Problem A. Martadella Strikes Again

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

Saeed and Shahhoud were attending a training camp for the ACM ICPC 2018 World Finals.

At dinner, they were very happy to see that the meal was martadella slices! **A martadella slice can be seen as a circle.**

Shahhoud received a martadella slice with a radius of R, while Saeed received two martadella slices with a radius of r each.

Saeed and Shahhoud were arguing about who received more martadella, can you help them find out?

Print "1" if the area of Shahhoud's martadella slice is strictly larger than the sum of the areas of the two slices that Saeed received, Otherwise, print "2" .

Input

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

Each test case consists of a single line containing two integers R and r. ($1 \leq R, r \leq 10^8$)

Output

For each test case, print "1" if the area of a martadella slice with radius R is strictly larger than the sum of areas of two martadella slices with radius r each, and print "2" otherwise.

Example

standard input	standard output
2 4 2 4 3	1 2

Problem B. Amer and Graphs

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

Amer loves graph algorithms, every morning when he wakes up, he draws a random graph and applies all kinds of graph algorithms on it.

Today, he decided to make things more interesting. First, he wrote down n undirected edges in a row, numbered from 1 to n. Then, for every two integers $1 \leq i \leq j \leq n$, he draws a graph that consists of all edges numbered between i and j (inclusive).

Drawing the same graph many times is boring, so Amer wants to know the number of pairs of equal graphs he will draw i.e. the number of pairs of intervals that represent the same graph. Can you help Amer?

Input

The first line contains one integer T: the number of test cases.

Each test case starts with a line that consists of one integer n, the number of edges Amer wrote down. $(1 \leq n \leq 2000)$

n lines follow, the i^{th} line contains two integers u and v, which means that the i^{th} edge connects nodes u and v. $(1 \leq u, v \leq 2 * n)$

Output

For each test case output the number of pairs of equal graphs Amer will draw.

Example

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

Note

Two graphs are considered equal if they have the exact same edges.

For example :

if graph $G1$ has edges $(\{1,2\},\{3,1\})$ and graph $G2$ has edges $(\{1,2\},\{1,2\},\{3,1\})$

$G1$ and $G2$ are **not** considered **equal**.

if graph $G3$ has edges $(\{1,2\},\{3,1\})$ and graph $G4$ has edges $(\{3,1\},\{1,2\})$

$G3$ and $G4$ are considered **equal**.

Problem C. Help Shahhoud

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

Shahhoud is participating in the first Div.3 contest on Codeforces, the first problem was:

Given two strings A and B of equal length N (N **is odd**), find the minimum number of steps needed to change A into B, or print -1 if it's impossible.

In each step, you can choose an **odd** integer x such that $1 \leq x \leq N$, and reverse the substring of length x that is centered in the middle of A. For example, performing a step with $x = 3$ on the string "*abcde*" results in "*adcbe*" and applying $x = 5$ on "*abcde*" results in "*edcba*".

Can you help Shahhoud solve the problem?

Input

The first line contains one integer T, the number of test cases.

Each test case consists of two lines, the first contains the string A, and the second contains the string B. ($1 \leq |A| = |B| \leq 10^5$) $|A| = |B|$ is odd.

Both strings consist of lowercase English letters.

Output

For each test case, print one line containing one integer, -1 if A can't be changed into B, or the minimum number of steps to change A into B.

Example

standard input	standard output
1 abcxdef fecxdba	2

Problem D. Simplified 2048

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

Ahmad was playing the famous game 2048, however, he found it very hard. He decided to create a simplified version of it on 1 dimension.

Basically, he has an array of length n that is initially empty.

He starts with a score of zero, then, the following steps are repeated until the array is full:

1. A number appears in the right-most cell of the array. Either a 4 with probability $\frac{p}{100}$, or a 2 with probability $(1 - \frac{p}{100})$.
2. All the cells are shifted once to the left by applying the following algorithm:

   Go through the array from left to right, for each cell that contains a number, there are 3 options:

   - if the cell to the left of it is empty, move it one step to the left.
   - if the cell to the left of it has a number **equal** to the current number, add the sum of both numbers (twice the current number) to the score, empty the current cell, and multiply the number in the cell to the left of it by 2.
   - if the cell to the left of it has a number **not equal** to the current number, do nothing.

   for example, this array:

32	8	4	4

   may become (with probability $(1 - \frac{p}{100})$) :

32	8	8	2

Soon, he realized that this game depends only on luck. To see how lucky he is, he asked you to find the expected score at the end of the game.

Input

The first line of input contains one integer T, the number of test cases.

Each test case contains two integers n, the number of cells, and p, the probability that the new number is 4. $(1 \leq n \leq 16)$ $(0 \leq p \leq 100)$

Output

For each test case output one line containing the expected score.

Your answer will be considered correct if the relative error is less than 10^{-6}.

Example

standard input	standard output
3 1 50 2 25 3 20	0.000000 3.875000 15.725298

Problem E. Floods

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

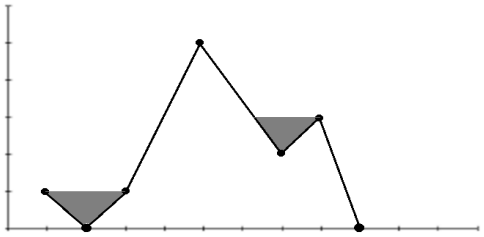
You probably heard and even saw the heavy rains that flooded the streets of Damascus recently.

Shahhoud is wondering if he should go to university or not. He asked you to find out how much rainwater is filling his street.

To make things simple, you can imagine Shahhoud's street as a 2D polyline consisting of N points. A 2D polyline is a number of points such that every point is connected to the point before it by a line segment. It is guaranteed that any vertical line crosses the polyline in at most one point.

Rain falls from above the polyline down the y axis. Your task is to calculate the total area that keeps rainwater.

The image below describes the second sample test:



Input

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

Each test case starts with a line containing one integer N ($1 \leq N \leq 10^5$), the number of points in the polyline that represents the street Shahhoud lives in.

The following N lines describe the points of the polyline. The i^{th} line contains two space separated integers x_i and y_i, the i^{th} point of the polyline. ($0 \leq x_i, y_i \leq 10^6$). It is guaranteed that $x_i < x_{i+1}$ for every $1 \leq i < N$.

Output

For each test case, print one line containing the total area that keeps rainwater.

Your answer will be considered correct if the relative error is less than 10^{-6}.

Example

standard input	standard output
2 2 1 1 2 1 7 1 1 2 0 3 1 5 5 7 2 8 3 9 0	0.00000000 1.83333333

Problem F. Random Sort

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

Saeed is teaching Algorithms 1 at Damascus University, his last lecture was about sorting algorithms. As homework, he gave the students an array A of length n and asked them to sort it in increasing order.

Shahhoud fell asleep during the lecture, so he doesn't know how to sort the array. He decided to create his own algorithm, Random Sort. He first chooses a permutation p of length n (A permutation of length n is an array of length n where each integer between 1 and n appears exactly once).

After that, he decides that the sorted array is A_{p_i} for each $1 \leq i \leq n$.

In other words sorting the array A_1, A_2, ..., A_n results in the array A_{p_1}, A_{p_2}, ... , A_{p_n}

This algorithm does not always sort the array correctly. Shahhoud is wondering about the number of ways he can choose a permutation p that results in a correctly sorted array. Since the number can be very large, he wants to calculate it modulo 7901. Can you help him?

Input

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

Each test case starts with a single line that contains an integer n, the length of the array A. ($1 \leq n \leq 1000$)

The next line contains n space-separated integers A_i, the array that needs to be sorted. ($1 \leq A_i \leq 1000$)

Output

For each test case, print one line containing one integer, the number of ways of choosing a permutation p that correctly sorts the array A in increasing order. Print the answer modulo 7901.

Example

standard input	standard output
2 3 1 2 3 2 5 5	1 2

Note

Two permutations P and Q are considered different if $P_i \neq Q_i$ for any $1 \leq i \leq n$

Problem G. Weird Requirements

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

It is hard to find teams for students to participate in ACM contests, most students have weird requirements for their team mates. For example, Ziad wants the GCD of all his team mate's ratings on all famous websites to be exactly X and the LCM of his ratings to be exactly Y.

There are N famous competitive programming websites. Ramzi's rating on the i^{th} website is A_i. Ramzi is very experienced, in one contest, he can change his rating on one website to any other value. What is the minimum number of contests that Ramzi must participate in, so that Ziad accepts him as his team mate?

Input

The first line contains one integer T, the number of test cases.

Each test case starts with one line containing three space-separated integers N, X, and Y, the number of famous websites, the required GCD value, and the required LCM value respectively. $(1 \leq N \leq 10^5)$ $(1 \leq X, Y \leq 10^9)$

The next line contains N space-separated integers A_i, Ramzi's rating on all websites. $(1 \leq A_i \leq 10^9)$

Output

For each test case print one line containing one integer, the minimum number of contests Ramzi must participate in so that he can become Ziad's team mate.

If it is impossible for Ziad to accept him as his team mate , print -1.

Example

standard input	standard output
1 5 1 10 1 5 1 10 10	0

Note

The Greatest Common Divisor (GCD) of an array is the maximum number that divides all integers in the array without remainder.

The Least Common Multiple (LCM) of an array is the minimum positive number that is a multiple of all integers in the array.

Problem H. Shahhoud the Chief Judge

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

Shahhoud is the Chief Judge for SCPC 2019. He created an interesting problem:

Given a binary tree with N nodes where each node has a weight assigned to it, your task is to find the sum of all paths in the tree (including the path from a node to itself). In other words, you need to calculate the sum of $D(u, v)$ for every $1 \leq u, v \leq N$. $D(u, v)$ is the sum of the weights of the nodes on the path from u to v.

Shahhoud generated test cases for the problem, but then he realized that he doesn't know how to solve it. In order to create test cases for the problem, judges usually need a correct solution to generate the correct output for each test case.

In order to solve this problem, he decided to edit the test cases such that the answer is always 0. This way, he doesn't need a correct solution because the output is always the same!

Manually editing the test cases is time consuming, so he asked you for help. He needs to know the minimum number of nodes that he must change their weights such that the answer becomes 0. He also needs the nodes that should be changed.

The weights of the chosen nodes can be changed to any integer number .

If there is more than one optimal solution, output any.

Input

The first line contains a single integer T, the number of test cases Shahhoud generated.

Each test case starts with a line containing a single integer N, the number of nodes in the binary tree. $(1 \leq N \leq 10^5)$.

The following line contains N space-separated integers w_i, the weight of the i^{th} node. $(-1000 \leq w_i \leq 1000)$.

$N - 1$ lines follow, each containing two space-separated integers u_i and v_i. This means that there is an edge between nodes u_i and v_i. $(1 \leq u_i, v_i \leq N)$

Output

For each test case, print one line that starts with K, the minimum number of nodes that need to be changed so that the answer becomes 0, followed by a space, then K space-separated integers v_i, the nodes that need to be changed.

Example

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

Note

A binary tree is a tree where every node is either a leaf, or has two sons.

Problem I. Ildar Yalalov

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

Ildar Yalalov is a famous eagle with the head of an uzbek guy. He is a very famous competitive programmer in Russia.

But what people don't know that his friend Sergey was feeding him for 3 months so that his wings grow. Few months ago Yalalov was in the top 20 in some VK cup round. In the next round he missed solving 1 problem because he forgot how to use setprecision function properly.

Sergey was very angry, because he spent all these months training Yalalov and growing his wings but for nothing so he decided to quit that and moved on to some other talented guys.

Ildar decided to challenge Sergey to some game to prove that Sergey is no more than a beginner problem-solver.

There are N piles of stones, the i^{th} pile contains A_i stones. Ildar and Sergey are playing a game, they take turns and Ildar starts the first move.

In each turn, the current player has two options:

1) Remove one stone from any pile.

2) Remove one stone from every pile if every pile has at least 1 stone.

The player who can't make a move loses. Can you determine the winner if both players play optimally?

Print "$Yalalov$" if Ildar Yalalov wins, and "$Shin$" otherwise.

Input

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

Each test case starts with a line containing a single integer N, the number of piles. $(1 \leq N \leq 100)$

The following line contains N space-separated integers A_i, the number of stones in each pile. $(1 \leq A_i \leq 10^6)$

Output

For each test case, print "$Yalalov$" if Ildar Yalalov wins the game, and "$Shin$" otherwise.

Example

standard input	standard output
1 2 1 2	Yalalov

Note

Ildar Yalalov

Problem J. Saeed and Folan

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

Saeed is waiting for Shahhoud who is late as usual. To kill time, Saeed decided to walk around the hallway. The hallway can be seen as a straight line with 10^9 tiles numbered from 1 to 10^9 from left to right.

Saeed starts his walk at the p_1^{th} tile facing either left or right. Each second he moves one tile in the direction he is facing. The boundaries of his walk are L_1 and R_1 ($L_1 < R_1$). This means that if he is walking left and reaches the L_1^{th} tile, he changes his direction and starts walking right, And if he is walking right and reaches the R_1^{th} tile, he changes his direction and starts moving left. (no time is needed to change direction)

Folan is also walking in a similar way, except that he starts at the p_2^{th} tile and the boundaries of his walk are L_2 and R_2 ($L_2 < R_2$).

Saeed hates Folan, and he is wondering how many times he will meet Folan at the same tile at the same moment within K seconds of walking (the direction of walking does not matter), can you help him?

Input

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

Each test case consists of 3 lines, the first line contains 4 space-separated integers L_1, R_1, p_1, and D_1 (if D_1 is 0 then Saeed is facing left, and if D_1 is 1 then Saeed is facing right).

The second line also contains 4 space-separated integers L_2, R_2, p_2 and D_2, the information of Folan's walk (similar to Saeed's).

$1 \leq L_1 < R_1 \leq 10^9$ and p_1 is in the range $[L_1, R_1]$.

$1 \leq L_2 < R_2 \leq 10^9$ and p_2 is in the range $[L_2, R_2]$.

$1 \leq K \leq 1000$

$p_1 \neq p_2$

Output

For each test case, print one line containing one integer, the number of times Saeed meets Folan on the same tile at the same time.

Example

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

Problem K. Another Shortest Path Problem

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

Shortest path problems have always been a part of competitive programming, appearing in many contests all around the world. In order to keep that tradition, we created another one:

You are given an undirected connected weighted graph with N nodes and N edges, and you have to answer Q queries. Each query consists of two nodes X and Y, and you have to find the length of the shortest path between nodes X and Y.

Input

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

Each test case starts with a line containing two integers N and Q, the number of nodes (and edges) and the number of queries. $(3 \leq N \leq 10^5)$ $(1 \leq Q \leq 10^5)$

Each of the following N lines contain the description of the edges. The i^{th} line contains 3 space-separated integers u_i, v_i, and w_i. This means that there is an undirected edge between nodes u_i and v_i, with a weight of w_i. $(1 \leq u_i, v_i \leq N)$ $(1 \leq w_i \leq 10^5)$

Then Q lines follow, the i^{th} line contains two integers X and Y. This means that you need to find the shortest path between nodes X and Y. $(1 \leq X, Y \leq N)$

It is guaranteed that the graph contains no self loops or multiple edges.

Output

For each test case, and for each query, print one line containing one integer, the shortest path between X and Y.

Example

standard input	standard output
1 6 3 1 2 2 1 3 4 2 6 3 3 4 1 3 5 10 3 6 6 1 4 2 5 3 2	5 16 6

Problem L. V–o_o–V

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

Last Month, Hussain was participating a programming contest. After only 10 minutes he started writing the solution of a problem about trees .

```
vector<long long> answer;
for (int j=2; j<=n; j++){        //Normal c++ loop with j as variable
    long long sum=0;
    for (int i=1; i < j; i++){        //Normal c++ loop with i as variable
        sum += V[ LCA(i,j) ];
        /*
        LCA(i, j) is a predefined function that calculates the
                    lowest common ancestor of 2 nodes in a tree
        V[LCA(i, j)] is the value written on that node (LCA).
        */
    }
    answer.push_back(sum);        //Put the answer of i-th node in the answer vector.
}
```

Well, Hussain kept getting TLE. Seems his solution was very slow. He sent over 10 submissions with TLE verdict. He knew that when the contest is finished if the problem isn't solved all his friends will call him a crab.

Noobs in gaming are called crabs (because they have claws not normal fingers) that's why they are bad at gaming (actually you can call noob coders crabs the same way).

Hussain asked you for help, can you write a code that performs exactly the same objective and write the answer vector to output for all test-cases (please see the example for better understanding).

Input

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

Each test case starts with a line containing a single integer N the number of nodes ($2 \leq N \leq 2 * 10^5$).

The next line contains N space separated integers. The i_{th} integer represents V_i which is the value written on the i_{th} node. ($1 \leq V_i \leq 10000$)

The next line contains N space separated integers. The i_{th} integer represents P_i which is the parent of the i_{th} node. Plase note that $P_1 = 0$ always. You can assume that the first node is the root of the tree.

It's guaranteed that the input is a valid tree.

Output

For each test-case output a single line consisting of $N - 1$ integers. The i_{th} of them represents the sum associated with the $(i + 1)_{th}$ node. In fact you need to output the vector "answer"in the source code as it's exactly.

Example

standard input	standard output
2 5 1 2 3 4 5 0 1 2 3 4 3 100 100 100 0 1 1	1 3 6 10 100 200