

Problem E. LinearMapReduce

Input file: `stdin`
Output file: `stdout`
Time limit: 1 s
Memory limit: 256 Mb

In computing paradigm linearMapReduce the basic units of data are records. Every record consists of two fields — the key and the value. Key and value in linearMapReduce are integers in the range $[0, 10^9 + 6]$. Data processing paradigm linearMapReduce uses operators of two types: linearMap and much less popular linearReduce. Operator linearMap converts input key-value pair $(Key_{in}, Value_{in})$ into another key-value pair $(Key_{out}, Value_{out})$ according to the following rule:

$$Key_{out} = (a_{11} \cdot Key_{in} + a_{12} \cdot Value_{in}) \bmod (10^9 + 7)$$

$$Value_{out} = (a_{21} \cdot Key_{in} + a_{22} \cdot Value_{in}) \bmod (10^9 + 7)$$

Thus, the operator linearMap can be completely determined by 4 integers: $a_{11}, a_{12}, a_{21}, a_{22}$.

Ksenia supports project X where computational paradigm linearMapReduce is widely used. During the next scaling Ksenia needs to effectively solve the following problem:

N linearMap operators $M_1, M_2, \dots, M_N$ are described by their coefficients. There are incoming queries consisting of four numbers: $Key, Value, a, b$, which are the key-value pair and two indices in the operator sequence. In response to a query output the result of applying operators with indices from the a -th to the b -th to record $(Key, Value)$.

Note that in case $a \leq b$ we have to apply operators in the following order: $M_a, M_{a+1}, \dots, M_{b-1}, M_b$, and in case $a > b$ the order should be $M_a, M_{a-1}, \dots, M_{b+1}, M_b$.

Input

The first line contains a single integer $1 \leq N \leq 100000$ the number of linearMap operators. Each of the following N lines contains linearMap operators described one per line. Each operator is described by four integers separated by spaces: $a_{11}, a_{12}, a_{21}, a_{22}$, where $0 \leq a_{11}, a_{12}, a_{21}, a_{22} \leq 10^9 + 6$. The $N + 2$ -th row contains a single integer Q ($1 \leq Q \leq 100000$), the number of queries. Every query consists of 4 integers: $Key, Value, a, b$ separated by a space, where $0 \leq Key, Value \leq 10^9 + 6$ and $1 \leq a, b \leq N$.

Output

For each query output the key-value pair obtained after applying operators from the a -th to the b -th one.

Examples

stdin	stdout
3 2	15 15
1 0 0 1	20 20
1 2 2 1	
1 3 3 1	
5 5 1 2	
5 5 3 3	

Problem F. Circles and trees

Input file: `stdin`
Output file: `stdout`
Time limit: `1 s`
Memory limit: `256 Mb`

Specifies the root directed tree consisting of N vertices, numbered from 1 to N . You need to place N circles x_i, y_i, r_i on the plane so that:

1. Each of the numbers x_i, y_i, r_i — integer, $-10^6 \leq x_i, y_i \leq 10^6$, $1 \leq r_i \leq 2 \cdot 10^6$;
2. Circles have no common points;
3. Circle i is embedded in the circle j only if the vertex j of a given rooted tree can get to vertex i .

Input

The first line contains the number N ($1 \leq N \leq 20000$) — number of vertices of the tree. The next N lines is a description of the root oriented tree. In the row i contains exactly one number p_i - ancestor of vertex $i - 1$ if $i - 1$ is not a root and -1 otherwise.

Output

The first line should display the number N . In the next N rows you should print a circle satisfying 1-3 in the format « $x_i y_i r_i$ » (without quotes).

Examples

<code>stdin</code>	<code>stdout</code>
3	4 0 4
-1	2 0 1
1	5 0 1
1	

Problem G. Petya and the game

Input file: `stdin`
Output file: `stdout`
Time limit: 1 s
Memory limit: 256 Mb

Little Petya loves playing computer games. His mother has recently gave him a game where he has to rule a kingdom. The kingdom consists of N cities numbered from 1 to N , where the capital has number 1. Some cities are connected by two-way roads with length given in kilometers. There are $N - 1$ roads in total and is guaranteed that one can get from any town to the capital in only one way without going by the same road more than once. Every city of the kingdom, except of the capital, has exactly one harbinger living in it. Harbingers are characterized by their speed and the time they spend for preparations before the trip. For different harbingers these characteristics may vary. When the city is attacked a harbinger is sent to the capital. He is preparing for the trip and then moves one road towards the capital. Then, if he has not yet reached the capital, he can either continue moving to the capital (without spending additional time on preparation) or pass the message to the harbinger located in the city where he stays right now. In this case, everything starts over again: the harbinger is preparing and then leaves for the capital performing exactly the same actions. Thus, any number of harbingers can participate in delivering the message to the capital.

Help Petya determine the minimum time that it takes for the message to be delivered from each city to the capital.

Input

The first line contains a single integer N ($1 \leq N \leq 100\,000$). Each of the following $N - 1$ lines contain three integers u, v and d ($1 \leq u \leq N, 1 \leq v \leq N, 1 \leq d \leq 10\,000$), which are the numbers of cities connected by a road and its length in kilometers. Then there are $N - 1$ lines. The i -th of them contains two numbers S_i and V_i ($0 \leq S_i \leq 10^9, 1 \leq V_i \leq 10^9$) characterizing the harbinger from the city $i + 1$. S_i is the time in minutes that a harbinger needs to get ready for a trip and V_i is the time in minutes that a harbinger spends to pass 1 kilometer of a road.

Output

Print the $N - 1$ numbers separated by spaces, where the i -th number has to be equal to the smallest time in minutes of message delivery from the $i + 1$ -th city to the capital.

Examples

<code>stdin</code>	<code>stdout</code>
5 1 2 20 2 3 12 2 4 1 4 5 3 26 9 1 10 500 2 2 30	206 321 542 328

Problem H. Petya and arrays

Input file: `stdin`
Output file: `stdout`
Time limit: 1 s
Memory limit: 256 Mb

Little Petya likes arrays of integers very much. The only thing he likes more than arrays is playing with little Masha. It appears that she has just received two integers N and P as a gift from her mother. To test the strength of their friendship, Masha asked Petya to find the number of arrays consisting of N integers with the following properties:

- Every element is between 1 and P , inclusive.
- There is no continuous sub-array in which the sum of elements is divisible by P .

Help Petya to find the number of such arrays. This number can be very large, so output it modulo $1\,000\,000\,007$ ($10^9 + 7$) in order not to scare the children.

Input

The first line of input contains the number of test cases T ($1 \leq T \leq 2500$). Each of the next T lines contains two integers N and P ($1 \leq N \leq 50$, $1 \leq P \leq 50$).

Output

For each test case output the number of arrays Masha is asking for modulo $10^9 + 7$. Separate answers for different test cases by a newline.

Examples

stdin	stdout
3	0
5 4	2
2 3	6
2 4	

Problem I. Petya and arrays 2

Input file: **stdin**
Output file: **stdout**
Time limit: **1 s**
Memory limit: **256 Mb**

Little Petya loves arrays of integers. Recently he has received an array consisting of N integers as a gift from his mother. Petya decided to find there a segment of consecutive elements for which the value of the expression $A \cdot S + B$ is maximized. A and B are given, and S is the sum of all elements from the selected segment. Please note that the selected segment must have non-zero length.

Input

The first line contains 3 integers N ($1 \leq N \leq 10^6$), A and B ($-10^6 \leq A \leq 10^6$, $-10^6 \leq B \leq 10^6$).

Output

Output the maximum value of the expression $A \cdot S + B$.

Examples

stdin	stdout
4 2 3 0 -1 -1 0	3
5 3 3 5 -1 4 5 2	48

Problem J. Petya and rectangles

Input file: `stdin`
Output file: `stdout`
Time limit: `1 s`
Memory limit: `256 Mb`

Little Petya likes rectangles a lot. Petya gave his mother a list of rectangles he wants to get for Christmas. Each rectangle has width w and height h . Petya's mother wants to make Petya happy and buy all the rectangles from his list. She went to the store and found out that the price of a rectangle is equal to its area. Luckily, the store has Christmas sale, so you can buy rectangles in sets. The cost of one set is calculated as the width of the widest rectangle multiplied by the height of the highest rectangle of this set. Note that you can't rotate the rectangles (thus swap their width and height). Help Petya's mother buy all the rectangles from the Petya's list spending a minimum amount of money on this.

Input

First line contains an integer N ($1 \leq N \leq 100\,000$), which is the number of rectangles in the Petya's list. Each of the next N lines contains 2 positive integers that do not exceed 10^6 , which represent width and height of the rectangle.

Output

Output the smallest amount of money that Petya's mom can spend to buy all the rectangles from the Petya's list.

Examples

<code>stdin</code>	<code>stdout</code>
4 100 1 15 15 20 5 1 100	500
5 1 10 2 20 3 30 4 40 10 1	170

Problem K. Yet Another Binary Tree Problem

Input file: `stdin`
Output file: `stdout`
Time limit: 1 s
Memory limit: 512 Mb

Ksusha and Sasha work as senior BGEs at a major outsourcing company. They have developed yet another board game called LRSRBTg. Now they are going to play LRSRBTg the very last time before sending it to their customers.

The board for LRSRBTg consists of a single perfect rooted binary tree with bonuses located in some of the $N = 2^h - 1$ vertices. Note that there can be at most one bonus located in a single vertex. In addition to the board, there are infinitely many black and white pieces included to the LRSRBTg package. The rules that have been invented by Ksusha and Sasha are pretty simple: initially there is only one white piece located in some vertex V_{start} of the tree and two players alternate their turns during the game. At their turns players can perform one of the following three moves:

1. “Go left” — move all the pieces remained on the board (regardless of their color) to the left descendants of the vertices they are currently located in.
2. “Go right” — move all the pieces remained on the board (regardless of their color) to the right descendants of the vertices they are currently located in.
3. “Split” move consists of three sub-steps:
 - Replace each of the pieces remained on the board (regardless of color) with 2 pieces: one of them being black and the other being white.
 - Apply “Go left” move to all white pieces and only them.
 - Apply “Go right” move to all black pieces and only them.

As you can notice these moves sometimes can lead to the situation when some pieces are falling off the board. If the “Go left(right)” move is applied to piece which located in vertex that does not have left(right) descendant then that piece will fell off the board. In particular this implies that any of the moves 1-3 will lead to falling off the board pieces that were located in the leaves prior to the move.

Eventually, when there are no pieces left on the board the game ends. To determine the winner players count the total number of bonuses that are located at the vertices visited by at least one of the pieces. If the number of bonuses is even then Ksusha wins the game, otherwise Sasha wins. Given the tree structure and the location of all bonuses determine who will be the winner assuming that both Ksusha and Sasha play optimally. Ksusha makes the first move.

Input

The first line contains an integer $N = 2^h - 1$ ($1 \leq N \leq 32767$), the number of vertices. The next N lines describe a perfect rooted binary tree used for LRSRBTg. In the i -th of these lines three numbers are listed: *left*, *right* and *bonus* where:

- *left* is the number of left child of i -th vertex or 0 if it doesn't have a left child.
- *right* is the number of right child of i -th vertex or 0 if it doesn't have a right child.
- *bonus* is equal to 1 if the i -th vertex contains a bonus and 0 otherwise.

Output

In the i - th line output the winner of the game (“Ksusha” or “Sasha”, quotes for clarity only), assuming that the starting position is located in the i - th vertex (playing the game with $V_{\text{start}} = i$) and Ksusha plays first.

Examples

stdin	stdout
3	Ksusha
2 3 0	Sasha
0 0 1	Ksusha
0 0 0	

Note

¹ Board Game Engineers, almost a real job title

² Abbreviation from Left-Right-Split Rooted Binary Tree game

A perfect binary tree is a binary tree with $2^h - 1$ vertices where h is the maximal depth of the tree, and each internal vertex has two descendants.

Problem L. Travel (High)

Input file: **stdin**
Output file: **stdout**
Time limit: **1 s**
Memory limit: **256 Mb**

Little Petya likes travelling a lot. There are N cities in his country Berland. These cities are located on a single line. Petya numbered them from 1 to N in the increasing order of their beauty. Petya lives in the city 1 and he wants to get to the city N . He doesn't want to spoil the impression about the trip, so he decided to visit cities in the increasing order of their numbers (remember, that he numbered them in the increasing order of their beauty).

To move between the cities Petya chose the only aircompany in his country "Berland Airlines". The cost of flight from the city i to the city j equals $c_i \cdot |x_i - x_j| + t_j$, where x_i is the coordinate of the city i , x_j is the coordinate of the city j , c_i is the cost of a single unit of fuel in the city i and t_j is the tax for entering the city j . Petya expects this trip to be the best trip in his life, so he decided to spend as much money as possible on it. Help him to determine the maximum amount of money he can spend. Note that it is not necessary to visit all cities.

Input

The first line of input contains one integer number N ($1 \leq N \leq 100\,000$), which is the number of cities in Berland. The i -th of the next N lines contains 3 numbers: x_i ($-10^6 \leq x_i \leq 10^6$), c_i ($1 \leq c_i \leq 10^6$) and t_i ($1 \leq t_i \leq 10^6$). All coordinates of cities are distinct.

Output

Print the required largest amount of money that Petya can spend to get from the city 1 to the city N . *It is guaranteed that the answer will not exceed 10^{12} .*

Examples

stdin	stdout
4 5 10 2 0 1 10 15 3 14 17 2 3	123
1 709 50 8	0

Note

Here are two possible optimal routes for the first test case: $1 \rightarrow 4$, $1 \rightarrow 3 \rightarrow 4$.

Problem M. Petya and average (High)

Input file: stdin
Output file: stdout
Time limit: 2 s
Memory limit: 256 Mb

Little Petya loves math. Not a long time ago, a teacher asked children to solve following problem as homework. Two array A and W consist of N integers. You need to find the segment of consecutive numbers in the array A with a maximum weighted average with weights from array W (see definition below). Petya solved this task very simple: he just proved that the answer is rather seek only among segments of length 1, and then looked over them all and chose the best one. Petya wants to complicate the task for himself, so he says that he would seek a segment of length not less than L . Help him solve this complicated task.

Input

The first line contains two integers N and L ($1 \leq L \leq N \leq 10^6$) — number of elements in the array, and the shortest length of the desired segment. The next line contains N of integers modulo do not exceed 10^3 — array A . The next line contains N of positive integers not exceeding $2 \cdot 10^9$ — array W .

Output

Output 2 numbers — indexes of start and end of the segment with the highest weighted average. The length of the found segment shouldn't be less than L . Elements of array are numbered starting with one. If there are several segments — you can output any of them.

Examples

stdin	stdout
5 2 2 3 4 3 2 1 1 1 1 1	2 3
4 1 -1 1 1 -1 2 2 3 2	2 2

Note

In this problem under the weighted average number of array A with weights W on the segment from i to j ($i \leq j$) mean the following values:

$$\frac{A_i \cdot W_i + A_{i+1} \cdot W_{i+1} + \dots + A_j \cdot W_j}{W_i + W_{i+1} + \dots + W_j}$$

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Problem N. Deputies on the tree (High)

Input file: `stdin`
Output file: `stdout`
Time limit: 1 s
Memory limit: 256 Mb

In consequence of excessive decentralization the capital has been eliminated in country X. Now country X has a complicated political situation, which can only be resolved after gathering the new council of deputies.

Deputies live in each of the N cities. City i ($1 \leq i \leq N$) has exactly d_i deputies living in it. There are $N - 1$ two-way roads between the cities of country X that provide exactly one way to get from any city to any other one. For each road i ($1 \leq i \leq N - 1$) we know the cities u_i and v_i it connects and the cost w_i of travelling by this road for a single person.

Since country X experiences serious problems with finances. To save the country deputies must meet in some city, so that the total cost spent on travelling will be the lowest possible. To simplify the problem, you as the acting Prime Minister of X are permitted to declare a free passage for $0 \leq K \leq N - 1$ roads.

Input

The first line contains two numbers N, K ($1 \leq N \leq 100000$, $0 \leq K \leq N - 1$). The second line contains N integers $1 \leq d_i \leq 100000$. The i -th of them is the number of deputies living in the i -th city. The remaining $N - 1$ lines describe the roads of country X. Each road is defined in a separate line by three numbers: u_i, v_i и w_i ($1 \leq u_i, v_i \leq N$, $1 \leq w_i \leq 100000$). It is guaranteed that a deputy can reach any city from any other one by specified roads.

Output

Print the minimum amount of money required to gather all deputies in one city.

Examples

stdin	stdout
4 1 10 10 10 1 1 2 1 1 3 10 3 4 1000	120