He ensured that the lair of criminals was empty before he started the surveillance and after he ended it.

Input

The input contains a single string of length no more than $5 \cdot 10^5$. This string consists of characters «`(`», «`)`» and «`?`». Character «`(`» means that someone entered into the lair, character «`)`» means that someone came out of it, and character «`?`» means that there is a greasy stain on this place, and it's impossible to determine which of the other two characters was there initially.

Output

Output a recovered string consisting of characters «`(`» and «`)`» only, so that Anatoliy really could write it in his notepad. If there are many suitable strings, output any of them. If Anatoliy messed up something and his records contained mistakes, output «`Impossible`», without quotes.

Examples

input
`(?(?))`
output
`()(())`

input
`()`
output
`()`

input
`?(`
output
`Impossible`

B Panoramic Photography

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

Most of the students of the law school prefer visiting photo club to the competitions in Roman law. Members of the photo club visit different interesting places, take photos of each other in front of them, and then rate their photos.

Once they appeared on a unbelievably long street which had n buildings in a row. Every member of the photo club took a photo contained, besides the members of the club and people passing by, a segment of the street. In other words, if you number the buildings in the order they are located on the street, each photo contained some buildings with the consecutive numbers.

Some day a Roman law professor of that law school came across the exhibition of the photos from that street. He hasn't remembered how many photos were there, but he has noticed that the i-th building was captured on a_i photos. Now he wants to estimate the minimal number of his students in the photo club, considering that no one could present more that one photo at the exhibition.

Input

The first line contains a single integer n ($1 \le n \le 2 \cdot 10^5$) — the number of buildings.

The second line contains n space-separated integers: a_i ($0 \le a_i \le 10^9$) — the number of photos that contain the i-th building.

Output

Output a single integer — the minimal number of students in the photo club.

Examples

input
4 1 3 2 0
output
3

input
6 1 2 3 1 2 3
output
5

Problem C Fill the Triangle

You are given an equilateral triangle drawn on an infinite hexagonal grid. The vertices of the triangle are in the centers of the grid cells and side of the triangle has length of n units (where one unit is equal to length of any side of any cell).

Some of cells are white and some of cells are black. As one can see, the triangle intersects exactly $n \cdot (n+1)/2$ hexagonal cells. You are allowed to simultaneously repaint to opposite color any three cells which have a common vertex (white cells become black and vice versa). It is allowed to do such operations only with vertices that lie inside triangle.

Your task is to determine whether it's possible to fill the entire triangle by black color.

Input

The input consists of one or more test cases. The first line of the case contains an integer n ($1 \leqslant n \leqslant 1000$). The i-th of the next n lines contains $n - i + 1$ characters '0' or '1', where zeroes correspond to black color and ones to white color.

The input is terminated by a case with $n = 0$. This case should not be processed.

Output

Adhere to the sample output below.

Example

standard input	standard output
3 100 01 0 2 10 1 0	Triangle 1 can be filled. Triangle 2 cannot be filled.

Problem D Longest Increasing Subsequences

Consider a permutation $a_1, a_2, \ldots, a_n$ of integers 1 through n. An *increasing subsequence* of a of length p is a sequence $a_{k_1}, a_{k_2}, \ldots, a_{k_p}$ where $1 \leqslant k_1 < k_2 < \ldots < k_p \leqslant n$ and $a_{k_1} < a_{k_2} < \ldots < a_{k_p}$.

Let l be the length of the longest increasing subsequence of a. Now, we want to know how many different increasing subsequences of length l one can find in a. Subsequences $a_{k_1}, a_{k_2}, \ldots, a_{k_l}$ and $a_{j_1}, a_{j_2}, \ldots, a_{j_l}$ are considered different if $k_i \neq j_i$ for some index i. Since the number of different longest increasing subsequences can be quite large, you should calculate it modulo m.

Input

On the first line of the input file, there are two integers n and m separated by a single space ($1 \leqslant n \leqslant 100\,000$, $1 \leqslant m \leqslant 10^9$). On the second line, there are n integer numbers $a_1, a_2, \ldots, a_n$ separated by single spaces. These n numbers are a permutation of $1, 2, \ldots, n$.

Output

On the first line of the output file, print a single integer — the number of longest increasing subsequences in a modulo m.

Examples

standard input	standard output
3 8 1 3 2	2
4 1000000000 2 4 1 3	3

Problem E Cut Tiles

Enzo is doing renovation for his new house. The most difficult part is to buy exactly the right number of tiles. He wants n tiles of different sizes. Of course they have to be cut from the tiles he bought. All the required tiles are square. The lengths of side of the tiles are $2^{s_1}, 2^{s_2}, \ldots, 2^{s_n}$. He can only buy a lot of tiles sized $m \times m$, and he decides to only cut tiles parallel to their sides for convenience. How many tiles does he need to buy?

Input

The first line of the input gives the number of test cases: t ($1 \leq t \leq 1000$). t lines follow. Each line start with the number n ($1 \leq n \leq 500$) and m ($1 \leq m \leq 2^{31} - 1$), indicating the number of required tiles and the size of the big tiles Enzo can buy. n numbers follow: $s_1, s_2, \ldots, s_n$ ($1 \leq 2^{s_k} \leq m$), showing the sizes of the required tiles.

Output

For each test case, output one line containing the number of the big tiles Enzo need to buy.

Example

standard input	standard output
4 1 6 2 2 6 2 2 3 6 2 1 1 7 277 3 8 2 6 1 3 6	1 2 1 2