Problem B. The Witcher

Input file:	*standard input*
Output file:	*standard output*
Time limit:	6 seconds
Memory limit:	512 mebibytes

The Witcher is now in some serious trouble! He needs to prepare a pocket map for his upcoming journey. He is now in a tavern and here there is a map of the whole Continent. For simplicity, we assume that the map is just an undirected graph without loops, but it may contain multiple edges between the same pair of nodes. There is an unwritten rule in the Witcher's world, that each graph placed in a pocket map should satisfy the following condition: the degree of each vertex should be even. The Witcher doesn't want to break the rule and also the graph in the pocket map should have the same set of nodes as the graph from the map in the tavern and the edges of this graph should form a subset of the edges from the graph in the tavern. Of course, there are some edges, which are necessary for the Witcher to complete his upcoming adventure, so he would also like to place them in his pocket map. The Witcher would like to know, if he can construct a valid graph, fulfilling the given conditions and if he can, then you should tell him, which edges he should take into his pocket map.

Input

In the first line one integer $Z \leq 100$ is given, denoting number of testcases described in following lines.

The first line of the standard input contains two integers n, m meaning the number of nodes and the number of edges in the graph from the map in the tavern. Each of the next m lines contains the description of one edge in the graph. i-th of them contains three integers a_i, b_i, x_i meaning that the i-th edge is connecting the nodes with numbers a_i and b_i, and if $x_i = 1$, then the Witcher needs this edge in his pocket map, otherwise you can choose it, but it is not necessary.

($n \in [1, 5 \cdot 10^5]$, $m \in [0, 5 \cdot 10^5]$), ($a_i, b_i \in [1, n]$, $a_i \neq b_i$, $x_i \in \{0, 1\}$).

Output

For each test case, the first line of the standard output should contain one word "`TAK`", if the Witcher can prepare the pocket map fulfilling all the conditions, or "`NIE`" otherwise. If the first line contains the word "`TAK`", then in the next m lines you should print the numbers $y_i \in \{0, 1\}$, such that $y_i \geq x_i$ and the graph formed from the edges with $y_i = 1$ should satisfy all the Witcher's conditions.

Example

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

Problem C. What a sequence!

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

Let a_n be a sequence defined by the recursive formula:

$$a_{n+2} = k \cdot a_{n+1} + a_n$$
$$a_0 = 0$$
$$a_1 = 1$$

Given a certain $k \in \{1, 3, 5, 7\}$ and an odd prime number p, your task is to find the value of $a_p \bmod p$.

Input

In the first line one integer $Z \leq 10^6$ is given, denoting number of testcases described in following lines.

For each test case, first and the only input line contains two natural numbers p and k, p being an odd prime number.

$k \in \{1, 3, 5, 7\}$. The total length of the numbers p in the all testcases doesn't exceed 10^6.

Output

For each test case you should print exactly one line containing the value of $a_p \bmod p$.

Example

standard input	standard output
3 3 5 11 1 13 3	2 1 0

Problem E. All in good fun!

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

Policeman Biteusz loves pranking his friends from the police station. For example, his last joke was signing up his friend Bajteusz for patrolling the city on all Sundays and holidays left this year. However, Biteusz hasnt been so happy since he heard about the new work. Biteusz have to patrol three designated streets. Roads in Bajtocja are straight and no two streets are parallel, so he will have to patrol some, perhaps degenerate to a point, triangle. The policeman will stand at the best place possible, so to minimalize the maximum distance, which he'd possibly have to travel, when called to run to the specified street. Biteusz has been wondering how far he will have to run when called. Help him and calculate the minimum distance!

Input

In the first line one integer $Z \leq 10^4$ is given, denoting number of testcases described in following lines.

The first line of the each test case contains 3 — the number of roads in Bajtocja. Each of the next 3 lines contains three integers a_i, b_i, c_i, the description of the i-th road, meaning that the road is a line fulfilling the equation:

$$a_i x + b_i y + c_i = 0$$

$|a_i|, |b_i|, |c_i| \leq 10^6$, $|a_i| + |b_i| > 0$. No two given lines are parallel.

Output

For each test case you should print the minimum distance, which Biteusz will have to travel. Your answer will be accepted, if the absolute or relative error wouldn't exceed 10^{-6}.

Example

standard input	standard output
2 3 1 0 0 0 1 0 1 1 -1 3 1 1 -3 -3 1 1 1 0 -4	0.292893218813452 1.399173588432128

Problem F. Five Nights at Freddy's

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

Maria has finally got her dream job! She became a professional night guard in a Sky Tower. One of her responsibilities is reporting about unwanted activity in the building. Fortunately for her, she can do her job without even leaving her cozy chair. All she has to do is keep track of cameras that are placed in the skyscraper. To do so she must handle n different cameras (enumerated from 1 to n). She wants to create the cycle of transmitting in which she will process information from the cameras. She will look at transition from some camera for one minute and then switch to the next camera on the cycle. Each camera should appear at least once on the cycle. There are some additional constraints. No two neighboring occurrences of the camera i on the cycle can be more than a_i places apart. Fortunately for Maria, for each $1 \leq i < j \leq n$ at least one of a_i and a_j is multiple of the other.

If it is possible, help Maria to create such cycle with length not exceeding 10^6.

Input

In the first line one integer $Z \leq 50$ is given, denoting number of testcases described in following lines.

The first line of each test case contains one integer n, denoting the number cameras in the Sky Tower.

Following line contains a description of cameras. i-th number denotes the parameter a_i of the i-th camera.

$n \in [1, 10^5]$, $a_i \in [1, 10^5]$.

Output

For each test case:

If it is impossible to construct such cycle, the first (and only) line of the output should consist of single word "`NIE`".

If it is possible to construct such cycle, in the first line output single word "`TAK`". The following line should contain description of a transition cycle. First number m denotes the length of the cycle. Next m numbers are numbers of the cameras on the cycle in order they appear on the cycle.

If there are several possible answers, print any of them.

Example

standard input	standard output
2 3 2 4 8 5 3 3 6 6 42	TAK 4 1 2 1 3 NIE

Problem G. Choreography

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

To celebrate the sixteenth anniversary of the unification of Vertical Byteland and Horizontal Byteland, a great parade will pass through the streets of the capital. The court choreographer Byteleon has decided to honor this event with a special choreography of the new national dance: Byterek.

Byterek is danced by n^2 dancers who are arranged in a square formation of size $n \times n$. It consists of a sequence of *vertical* and *horizontal* phases. During the dance dancers freely swap places with each other, on one condition, that for the time of vertical phases swapping is allowed exclusively within dancer's own column and during horizontal phases – within one's own row.

The choreography will also carry an additional meaning which should please king Byteasar. Every dancer will have an assigned costume of a specific color, so that the formation creates an image seen from the royal balcony. Byteleon wants the image to initially look like the flag of Vertical Byteland, and at the end of the dance – the flag of Horizontal Byteland. Unfortunately this task seems to be too hard for him, especially that the dance should consist of as few phases as possible, not to bore Byteasar. Please, help Byteleon and write a program that generates phases of Byterek.

Input

In the first line one integer $Z \leq 100$ is given, denoting number of testcases described in following lines.

The first line of each test case contains one integer n, denoting the length of columns and rows of the formation. The next n lines, each containing n integers, describe the initial arrangement of the dancers. Every number in $[1, n^2]$ occurs only once in this description and represents the desired position of the dancer in the final arrangement. This means that the final arrangement is a table in which every row and column is sorted, just like in the sample tests.

$n \in [1, 500]$, sum of n over all test cases does not exceed 1000.

Output

For each test case, in the first line your program should output an integer k – the minimum number of phases of Byterek. Then it should output k descriptions of arrangements in subsequent phases. The description of one arrangement consists of n rows each consisting of n integers, where each integer in $[1, n^2]$ occurs exactly once. If $k > 0$, the first arrangement must be possible to reach from the one given in the input after one phase of Byterek. The next one should be possible to reach from the previous one etc. The last arrangement should be equal to a sorted table. The order of vertical and horizontal phases is arbitrary.

Example

standard input	standard output
3 2 2 3 4 1 3 9 2 7 8 1 4 6 5 3 2 1 2 3 4	2 2 1 4 3 1 2 3 4 3 2 7 9 8 1 4 5 6 3 2 1 3 5 6 4 8 7 9 1 2 3 4 5 6 7 8 9 0

Problem H. Cheat

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

Eryk with his partner called "Synek" are planning next spoof. Usually they swindle foreingers by offering false banknotes on low exchange rate, so they have to drive a lot around country to avoid recognition.

But to do this, they need to find a city where they can build a base. Cities and roads in their homeland can be viewed as a directed graph with n vertices numbered with integers from 1 to n and specific property – there is a directed edge from vertex i to vertex $i + 1$ for each valid i.

Since they want to get back to base after each "trip" so they finds cycles really attractive. They decided to build a base in a city which lies on all cycles in their country. Because there can be multiple such cities, they asked you to write down all of them. If there is no cycle in the graph, they can build a base in any city.

Formally a cycle is a path starting and ending in the same city and visiting at least one other city (possibly multiple times).

Input

In the first line one integer $Z \leq 50$ is given, denoting number of testcases described in following lines.

The first line of the test case contains two integers n and m, denoting the number of cities and roads. Each of the following m lines two integers a_i, b_i ($a_i \neq b_i$), denoting that there is a directed road from a_i to b_i. There can exist more than one road from a_i to b_i.

$n \in [1, 500\,000], m \in [0, 500\,000]$, sum of n and sum of m over all testcases does not exceed $1\,000\,000$.

Output

For each test case your program should write the number of cities where Eryk and "Synek" can build base, followed by indices of those cities in ascending order.

Example

standard input	standard output
sample.in	sample.out

Problem J. Planet of the singles

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

Ania and Tomek have recently fallen in love. They are texting each other all the time. We can assume that each such message is a binary sequence. Tomek's father, Maksymilian, is not very keen on this whole situation. He decided to capture one of the lovers message and change it to his desired message, both this messages have the same length. He has to do it as fast as he can, because he doesn't want to gain unnecessary attention. Maksymilian can make three types of operations:

1. change 0 to 1 on some fixed position,
2. change 1 to 0 on some fixed position,
3. swap the bits on two fixed neighbouring positions.

Each of this operations take some time. The first one takes t_0 seconds, the second one t_1 seconds and the third one t_s seconds. Father can use any operation multiple times (possibly zero) and would like to change the given message into the desired one as fast as possible. Help him!

Input

In the first line one integer $Z \leq 20$ is given, denoting number of testcases described in following lines.

To compress the size of the input, all the binary sequences are converted into hexadecimal ones, so you may assume that the length of each such binary sequence is divisible by four.

The first line of the each test case contains four natural numbers n, t_0, t_1, t_s meaning the length of the hexadecimal sequences and the times described in the task description. The second line contains the message father got and the third line contains the message that father is going to make. This sequences consist of only characters from the set {`0, 1, ..., 9, A, B, ..., F`}.

$n \in [1, 10^6]$, $t_0, t_1, t_s \in [1, 10^{12}]$

Output

The first and only line of the output for each test case should contain one integer meaning the minimal number of seconds needed to change the first sequence into the second one.

Example

standard input	standard output
2 2 1 2 3 F0 D5 3 1 1 1 201 110	4 3

Note

In the first example the decoded binary sequences are `11110000` and `11010101`.

Problem K. Shadow

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

As we all know, Earth is a unlimited plane in a 3D space and the sun is just a tiny ball shining evenly in all directions, for simplicity represented as a single point in a 3D space. One day the Death Star comes. The Death Star is a sphere with radius R. Because it is really big, some area on Earth was covered by the shadow. Your task is to calculate the area of the shadow, given the initial positions of Earth, the Death Star and the sun.

Input

In the first line one integer $Z \leq 10^4$ is given, denoting number of testcases described in following lines.

The first line of each test case contains three integers X_s, Y_s, Z_s meaning the initial sun coordinates. The second line contains four integers X_d, Y_d, Z_d and R meaning the position of the center of the Death Star and its radius. The third and last line contains four integers A, B, C and D meaning that Earth is a plane consisting of points (x, y, z) such that $Ax + By + Cz + D = 0$. You may assume that Earth, the Death Star and the sun are disjoint (they have no common points) and that the answer is greater than 0 and not infinity.

$X_s, Y_s, Z_s \in [-10^4, 10^4]$

$X_d, Y_d, Z_d \in [-10^4, 10^4]$, $R \in [1, 10^4]$

$A, B, C, D \in [-10^4, 10^4]$

Output

For each test case, the first and only line of the standard output should contain one real number, meaning the area of the shadow cast by the Death Star on Earth. Your answer will be accepted, if the relative or absolute error will not exceed 10^{-6}.

Examples

standard input	standard output
2 0 0 0 0 0 5 3 0 0 5 -50 0 0 0 6 8 0 6 6 8 0 -180	176.714586764 572.555261117
1 3 1 2 5 -1 4 2 2 -1 1 -22	77.432452329

Problem L. Boss of all bosses

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

Krzysztof J. is a well-known and respected mafia boss from Szczecin. Next week, he is arranging a meeting with his associates. For simplicity let's denote them by numbers $1, 2, \ldots, n$. They will go for sushi or bowling and then talk business over dinner. Organizing such event is not an easy task though, because the invited mafiosos have a rather fiery temper and they often disagree on many topics, which sometimes results in fights. That is why he asked for your help.

You know that exactly $n - 1$ pairs of mafiosos are friends and for every such pair you have determined the expected time of *reaching a direct agreement* between them. You have also built a graph defined by the relation of friendship. As it turns out, that graph is connected, so for the pairs of mafiosos that are not friends, the expected time of *reaching an agreement* is the minimum sum of times of *reaching direct agreements* between adjacent mafiosos on the path connecting them in the graph.

During the dinner mafiosos will seat on one side of a long table. The seats have numbers $1, 2, \ldots, w + 1$, where w is the width of the table. Krzysztof doesn't want to provoke any fights during the dinner, so he decided that if there is a pair of mafiosos with seat numbers i and j and their expected time of *reaching an agreement* is d, then $d \leq |i - j|$ must hold. Because of that it can happen, that some seats remain empty. Your job is to determine the minimum width of the table, at which the guests can be seated.

Input

In the first line one integer $Z \leq 10^6$ is given, denoting number of testcases described in following lines.

The first line of each test case contains single integer n, denoting the number of mafiosos. Each of the following $n-1$ lines describes a pair of mafiosos that are friends. Pair i is denoted by three positive integers a_i, b_i and c_i – the labels of mafiosos and the expected time of *reaching a direct agreement* between them.

$n \geq 3$, sum of n over all test cases does not exceed 10^6.

Output

For each test case your program should write the minimum width of the table.

Example

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

Problem M. Attack and Defence

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 seconds
Memory limit:	512 mebibytes

In Tower Defence games, you should build some towers to protect your kingdom from monsters. And now another wave of monsters is coming and you need again to know whether you can get through it.

The path of monsters is a straight line, and there are N blocks on it (numbered from 1 to N continuously). Before enemies come, you have M towers built. Each tower has an attack range $[L, R]$, meaning that it can attack all enemies in every block i, where $L \le i \le R$. Once a monster steps into block i, every tower whose attack range include block i will attack the monster once and only once. For example, a tower with attack range $[1, 3]$ will attack a monster three times if the monster is alive, one in block 1, another in block 2 and the last in block 3.

A witch helps your enemies and makes every monster has its own place of appearance (the i-th monster appears at block X_i). All monsters go straightly to block N.

Now that you know each monster has HP H_i and each tower has a value of attack D_i, one attack will cause D_i damage (decrease HP by D_i). If the HP of a monster is decreased to 0 or below 0, it will die and disappear.

Your task is to calculate the number of monsters surviving from your towers so as to make a plan B.

Input

The first line of the input is an integer N ($0 < N <= 10^5$), the number of blocks in the path. The second line is an integer M ($0 < M \le 10^5$), the number of towers you have. The next M lines each contain three numbers, L_i, R_i, D_i ($1 \le L_i \le R_i \le N$, $0 < D_i \le 1000$), indicating the attack range $[L, R]$ and the value of attack D of the i-th tower. The next line is an integer K ($0 < K \le 10^5$), the number of coming monsters. The following K lines each contain two integers H_i and X_i ($0 < H_i \le 10^{18}$, $1 \le X_i \le N$) indicating the i-th monster's live point and the number of the block where the i-th monster appears.

Output

Output one line containing the number of surviving monsters.

Example

standard input	standard output
5 2 1 3 1 5 5 2 5 1 3 3 1 5 2 7 3 9 1	3

Problem N. Build The Dice

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

Lets call a dice *correct*, if sum of scores on each pair of parallel faces is the same. For example, dice with 0 on the upper face, 3 on the lower face, 2 on the right face, 1 on the left face, 1 on the back face, 2 on the front face is correct, while dice with 1 on the upper face, 6 on the lower face, 2 on the right face, 5 on the left face, 4 on the back face, 7 on the front face is incorrect (sums are 7, 7 and 11). You are given six non-negative integers. Check if you can find a way to put all those integers on faces of the cube to form correct dice.

Input

The first and only line of the input file contains six non-negative integers, each of them is not greater than 1000.

Output

Print "`Yes`", if it is possible to form the correct dice with those six numbers on the faces, or "`No`" otherwise.

Examples

standard input	standard output
0 1 3 2 2 1	Yes
1 2 4 5 6 7	No

Problem O. Identification of Cockroaches

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 seconds
Memory limit:	512 mebibytes

There live n cockroaches in the campus of Byteland University of Fence Building. All cockroaches have personal numbers — positive integers from 1 to n.

Also there are several locations in the campus. Cockroaches can migrate between locations and may identify each other in there (fact that cockroach A identifies cockroach B in location $L1$ does not leads to conclusion that cockroach B identifies cockroach A in location $L1$, neither that cockroach A identifies cockroach B in some other location $L2$). Define *rating of popularity* $k_{i,l}$ of cockroach i in location l as number of different cockroaches, who can identify i in l (cockroach i itself is not included in this list).

To make communications between humanity and cockroaches easy, you must determine for each location cockroach with maximal rating of popularity.

Input

First line contains two integers m and n ($1 \le m \le 10^5$, $1 \le n \le 10^5$), where m is the quantity of identification records, and n is the total number of cockroaches. Then m lines follow, describing cockroaches identification.

Each line contains two integers a and b and a non-empty string l, consisting of no more than 12 lowercase English letters, meaning that cockroach a identifies cockroach b in the location named l ($1 \le a, b \le n$, $a \ne b$). It is guaranteed that there is no more than 15 locations and that in any two distinct lines atleast one of parameters a, b and l is different.

Output

For each location print in the new line location name and number of most popular cockroach. In case of a tie print cockroach with smallest number. Order of locations must correspond to order, in which locations appear in the input file for the first time.

Examples

standard input	standard output
8 5 1 2 kitchen 3 2 library 3 4 room512 4 3 room512 2 3 room512 2 3 kitchen 4 2 library 5 2 kitchen	kitchen 2 library 2 room512 3
5 2 1 2 room512 1 2 roof 1 2 myworkplace 2 1 recyclingbin 2 1 mycomputer	room512 2 roof 2 myworkplace 2 recyclingbin 1 mycomputer 1