Problem A: Water Splashing

After the contest ended, Gholi decided to splash water on the contest organizers because of the difficulty of the problems. He waited until the post-contest photo session, when everyone in the hall stood in a single line.

The organizers, who were very good friends, decided to stand together in the photo, from the l-th person from the left to the r-th person from the left. At that moment, Gholi turned on the water tap and aimed the hose at the organizers. But at that very moment, his mischievous friend Rajab pushed him, causing him to accidentally splash water on people from the x-th to the y-th person from the left instead.

Now, Gholi wants to know how many of the organizers got wet.

Input

The only line of input contains four integers l, r, x, and y ($1 \le l \le r \le 10^6, 1 \le x \le y \le 10^6$).

Output

Output a single integer representing the number of organizers who got wet.

Example

Standard Input	Standard Output
`1 5 4 9`	`2`

Problem B: Giveaway

After the contest ended, there were many balloons left at the contest site. The executive staff members, who had spent a lot of time inflating the balloons, didn't want to pop them. So, they decided to give the balloons away to the contestants.

There are n different colors of balloons, and there are a_i balloons of color i. A contestant becomes happy if they can receive at least k balloons of the same color.

The head of the executive team is now wondering what is the maximum number of contestants that can be made happy with this giveaway. Since he is busy distributing balloons, your task is to calculate this number for him.

Input

The first line contains two integers n and k ($1 \leq n \leq 100$, $1 \leq k \leq 10^6$) representing the number of different balloon colors and the required number of balloons with the same color to make one contestant happy.

The second line contains n integers $a_1, a_2, \ldots, a_n$ ($1 \leq a_i \leq 10^6$) where a_i is the number of balloons of color i.

Output

Print a single integer representing the maximum number of contestants that can be made happy.

Standard Input	Standard Output
3 2 2 4 5	5

Standard Input	Standard Output
4 3 6 2 3 7	5

Problem C: Inflation

The night before the contest, the executive staff members were inflating balloons, but there were still n uninflated ones left. Suddenly, the head of the executive team entered the room with a new device. This device can inflate 1, 2, or 3 balloons in a single use.

However, there are three cursed numbers. If the number of uninflated balloons ever becomes equal to any of these numbers, all inflated balloons will pop, and the device will stop working.

The staff members want to know the minimum number of times they must use the device to inflate all balloons without triggering the curse.

Input

The first line contains an integer n ($4 \leq n \leq 300$) representing the number of uninflated balloons. The second line contains three integers a, b, and c ($1 \leq a < b < c < n$) representing the cursed numbers.

Output

Print a single integer representing the minimum number of device usages needed to inflate all the balloons safely. If it is impossible, print `-1`.

Standard Input	Standard Output
`12` `2 6 8`	`5`

Standard Input	Standard Output
`4` `1 2 3`	`-1`

Problem D: Color Game

Arash and Moein are playing a game called "Color Game." Initially, Arash has colored an $n \times m$ grid using four colors, represented by integers 1, 2, 3, and 4.

Now it is Moein's turn. He must recolor the grid according to the following rules:

1. The new color of each cell must be different from its original color.
2. No two adjacent cells (sharing an edge) may have the same color in the final grid.
3. Each color must be chosen from the set $\{1, 2, 3, 4\}$.

Determine whether it is possible to recolor the grid following these rules. If it is possible, print one valid final coloring.

Input

The first line contains two integers n and m ($1 \le n, m \le 50$) representing the number of rows and columns. Each of the next n lines contains m integers from the set $\{1, 2, 3, 4\}$ representing the initial grid colors.

Output

If it is possible, print n lines each containing m integers representing the new colors of the grid. Otherwise, print `impossible`.

Example

Standard Input	Standard Output
2 3 122 311	431 142

Problem E: Snack Orders

You are managing an online snack delivery platform. Each snack item is available in three package sizes: **small**, **medium**, and **large**, each with a fixed price.

You are given the price list of available snacks, followed by customer orders. Each order includes a customer's name, the snack name, and the package size. A single customer may appear multiple times, as they can place several orders.

Your task is to determine how much each customer must pay in total.

The total charge for a customer is the sum of:

- The prices of all snacks they ordered, and
- A delivery fee of $\lfloor \frac{100}{K} \rfloor$ dollars, where K is the number of unique customers.

After adding the delivery fee, if the total differs from the nearest multiple of 5 by exactly one dollar, it should be adjusted to that multiple of 5. For example, 24 and 26 become 25, while 27 and 28 remain unchanged.

Input

The first line contains an integer T representing the number of test cases. Each test case begins with two integers n and m $(1 \leq n, m \leq 100)$ representing the number of available snack types and the number of orders.

The next n lines describe the snacks. Each line contains a snack name $item_i$ (a non-empty string of at most 20 English letters) and three integers S_i, M_i, and L_i $(1 \leq S_i, M_i, L_i \leq 10^9)$ representing the prices of the small, medium, and large packages.

The next m lines describe the orders. Each line contains three strings $name_i$, $type_i$, and $size_i$, representing the customer name, the snack name, and the chosen size.

All snack names in the orders are guaranteed to exist in the price list. All names and snack types consist only of English letters and are at most 20 characters long.

Output

For each test case, print one line per unique customer in the order their names first appear. Each line should contain the customer's name and their total payment after adding the delivery fee and applying the rounding rule.

Example

Standard Input	Standard Output

`1`
`3 7`
`Chips 80 120 198`
`Cookie 88 111 150`
`Brownie 95 126 160`
`Arshia Chips large`
`Arshia Cookie small`
`Arshia Cookie small`
`Bardia Cookie medium`
`Fateme Brownie medium`
`Setayesh Brownie small`
`Setayesh Brownie small`
	`Arshia 400`
	`Bardia 135`
	`Fateme 150`
	`Setayesh 215`

Note

As there are 4 unique customers, then each pays a delivery fee of $\left\lfloor \frac{100}{4} \right\rfloor = 25$.

- **Arshia:** orders one large chips (198) and two small cookies (88 + 88), subtotal = 374, plus delivery 25 = 399, rounded to 400.
- **Bardia:** orders one medium cookie (111), plus delivery 25 = 136, rounded to 135.
- **Fateme:** orders one medium brownie (126), plus delivery 25 = 151, rounded to 150.
- **Setayesh:** orders two small brownie (95+95), plus delivery 25 = 215.

Problem F: Museum

In a museum, there are n jewels arranged in a row. The value of the i-th jewel is a_i. A thief wants to steal a consecutive segment of jewels, but he is only interested in **beautiful** segments.

A segment of length k is called beautiful if every jewel in that segment has a value greater than or equal to k. Help the thief determine the length of the longest beautiful segment he can steal.

Input

The first line contains an integer n $(1 \le n \le 10^5)$. The second line contains n integers $a_1, a_2, \ldots, a_n$ $(1 \le a_i \le 10^9)$.

Output

Print a single integer representing the length of the longest beautiful segment.

Standard Input	Standard Output
5 1 2 3 4 5	3

Standard Input	Standard Output
4 4 4 4 4	4

Standard Input	Standard Output
10 1 2 3 4 5 5 4 3 2 1	4

Problem G: Heads or Tails

Maryam is playing a game with a grid of coins of size $n \times m$. Each coin shows either heads or tails, represented by the characters `S` (for *Shir*, i.e. heads) and `K` (for *Khat*, i.e. tails).

In one move, she can choose a row or a column and flip all coins in it, turning heads into tails and tails into heads. Her goal is to make all coins show tails using the minimum possible number of moves.

Input

The first line contains two integers n and m ($1 \leq n, m \leq 500$). Each of the next n lines contains m characters, each being either `S` or `K`, representing the initial state.

Output

Print a single integer representing the minimum number of moves required to turn all coins to tails. If it is impossible, print `-1`.

Standard Input	Standard Output
2 2 KS KS	1

Problem H: Colored Hats

Pooya has recently been accepted to a university and has bought K hats with different colors to wear during the N days of the first semester. He already has a plan for which hat to wear on each day. According to the plan, he wears the hat with color A_i on day i, where each A_i is an integer between 1 and K.

After going to university, Pooya realizes that he must wash a hat after wearing it, so he cannot wear the same hat on two consecutive days.

Help Pooya adjust his plan by changing the minimum possible number of days so that no two consecutive days have the same hat color. Formally, construct an array $B_1, \ldots, B_N$ with each $B_i \in \{1, \ldots, K\}$ such that for all $2 \leq i \leq N$ $B_i \neq B_{i-1}$, and the number of positions changed $\{i \in \{1, \ldots, N\} \mid A_i \neq B_i\}$ is minimized. If there are several optimal arrays, output any one of them.

If there are multiple valid plans, print any of them.

Input

The first line contains two integers N and K ($2 \leq K \leq N \leq 10^6$) representing the number of days and the number of hats. The second line contains N integers $A_1, A_2, \ldots, A_N$ ($1 \leq A_i \leq K$) representing the original plan.

Output

Print N integers representing the new plan. If there are multiple valid answers, print any of them.

Standard Input	Standard Output
5 3 1 2 2 3 1	1 2 1 3 1

Standard Input	Standard Output
5 2 2 1 1 2 1	1 2 1 2 1

Problem I: Labeling

There are n desks in the Computer Department, numbered from 1 to n. Kambiz, who was responsible for attaching labels to the desks, mistakenly attached label a_i to desk i.

To fix the labels, Fereydoon has hired m staff members. The i-th staff member can swap the labels between desks x_i and y_i and has a strength value p_i.

Fereydoon wants to select strong staff members to fix all labels correctly. Among all possible subsets that can fix the labels, he wants to maximize the minimum strength of the chosen staff members. If the labels are already in the correct order, no staff need to be selected.

Input

The first line contains two integers n and m ($1 \le n, m \le 10^5$). The second line contains n integers $a_1, a_2, \ldots, a_n$ ($1 \le a_i \le n$) representing the current labeling. It is guaranteed that a is a permutation of 1 to n. Each of the next m lines contains three integers x_i, y_i, and p_i ($1 \le x_i, y_i \le n$, $1 \le p_i \le 10^9$), which correspond to the desk indices and the strength of the i-th staff member.

Output

Print one of the following:

- `sorted` if the labels are already in the correct order,
- `impossible` if it is impossible to fix the labels,
- otherwise, print a single integer representing the maximum possible minimum strength.

Standard Input	Standard Output
5 10 1 5 2 3 4 5 3 3 3 1 10 4 5 4 2 1 6 5 1 8 3 2 8 5 2 10 4 1 3 1 4 2 2 4 9	8

Problem J: Vulnerability

After achieving success in a recent CTF competition, A.Sh. decided to attempt his first real-world cyberattack on the university network. The university network consists of n servers. Due to a shortage of cables, the servers are connected by $n-1$ cables in such a way that it is possible to transmit data between any two servers. Servers may forward data through other servers if necessary.

When A.Sh. realized that hacking into the university network was much harder than he had anticipated, he decided to use an old trick. On the day of the ICPC contest, he planned to take a pair of scissors and cut one of the cables, disrupting communication between the servers.

Fortunately, the ICPC technical staff discovered A.Sh.'s plan in time. To improve the network's resilience, they decided to add exactly one new cable between two different servers. A cable may already exist between those servers.

A cable is called **vulnerable** if, after cutting that cable, there exist two servers s and t such that data can no longer be transmitted from s to t. It can be shown that before adding the new cable, every cable is vulnerable.

The **vulnerability** of the network is defined as the total number of vulnerable cables. The technical staff believe that if the network's vulnerability is at most k, A.Sh. will not be able to successfully hack the network.

Your task is to determine the number of distinct ways to add exactly one new cable between two different servers so that the resulting network's vulnerability is at most k.

Input

The first line contains two integers n and k ($2 \le n \le 200000$, $0 \le k \le n$) representing the number of servers and the maximum acceptable vulnerability. Each of the next $n-1$ lines contains two integers u_i and v_i ($1 \le u_i, v_i \le n$), indicating a cable between servers u_i and v_i. It is guaranteed that the initial network is connected.

Output

Print a single integer representing the number of ways to add exactly one cable between two distinct servers such that the resulting network's vulnerability does not exceed k.

Standard Input	Standard Output
4 1 1 3 3 2 1 4	3