Art Appreciation
Problem ID: artappreciation

Brandon Greg Jr. is an art enthusiast who covered the entirety of the walls of his room with works of art. Brandon's room is in the shape of a simple polygon (simple means that the polygon does not intersect itself). If Brandon is at point X, then he can see all points Y such that the line segment XY (excluding point Y) does not intersect any walls. Since Brandon's happiness is proportional to the amount of art he can see by turning his head, he wants to know the area of the set of points from where he could see all of the walls of his room (and thus see his entire art collection). You may assume that Brandon has a very flexible neck.

Input

The first line of input contains a single integer n ($3 \leq n \leq 2 \cdot 10^5$), representing the number of vertices of Brandon's room.

Each of the next n lines of input contains two space-separated real numbers x_i and y_i ($|x_i|, |y_i| \leq 10^5$), representing the cartesian coordinates of the i-th vertex of Brandon's room. The coordinates have at most two digits after the decimal place. It is guaranteed that the polygon is simple. The vertices may be given in clockwise or counterclockwise order.

Output

Output the area of the set of points from where Brandon could see all of the walls of his room. The output will be considered correct if the absolute or relative error is within 10^{-4} of the answer (if a is the output and b is the answer, then a will be considered correct if $\frac{|a-b|}{\max\{1,b\}} \leq 10^{-4}$.

Sample Input 1	Sample Output 1
5 2 0 1 1 0 2 -2 0 0 -2	8.0000000000

Sample Input 2	Sample Output 2
5 0.2 0.00 0 -0.2 0.0 0 -0.2 0 0 0.20	0.0200000000

Sample Input 3	Sample Output 3
6 0 0 5 0 2 1 5 5 0 5 3 4	0.0000000000

Big Boxes
Problem ID: bigboxes

Brandon Greg Jr. is moving to the United States to double his salary. He has n items that he needs to pack into k big boxes. The n items are currently arranged in a row, and Brandon doesn't want to bother reordering them, so he will partition the n items into k groups of consecutive items, and put each of the k groups into their own box. For convenience when moving, Brandon wants to minimize the weight of the heaviest box. The weights of the boxes themselves are negligible.

Input

The first line contains two space-separated integers n and k ($1 \le k \le n \le 10^5$), denoting the number of items and the number of boxes respectively.

The second line of input contains n space-separated integers w_i ($1 \le w_i \le 10^4$), representing the weight of each item in order.

Output

The only line of output should contain a single integer, denoting the minimum possible weight of the heaviest box.

Sample Input 1	Sample Output 1
7 2 3 1 1 3 9 5 2	16

Sample Input 2	Sample Output 2
7 4 1 2 8 3 5 2 7	9

Sample Input 3	Sample Output 3
7 5 1 2 8 3 5 2 7	8

Chromium Shipping

Problem ID: chromiumshipping

Greg Brandon Sr. is working at a shipping company in Redmond that specializes in shipping Chromium. Redmond contains n intersections and m two-way roads that directly connect two intersections (Redmond can be modelled as a graph with n vertices and m edges). It is always possible to travel from any intersection to any other intersection via the roads.

The shipping company has two warehouses and s employees. The warehouses and employees are currently located at some of the intersections in Redmond. Greg needs to make t deliveries to his clients who are also located at some of the intersections in Redmond. For each delivery, one of his employees will travel to either warehouse to pick up the item to deliver, then travel to the corresponding client. Each warehouse always contains an infinite amount of each item. Greg would like to minimize the total distance travelled by his employees (he does not care about the return trip). Each employee may make at most one delivery.

Input

The first line of input contains four space-separated integers n, m, s, and t ($2 \le n \le 10^5$, $n-1 \le m \le 2 \cdot 10^5$, and $1 \le t \le s \le 10^5$), denoting the number of intersections, the number of roads, the number of employees, and the number of deliveries respectively.

The second line of input contains two space-separated integers a and b ($1 \le a, b \le n$), denoting the locations of the two warehouses. The warehouses could be at the same intersection.

The third line of input contains s space-separated integers x_i ($1 \le x_i \le n$), denoting the locations of the s employees. The x_i's are not necessarily distinct.

The fourth line of input contains t space-separated integers y_i ($1 \le y_i \le n$), denoting the locations of the clients for the t deliveries. The y_i's are not necessarily distinct.

Each of the next m lines of input contains three space-separated integers u, v, and d ($1 \le u, v \le n$, $u \ne v$, and $1 \le d \le 10^8$), denoting a road of distance d connecting intersections u and v. It is always possible to travel from one intersection to all other intersections.

Output

The only line of output should contain a single integer denoting the minimum total distance.

Sample Input 1

```
7 8 3 2
1 2
7 3 4
5 6
1 3 2
1 4 1
1 5 1
1 6 6
2 3 9
2 4 2
2 6 4
7 6 5
```

Sample Output 1

```
9
```

Sample Input 2

```
2 1 1 1
2 2
1
1
1 2 1
```

Sample Output 2

```
2
```

Drowning Combinatorist
Problem ID: drowningcombinatorist

logloglogglog. Brandon Greg Jr. is sometimes a drowning combinatorist.

A permutation of length n can be represented as some order of the integers $\{1, 2, \ldots, n\}$. A *run* of length k in a permutation is k consecutive elements that appear in increasing or decreasing order. For example, $[5, 2, 4, 3, 1]$ is a permutation of length 5, where (among other runs), $[2, 4]$ is a run of length 2 and $[4, 3, 1]$ is a run of length 3.

Brandon found a way to count the number of permutations of length n that have runs of length at most k. He wants you to do the same so he could check his answers. Since the numbers get very large, Brandon will ask for it modulo some prime p of his choice.

Input

The only line of input contains three space-separated integers n, k, p ($1 \leq n \leq 2\,000$, $2 \leq k \leq 7$, $10^8 < p \leq 10^9 + 9$), where n is the length of the permutations, k is the maximum length of a run, and p is the prime of Brandon's choice.

Output

Output one integer representing the number of permutations of length n that have runs of length at most k, modulo p.

Sample Input 1	Sample Output 1
`1 7 1000000007`	`1`

Sample Input 2	Sample Output 2
`3 2 1000000007`	`4`

Sample Input 3	Sample Output 3
`9 3 1000000009`	`224458`

Eerie Subarrays
Problem ID: eeriesubarrays

Brandon Greg Jr. considers an array to be scary if **its leftmost element is the median** of its elements. Given an array with **distinct** elements $[p_1, p_2, \ldots, p_n]$, Brandon wants to count the number of scary subarrays.

A subarray is some contiguous chunk of elements $[p_l, p_{l+1}, \ldots, p_r]$ where $l \le r$. The median of a set of n numbers is the middle number in sorted order if n is odd, or the average of the middle two numbers in sorted order if n is even. Note that all subarrays of length 1 are scary, and no even-length subarrays are scary because the elements are all distinct.

Input

The first line of input contains a single integer n ($1 \le n \le 2 \cdot 10^5$), representing the length of the given array.

The second line of input contains n space-separated integers p_i ($1 \le p_i \le n$), representing the given array. It is guaranteed that the p_i's are distinct.

Output

Output one integer representing the number of scary subarrays.

Sample Input 1	Sample Output 1
5 1 2 3 4 5	5

Sample Input 2	Sample Output 2
6 3 2 1 6 4 5	8

Sample Input 3	Sample Output 3
7 2 1 5 3 6 7 4	11

Find the Graph
Problem ID: findthegraph

Brandon Greg Jr. told you that he found an interesting undirected graph G. The graph has n vertices labelled with the integers $1, 2, \ldots, n$. The graph is simple, meaning that each edge is between two distinct vertices, and no two edges are between the same pair of vertices.

Since Brandon doesn't talk very much, you'll have to play 3 000 questions and solve this interactive problem to guess the graph. For each question, you may give him a subset $S \subset V(G)$ of the vertices. Brandon (the judge) would then tell you the number of edges between S and $V(G) \setminus S$.

Can you guess the graph in at most 3 000 queries?

Interaction

The judge will start by outputting a single line containing a single number n ($2 \leq n \leq 50$), the number of vertices in the graph.

For each query, you may output one of the following:

- `?` $k\ v_1\ v_2\ \ldots\ v_k$ – If you output a question mark followed by an integer k ($1 \leq k \leq n$) and the indices of k vertices, the judge will reply with the number of edges in the cut between $S = \{v_1, v_2, \ldots, v_k\}$ and the remaining $n - k$ vertices in $V(G) \setminus S$. If your input is malformed, the judge will output -1. If you receive a reply of -1, please terminate your program immediately, or you may get an unexpected verdict.

- `!` – After outputting an exclamation mark, you must output the adjacency matrix of the graph on n lines, each containing n numbers. The j-th number on the i-th line should be 1 if there is an edge between vertices i and j, or 0 otherwise. Your program must terminate immediately after outputting this matrix.

You may output no more than 3 000 queries beginning with `?`. Remember to flush your output after each query. The sample input and output only serve to show how one should interact with the judge, and the empty lines are for easier reading.

Sample Interaction 1

Read	Write
4	
	? 3 1 2 3
2	
	? 4 1 4 3 2
0	
	? 2 1 3
3	
	! 0 1 0 0 1 0 1 1 0 1 0 1 0 1 1 0

Sample Interaction 2

Read	Write
4	
	42
-1	

Grid Magic

Problem ID: gridmagic

Brandon Greg Jr. the number theorist and combinatorist is working on prime numbers in grids. An n by m grid of digits (0 to 9) is called a *superprime grid* if every non-empty prefix of every row and column (including the full rows and columns) are primes when concatenated.

For example, the following is a superprime grid:

$$\begin{matrix} 2 & 3 & 3 \\ 3 & 1 & 1 \\ 3 & 1 & 7 \end{matrix}$$

This is because 2, 23, 233, 3, 31, 311, and 317 are all prime.

Brandon wants to count the number of n by m superprime grids.

Input

The only line of input contains two space-separated numbers n and m ($1 \leq n, m \leq 8$).

Output

Output the number of n by m superprime grids.

Sample Input 1	Sample Output 1
`1 1`	`4`

Sample Input 2	Sample Output 2
`3 2`	`5`

Huge Campus
Problem ID: hugecampus

Gregory Brandon Sr. works at some startup in Redmond that owns a huge campus with a lot of office buildings. Since Gregory likes to work in different environments, he will work in exactly two buildings every day. On the i-th day, Gregory walks from his home to building a_i in the morning, walks from building a_i to building b_i at noon, and walks from building b_i to his home in the evening.

Gregory owns two umbrellas, but he does not like to carry them around. However, it rains a lot in Redmond, and Gregory must use an umbrella if he walks when it is raining (otherwise he will become infinitely unhappy). Gregory currently has both umbrellas at home, but he may choose to leave them in the office buildings for convenience. It will cost one unit of Gregory's happiness every time he needs to carry an umbrella while walking, regardless of whether he carries one or two umbrellas, and regardless of whether he is using the umbrella. Luckily, Gregory can accurately predict the weather in the morning, at noon, and in the evening for up to n days. Knowing the weather for the next n days, how many units of happiness must Gregory lose from carrying umbrellas?

Input

The first line of the input contains two space-separated integers n and k ($1 \leq n \leq 10^4$, $2 \leq k \leq 30$), denoting the number of days and the number of buildings Gregory will ever work in. These buildings are numbered from 1 to k.

Each of the next n lines of input contains two space-separated integers a_i and b_i ($1 \leq a_i, b_i \leq k$, $a_i \neq b_i$), denoting the buildings that Gregory will work in during the morning and the afternoon respectively.

Each of the next n lines of input contains a string of three characters w_i, representing the weather on the i-th day. Each character is either `S`, to denote that it will be sunny or `R` to denote that it will be rainy. The first, second, and third characters in the string w_i respectively represent the weather in the morning, at noon, and in the evening of the i-th day.

Output

Output the minimum number of happiness units Gregory must lose from carrying umbrellas.

Sample Input 1

```
1 2
1 2
SSR
```

Sample Output 1

```
3
```

Sample Input 2

```
2 3
3 2
3 1
SRS
SRR
```

Sample Output 2

```
4
```

Sample Input 3

```
1 30
30 1
RSS
```

Sample Output 3

```
1
```