Problem C. Cleopatra

Input file:	standard input
Output file:	standard output
Balloon Color:	Light Blue

Once upon a time, there was a legendary queen named Cleopatra, ruling over ancient Egypt around 2,000 years ago, from 51 BCE to 30 BCE. Her story seems so ancient to us now. But wait, here's a fascinating twist! The great pyramids, those incredible structures, were already standing tall roughly 3,000 years before her era! That means her time is much closer to ours than it was to the age of those majestic pyramids. It's mind-boggling to think just how ancient those pyramids truly are!

Cleopatra was fascinated by mathematics and cryptography. She often liked to challenge her advisors and generals with puzzles and riddles. One day, she came up with a new problem:

Given an integer array $a_1, a_2, \ldots, a_n$, and an integer x. Find a subarray of a whose $XOR = x$ and its GCD is as maximum as possible. If there are multiple subarrays having the maximum GCD, consider the subarray whose length is the maximum. If there is more than one, any of them will be valid.

Cleopatra wrote it down on a papyrus scroll and hid it in one of the pyramids. You were the lucky one who found it, can you solve Cleopatra's problem?

Input

The first line contains a single integer T — the number of test cases.

The first line of each test case contains two integers, n and x $(1 \le n \le 2 * 10^5, 0 \le x < 2^{30})$.

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

Output

For each test case, if there is no answer print 1 -1 otherwise print a single line containing two integers l and r $(l \le r)$ denoting the bounds of the subarray as stated above.

Example

standard input	standard output
3 6 0 4 8 4 8 2 16 6 4 5 2 4 6 4 7 6 8 1 3 1 4 1 2	1 4 3 3 -1 -1

Problem D. Djoser

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	Purple

In the ancient land of Egypt, a mighty king named Djoser reigned. His name echoed across time, for he embarked on a remarkable endeavor—the construction of a groundbreaking step pyramid at Saqqara. With the ingenious architect Imhotep at his side. This grand monument heralded a new era in Egyptian funerary architecture, captivating the imagination of people throughout history, including Nour, the young archaeologist.

As Nour explored the ancient step pyramid of Djoser at Saqqara, she discovered a hidden chamber containing a directed weighted rooted tree (not necessarily rooted at node 1) of N nodes. All the edges are directed toward the children.

While she was studying the tree, she uncovered a papyrus with an intriguing message: Let's define the cost of the tree as the sum of the shortest distances from the root to all other nodes, you can add exactly one edge of weight X between any two (not necessarily different) nodes. Find the minimum possible cost.

Note: You can add the edge as a second edge between any two nodes normally.

Nour couldn't help but wonder if this was a riddle left by Djoser himself, waiting to be solved by someone with the right skills and knowledge. And so, she set out to solve the puzzle. Can you help her solve it?

Input

The first line of the input contains a single integer T — the number of test cases.

The first line of each test case contains two integers, N and X ($2 \le N \le 10^5, 0 \le X \le 10^8$) — the number of nodes in the tree and the weight of the added edge, respectively.

After that follow $N-1$ lines, each contains u_i, v_i and w_i ($1 \le u_i, v_i \le N, 0 \le w_i \le 10^8$) — indicating a directed edge from u_i to v_i with weight w_i.

It's guaranteed that the sum of N over all test cases doesn't exceed 10^5.

Output

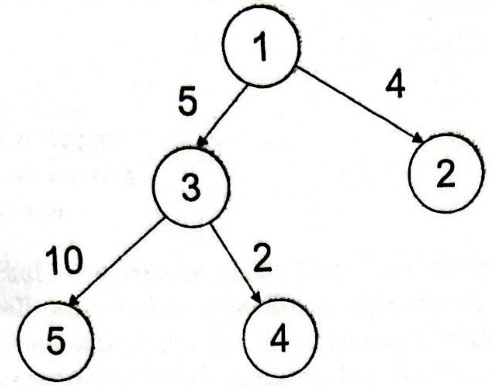
The minimum cost after adding the edge.

Example

standard input	standard output
2 5 2 1 2 4 1 3 5 3 4 2 3 5 10 6 1 2 1 3 2 3 4 2 4 5 2 5 6 2 6 7	18 19

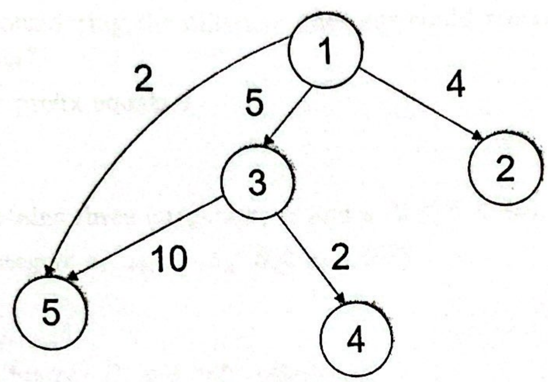
Note

In the first test case, the tree was like this:



Before

The best way to add the edge is like this:



After

The total cost is $4 + 5 + (5 + 2) + 2 = 18$.

In the second test case, note that the root is 2 and that the best way to add the edge is between nodes 2 and 6.

roblem E. Edfu

Input file: standard input
Output file: standard output
Balloon Color: Dark Green

In a cozy café, Sara and Nour chatted excitedly about their love for ancient Egypt. Nour talked about Edfu, a city known for its big, well-preserved temple. She described how the temple was made from huge blocks of stone, set out like a giant map of the sky. Sara listened, wide-eyed, particularly taken by the idea of an ancient tool used to measure the Nile's water during the flood season. Together, they dreamed of traveling to Egypt to see these wonders with their own eyes.

As they talked, Nour presented a problem for Sara to solve: given an array A of N non-negative integers, and two different integers x and y, could you permute the array A into a new array B in such a way that after creating the XOR prefix of the array B, both x and y would appear in it?

Sara pondered the problem, considering the different ways she could rearrange the array to achieve the desired result. Can you help her?

Note: the XOR of the empty prefix equals 0.

Input

The first line of the input contains three integers n, x, and y $(2 \le n \le 30)$, $(0 \le x, y < 2^{10}, x \ne y)$.

The second line contains n integers $a_1, a_2, \ldots, a_n$ $(0 \le a_i < 2^{10})$.

Output

Print "YES" if there is such an array B, and "NO" otherwise.

Examples

standard input	standard output
5 1 7 1 2 3 4 5	YES
3 8 9 1 2 3	NO

...roblem F. Fayoum

Input file:	standard input
Output file:	standard output
Balloon Color:	Yellow

In the western desert of Egypt, lies the ancient city of Fayoum, where history spans not only thousands of years but millions. A city that is filled with countless natural and historical wonders such as Lake Qarun and Wadi Al-Rayyan. Of all the interesting archaeological sites, Sara found Wadi Al Hitan to be the most extraordinary site that reveals a rich fossil record of ancient marine life from the Eocene epoch. Among its wonders are fossilized whale skeletons and bones, revealing precious insights into the ancient ancestors of today's magnificent whales.

As Sara marveled at the wonders of Wadi Al Hitan, she was reminded of a problem she had been working on.

Given two strings, s and t, where t contains unique characters (each character, if it exists, has only one occurrence), she was given only one operation to perform: selecting a substring from s that matches t, removing it from s, and then merging the left and right substrings that remain from s (if both exist).

To solve the problem, Sara needs to find the maximum number of times she can perform this operation on s. Since Sara is busy exploring the wonders of Wadi Al Hitan, she gave you this problem to solve for her, can you do this?

Input

The first line of the input contains a single integer T — The number of test cases.

**There is a blank line at the beginning of each test case.

The first line of each test case contains a single string s, $(1 \le |s| \le 10^5)$ — The first string.

The second line of each test case contains a single string t, $(1 \le |t| \le 26)$ — The second string.

Output

Print the maximum number of times the operation can be performed.

Example

standard input	standard output
3 abcde cd ababab ab icpc ipc	1 3 0

Problem G. Giza

Input file:	standard input
Output file:	standard output
Balloon Color:	Gold

In ancient history, Giza city witnessed humanity's most astounding achievement — the Great Pyramids. Over 4,500 years ago, the majestic structures of Khufu, Khafre, and Menkaure rose on the Giza Plateau, Egypt. As tombs for powerful kings, these remarkable pyramids showcased ancient Egyptian ingenuity and precision. Enduring through time, these iconic monuments captivate the world, a testament to the enigmatic allure of ancient engineering prowess.

You are a young explorer who wants to discover the secrets of the Great Pyramids. You have a device that can scan the pyramids and create a graph of their internal structure, where each node is a chamber and each edge is a connection between them.

The device generated a connected undirected graph where each node u has a circular track of length a_u numbered from 0 to $a_u - 1$. You can jump from your current position x at the current node u to position y at node v with a cost c if there is an edge between nodes u and v.

The new position y is given by the function $g(x) = (x+1)^2 \ \% \ a_v$, and the cost c is given by the function $f(x) = (x+1)^2$ where x is the current position in node u.

You start at node 1 at position 0, and your goal is to answer q queries. Each query gives you v and x asking you to find the minimum cost to reach position x at node v from position 0 at node 1.

Input

The first line contains a single integer t denoting the number of test cases.

The first line of each test case contains two integers, n and m $(2 \leq n \leq 2 * 10^5)$, $(n-1 \leq m \leq min(\frac{n(n-1)}{2}, 2 * 10^5))$ — the number of nodes in the graph, and the number of edges, respectively.

The second line of each test case contains n integers $a_1, a_2, ...a_n$ $(1 \leq a_i \leq 2 * 10^5)$ — a_i represents the length of the $i-th$ node's track.

Each of the following m lines contains two integers, u and v $(1 \leq u, v \leq n, u \neq v)$, representing that there is an edge between nodes u and v.

The next line contains an integer q $(1 \leq q \leq 2 * 10^5)$ — the number of queries.

Each of the following q lines contains two integers, v and x $(1 \leq v \leq n)$, $(0 \leq x \leq a_v - 1)$ — asking for the minimum cost to reach position x at node v.

It's guaranteed that the sum of lengths of the tracks $\sum_{i=1}^{n} a_i$, the sum of q, and the sum of m over all test cases does not exceed $2 * 10^5$.

Output

For each test case, output q lines. Each line represents the minimum cost to reach position x at node v, or -1 if you can not reach that position.

amples

standard input	standard output
1 4 6 4 5 9 2 1 2 1 3 1 4 2 3 2 4 3 4 7 4 0 3 7 3 5 3 1 2 4 2 2 1 1	5 30 -1 1 5 -1 6
1 5 9 1 2 2 1 2 1 2 1 3 1 4 2 3 2 4 2 5 3 4 3 5 4 5 4 5 1 4 0 5 1 5 1	2 1 2 2

Scanned with CamScanner

Problem H. Heliopolis

Input file: `standard input`
Output file: `standard output`
Balloon Color: `White`

Long ago, the city of Heliopolis stood tall in what is now Cairo. It had big stone pillars that reached for the sky, showing people's interest in the stars and the sun. It was a place full of learning and big ideas. Heliopolis still leaves a mark on history, inviting us all to dig deeper and learn more about the past.

As you reflect on the legacy of Heliopolis, you are faced with a new challenge.

You are given a tree with n nodes, where each node has a value v_i assigned to it. The tree is rooted at node 1. A subtree is called *k-good* if every value in that subtree appears exactly k times. Some nodes have erasable values, which means you can remove them for a cost c_u, where u is the value on the node.

For each node i $(1 \leq i \leq n)$, you need to find the largest k such that the subtree rooted at i is *k-good*, and the smallest cost to make it *k-good* by erasing some values.

Note: When you erase a value from a node, you only erase the value, not the node itself. The tree remains connected after erasing. The cost of erasing depends on the value you erase, not the node you erase it from.

Input

The first line contains a single integer T denoting the number of test cases.

The first line of each test case contains a single integer n $(3 \leq n \leq 2 * 10^5)$ — the number of nodes.

The second line contains a binary string s of length n, if s_i = '1' then the value of the $i-th$ node is erasable. Otherwise, it's not.

The third line contains n integers $v_1, v_2, \ldots, v_n$ $(1 \leq v_i \leq n)$ — the values of the nodes.

The fourth line contains n integers $c_1, c_2, \ldots, c_n$ $(1 \leq c_i \leq 10^9)$ — c_i represents the cost of erasing the value i.

Then follow $n-1$ lines, each contains a_i and b_i $(1 \leq a_i, b_i \leq n)$ — indicating an edge between nodes a_i and b_i.

It's guaranteed that the given graph forms a tree and that the sum of n over all test cases does not exceed $2 * 10^5$.

Output

For each test case, output n lines denoting the answer of each subtree rooted at node i for $(1 \leq i \leq n)$.

If no k is achievable for some subtree print -1 -1. Otherwise, print the maximum k for this subtree and the minimum cost to achieve that k.

Examples

standard input	standard output
1 5 01111 4 4 3 4 5 1 5 2 4 2 5 2 3 4 2 1 3 2	3 4 2 4 1 0 1 0 1 0
1 6 000000 6 2 6 2 1 4 4 6 6 1 2 4 2 6 2 1 2 4 5 2 1 3	-1 -1 -1 -1 1 0 1 0 1 0 1 0
1 8 00010101 1 2 8 6 2 2 2 3 3 1 1 7 3 4 6 3 4 1 1 2 2 7 3 1 8 7 3 5 6 2	-1 -1 3 1 1 0 1 0 1 0 1 0 1 0 1 0

Note

Note that the value of k can differ from one subtree to another.

Problem I. Imhotep

Input file: standard input
Output file: standard output
Balloon Color: Silver

Imhotep was a brilliant man who served as the chief minister, architect, and physician of King Djoser in ancient Egypt. He designed the first step pyramid at Saqqara, which was a marvel of engineering and a symbol of royal power. He was also skilled in astronomy, mathematics, and medicine, and wrote many books on various subjects. Imhotep was facing a complex problem, but unfortunately, he passed away before he could solve it. Now, it's your mission to solve Imhotep's complex problem.

You are given a sequence of decimal numbers that follow certain restrictions. Your goal is to find the k_{th} number in this sequence.

The sequence is generated as follows:

You will be given n restrictions where each restriction represents a number of decimal digits that cannot appear in a specific position in any of the numbers of the sequence.

Each restriction consists of:

- An integer p indicates the exact position where this restriction applies.
- An integer d represents the number of digits that cannot appear at position p.
- A list of d decimal digits, which are the digits not allowed at position p.

Note that we start numbering the positions from right to left, i.e. position 1 is the least significant position.

For example, let's say we have the following restrictions:

- At position 1, digits 3 and 4 are not allowed.
- At position 2, digits 1, 2, and 6 are not allowed.

Based on these restrictions, the sequence will start with (0, 1, 2, 5, 6, 7, 8, 9, 30, 31, 32, 35, 36, 37, 38, 39).

It is guaranteed that there will be at least two allowed digits for each position.

For the remaining unrestricted positions you can place any digit from 0-9.

Note that leading zeros are considered and thus, if a restriction was made such that digit 0 is not allowed at position 2, then number 1 wouldn't be part of the sequence as it's equivalent to 01.

Input

The first line in the input contains a single integer T — the number of test cases.

**There are 2 blank lines at the beginning of each test case.

The first line in each test case contains two integers, n and k $(1 \le n \le 64)$, $(1 \le k \le 10^{18})$ — The number of restrictions, and the index of the number to be printed, respectively.

**There is a blank line before each restriction.

The first line in each restriction contains two integers, p and d $(1 \le p \le 64)$, $(1 \le d \le 8)$ — The position in which this restriction is on, and the number of digits that is restricted in that position, respectively.

The second line in each restriction contains d **decimal digits**, where $(0 \le d_i \le 9)$.

It is guaranteed that each position p will appear only once among the restrictions in a single test case.

Output

For each test case, output the k_{th} number in the given sequence in a new line.

Example

standard input	standard output
3 2 5 1 2 3 4 2 3 1 2 6 2 15 1 2 3 4 2 3 1 2 6 2 1 1 2 3 4 2 3 0 2 6	6 38 10

Problem J. Jewels

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Orange`

Diving into ancient Egypt's rich past, we've discovered so many jewels. Yet, much more is still hidden waiting for you to uncover. Take a tour on the Nile. Ancient wonders abound, a tapestry of history. Carved in stone, secrets veiled in mystery. A journey through time, on the majestic Nile.

Given an integer a, find the number of integers b $(0 \le b \le a)$ such that $a \oplus b = a - b$.

Note: the $\oplus$ denotes the bitwise XOR operation.

Input

The first line contains an integer T $(1 \le T \le 2 * 10^5)$ denoting the number of test cases.

Each of the next T lines contains an integer a $(1 \le a \le 10^{18})$.

Output

For each test case, print a single integer denoting the answer to the problem.

Example

standard input	standard output
4 1 2 3 4	2 2 4 2

Problem K. Karnak

Input file: `standard input`
Output file: `standard output`
Balloon Color: `Dark Blue`

In the ancient ruins of Karnak City near Luxor, Nour was amazed. The magnificent Karnak Temple Complex stood before her. The grand temples and statues showcased the brilliance of ancient Egyptian architecture. As she explored the sacred site, Nour imagined the elaborate religious ceremonies that once made Karnak the spiritual heart of Egypt. The whispers of history enveloped her, urging her to uncover the secrets of this timeless place.

Inspired by the ingenuity and dedication of the ancient Egyptians, Nour turned her attention to a new challenge: Given two permutations A and B both of size n, determine if you can make A equal to B by doing the following operation any number of times:

Split A into two parts i.e $A[1]....A[i]$ and $A[i+1].....A[n]$ $(1 \leq i < n)$ and swap them.

Note: A permutation of size n is an array of length n that contains all numbers from 1 to n, and every number occurs only once in it. For example, $[1,3,2,4]$ is a permutation of size 4, but $[1,1,2,3]$ is not a permutation.

Lost in thought, Nour wondered what other secrets lay hidden within Karnak's walls. Can you help her solve the permutation problem and unravel the mysteries of the ancient world?

Input

The first line contains a single integer T — denoting the number of test cases.

For each test case:

The first line contains an integer n $(2 \leq n \leq 2 * 10^5)$.

The second line contains the permutation A.

The third line contains the permutation B.

It's guaranteed that the sum of n over all test cases does not exceed $2 * 10^5$.

Output

For each test case, print on a single line `YES` if you can make A equal to B using the aforementioned operation. Otherwise, print `NO`.

Example

standard input	standard output
2 5 5 2 1 4 3 1 4 3 5 2 6 1 6 2 3 5 4 1 6 2 5 3 4	YES NO

Input file: `standard input`
Output file: `standard output`
Balloon Color: `Bronze`

Luxor, the "Hundred Gates City,"boasts the iconic Luxor Temple at its heart. Dedicated to the Theban triad of Amun, Mut, and Khonsu, this ancient masterpiece showcases grand statues, towering obelisks, and intricate hieroglyphics. A living relic of human civilization, the temple exudes an ethereal charm, especially when illuminated by the setting sun.

Lamis is visiting Luxor Temple, a living relic of human civilization. She is fascinated by the hieroglyphics that cover the temple walls. She snapped a picture of one of the walls and analyzes it with her laptop. She turned the image into an array of integers, where each integer is the color value of a pixel.

Let's define the OR of a subarray as the bitwise OR of all of its elements, Lamis wrote a program that can perform bitwise OR operations on any subarray of the array.

She noticed that some subarrays have the same OR value, while others have different ones. She wonders how many distinct OR values she can get by selecting different subarrays. So, she gave you this problem to solve for her:

You are given an array a of n integers and q queries. For each query, you will be given two integers l and r that represent a range in the array a.

Your task is to count the number of **distinct** OR values that can be formed by selecting any subarray within the range given in each query (**inclusive**).

Can you help her solve the problem?

Input

The first line contains two integers, n and q $(1 \le n, q \le 10^5)$ — the length of the array a, and the number of queries.

The next line contains n integers $a_1, a_2, \ldots, a_n$ $(1 \le a_i \le 10^9)$ — the elements of the array a.

Each of the next q lines contains two integers, l and r $(1 \le l \le r \le n)$.

Output

For each query, print one line contains a single integer: the answer to the query.

Examples

standard input	standard output
4 5 1 2 3 4 1 2 2 4 1 4 2 3 1 3	3 4 5 2 3
8 5 1 2 4 8 16 32 64 128 1 8 2 4 1 1 8 8 3 5	36 6 1 1 6

Problem M. Memphis

Input file: `standard input`
Output file: `standard output`
Balloon Color: `Pink`

In ancient Egypt, Memphis stood as the first capital of the unified country, founded around 3100 BC by King Menes. This influential city witnessed the rise and fall of many dynasties and kings, flourishing as a cultural and artistic hub. Grand monuments, temples, and statues adorned its landscape. However, Memphis's significance waned with the ascent of Thebes and Alexandria, eventually leading to its abandonment and burial under the sand.

While you're discovering the ancient Egypt temples in Egypt, you decided to live there for a period, and you started working in a hotel consisting of 7 rooms.

Room 1 is reserved for "Mohamed".

Room 2 is reserved for "Ahmed".

Room 3 is reserved for "Mohsen".

Room 4 is reserved for "Sara".

Room 5 is reserved for "Mona".

Room 6 is reserved for "Yasser".

Room 7 is reserved for "Ali".

The hotel owner will give you a key that corresponds to a room number, and your task is to tell him who booked this room.

Input

A single line contains an integer $k (1 \le k \le 7)$ — the room key.

Output

Output the name of the person who booked this room.

Examples

standard input	standard output
5	Mona
2	Ahmed
6	Yasser

Problem B. Bolbitine

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Black`

In the year 1799, an intriguing stone slab, laden with three unique scripts, surfaced near the town of Bolbitine. An enigma etched in stone, it bore the key to unlocking ancient Egyptian hieroglyphs - the Rosetta Stone. Today, the original stone resides in the British Museum, while a replica stands in its discovery place, the town of Bolbitine, also known as Rosetta or Rashid.

Abdelrahman was excited to explore those three unique scripts on the stone, thinking it might enable him to discover more, so he flew to the British Museum. There, he saw this riddle written on the stone. The riddle revolves around a series, let's call it "S"which can be defined using the following recurrence relation:

$$S_i = a * S_{i-2} + b * S_{i-1}$$

Here, S_i represents the i^{th} term in the series, and both a and b are positive integers.

To define the series properly, two base cases are required: S_0 and S_1.

You will be given the two positive weights a and b, along with two terms of the series and their respective positions or indices in the series. Specifically, you will be provided with the values of i, S_i, j, and S_j where i and j are the positions of these terms in the series.

Can you help Abdelrahman solve this riddle and find S_0 and S_1?

Input

The first line of each test file contains a single integer T $(1 \le T \le 10^4)$ — the number of test cases in the file.

Each test case contains a, b, i, S_i, j, S_j $(1 \le a, b \le 100, 2 \le i < j \le 100, 0 \le S_i, S_j \le 10^{16})$ — the weights, i and the i^{th} element, and j and the j^{th} element, respectively.

Output

For each test case, print the base cases: S_0 and S_1.

Example

standard input	standard output
5 2 3 2 23 3 79 1 1 2 1 3 2 3 7 2 13 3 94 1 10 2 21 3 212 2 3 3 79 4 283	4 5 0 1 2 1 1 2 4 5

Problem A. Ancient

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	Red

In the hushed sands of time, a story unfolds, tracing back over 5,000 years to the birth of an ancient civilization along the banks of the Nile. Egypt's history, steeped in mystery and grandeur, weaves tales of ancient Egyptians, pyramids, and a timeless legacy that continues to captivate the world to this day.

Nour, a determined archaeologist, and Sara, a young historian, unite to unravel Egypt's enigmatic past. Their shared journey leads them through the ages, revealing secrets that will reverberate through time, as they uncover the untold tales of the mighty ancient Egyptians and the lost wonders of an ancient world.

Before they start their journey, Nour gave Sara an integer x ($1 \le x \le 10^{100}$) and asked her to find out if x is greater than or equal to its reverse. Can you help Sara?

Input

The first line of the input contains a single integer T — The number of test cases.

Each test case contains a single integer x ($1 \le x \le 10^{100}$). It is guaranteed that the sum of the lengths of x over all test cases does not exceed 10^6.

Output

For each test case, output "YES" if the condition above is satisfied, and "NO" otherwise.

Example

standard input	standard output
6 22222222 109365 22223322 723327 44433444 5355	YES NO NO YES YES NO