Problem A. Yes, Prime Minister

Input file:	`standard input`
Output file:	`standard output`
Time limit:	6 seconds
Memory limit:	512 megabytes

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

However, permanent secretary Sir Humphrey's id number is x and he cannot be kicked out so there must be $l \le x \le r$. Mr. Hacker wants to be Prime Minister so he demands that the sum of people's id number $\sum_{i=l}^{r} i$ 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 $T (1 \le T \le 10^6)$ - the number of test cases. Then T test cases follow.

The first and only line of each test case contains one integer $x_i (-10^7 \le x_i \le 10^7)$ - Sir Humphrey's id number.

Output

For each test case, you need to output the minimal number of people kept if such a plan exists, output -1 otherwise.

Example

standard input	standard output

<pre>10
-2
-1
0
1
2
3
4
5
6
7</pre>
	<pre>6
	4
	3
	2
	1
	1
	2
	1
	2
	1</pre>

Problem B. Might and Magic

Input file:	`standard input`
Output file:	`standard output`
Time limit:	12 seconds
Memory limit:	512 megabytes

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, DEFENCE, 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 attritubes are $A_i, D_i, P_i, K_i, H_i (0 \le i \le 1)$. For hero i, its physical attack's damage is $C_p \max(1, A_i - D_{1-i})$ while its magical attack's damage is $C_m P_i$ where C_p, C_m are given constants.

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

Now you know your enemy is 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 to four attributes A_0, D_0, P_0, K_0 arbitrarily which means these attributes can be any non-negative integer satisfying $0 \le A_0 + D_0 + P_0 + K_0 \le N$.

Given C_p, C_m, H_0, A_1, D_1 and N, please calculate the maximum H_1 that you have a chance to win.

Input

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

The only line of each test case contains six integers $C_p, C_m, H_0, A_1, D_1, N (1 \le C_p, C_m, H_0, A_1, D_1, N \le 10^6)$ - attritubes described above.

Output

For each test case, output one integer representing the answer.

Example

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

Problem C. 0 tree

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	512 megabytes

We have a tree $\langle V, E\rangle$ consists of n vertices with weight $a_i(i \in V)$ on the vertices and weight $b_e(e = \langle u, v\rangle \in E)$ on the bidirectional edges. a_i is a non-negative integer and b_e is an integer.

You can perform no more than $4n$ following operations:

For the shortest path from x to y traveling $k+1$ vertices $(v_0, v_1, v_2, ..., v_k)$ where $v_0 = x, v_k = y$, let $e_i = \langle v_i, v_{i+1}\rangle (0 \le i < k)$. In one operation, you can choose 2 vertices x, y and a non-negative integer w, to make:

$$a_x \leftarrow a_x \bigoplus w; \quad a_y \leftarrow a_y \bigoplus w; \quad w_{e_i} \leftarrow w_{e_i} + (-1)^i w \, (0 \le i < k)$$

Where $\bigoplus$ 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, b_e equal to 0. If it is possible, output a solution using no more than $4n$ operations described above.

Input

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

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

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

Then $n-1$ lines follow, each line contains three integers $x_j, y_j, w_j (1 \le x_j, y_j \le n, -10^9 \le w_j \le 10^9)$, representing an edge between vertices x_j, y_j with weight w_j. It is guaranteed that the given edges form a tree.

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

Output

For each test case, output "YES" in the first line if you can make all a_i, 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 $k+1 (0 \le k \le 4n)$ lines as follows.

The first line contains one integer k - the number of operations you make.

Then k lines follow, each line contains 3 integers $X_j, Y_j, W_j (1 \le X_j, Y_j \le n, 0 \le W_j \le 10^{14})$, representing one operation.

If there are multiple possible solutions, output any.

Example

standard input	standard output
3 1 0 2 2 3 1 2 -2 3 5 6 3 1 2 -5 2 3 -5	YES 0 NO YES 3 1 3 5 2 3 7 2 3 3

Problem D. Decomposition

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	512 megabytes

You are given an undirected complete graph with n vertices (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 $(1 \le i \le k, 1 \le l_i \le n-3)$, and each undirected edge is used exactly once.

A complete graph is a simple undirected graph in which every pair of distinct vertices is connected by a unique edge. A simple path with length l here means the path covers l edges, and the vertices in the path are pairwise distinct.

It can be proved 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 $T (1 \le T \le 100000)$ - the number of test cases. Then T test cases follow.

The first line of each test case contains two integers $n, k (5 \le n \le 1000, 1 \le k \le \frac{n(n-1)}{2}, n \equiv 1 \pmod 2)$ - the number of vertices and paths.

The next line contains k integers $l_1, l_2, \cdots, l_k (1 \le l_i \le n-3)$ - the length of each path.

It is guaranteed that $\sum_{i=1}^{k} l_i = \frac{n(n-1)}{2}$ holds for each test case, and $\sum \frac{n(n-1)}{2} \le 4 \times 10^6$.

Output

For each test case, firstly output one line containing `Case #x:`, where $x (1 \le x \le T)$ is the test case number. Then output k lines. the i-th line contains $l_i + 1$ numbers denoting the i-th path.

If there are multiple answers, print any.

Example

standard input	standard output
3 5 6 2 1 1 2 2 2 7 8 1 1 4 3 4 1 3 4 5 10 1 1 1 1 1 1 1 1 1 1	Case #1: 5 4 2 2 3 5 1 2 1 4 3 5 2 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:	1 second
Memory limit:	512 megabytes

Mr. docriz has n different integers $1, 2, \cdots, n$. He wants to divide these numbers into m disjoint sets so that the median of the j-th set is b_j. Please help him determine whether it is possible.

Note: For a set of size k, sort the elements in it as $c_1, c_2, \cdots, c_k$, the median of this set is defined as $c_{\lfloor (k+1)/2 \rfloor}$.

Input

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

The first line of each test case contains 2 integers $n, m (1 \le m \le n \le 10^5)$ - the number of integers that Mr. docriz has, and the number of sets he want to divide these numbers into.

The next line contains m integers $b_1, b_2, \cdots, b_m (1 \le b_i \le n)$. It is guaranteed that all the numbers in b are distinct.

It is guaranteed that $\sum n \le 2 \times 10^6$.

Output

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

Example

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

Problem F. The Struggle

Input file:	`standard input`
Output file:	`standard output`
Time limit:	4 seconds
Memory limit:	512 megabytes

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 faraway 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 crushed by the 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 value $\sum (x \oplus y)^3 x^{-2} y^{-1} \mod 10^9+7$ for all integer points (x, y) in the ellipse, where $\oplus$ is the bitwise XOR operation.

In more formal words, you are given integers a, b, c, d, e, f, and you are required to calculate $\sum_{(x,y)\in E} (x \oplus y)^3 x^{-2} y^{-1} \mod 10^9+7$ where $E = \{(x, y) | x, y \in \mathbb{Z}, a(x-b)^2 + c(y-d)^2 + e(x-b)(y-d) \le f\}$. It is guaranteed that all such points satisfy $0 < x, y < 4 \times 10^6$ and that the ellipse contains at least one integer point.

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

Input

The first line contains an integer $T (1 \le T \le 10000)$ - the number of test cases. Then T test cases follow.

The only line of each test case contains six integers $a, b, c, d, e, f (1 \le a, c \le 100, -100 \le e \le 100, 1 \le b, d \le 4 \times 10^6, 0 \le f \le 10^{15})$.

It is guaranteed that there are no more than 1000 test cases for which $\max_{(x,y)\in E} \max(x, y) > 100$; no more than 100 test cases for which $\max_{(x,y)\in E} \max(x, y) > 1000$; no more than 10 test cases for which $\max_{(x,y)\in E} \max(x, y) > 10000$; no more than 3 test cases for which $\max_{(x,y)\in E} \max(x, y) > 1000000$; no more than 1 test case for which $\max_{(x,y)\in E} \max(x, y) > 2000000$, and $\sum \max_{(x,y)\in E} \max(x, y) \le 1.1 \times 10^7$.

Output

For each test case, output one integer representing the answer.

Example

standard input	standard output
2 2 2 1 3 -1 6 13 19 11 17 6 1919	483333436 102810867

Problem G. Power Station of Art

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	512 megabytes

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 $T (1 \le T \le 30000)$ - the number of test cases. Then T test cases follow.

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

Then m lines follow, each line contains two integers $u_i, v_i (1 \le u_i, v_i \le n, u_i \ne v_i)$ 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 $a_i (0 \le a_i \le 10^6)$ representing the number of the i-th node of the graph.

The second line contains n characters. If the i-th character is 'R', the i-th node is red. If the i-th character is 'B', the i-th node is black.

It is guaranteed that $\sum n \le 10^6, \sum m \le 10^6$.

Output

For each test case, output "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 2 1 1 2 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	YES NO YES

Problem H. Command and Conquer: Red Alert 2

Input file:	`standard input`
Output file:	`standard output`
Time limit:	8 seconds
Memory limit:	512 megabytes

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, and 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 $\max(|x_s - x_e|, |y_s - y_e|, |z_s - z_e|) \le k$, 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.

If it is only possible to move the sniper from (x, y, z) to $(x + 1, y, z)$, $(x, y + 1, z)$ or $(x, y, z + 1)$, what is the minimum k such that the sniper can kill all enemies?

The sniper is allowed to move unlimited number of steps, and is allowed to kill enemies whenever he is on an integer coordinate.

Input

The first line contains an integer $t (1 \le T \le 50000)$ - the number of test cases. Then T test cases follow.

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

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

It is guaranteed that $\sum n \le 2 \times 10^6$.

Output

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

Example

standard input	standard output
3 2 0 0 0 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	0 1 2

Problem I. Typing Contest

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	512 megabytes

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 $1, 2, 3, \cdots, k$ form a team, the actual typing speed of student 1 is $s_1 \times (1 - f_1 f_2 - f_1 f_3 - \cdots - f_1 f_k)$, and the actual typing speed of student 2 is $s_2 \times (1 - f_2 f_1 - f_2 f_3 - \cdots - f_2 f_k)$, 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 $T (1 \le T \le 1000)$ - the number of test cases. Then T test cases follow.

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

Then n lines follow, each line contains 2 numbers $s_i, f_i (1 \le s_i \le 10^{12}, 0 \le f_i \le 1)$, where s_i is an integer and f_i is a real number with **exactly 2 decimal places**.

It is guaranteed that $\sum n < 1.2 \times 10^4, \sum n^2 < 2.4 \times 10^5, \sum n^3 < 1.2 \times 10^7, \sum n^4 < 9 \times 10^8$.

Output

For each test case, output a single real number - the maximum typing speed that teacher docriz can achieve. Keep your answers to **exactly 9 decimal places**.

It is guaranteed that there is no precision error in the answer when 9 decimal places are reserved, so we don't have special judge for this problem. **Please ensure the accuracy of your output**.

Example

standard input	standard output
4 3 10 0.00 11 0.00 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	33.000000000 12.000000000 17.250000000 20.421900000

Note

Kindly remind: The judger runs very fast. When evaluating whether the algorithm you designed can pass, it is recommended to refer to the following information.

Polynomial convolution with $O(n^2)$ time complexity takes about 1 second on this judger for $n = 40000$. Testing code is available here: `https://www.luogu.com.cn/paste/zq0kp7pm`.

Problem J. Array

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	512 megabytes

Koishi gives you an array B of length n satisfying $1 \le B_1 \le B_2 \le \cdots \le B_n \le n+1$.

Let $S(T)$ denote the set of numbers that appear in array T. She asks you whether an array A of length n exists so that for any $l, r (1 \le l \le r \le n)$, $S(A[l,r]) = S(A[1,n])$ holds if and only if $r \ge B_l$.

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

Notice: If there exists a $i (1 \le i \le n)$, that $b_i < i$ holds, the required A must not exist.

Input

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

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

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

It is guaranteed that $\sum n \le 4.5 \times 10^6$.

Output

For each test case, output "YES" if the array A exists, or "NO" otherwise.

Example

standard input	standard output
3 4 3 3 5 5 7 4 6 6 7 8 8 8 5 2 3 4 4 6	YES YES NO

Problem K. Game

Input file:	`standard input`
Output file:	`standard output`
Time limit:	6 seconds
Memory limit:	512 megabytes

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. When it comes to 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.

It is too boring for Koishi, so she comes up with the following 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), which means that when it comes to 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 $z_i = 0$. Moreover, if there is a special sub-segment $(x, x, 1)$, then the player will immediately win when the remaining array is $[x, x]$ (In default case, when there is only one number, the player will lose).

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 subsegment $[a_i, b_i]$. 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 $T(1 \leq T \leq 2 \times 10^3)$ - the number of test cases. Then T test cases follow.

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

Then n lines follow, each line contains 3 integers $l_i, r_i, z_i(1 \leq l_i \leq r_i \leq 10^9, 0 \leq z_i \leq 1)$, satisfing that for any $i \neq j$, $(l_i, r_i) \neq (l_j, r_j)$ holds.

Then q lines follow, each line contains 2 integers $a_i, b_i(1 \leq a_i \leq b_i \leq 10^9)$ - the initial sub-segment of the i-th game.

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

Output

For each test case, output one line with q integers $v_i(0 \leq v_i \leq 1)$ without spaces, that $v_i = 0$ if Koishi will lose in the i-th game and $v_i = 1$ if she will win in the i-th game.

Example

standard input	standard output
1 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	0010111101