Problem A. Destroying Bridges

Time Limit 1000 ms
Mem Limit 262144 kB

There are n islands, numbered $1, 2, \ldots, n$. Initially, every pair of islands is connected by a bridge. Hence, there are a total of $\frac{n(n-1)}{2}$ bridges.

Everule lives on island 1 and enjoys visiting the other islands using bridges. Dominater has the power to destroy at most k bridges to minimize the number of islands that Everule can reach using (possibly multiple) bridges.

Find the minimum number of islands (including island 1) that Everule can visit if Dominater destroys bridges optimally.

Input

Each test contains multiple test cases. The first line contains a single integer t ($1 \leq t \leq 10^3$) — the number of test cases. The description of the test cases follows.

The first and only line of each test case contains two integers n and k ($1 \leq n \leq 100, 0 \leq k \leq \frac{n \cdot (n-1)}{2}$).

Output

For each test case, output the minimum number of islands that Everule can visit if Dominater destroys bridges optimally.

Examples

Input	Output
6 2 0 2 1 4 1 5 10 5 3 4 4	2 1 4 1 5 1

Note

In the first test case, since no bridges can be destroyed, all the islands will be reachable.

In the second test case, you can destroy the bridge between islands 1 and 2. Everule will not be able to visit island 2 but can still visit island 1. Therefore, the total number of islands that Everule can visit is 1.

In the third test case, Everule always has a way of reaching all islands despite what Dominater does. For example, if Dominater destroyed the bridge between islands 1 and 2, Everule can still visit island 2 by traveling by $1 \to 3 \to 2$ as the bridges between 1 and 3, and between 3 and 2 are not destroyed.

In the fourth test case, you can destroy all bridges since $k = \frac{n \cdot (n-1)}{2}$. Everule will be only able to visit 1 island (island 1).

Problem B. Rumor

Time Limit 2000 ms
Mem Limit 262144 kB

Vova promised himself that he would never play computer games... But recently Firestorm — a well-known game developing company — published their newest game, World of Farcraft, and it became really popular. Of course, Vova started playing it.

Now he tries to solve a quest. The task is to come to a settlement named Overcity and spread a rumor in it.

Vova knows that there are n characters in Overcity. Some characters are friends to each other, and they share information they got. Also Vova knows that he can bribe each character so he or she starts spreading the rumor; i-th character wants c_i gold in exchange for spreading the rumor. When a character hears the rumor, he tells it to all his friends, and they start spreading the rumor to their friends (for free), and so on.

The quest is finished when all n characters know the rumor. What is the minimum amount of gold Vova needs to spend in order to finish the quest?

Take a look at the notes if you think you haven't understood the problem completely.

Input

The first line contains two integer numbers n and m ($1 \le n \le 10^5, 0 \le m \le 10^5$) — the number of characters in Overcity and the number of pairs of friends.

The second line contains n integer numbers c_i ($0 \le c_i \le 10^9$) — the amount of gold i-th character asks to start spreading the rumor.

Then m lines follow, each containing a pair of numbers (x_i, y_i) which represent that characters x_i and y_i are friends ($1 \le x_i, y_i \le n, x_i \ne y_i$). It is guaranteed that each pair is listed at most once.

Output

Print one number — the minimum amount of gold Vova has to spend in order to finish the quest.

Examples

Input	Output
5 2 2 5 3 4 8 1 4 4 5	10

Input	Output
10 0 1 2 3 4 5 6 7 8 9 10	55

Input	Output
10 5 1 6 2 7 3 8 4 9 5 10 1 2 3 4 5 6 7 8 9 10	15

Note

In the first example the best decision is to bribe the first character (he will spread the rumor to fourth character, and the fourth one will spread it to fifth). Also Vova has to bribe the second and the third characters, so they know the rumor.

In the second example Vova has to bribe everyone.

In the third example the optimal decision is to bribe the first, the third, the fifth, the seventh and the ninth characters.

Problem C. Badge

Time Limit 1000 ms
Mem Limit 262144 kB

In Summer Informatics School, if a student doesn't behave well, teachers make a hole in his badge. And today one of the teachers caught a group of n students doing yet another trick.

Let's assume that all these students are numbered from 1 to n. The teacher came to student a and put a hole in his badge. The student, however, claimed that the main culprit is some other student p_a.

After that, the teacher came to student p_a and made a hole in his badge as well. The student in reply said that the main culprit was student p_{p_a}.

This process went on for a while, but, since the number of students was finite, eventually the teacher came to the student, who already had a hole in his badge.

After that, the teacher put a second hole in the student's badge and decided that he is done with this process, and went to the sauna.

You don't know the first student who was caught by the teacher. However, you know all the numbers p_i. Your task is to find out for every student a, who would be the student with two holes in the badge if the first caught student was a.

Input

The first line of the input contains the only integer n ($1 \le n \le 1000$) — the number of the naughty students.

The second line contains n integers p_1, ..., p_n ($1 \le p_i \le n$), where p_i indicates the student who was reported to the teacher by student i.

Output

For every student a from 1 to n print which student would receive two holes in the badge, if a was the first student caught by the teacher.

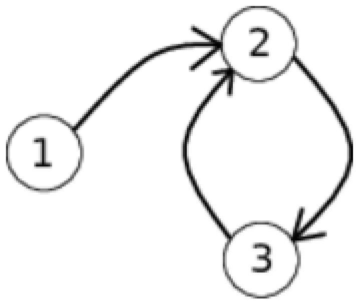
Examples

Input	Output
3 2 3 2	2 2 3

Input	Output
3 1 2 3	1 2 3

Note

The picture corresponds to the first example test case.



When $a = 1$, the teacher comes to students 1, 2, 3, 2, in this order, and the student 2 is the one who receives a second hole in his badge.

When $a = 2$, the teacher comes to students 2, 3, 2, and the student 2 gets a second hole in his badge. When $a = 3$, the teacher will visit students 3, 2, 3 with student 3 getting a second hole in his badge.

For the second example test case it's clear that no matter with whom the teacher starts, that student would be the one who gets the second hole in his badge.

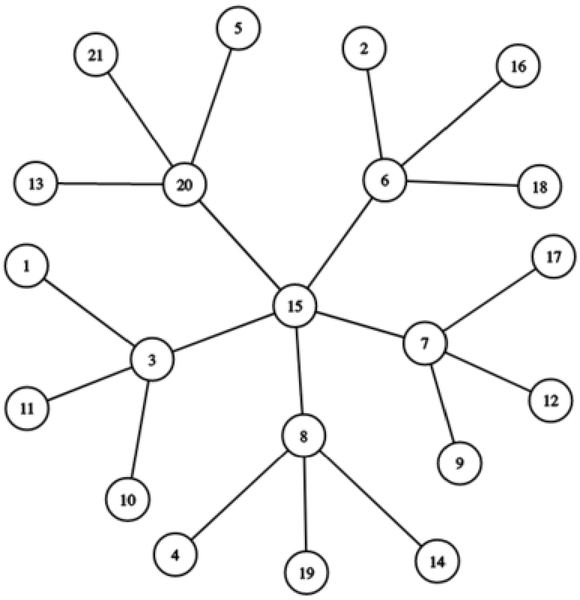
Problem D. Forever Winter

Time Limit 2000 ms
Mem Limit 262144 kB

A *snowflake* graph is generated from two integers x and y, both greater than 1, as follows:

- Start with one central vertex.
- Connect x new vertices to this central vertex.
- Connect y new vertices to **each** of these x vertices.

For example, below is a snowflake graph for $x = 5$ and $y = 3$.



The snowflake graph above has a central vertex 15, then $x = 5$ vertices attached to it (3, 6, 7, 8, and 20), and then $y = 3$ vertices attached to each of those.

Given a snowflake graph, determine the values of x and y.

Input

The first line contains a single integer t ($1 \le t \le 1000$) — the number of test cases.

The first line of each test case contains two integers n and m ($2 \le n \le 200$; $1 \le m \le \min\left(1000, \frac{n(n-1)}{2}\right)$) — the number of vertices and edges in the graph, respectively.

The next m lines each contain two integers each u and v ($1 \le u, v \le n$, $u \ne v$) — the numbers of vertices connected by an edge. The graph does not contain multiple edges and self-loops.

It is guaranteed that this graph is a snowflake graph for some integers x and y both greater than 1.

Output

For each test case, on a separate line output the values of x and y, in that order, separated by a space.

Examples

Input	Output
3 21 20 21 20 5 20 13 20 1 3 11 3 10 3 4 8 19 8 14 8 9 7 12 7 17 7 18 6 16 6 2 6 6 15 7 15 8 15 20 15 3 15 7 6 1 2 1 3 2 4 2 5 3 6 3 7 9 8 9 3 3 6 6 2 2 1 5 2 2 7 4 3 3 8	5 3 2 2 2 3

Note

The first test case is pictured in the statement. Note that the output `3 5` is **incorrect**, since x should be output before y.

Problem E. Building Teams

Time Limit 1000 ms
Mem Limit 524288 kB

There are n pupils in Uolevi's class, and m friendships between them. Your task is to divide the pupils into two teams in such a way that no two pupils in a team are friends. You can freely choose the sizes of the teams.

Input

The first input line has two integers n and m: the number of pupils and friendships. The pupils are numbered $1, 2, \dots, n$.

Then, there are m lines describing the friendships. Each line has two integers a and b: pupils a and b are friends.

Every friendship is between two different pupils. You can assume that there is at most one friendship between any two pupils.

Output

Print an example of how to build the teams. For each pupil, print "1" or "2" depending on to which team the pupil will be assigned. You can print any valid team.

If there are no solutions, print "IMPOSSIBLE".

Constraints

- $1 \leq n \leq 10^5$
- $1 \leq m \leq 2 \cdot 10^5$
- $1 \leq a, b \leq n$

Example

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

Problem F. Christmas Trees

Time Limit 2000 ms
Mem Limit 262144 kB

There are n Christmas trees on an infinite number line. The i-th tree grows at the position x_i. All x_i are guaranteed to be distinct.

Each **integer** point can be either occupied by the Christmas tree, by the human or not occupied at all. Non-integer points cannot be occupied by anything.

There are m people who want to celebrate Christmas. Let $y_1, y_2, \dots, y_m$ be the positions of people (note that all values $x_1, x_2, \dots, x_n, y_1, y_2, \dots, y_m$ should be **distinct** and all y_j should be **integer**). You want to find such an arrangement of people that the value $\sum\limits_{j=1}^{m} \min\limits_{i=1}^{n} |x_i - y_j|$ is the minimum possible (in other words, the sum of distances to the nearest Christmas tree for all people should be minimized).

In other words, let d_j be the distance from the j-th human to the nearest Christmas tree ($d_j = \min\limits_{i=1}^{n} |y_j - x_i|$). Then you need to choose such positions $y_1, y_2, \dots, y_m$ that $\sum\limits_{j=1}^{m} d_j$ is the minimum possible.

Input

The first line of the input contains two integers n and m ($1 \le n, m \le 2 \cdot 10^5$) — the number of Christmas trees and the number of people.

The second line of the input contains n integers $x_1, x_2, \dots, x_n$ ($-10^9 \le x_i \le 10^9$), where x_i is the position of the i-th Christmas tree. It is guaranteed that all x_i are distinct.

Output

In the first line print one integer res — the minimum possible value of $\sum\limits_{j=1}^{m} \min\limits_{i=1}^{n} |x_i - y_j|$ (in other words, the sum of distances to the nearest Christmas tree for all people).

In the second line print m integers $y_1, y_2, \dots, y_m$ ($-2 \cdot 10^9 \le y_j \le 2 \cdot 10^9$), where y_j is the position of the j-th human. All y_j should be distinct and all values $x_1, x_2, \dots, x_n, y_1, y_2, \dots, y_m$ should be **distinct**.

If there are multiple answers, print any of them.

Examples

Input	Output
2 6 1 5	8 -1 2 6 4 0 3

Input	Output
3 5 0 3 1	7 5 -2 4 -1 2

Problem G. Valid BFS?

Time Limit 2000 ms
Mem Limit 262144 kB

The BFS algorithm is defined as follows.

1. Consider an undirected graph with vertices numbered from 1 to n. Initialize q as a new queue containing only vertex 1, mark the vertex 1 as used.
2. Extract a vertex v from the head of the queue q.
3. Print the index of vertex v.
4. Iterate in arbitrary order through all such vertices u that u is a neighbor of v and is not marked yet as used. Mark the vertex u as used and insert it into the tail of the queue q.
5. If the queue is not empty, continue from step `2`.
6. Otherwise finish.

Since the order of choosing neighbors of each vertex can vary, it turns out that there may be multiple sequences which `BFS` can print.

In this problem you need to check whether a given sequence corresponds to some valid `BFS` traversal of the given tree **starting from vertex** 1. The tree is an undirected graph, such that there is exactly one simple path between any two vertices.

Input

The first line contains a single integer n ($1 \le n \le 2 \cdot 10^5$) which denotes the number of nodes in the tree.

The following $n - 1$ lines describe the edges of the tree. Each of them contains two integers x and y ($1 \le x, y \le n$) — the endpoints of the corresponding edge of the tree. It is guaranteed that the given graph is a tree.

The last line contains n distinct integers $a_1, a_2, \ldots, a_n$ ($1 \le a_i \le n$) — the sequence to check.

Output

Print "`Yes`" (quotes for clarity) if the sequence corresponds to some valid `BFS` traversal of the given tree and "`No`" (quotes for clarity) otherwise.

You can print each letter in any case (upper or lower).

Examples

Input	Output
4 1 2 1 3 2 4 1 2 3 4	Yes

Input	Output
4 1 2 1 3 2 4 1 2 4 3	No

Note

Both sample tests have the same tree in them.

In this tree, there are two valid `BFS` orderings:

- $1, 2, 3, 4$,
- $1, 3, 2, 4$.

The ordering $1, 2, 4, 3$ doesn't correspond to any valid `BFS` order.

Problem H. Forming Friendships

Time Limit	3000 ms
Mem Limit	524288 kB
OS	Windows
Statement	Statements (PDF) (en)

Inspired by some ideas from the Muggle world, a bunch of Ravenclaw students recently founded Studentbook. This is actually a book (magically enhanced, of course), which has a page for each Hogwarts student showing their recent social activities.

Every interested student can buy their own small version of this book, which shows recent activities of their friends. Unfortunately, this is not very popular at the moment, because everybody already knows what their friends are up to anyways.

One of the Ravenclaw students behind Studentbook, Michael Corner, has a plan to fix this. He wants to perform the powerful spell Amicitia, also known as the friendship spell. This spell acts permanently and does the following: If student a and student b are friends and student b and student c are friends as well, then student a and c will be made friends by the spell.

Michael was immediately alerted to the potentially catastrophic consequences of his plan. Due to the spell, it might happen, that more and more friendships will be formed, completely disrupting the social balance in Hogwarts.

But he does not want to abandon his idea so easily. Instead, he first wants to find out how many friendships would be formed by the spell.

Input

The input consists of:

- One line with two integers n and m $(1 \leq n \leq 2 \cdot 10^5, 0 \leq m \leq 2 \cdot 10^5)$, the number of students and friendships at Hogwarts.
- m lines, each containing two integers a and b $(1 \leq a, b \leq n, a \neq b)$, indicating that the students a and b are friends.

Each friendship is given at most once.

Output

Output the number of new friendships due to the Amicitia spell.

Examples

Input	Output
3 3 1 2 2 3 1 3	0

Input	Output
4 3 1 2 3 2 3 4	3

Input	Output
5 3 1 2 2 3 4 5	1

Problem I. Path Graph?

Time Limit 2000 ms

Mem Limit 1048576 kB

Problem Statement

You are given a simple undirected graph with N vertices and M edges. The vertices are numbered $1, 2, \ldots, N$, and the edges are numbered $1, 2, \ldots, M$.
Edge i $(i = 1, 2, \ldots, M)$ connects vertices u_i and v_i.

Determine if this graph is a path graph.

▶ What is a simple undirected graph?

▶ What is a path graph?

Constraints

- $2 \leq N \leq 2 \times 10^5$
- $0 \leq M \leq 2 \times 10^5$
- $1 \leq u_i, v_i \leq N \, (i = 1, 2, \ldots, M)$
- All values in the input are integers.
- The graph given in the input is simple.

Input

The input is given from Standard Input in the following format:

$$
\begin{array}{l}
N \ M \\
u_1 \ v_1 \\
u_2 \ v_2 \\
\vdots \\
u_M \ v_M
\end{array}
$$

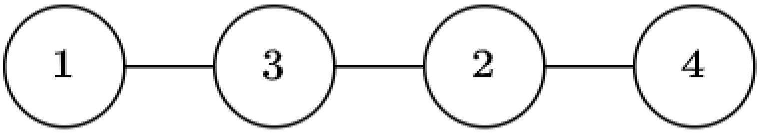
Output

Print `Yes` if the given graph is a path graph; print `No` otherwise.

Sample 1

Input	Output
4 3 1 3 4 2 3 2	Yes

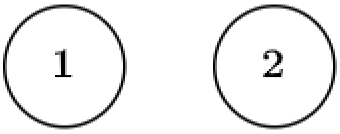
Illustrated below is the given graph, which is a path graph.



Sample 2

Input	Output
2 0	No

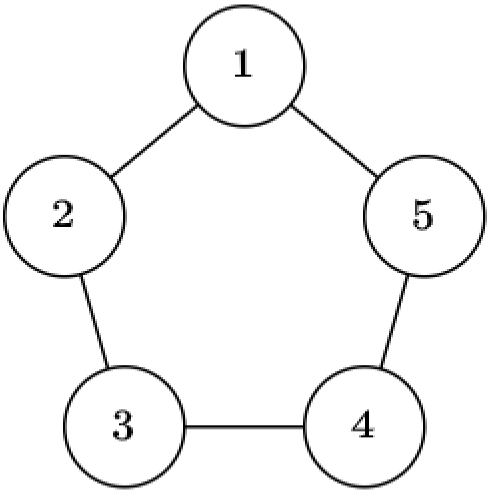
Illustrated below is the given graph, which is not a path graph.



Sample 3

Input	Output
5 5 1 2 2 3 3 4 4 5 5 1	No

Illustrated below is the given graph, which is not a path graph.


1
2
5
3
4

Problem J. High Score

Time Limit 1000 ms
Mem Limit 524288 kB

You play a game consisting of n rooms and m tunnels. Your initial score is 0, and each tunnel increases your score by x where x may be both positive or negative. You may go through a tunnel several times.

Your task is to walk from room 1 to room n. What is the maximum score you can get?

Input

The first input line has two integers n and m: the number of rooms and tunnels. The rooms are numbered $1, 2, \ldots, n$.

Then, there are m lines describing the tunnels. Each line has three integers a, b and x: the tunnel starts at room a, ends at room b, and it increases your score by x. All tunnels are one-way tunnels.

You can assume that it is possible to get from room 1 to room n.

Output

Print one integer: the maximum score you can get. However, if you can get an arbitrarily large score, print -1.

Constraints

- $1 \le n \le 2500$
- $1 \le m \le 5000$
- $1 \le a, b \le n$
- $-10^9 \le x \le 10^9$

Example

Input	Output
4 5 1 2 3 2 4 -1 1 3 -2 3 4 7 1 4 4	5