

Problem A. Yes, Prime Minister

Input file: *standard input*
Output file: *standard output*
Time limit: 10 seconds
Memory limit: 512 mebibytes

Mr. Hacker's Department of Administrative Affairs (DAA) has an infinite amount of civil servants. Every integer is used as an ID (identification number) by exactly one civil servant. Mr. Hacker is keen on reducing overmanning in civil service, so he will only keep people with consecutive IDs in $[l, r]$, and dismiss all the others.

However, permanent secretary Sir Humphrey's ID is x , and he cannot be kicked out, so $l \leq x \leq r$ must hold. Mr. Hacker wants to be Prime Minister, so he demands that the sum of people's IDs $\sum_{i=l}^r i$ must be a prime number.

You, Bernard, need to make the reduction plan which meets the demands of both bosses. Otherwise, Mr. Hacker or Sir Humphrey will fire you.

Mr. Hacker would be happy to keep as few people as possible. Please calculate the minimum number of people left to meet their requirements.

A prime number p is an integer greater than 1 that has no positive integer divisors other than 1 and p .

Input

The first line contains an integer T ($1 \leq T \leq 10^6$), the number of test cases. Then T test cases follow.

The first and only line of each test case contains one integer x_i ($-10^7 \leq x_i \leq 10^7$), the ID of Sir Humphrey.

Output

For each test case, print a line with one integer: the minimal number of people kept if such a plan exists, or -1 otherwise.

Example

standard input	standard output
10	6
-2	4
-1	3
0	2
1	1
2	1
3	2
4	1
5	2
6	1
7	

Problem B. Might and Magic

Input file: *standard input*
Output file: *standard output*
Time limit: 2 seconds
Memory limit: 512 mebibytes

Two heroes are fighting, whose names are hero 0 and hero 1 respectively.

You are controlling the hero 0, and your enemy is the hero 1. Each hero has five integer attributes: ATTACK, DEFENSE, POWER, KNOWLEDGE, and HEALTH. When two heroes battle with each other, they will take turns to attack, and your hero moves first. One hero can make **exactly one attack** in one turn, either a physical attack or a magical attack.

Assume their attributes are A_i, D_i, P_i, K_i, H_i ($0 \leq i \leq 1$). For hero i , its physical attack's damage is $C_p \cdot \max(1, A_i - D_{1-i})$, while its magical attack's damage is $C_m \cdot P_i$. Here, C_p and C_m are given constants.

After hero i 's attack, H_{1-i} will decrease by the damage of its enemy. If H_{1-i} is lower or equal to 0, the hero $(1 - i)$ loses, the hero i wins, and the battle ends.

Hero i can make magical attacks no more than K_i times in the whole battle.

Now you know your enemy is a Yog who is utterly ignorant of magic, which means $P_1 = K_1 = 0$, and he will only make physical attacks. You can distribute N attribute points into four attributes A_0, D_0, P_0, K_0 arbitrarily, which means these attributes can be any non-negative integers satisfying $0 \leq A_0 + D_0 + P_0 + K_0 \leq N$.

Given C_p, C_m, H_0, A_1, D_1 , and N , please calculate the maximum H_1 such that you can build hero 0 and fight so that it wins the game.

Input

The first line contains an integer T ($1 \leq T \leq 10^4$), the number of test cases. Then T test cases follow.

The first and only line of each test case contains six integers $C_p, C_m, H_0, A_1, D_1, N$ ($1 \leq C_p, C_m, H_0, A_1, D_1, N \leq 10^6$), the attributes described above.

Output

For each test case, print a line with one integer: the maximum enemy health such that it is possible to win.

Example

standard input	standard output
2	4
1 1 4 5 1 4	25
2 5 1 9 9 6	

Problem C. 0 Tree

Input file: *standard input*
Output file: *standard output*
Time limit: 2 seconds
Memory limit: 512 mebibytes

We have a tree $\langle V, E \rangle$ that consists of n vertices numbered from 1 to n . Each vertex $i \in V$ has weight a_i . Each bidirectional edge $e = \langle u, v \rangle \in E$ has weight b_e . Here, a_i are non-negative integers, and b_e are integers.

You can perform at most $4n$ operations. For each operation, select two vertices X and Y , and a non-negative integer W . Consider the shortest path from X to Y (a path is shortest if the number of edges k in it is minimum possible). Let this path consist of $k + 1$ vertices $(v_0, v_1, v_2, \dots, v_k)$ where $v_0 = X$, $v_k = Y$, and for $0 \leq i < k$, the edges $e_i = \langle v_i, v_{i+1} \rangle \in E$. The operation changes the weights as follows:

$$a_X \leftarrow a_X \oplus W; \quad a_Y \leftarrow a_Y \oplus W; \quad b_{e_i} \leftarrow b_{e_i} + (-1)^i \cdot W \text{ for } 0 \leq i < k.$$

Here, \oplus denotes the bitwise XOR operation. We can notice that, if $X = Y$, nothing will change.

You need to decide whether it is possible to make all a_i and all b_e equal to 0. If it is possible, find a way to do so.

Input

The first line contains an integer T ($1 \leq T \leq 250$), the number of test cases. Then T test cases follow.

The first line of each test case contains a single integer n ($1 \leq n \leq 10^4$), the number of vertices.

The second line contains n non-negative integers a_i ($0 \leq a_i < 2^{30}$), the weight on each vertex.

Then $n - 1$ lines follow, each of them contains three integers u_j, v_j, w_j ($1 \leq u_j, v_j \leq n, -10^9 \leq w_j \leq 10^9$), representing an edge between vertices u_j and v_j with weight w_j . It is guaranteed that the given edges form a tree.

It is guaranteed that $\sum n \leq 10^5$.

Output

For each test case, output "YES" on the first line if you can make all a_i and all b_e equal to 0 with no more than $4n$ operations. Output "NO" otherwise.

If you can make all weights equal to 0, output your solution in the following $k + 1$ ($0 \leq k \leq 4n$) lines as follows.

On the next line, print an integer k : the number of operations you make.

Then print k lines, each line containing three integers X, Y , and W ($1 \leq X, Y \leq n, 0 \leq W \leq 10^{14}$), representing one operation.

If there are several possible solutions, print any one of them.

Example

standard input	standard output
3	YES
1	0
0	NO
2	YES
2 3	3
1 2 -2	1 3 5
3	2 3 7
5 4 1	2 3 3
1 2 -5	
2 3 -5	

Problem D. Decomposition

Input file: *standard input*
Output file: *standard output*
Time limit: 2 seconds
Memory limit: 512 mebibytes

You are given an undirected complete graph with n vertices, where n is odd. You need to partition its edge set into k **disjoint simple** paths, satisfying that the i -th simple path has length l_i , and each undirected edge is used exactly once. The given lengths l_i are integers from 1 to $n - 3$.

A complete graph is a simple undirected graph in which every pair of distinct vertices is connected by a unique edge. A simple path is a path where vertices are pairwise distinct. The length of a path is the number of edges in it.

It can be shown that an answer always exists if $\sum_{i=1}^k l_i = \frac{n(n-1)}{2}$ holds.

Input

The first line contains an integer T ($1 \leq T \leq 10^5$), the number of test cases. Then T test cases follow.

The first line of each test case contains two integers n and k ($5 \leq n \leq 1000$, $1 \leq k \leq \frac{n(n-1)}{2}$, n is odd), the number of vertices and paths, respectively. The second line contains k integers l_1, l_2, \dots, l_k ($1 \leq l_i \leq n-3$), the required lengths of the paths.

It is guaranteed that $\sum_{i=1}^k l_i = \frac{n(n-1)}{2}$ holds for each test case.

It is also guaranteed for the total number of edges over all test cases that $\sum \frac{n(n-1)}{2} \leq 10^6$.

Output

For each test case, start by printing one line containing "Case # x :", where x ($1 \leq x \leq T$) is the test case number. Then output k lines. In the i -th of these lines, print $l_i + 1$ integers denoting the vertices of the i -th path in order of traversal.

If there are multiple answers, print any one of them.

Example

standard input	standard output
3	Case #1:
5 6	5 4 2
2 1 1 2 2 2	2 3
7 8	5 1
1 1 4 3 4 1 3 4	2 1 4
5 10	3 5 2
1 1 1 1 1 1 1 1 1 1	1 3 4
	Case #2:
	6 7
	1 3
	6 5 1 2 3
	7 1 4 2
	1 6 4 7 5
	7 3
	2 6 3 5
	3 4 5 2 7
	Case #3:
	5 3
	5 2
	4 3
	1 5
	1 3
	2 3
	4 2
	4 1
	1 2
	4 5

Problem E. Median

Input file: *standard input*
 Output file: *standard output*
 Time limit: 2 seconds
 Memory limit: 512 mebibytes

Mr. Docriz has n different kinds of objects indexed by $1, 2, \dots, n$. An object of the i -th kind weighs i kilograms. For each i , Mr. Docriz has b_i objects of the i -th kind. Among those objects, there are a_i precious objects, and the remaining ones are common objects. Now, he wants to divide all his objects into some (one or more) disjoint sets. These sets have to satisfy the following conditions:

1. Each object should go to exactly one set.
2. Each set should contain exactly one precious object.
3. In each set, the weight of the precious object should be the median weight of this set.

Please tell him whether it is possible.

For a set of size k , if we sort its elements by non-descending weight as c_1, c_2, \dots, c_k , the median weight of this set is defined as the weight of $c_{\lfloor (k+1)/2 \rfloor}$.

Input

The first line contains an integer T ($1 \leq T \leq 1000$), the number of test cases. Then T test cases follow.

The first line of each test case contains one integer n ($1 \leq n \leq 10^6$), specifying how many different kinds of objects Mr. Docriz has.

Then n lines follow. The i -th of these lines contains two integers a_i and b_i ($0 \leq a_i \leq b_i \leq 10^9$), indicating that there are a_i precious objects of the i -th kind, and b_i objects of the i -th kind in total.

It is guaranteed that $\sum n \leq 2 \cdot 10^6$.

Output

For each test case, output "YES" if it is possible to achieve the goal, or "NO" otherwise.

Example

standard input	standard output
3	YES
4	YES
1 1	NO
1 1	
1 1	
1 1	
4	
1 1	
0 1	
1 1	
1 1	
4	
0 1	
1 1	
1 1	
1 1	

Problem F. The Struggle

Input file: *standard input*
Output file: *standard output*
Time limit: 4.5 seconds
Memory limit: 512 mebibytes

Nocriz is a student who, like many, has a dream for his life. Unfortunately, life isn't always easy, and there are times when the dream seems far away and the pursuit feels difficult.

Reality often drives people away from their pursuit of dreams to settle for what they have at hand. Lured to set aside the struggle, Nocriz said to Artemisia, "But I shouldn't give up the dream, right?". Artemisia replied: "Of course one should not give up the dream easily! Struggle, struggle until you are crushed by a rock!".

That night, Nocriz had a very bad dream. In his dream, there was a rock in the shape of an ellipse, and he was asked to calculate the sum of values $(x \oplus y)^{33}x^{-2}y^{-1}$, performing the calculations modulo $10^9 + 7$, for all integer points (x, y) in the ellipse, where \oplus is the bitwise XOR operation.

Formally, the ellipse is specified by six integers a, b, c, d, e, f . Consider the ellipse $E = \{(x, y) \mid x, y \in \mathbb{Z}, a(x - b)^2 + c(y - d)^2 + e(x - b)(y - d) \leq f\}$. It is guaranteed that all points of the ellipse satisfy $0 < x, y < 4 \cdot 10^6$, and that the ellipse contains at least one integer point. Now, consider the coordinates as residues modulo $10^9 + 7$, and calculate

$$\sum_{(x,y) \in E} (x \oplus y)^{33}x^{-2}y^{-1}.$$

In particular, considering numbers as residues means that z^{-1} is the modular inverse of z , and the result of every addition and multiplication has to be taken modulo $10^9 + 7$.

Nocriz was not crushed by the rock that day. Can you solve this problem, like Nocriz did?

Input

The first line contains an integer T ($1 \leq T \leq 10^4$), the number of test cases. Then T test cases follow.

The first and only line of each test case contains six integers a, b, c, d, e, f ($1 \leq a, c \leq 100, -100 \leq e \leq 100, 1 \leq b, d \leq 4 \cdot 10^6, 0 \leq f \leq 10^{15}$). It is guaranteed that all points (x, y) of the ellipse satisfy $0 < x, y < 4 \cdot 10^6$, and that the ellipse contains at least one integer point.

It is also guaranteed that the sum of the values $\max_{(x,y) \in E} \max(x, y)$ over all test cases is at most $4 \cdot 10^6$.

Output

For each test case, output a single line with the integer representing the answer. Don't forget to treat coordinates as residues modulo $10^9 + 7$ in calculations.

Example

standard input	standard output
2	566081223
2 2 1 3 -1 6	453578240
13 19 11 17 6 1919	

Problem G. Power Station of Art

Input file: *standard input*
Output file: *standard output*
Time limit: 3 seconds
Memory limit: 512 mebibytes

As a modern art lover, Nocriz loves going to the Power Station of Art.

Currently, art pieces of a modern genre of art called “red-black graphs” are exhibited in the Power Station of Art. Every red-black graph art piece is an undirected labeled graph with numbers and colors associated with each vertex. Each vertex is either red or black.

It is possible to modify a graph in the following way: choose an edge and swap the numbers written on the corresponding vertices. In addition, if the colors of the two vertices are the same, the colors of both vertices are changed (from red to black or from black to red). Otherwise, the colors of the two vertices remain unchanged.

Now, Nocriz is studying two art pieces. The graphs are the same but the numbers and colors may be different. Is it possible to make some (possibly zero) modifications to the art pieces to make them be the same?

Input

The first line contains an integer T ($1 \leq T \leq 3 \cdot 10^4$), the number of test cases. Then T test cases follow.

The first line of each test case contains two integers n and m ($1 \leq n \leq 10^6$, $0 \leq m \leq 10^6$), the number of vertices and edges.

Then m lines follow, each of them contains two integers u_i and v_i ($1 \leq u_i, v_i \leq n$, $u_i \neq v_i$) representing an edge. It is guaranteed that there are no multiple edges in the input, and the graph **may** be unconnected.

Then numbers and colors of the two graphs follow. For each graph:

The first line contains n integers, the i -th integer a_i ($0 \leq a_i \leq 10^6$) representing the number written on the i -th vertex of the graph.

The second line contains n characters. If the i -th character is ‘R’, the i -th vertex is red. If the i -th character is ‘B’, the i -th vertex is black.

It is guaranteed that $\sum n \leq 10^6$ and $\sum m \leq 10^6$.

Output

For each test case, output a single line containing “YES” if it is possible to make some (possibly zero) modifications to the art pieces to make them be the same, or “NO” otherwise.

Example

standard input	standard output
3	YES
2 1	NO
1 2	YES
3 4	
RR	
4 3	
BB	
3 2	
1 2	
2 3	
1 1 1	
RBR	
1 1 1	
BBB	
3 3	
1 2	
2 3	
3 1	
1 1 1	
RBR	
1 1 1	
BBB	

Problem H. Command and Conquer: Red Alert 2

Input file: *standard input*
Output file: *standard output*
Time limit: 10 seconds
Memory limit: 512 mebibytes

Being a nostalgic boy, Nocriz loves watching HBK08 and Lantian28 playing the game Command and Conquer: Red Alert 2. However, he doesn't know how to play the game himself.

In the game, you own a sniper initially located at $(-10^{100}, -10^{100}, -10^{100})$ in a 3D world. There are n enemy soldiers, where the i -th soldier is located at (x_i, y_i, z_i) . We say the range of the sniper to be k if the sniper can kill all enemies such that $\max(|x_s - x_e|, |y_s - y_e|, |z_s - z_e|) \leq k$, where (x_s, y_s, z_s) is the location of the sniper and (x_e, y_e, z_e) is the location of the enemy.

In one step, the sniper can move from (x, y, z) to $(x + 1, y, z)$, $(x, y + 1, z)$, or $(x, y, z + 1)$. The enemies don't move. The sniper is allowed to make an unlimited number of steps, and is allowed to kill all enemies in range whenever all his coordinates are integers. What is the minimum range k such that the sniper can eventually kill all enemies?

Input

The first line contains an integer T ($1 \leq T \leq 5 \cdot 10^4$), the number of test cases. Then T test cases follow.

The first line of each test case contains a single integer n ($1 \leq n \leq 5 \cdot 10^5$), the number of enemies.

Then n lines follow, each contains three integers x_i, y_i, z_i ($-10^9 \leq x_i, y_i, z_i \leq 10^9$) denoting the location of the i -th enemy.

It is guaranteed that $\sum n \leq 2 \cdot 10^6$.

Output

For each test case, output a line with a single integer representing the answer.

Example

standard input	standard output
3	0
2	1
0 0 0	2
1 1 1	
2	
0 1 0	
1 0 1	
5	
1 1 4	
5 1 4	
1 9 1	
9 8 1	
0 0 0	

Problem I. Typing Contest

Input file: *standard input*
Output file: *standard output*
Time limit: 2 seconds
Memory limit: 512 mebibytes

Teacher Docriz is planning to select some students in his class for a typing contest.

There are n students in the class. The i -th classmate's initial typing speed is s_i and the typing noise is f_i . However, when several students are selected to compete, their total typing speed is not the sum of everyone's initial typing speed, because the noise each person makes affects others.

Specifically, if students $1, 2, 3, \dots, k$ form a team, the actual typing speed of student 1 is $s_1 \cdot (1 - f_1 f_2 - f_1 f_3 - \dots - f_1 f_k)$, the actual typing speed of student 2 is $s_2 \cdot (1 - f_2 f_1 - f_2 f_3 - \dots - f_2 f_k)$, and so on.

Teacher Docriz wants to form a team so that the total typing speed is as large as possible. Please help him calculate the maximum typing speed he could possibly achieve.

Input

The first line contains an integer T ($1 \leq T \leq 2000$), the number of test cases. Then T test cases follow.

The first line of each test case contains a single integer n ($1 \leq n \leq 100$), the number of students.

Then n lines follow, each line contains two numbers s_i, f_i ($1 \leq s_i \leq 10^{12}$, $0 \leq f_i \leq 1$), where s_i is an integer and f_i is a real number with **exactly two decimal places**.

It is guaranteed that $\sum n \leq 2000$.

Output

For each test case, output a line with a single real number: the maximum typing speed that teacher Docriz can achieve. Keep your answers to **exactly 9 decimal places** after the decimal point.

It is guaranteed that the answer is absolutely precise when 9 decimal places are used, so only the answers that **coincide** with the model solution are accepted, so **please ensure the accuracy of your output**.

Example

standard input	standard output
4	33.000000000
3	12.000000000
10 0.00	17.250000000
11 0.00	20.421900000
12 0.00	
3	
10 1.00	
11 1.00	
12 1.00	
3	
10 0.50	
11 0.50	
12 0.50	
3	
10 0.33	
11 0.21	
12 0.92	

Problem J. Game

Input file: *standard input*
Output file: *standard output*
Time limit: 8 seconds
Memory limit: 512 mebibytes

Koishi is playing a game with Satori.

There is an array of length 10^{18} . In the game, Koishi and Satori take turns operating on this array, and Koishi goes first. At the start of a player's turn, if there is only one element left in the array, she loses the game immediately. Otherwise, she needs to delete either the leftmost number or the rightmost number of the remaining array.

The game is too boring for Koishi, so she came up with the following modified rules.

There are n sub-segments of this array that are special. Specifically, the i -th sub-segment is described by three integers (l_i, r_i, z_i) . They mean that, at the start of a player's turn, if the remaining array is the sub-segment $[l_i, r_i]$, she will win immediately if $z_i = 1$ or lose immediately if $z_i = 0$.

If there is a special sub-segment $(x, x, 1)$ given for some x , a player will immediately win when the remaining array is $[x, x]$ at the start of their turn. Importantly, if there is no special sub-segment $(x, x, 1)$ given for some x , it is assumed that $[x, x]$ is an immediate loss, as in the original rules.

There will be q games. At the beginning of the i -th game, Utuoho will give two players the sub-segment $[a_i, b_i]$ and take away all other parts of the array. That means Koishi and Satori only play on sub-segment $[a_i, b_i]$, not on the whole array. All the q games are independent.

Two players always use the optimal strategy. Please tell them who will win in each game.

Input

The first line contains an integer T ($1 \leq T \leq 2000$), the number of test cases. Then T test cases follow.

The first line of each test case contains two integers n and q ($1 \leq n, q \leq 10^5$), the number of sub-segments and the number of games.

Then n lines follow. Each of them contains three integers: l_i, r_i, z_i ($1 \leq l_i \leq r_i \leq 10^9$, $0 \leq z_i \leq 1$). You may assume that, for any $i \neq j$, $(l_i, r_i) \neq (l_j, r_j)$ holds.

After that, q lines follow. Each of them contains two integers a_i and b_i ($1 \leq a_i \leq b_i \leq 10^9$) describing the initial sub-segment of the i -th game.

It is guaranteed that $\sum(n + q) \leq 9 \cdot 10^5$.

Output

For each test case, output one line with q integers v_i ($0 \leq v_i \leq 1$) without spaces: $v_i = 0$ if Koishi loses the i -th game and $v_i = 1$ if she wins the i -th game, respectively.

Example

standard input	standard output
1	0010111101
5 10	
1 2 0	
3 3 1	
3 4 1	
2 4 1	
1 3 0	
1 2	
1 3	
1 4	
1 5	
2 3	
2 4	
2 5	
3 4	
3 5	
4 5	

Problem K. Array

Input file: *standard input*
Output file: *standard output*
Time limit: 2 seconds
Memory limit: 512 mebibytes

Koishi gives you an integer array B of length n satisfying $1 \leq B_1 \leq B_2 \leq \dots \leq B_n \leq n + 1$.

Let $S(T)$ denote the set of numbers that appear in array T . Koishi asks you whether an array A of length n exists such that, for any l and r such that $1 \leq l \leq r \leq n$, the equality $S(A[l, r]) = S(A[1, n])$ holds if and only if $r \geq B_l$. If so, please construct an array A that satisfies the condition above.

Here, $A[l, r]$ represents the sub-array of A formed by A_l, A_{l+1}, \dots, A_r .

You can only use integers from 0 to 10^9 in the array. It can be shown that, if a solution exists, then there also exists a solution satisfying this condition.

Notice: If there exists such an index i ($1 \leq i \leq n$) that $B_i < i$ holds, the required A must not exist.

Input

The first line contains an integer T ($1 \leq T \leq 6 \cdot 10^4$), the number of test cases. Then T test cases follow.

The first line of each test case contains an integer n ($1 \leq n \leq 2 \cdot 10^5$), the length of array B (and A).

The next line contains n integers B_1, B_2, \dots, B_n ($1 \leq B_1 \leq B_2 \leq \dots \leq B_n \leq n + 1$), the array that Koishi gives you.

It is guaranteed that $\sum n \leq 2.6 \cdot 10^6$.

Output

For each test case, print one line. If such an array A doesn't exist, output -1 . Otherwise, you should output n numbers: the array A consisting of integers in the range from 0 to 10^9 . If there are several possible solutions, print any one of them.

Example

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