Problem A. Lucky Layers

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

"Welcome to the Squid Code. 14 rounds.
Only coders survive"

The masked judge

The masked announcer spins a glass sphere filled with colored tiles. "The more combinations you can form — without repetition — the better your odds. Choose wisely. The sum of all possibilities decides your fate."

The *value* of an array is defined as the number of its **subsets** in which all elements are distinct.

For all arrays of length less than or equal to n, where each element is an integer between 1 and k,

Compute the **sum of values** of all such arrays. Output the result modulo 998244353.

Input

The first line contains a single integer t ($1 \le t \le 10^5$), the number of test cases.

Each of the next t lines contains two integers n and k ($1 \le n \le 10^9$) ($1 \le k \le 10^5$), the maximum length of the array and the maximum value of the elements of the array.

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

Output

For each test case, output the **sum of values** of all such arrays modulo 998244353.

Example

standard input	standard output
4 1 1 2 2 3 4 4 3	1 12 408 888

Problem B. Boundary Test

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Lim Green`

"Welcome to the Squid Code. 14 rounds.
Only coders survive"

The masked judge

You're led into a dark room. A large glowing shape floats mid-air. The masked figure speaks: "Only those who understand its curves may escape."

You are given a convex polygon with n vertices listed in counterclockwise order.

Determine whether there exist three consecutive vertices of the polygon such that the circle passing through them contains all the vertices of the polygon.

If such a triple exists, print the indices of those three vertices in order: $[i, i+1, i+2]$, using 1-based indexing and wrapping around when needed (for example, if $i = n$, then the triple is $[n, 1, 2]$).

A polygon is convex if all its interior angles are strictly less than 180°, and for any two points inside the polygon, the line segment connecting them lies entirely inside the polygon.

Input

The first line contains a single integer n ($3 \le n \le 2 \cdot 10^5$) — the number of vertices of the polygon.

Each of the next n lines contains two integers x_i, y_i ($-10^9 \le x_i, y_i \le 10^9$) — the coordinates of the i-th vertex.

It is guaranteed that the vertices are given in counterclockwise order and form a convex polygon.

Output

If such a triple of vertices exists, print the indices of the three vertices separated by spaces.

Otherwise, print -1.

Example

standard input	standard output
4 5 0 9 1 10 5 0 9	4 1 2

Problem C. No Way Out

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

"Welcome to the Squid Code. 14 rounds.
Only coders survive"

The masked judge

You stand in a field of glowing circles. A laser targets you — choose the right path, or burn.

We have n circles, each defined by coordinates (x_i, y_i) and a radius r_i. Additionally, there are m inclined lines, each characterized by a displacement b_j from the origin $(y = x + b_i)$.

Your task is to print the number of the line that intersects with the maximum number of circles. If there are multiple lines that meet this criterion, print the line with the lowest index.

Input

The first line contains two integers n and m $(1 \le n, m \le 10^5)$.

The second line contains m integers $b_1, b_2, \ldots, b_m$ $(0 \le |b_i| \le 10^9)$.

Then n lines follow, the i'th line of them contains three integers x_i, y_i and r_i $(0 \le |x_i|, |y_i| \le 10^9)$, $(1 \le r_i \le 10^9)$, the coordinates of each circle and its radius .

Output

Print the number of the line that intersects with the maximum number of circles. If there are multiple lines that meet this criterion, print the line with the lowest index.

Example

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

Problem D. Inhale or Fall

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

> “Welcome to the Squid Code. 14 rounds. Only coders survive”
>
> The masked judge

You awaken with a mask over your face. A voice echoes: "This mask gives you oxygen. Lose it for too long... and you won’t wake up again."Your task is simple — reach the exit before your oxygen runs out.

Baran, a guy who gets powered by oxygen, woke up someday and found himself on a row with n cells numbered from 1 through n increasingly.

The grid has three types of cells:

1. Normal cells, where Baran can go to adjacent non-blocked cells in one second (adjacent cells are cells that share a common side).
2. Oxygen cells, where Baran can jump to another non-blocked cell with distance less than or equal to m in one second; he also gets powered by oxygen in this type of cells.
3. Blocked cells, where Baran can’t go in or out.

Baran starts at cell 1 and wants to reach cell n, but there’s an extra restriction: Baran can’t stay for longer than k seconds without being powered by oxygen (initially he is powered up).

Can you tell whether he can make it to cell n or not ?

Input

The first line of the input contains three integers n, m, k ($1 \le n, k, m \le 10^5$) — the number of cells, the maximum jump from an oxygen cell, and the maximum amount of time Baran can stay without oxygen, respectively.

The second line contains n integers $a_1, a_2, a_3, ..., a_n$ ($1 \le a_i \le 3$) — the description of cells according to the statement.

It is guaranteed that $a_1 \ne 3$ and $a_n \ne 3$.

Output

Print “YES” (without the quotes) if he can make it, otherwise print “NO” (without the quotes).

Examples

standard input	standard output
10 3 2 2 3 3 1 2 1 1 1 2 1	YES
1 1 1 1	YES
6 2 1 2 3 2 1 1 1	NO

Problem E. Escape the Tree

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

"Welcome to the Squid Code. 14 rounds.
Only coders survive"

The masked judge

In this round, the tree hides the prize. Only those who trace its strongest root will advance.

Fofo was jumping and running around with his cat Bisseh until Bisseh jumped high up on a large undirected tree with n nodes. Each node v has an associated value a_v.

Fofo asked Bisseh to come down so they could continue playing, but Bisseh refused and said he wouldn't come down until Fofo gave him the maximum possible value for $f(p)$.

Let p be a †subtree of size k with nodes $[p_1, p_2, \ldots, p_k]$, then: $f(p) = k * \gcd(a_{p_1}, a_{p_2}, ..., a_{p_k})$.

Can you help Fofo find the maximum possible value of $f(p)$?

† A subtree is a subset of nodes from the initial graph which forms a connected tree.

Input

The first line of the input contains an integer t ($1 \le t \le 10^4$) — the number of testcases.

The first line of each test case contains an integer n ($2 \le n \le 10^5$) — the number of nodes.

The second line contains n integers a_i ($1 \le a_i \le 10^5$) — array a values.

Each of the following $n-1$ lines contains 2 integers u, v ($1 \le u, v \le n$) — the description of the tree edges.

It is guaranteed that the sum of n across all testcases doesn't exceed 10^5.

Output

For each testcase, output a single integer, the maximum possible value for $f(p)$.

Example

standard input	standard output
1 8 2 3 3 3 2 2 2 2 1 2 2 3 3 4 2 5 5 6 5 7 6 8	9

Problem F. Masked Marksman

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

"Welcome to the Squid Code. 14 rounds.
Only coders survive"

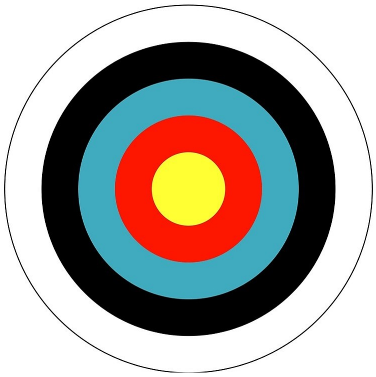
The masked judge

Every shot counts. Miss the center — and you're next on the line.

Mo3tazoleq and Caroot are good friends who enjoy competing in every possible way. One day, they discovered a game where they shoot arrows at a target consisting of concentric circular rings.

They played the game, and Caroot asked for your help in calculating his final score.

The target is centered at the origin $(0, 0)$. It consists of **five rings**: The yellow circle has a radius of m, and each additional ring increases the radius by m. For example, the yellow circle plus the red ring have a total radius of $2m$



The scoring rules are as follows:

- A player's score is the sum of the points earned by all their arrows.
- The points earned by an arrow depend on which ring it lands in:
  - The innermost yellow circle is worth 5 points.
  - Each successive outer ring has a value 1 point less than its inner neighbor (e.g., the red ring is worth 4 points, the blue ring 3 points, and so on).
- Any arrow landing beyond the rings earns 0 points.

Given the coordinates of Caroot's arrows, calculate his final score.

Input

The first line of input contains two integers, n and m ($1 \le n \le 10^4$, $1 \le m \le 10^6$)— where n is the number of arrows and m is the radius of the innermost circle.

The following n lines each contain two integers x_i and y_i ($-10^9 \le x_i, y_i \le 10^9$) — representing the x and y coordinates of the point where the i-th arrow landed.

Output

The output should be a single integer representing Caroot's final score.

Example

standard input	standard output
1 2 3 0	4

Problem G. Killer Pattern

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

> "Welcome to the Squid Code. 14 rounds.
> Only coders survive"
>
> The masked judge

One wrong move and you're out. The tree obeys a pattern — only those who follow it live.

Go8 gives you a complete binary tree of height h, rooted at node 1. The nodes are numbered in level order from 1 to $2^h - 1$.

Define two types of jumps:

- **Sibling jump**: from a node, move to the next greater-numbered node on the same level; if none exists, stay at the current node.
- **Child jump**: from a node, move to its left child; if the node has no children, stay at the current node.

You will be given q queries. Each query is a pair of integers (v, t). You start at node v and perform exactly t jumps, alternating between sibling and child jumps, beginning with a sibling jump: sibling, child, sibling, child, ...

After t jumps, you arrive at some node; report its number modulo $10^9 + 7$.

Input

The first line contains two integers h and q ($1 \le h \le 10^9$, $1 \le q \le 2 \times 10^5$) — the height of the tree and the number of queries. Each of the next q lines contains two integers v and t ($1 \le v \le \min(2^h - 1, 10^9)$, $0 \le t \le 10^9$) — the starting node and the number of jumps.

Output

For each query, output a single integer — the final node reached after t jumps, taken modulo $10^9 + 7$.

Example

standard input	standard output
3 3 2 1 6 2 7 100	3 7 7

Problem H. Hold the Throne

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

"Welcome to the Squid Code. 14 rounds.
Only coders survive"

The masked judge

Choose the targets wisely — the king rewards success, but punishes failure without mercy.

On a faraway planet, there are $2n$ kingdoms. The evil King Khaled has already taken control over **the first** n **kingdoms**, but because of his greed, he wants to conquer the remaining n kingdoms.

On this planet, there are m directional roads between kingdoms, and there are q strange beliefs like this: kingdom a believes that it can easily invade kingdom b if there is a specific kingdom c located on one of the shortest paths from kingdom a to b.

When kingdom a invades kingdom b, the strength of kingdom b becomes equal to the strength of kingdom a.

King Khaled wants to invade all the remaining kingdoms as soon as possible, so he will order each kingdom under his control to invade **exactly one** of the unconquered kingdoms, such that all kingdoms end up under his control.

The king expresses his power as :

$$\sum_{i=1}^{2n}\sum_{j=1}^{i} Strength(j)$$

Being Khaled's personal advisor, you have to help him by telling him what is the maximum power he can achieve after the invasion ends.

Input

The first line contains two integers n and m $(1 \le n \le 250,\ 1 \le m \le 1000)$.

The second line contains $2n$ integers $(1 \le a_i \le 10^6)$, where a_i is the strength of the i-th kingdom.

Each of the next m lines contains three integers x_i, y_i, and z_i $(1 \le x_i, y_i, z_i \le 2n)$, representing a directed road from kingdom x_i to kingdom y_i with length z_i.

The next line contains a single integer q $(1 \le q \le n^2)$.

Each of the following q lines contains three integers a_i, b_i, and c_i $(1 \le a_i, b_i, c_i \le 2n)$, meaning that kingdom a_i believes it can invade kingdom b_i only if kingdom c_i lies on some shortest path from a_i to b_i.

Output

Print a single integer, the maximum power the king will have after the end of the invasion. If it's impossible to invade all the remaining kingdoms, print -1.

Example

standard input	standard output
3 6 1 2 3 4 5 6 1 3 1 2 3 1 3 2 1 2 6 1 3 4 1 3 5 1 5 1 4 3 2 5 3 3 6 2 1 5 3 2 4 3	39

Problem I. Digit Hunt

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

> "Welcome to the Squid Code. 14 rounds.
> Only coders survive"
>
> The masked judge

A masked guard drops a pile of digits at your feet. "You must be able to display every number from** 1 **to** N **— one at a time. Choose your cards wisely. You get no spares."

You are given an integer N.

You want to buy digit cards (from 0 to 9) so that you can form every number from 1 to N (inclusive), using the cards to represent one number at a time.

What is the minimum total number of digit cards you need to buy?

Input

The only line contains a single integer N ($1 \le N \le 10^{18}$).

Output

Print the minimum number of digit cards needed.

Example

standard input	standard output
11	11

Note

To write all numbers from 1 to 11, you need the following digit cards: $0, 1, 1, 2, 3, 4, 5, 6, 7, 8, 9$ — that is, 11 cards in total.

Problem J. Judgment Strip

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

"Welcome to the Squid Code. 14 rounds.
Only coders survive"

The masked judge

A thin walkway lies ahead, lit by a shifting pulse of red and white light. You must move with care — balance and timing are everything. A single mistake, and the judgment will come.

Given an array a with n integers, you should apply the following operation at least once:

- Choose two integers l, r such that $(1 \le l \le r \le n)$ and $r - l + 1 = k$, where k is a given integer.
- Assign: $a_i = -a_i$, for every i such that $l \le i \le r$

Another constraint on the problem is that after applying the previous operation some positive number of times, the distance between any negative integers in the array shouldn't exceed k .

You have to calculate the maximum possible sum for array a elements after applying the previous operation some positive number of times.

Input

Each test consists of multiple test cases. The first line contains a single integer t $(1 \le t \le 10^4)$ — the number of test cases. The description of the test cases follows.

The first line of each test case contains two integers n, k $(1 \le k \le n \le 10^5)$ — the length of the array a, and the fixed length k.

The second line of each test case contains n integers $a_1, a_2, \ldots, a_n$ $(-10^9 \le a_i \le 10^9, a_i \ne 0)$ — the elements of the array a.

It is guaranteed that the sum of n over all test cases does not exceed 10^5.

Output

For each test case, print on a single line the maximum possible sum.

Example

standard input	standard output
4 5 2 1 2 -3 4 5 6 3 -2 4 1 -3 -2 3 6 3 -1 -1 -1 3 -4 -2 7 4 -1 2 -3 4 -5 6 -7	13 11 10 28

Problem K. Goodbye Paths

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

> "Welcome to the Squid Code. 14 rounds.
> Only coders survive"
>
> The masked judge

You stand before a branching path of glowing tiles. Only certain steps are allowed — each one must be coprime with the last. One misstep, and you're gone.

You are given an integer n ($1 \le n \le 10^5$).

Your task is to count the number of different strictly increasing arrays a such that:

- The array can have any length m ($1 \le m \le n$).
- Each element a_i satisfies $1 \le a_i \le n$, for all $1 \le i \le m$.
- For every i ($2 \le i \le m$), $\gcd(a_i, a_{i-1}) = 1$.

Print the total number of such arrays modulo $10^9 + 7$.

Input

The first line contains a single integer t ($1 \le t \le 10^5$) — the number of test cases.

Each of the next t lines contains a single integer n ($1 \le n \le 10^5$).

Output

For each test case, print a single integer — the number of valid arrays modulo $10^9 + 7$.

Example

standard input	standard output
3 1 2 20	1 3 161537

Problem L. Awakening

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

"Welcome to the Squid Code. 14 rounds. Only coders survive"

The masked judge

You wake up in a strange place with* 456 *other coders. A masked figure says: "Welcome to Squid Code. Each round, you'll face a logic game. Solve it — or be eliminated. Survive all rounds, and your wish will be granted." The only way forward... is to code your way out.

Nour and Mohamed joined a mini-game challenge during the programming contest break. Each of them scored some points. But the rules are a bit strange: if Nour's score is at least double Mohamed's, then Mohamed wins the game! Otherwise, Nour is the winner. Can you tell who wins?

Input

Two integers N and M $(1 \leq N, M \leq 10000)$ — the points scored by Nour and Mohamed, respectively.

Output

Print **"MOHAMED"** if Mohamed wins; otherwise, print **"NOUR"**.

Examples

standard input	standard output
10 5	MOHAMED
10 6	NOUR

Problem M. Fragment the Links

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

"Welcome to the Squid Code. 14 rounds.
Only coders survive"

The masked judge

They gave you the web intact — but only the sharpest will tear it apart for the highest score.

You are given an undirected connected graph with n vertices and n edges.

You will perform exactly n operations. In each operation, you must delete one of the remaining edges from the graph. After deleting an edge, you earn a score equal to the number of connected components in the graph **after** the deletion.

Repeat this process until all n edges are deleted.

Your task is to determine the **maximum total score** you can achieve by choosing the order in which you delete the edges.

Input

The first line contains a single integer t ($1 \le t \le 10^5$), the number of test cases.

The first line of each test case contains an integer n ($3 \le n \le 3 \times 10^5$), the number of vertices.

The next n lines describes the edges of the graph, each line contains two integers u,v ($1 \le u, v \le n$), which means there is an edge between node u and node v.

It is guaranteed that the sum of n over all test cases doesn't exceed 10^5. It is guaranteed that the edges form a connected graph and there are no multiple edges and self loops.

Output

In each test case, print the maximum score you can obtain on the first line. In the next line, print n integers, the order of indices of the edges you will delete. If there are multiple answers, print any of them.

Example

standard input	standard output
2 3 1 2 2 3 3 1 5 1 2 1 3 2 4 2 5 3 5	6 1 2 3 16 3 1 2 4 5

Problem N. Code Under Pressure

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

"Welcome to the Squid Code. 14 rounds. Only coders survive"

The masked judge

The screen lights up with numbers. Each pair you touch could either save you or shatter your fate.

You are given an array of positive integers of length N. And we are interested in some weird function $F(L, R)$, which is described as the following:

$$F(L, R) = max(a_L, a_{L+1}, \ldots, a_R) * gcd(a_L, a_{L+1}, \ldots, a_R)$$

You are asked to calculate the sum of $F(L, R)$ over all ranges of the given array. More formally, you are asked to calculate the following:

$$\sum_{i=1}^{n} \sum_{j=i}^{n} F(i, j)$$

Since the sum might be huge, you are asked to print it modulo $10^9 + 7$.

Input

The first line contains a single integer number N ($1 \leq N \leq 2 * 10^5$) — the size of the previous array.

The second line contains N integer numbers $a_1, a_2, ..a_N$ ($1 \leq a_i \leq 10^9$), the elements of the array.

Output

Print the sum of the function over all ranges of the array modulo $10^9 + 7$.

Examples

standard input	standard output
4 1 3 6 8	169
2 1 2	7