The International Collegiate Programming Contest
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ECPC
EGYPTIAN COLLEGIATE
PROGRAMMING CONTEST

The 2020 Egyptian Collegiate Programming Contest

(Contest Problems)

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Problem A. GcdHBD

Input file:	`hbd.in`
Output file:	`standard output`
Balloon Color:	`Pink`

El-Khadrawy created a new function called `GcdHBD(`x`,`y`,`k`)`. This function works as follows:

First, it finds the prime factors of x and y and puts them in an increasing order of their values.

Then, If the number of factors of x or y is less than k, the function returns -1. Otherwise, it returns the product of the first k factors of x and the last k factors of y.

For example, let $x = 132$ and $y = 105$, their prime factorization is : $x = 2 \times 2 \times 3 \times 11$ and $y = 3 \times 5 \times 7$.

Now, suppose that $k = 2$, then `GcdHBD(132, 105, 2)` $= 2 \times 2 \times 5 \times 7 = 140$

El-Khadrawy wants to test your skills. Given two integers n and k, find the number of pairs (x,y), such that, $(1 \leq x, y \leq n)$ and `gcd(`x`, `y`)` = `GcdHBD(`x`, `y`, `k`)`.

Note that the function `gcd(`x`, `y`)` returns the normal Greatest Common Divisor of two integers x and y.

Input

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

Each test case is given on a separate line containing two integers n $(1 \leq n \leq 10^5)$ and k $(1 \leq k \leq 20)$.

Output

For each test case print a single line containing one integer denoting the answer to the problem.

Example

hbd.in	standard output
5 50 1 60 2 20 1 75 3 500 1	116 13 25 1 4803

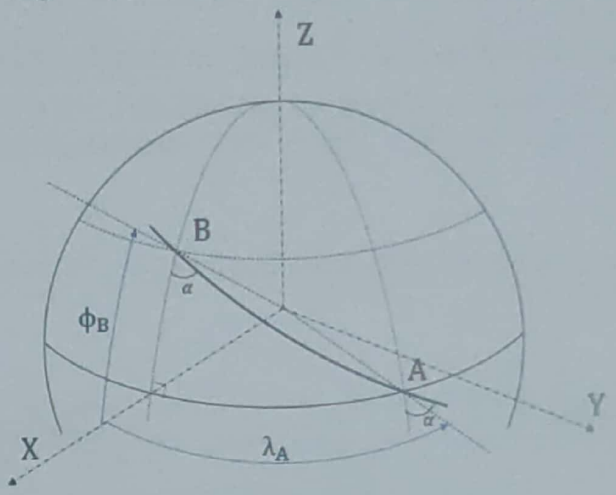
Problem B. Navigation

Input file:	`nav.in`
Output file:	`standard output`
Balloon Color:	`Yellow`

An aircraft wants to go from a point X to a point Y in such a way that its path is located on the surface of a sphere whose center is $(0, 0, 0)$ and whose radius is R.

A meridian is a **half circle** of radius R that can be obtained with an intersection of the sphere with a rotation of the **half plane** $(XZ/X \geq 0)$ around the Z axis.

This aircraft can go from a point A to a point B only if the path AB is crossing all meridians between the two points at the same angle α (in the figure below there is an infinity meridians between A and B, only 2 are represented).



In a trip the angle can be changed at most once. What is the length of the shortest path between X, Y ?

Input

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

Each test case consists of a line with 5 integers : R The radius of the sphere, λ_x ϕ_x λ_y ϕ_y the longitudes and the lattitudes in degrees of X and Y respectively($1 \leq R \leq 10^6$, $-180 < \lambda \leq 180, -90 \leq \phi \leq 90$).

Output

For each test case output one line with one number : the length of the shortest path between X and Y **rounded to exactly 3 decimal places.**

Example

nav.in	standard output
2 1000 0 0 0 20 1000 10 20 10 -20	349.066 698.132

Note

The longitude of a point is the angle between the meridian containing this point and the plane (XZ).

The latitude of a point is the angle between this point, the origin, and the intersection of the (XY) plane with the meridian containing that point.

Positive angles are represented in the figure.

Problem C. No time for a story

Input file:	pop.in
Output file:	standard output
Balloon Color:	Orange

Shiraz invites you to **El-Khadrawy**'s House to play a game. She will give you an array A, and askes you to reduce its size by doing the following operation at most twice:

You can choose one sub-array of equal elements and delete it, then merge the remaining two sub-arrays, in the same order as in the original array.

What is the maximum number of elements that can be deleted?

Input

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

Each test case is given in a new line. This line starts with an integer N : the size of the array, followed by N integers A_i denoting the elements of the array ($1 \leq N \leq 10^5$ and $1 \leq A_i \leq 10^9$).

Output

For each test case, in a new line, output the maximum number of elements that can be deleted from the array.

Example

pop.in	standard output
3 6 1 1 2 1 1 4 3 1 1 1 4 1 1 2 2	5 3 4

Problem D. Good Pairs

Input file:	pairs.in
Output file:	standard output
Balloon Color:	Cyan

El-Khadrawy is planning to launch a new company that produces n products, each one has a name S_i. Since El-Khadrawy is busy with El-Khadrawy Group, multiple products may end up having the same name.

However, El-Khadrawy is interested in making the names of his products look good. To do this, he wants to calculate the number of good pairs of his products. Two products i and j are considered good if S_i is a substring of S_j. Note that i and j are not necessarily different.

Before launching the products into the market, El-Khadrawy decided to make one last change to their names. He can choose any product's name among the n ones and add a single character to its ending.

El-Khadrawy spent a lot of time to come up with the current names, he might perform this operation to a single product's name and only once. Of course, El-Khadrawy might choose not to change anything.

El-Khadrawy is interested in finding the maximum number of good pairs after performing the described operation at most once. Nevertheless, he is really busy with the company papers, so, he decided to ask you for help.

Input

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

Each test case starts with a line containing an integer n ($1 \leq n \leq 10^4$) that denotes the number of products.

n lines follow. Each line contains a string S_i ($1 \leq |S_i| \leq 10^5$) that denotes the name of the i^{th} product. It's guaranteed that S_i consists of lower case English letters only , and that the sum of $|S_i|$ over all test cases doesn't exceed 10^5.

Output

For each test case, print a single line containing a single integer denoting the maximum number of good pairs El-Khadrawy can get.

Example

pairs.in	standard output
1 10 a a a b b b c c ab a	40

Note

A string x is said to be a substring of y if it can be obtained from y by deleting zero or more characters

from the beginning and the end of y.

$|S_i|$ means the length of string S_i.

Problem E. El-Khadrawy Group Bus

Input file:	`bus.in`
Output file:	`standard output`
Balloon Color:	`Green`

El-Khadrawy Group (El-G for short) is in charge of public transport in Mansoura city. Because of a series of paranormal events, new rules were issued that El-G needs to comply with.

El-G owns a large number of buses, they want to know at every moment the number of different persons who used each bus.

Initially, all buses are empty. When a bus arrives at a stop, exactly one person will get in or get off the bus.

Given the list of operations for each bus (entries and exits), El-G needs your help to output the number of different persons who used that bus.

Input

The first line of the input contains an integer B : the number of buses.

Then follows data for each bus. They start with a line containing two integers : N the number of stops and T the time at which they want to know the number of persons who used the bus ($1 \leq N \leq 10^5$, $0 \leq T \leq 10^9$).

N lines will follow, each one will contain two integers: P_i and t_i, meaning that the bus arrived to a station at time t_i and the person $|P_i|$ got in (if P_i is positive) or got off (if P_i is negative) the bus. ($-10^5 \leq P_i \leq 10^5$, $1 \leq T_i \leq 10^9$).

It is guaranteed that nobody will get off the bus without getting in first.

Output

For each bus, in a new line, output the number of different persons who used that bus at time $t \leq T$.

Example

bus.in	standard output
2 3 4 -1 3 1 1 2 2 3 3 1 1 3 2 2 4	2 2

Problem F. Coloring the Fence

Input file:	`fence.in`
Output file:	`standard output`
Balloon Color:	`Blue`

El-Khadrawy bought a new house with a long fence in front of it. The fence consists of N blocks, where the i^{th} block has a color denoted as B_i.

El-Khadrawy doesn't like that the fence has so many different colors. Therefore, he's determined to change the color of some blocks to make the fence look beautiful. El-Khadrawy thinks that a fence looks beautiful if it consists of at most three parts, where the first and third parts have blocks of the same color. Formally:

$aaa....bbbbb.....aaa$, where a, b are some colors.

In addition, **Any of these parts can be empty, and not contain any blocks**.

El-Khadrawy can change the color of any block to any other color he wants. However, to repaint every single block, El-Khadrawy needs to buy exactly one unit of paint. So, El-Khadrawy is interested in finding out the minimum number of paint units needed to make the fence beautiful.

Input

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

The first line of each test case contains a single integer N ($1 \leq N \leq 2 \times 10^5$).

The second line of each test case contains N integers B_i ($1 \leq B \leq 200$).

Output

For each test case, print a single line, containing a single integer, denoting the minimum number of paint units needed to make the fence look beautiful.

Example

fence.in	standard output
1 5 1 3 2 2 1	1

٥

٥ '

beautiful علة متساوى

Problem G. Football Game

Input file:	`foot.in`
Output file:	`standard output`
Balloon Color:	`White`

El-Khadrawy coaches the famous El-Khadrawy Group (El-G for short) football club that is playing in the Premier League (PL for short).

From the start of the season, El-G team has played and won most of their games so far. However, due to a series of paranormal activities, El-Khadrawy knows that his team (El-G team) will lose all its remaining games this season.

El-Khadrawy decided to call one of the oldest El-G members, **Shiraz**, to help him. Shiraz can choose one game that El-G team will play (without knowing the other teams' results) and win that game (if such game exists).

You will be given N as the number of teams participating in the Premier League. For each team, you will be given its name S_i and the number of points A_i that this team collected by now.

In addition, you will be provided with M games information. Each information consists of V_i and U_i denoting an upcoming match between the team with name V_i against the team with the name U_i.

Shiraz is very busy visiting and partying with the neighbors. So, she asked you **nicely** to check whether it's possible to choose exactly one game for El-G team to win while losing all the other games, such that, your team can still win the PL no matter how other matches end? Note that the winning team is the team that has the largest amount of points. In case of a tie in the largest amount of points, no team wins the PL this year, and of course, neither El-Khadrawy nor Shiraz want to have the same number of points as any other team.

Note that in a match, a winning team is awarded 3 points, a draw awards 1 point for each team and a losing team is awarded 0 points.

Input

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

The first line of each test case contains a single integer N ($1 \leq N \leq 10^5$) denoting the number of teams participating in the Premier League this year.

Then follows N lines, each containing a string S_i ($1 \leq |S_i| \leq 50$) and an integer A_i ($1 \leq A \leq 10^5$) denoting respectively the name of the i^{th} team and the number of points that this team has so far. El-G team is always the first team that is given at the first line.

After that, a single line containing an integer M ($1 \leq M \leq 10^5$) denoting the number of remaining matches.

M lines follow. Each line has two strings V_i and U_i ($1 \leq |U_i|, |V_i| \leq 50$) denoting an upcoming match between teams V_i and U_i. It's guaranteed that all U_i and V_i are from the initially given teams.

Output

For each test case, in a new line output *YES* if El-G's team can win the league, or *NO* otherwise.

Example

foot.in	standard output
1 2 awelteam 2 tanyteam 2 1 awelteam tanyteam	YES

Note

$|S|$ means the length of the string S.

Problem H. Big Integer

Input file:	bigint.in
Output file:	standard output
Balloon Color:	Gold

El-Khadrawy has more money than anyone can imagine. He's very proud of his wealth that, every now and then, he likes to create a different game to play with the number of dollars he has : N.

To reduce the input size, El-Khadrawy will give you N as a concatenation of K parts. each part contains a digit a_i and a number b_i meaning that this part consists of the digit a_i repeated b_i times. The resulting integer N is the concatenation of all the K parts, one after another.

In addition, El-Khadrawy will give you a special integer m. You need to calculate the number of positive integers X such that $(1 \leq X \leq N)$ and $(X\%m = 0)$, where $\%$ corresponds to the modulo operation. Since the answer can be very large, print it modulo $10^9 + 7$.

El-Khadrawy is really busy collecting more money from here and there, so he needs your help.

Input

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

The first line of each test case contains two integers m $(1 \leq m \leq 10^9)$ and K $(1 \leq K \leq 10^5)$ denoting the special number and the number of parts inside N.

Each of the following K lines contains two integers a_i $(0 \leq a_i \leq 9)$ and b_i $(1 \leq b_i \leq 10^9)$ denoting the digit in the i^{th} part and its repetition respecitvely.

Output

For each test case print a single line containing a single integer denoting the answer to the problem modulo $10^9 + 7$.

Example

bigint.in	standard output
2 10 2 1 1 0 10 132 3 3 9 2 2 3 2	1000000000 252525069

Problem I. Triangles

Input file:	`triangles.in`
Output file:	`standard output`
Balloon Color:	Black

El-Khadrawy was carrying a right-angled triangle made of 3 sticks. El-Khadrawy left his triangle in his house and went to the nearby lake after hearing someone calling his name. When he came back he didn't find it, but he found 3 sticks, he wasn't sure if these sticks formed his triangle as he was still thinking about the conversation he just had with that interesting person by the lake.

Shiraz (one of El-Khadrawy Group) decided to help him. She used her paranormal skills to talk to **Pythagoras** (an ancient member of El-Khadrawy Group). Pythagoras told Shiraz the secret of right angled triangles. He told her that for a triangle to be right angled a condition must hold. This condition is that the sum of squares of the shortest 2 sides' lengths must equals the square of the longest side' length.

Shiraz went to visit the neighbors and left you with El-Khadrawy's buzzlement and Pythagoras's note and asked you to help decide if these 3 sticks can form any right-angled triangle.

Input

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

Each test case has only one line containing 3 space-separated integers A, B, C $(1 \leq A \leq B \leq C \leq 10^9)$ denoting the length of each stick.

Output

For each test case, in a new line, print 'YES' if you can form a right-angled triangle with the given sticks or 'NO' otherwise.

Example

`triangles.in`	`standard output`
2 3 4 5 1 1 2	YES NO

Note

The first sample 3 4 5 makes a right angled triangle according to Pythagoras's note. As 3 squared = 9, and 4 squared = 16, and 5 squared = 25. And 9 + 16 = 25.

But for the second sample 1 squared = 1 and 2 squared = 4 and 1 + 1 is not equal to 4.

Problem J. XOR for Ehab

Input file:	xor.in
Output file:	standard output
Balloon Color:	Silver

Ehab loves XOR problems. Whenever he sets a Queueforces contest, most of his problems are about XOR operation. In ECPC2020, the judges decided to thank him and set an XOR for him as well.

You will be given a very large integer N. However, to reduce the input size, you will be given N as a concatenation of K parts. each part contains a digit a_i and a number b_i meaning that this part consists of the digit a_i repeated b_i times. The resulting integer N is the concatenation of all the K parts, one after another.

It's guaranteed that all a_i are sorted in the non-increasing order. In other words, if $i < j$, then $a_i \geq a_j$.

Also, you will be given a very special integer m. The goal is to calculate the number of non-negative integers X such that $(0 \leq X \leq N)$ and the XOR of all of its digits is equal to m. Since the answer can be very large, print it modulo $10^9 + 7$.

Input

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

The first line of each test case contains two integers m $(0 \leq m \leq 15)$ and K $(1 \leq K \leq 10^5)$ denoting the special number and the number of parts inside N.

Each of the following K lines contains two integers a_i $(0 \leq a_i \leq 9)$ and b_i $(1 \leq b_i \leq 10^9)$ denoting the digit in the i^{th} part and its repetition respecitvely.

Output

For each test case print a single line containing a single integer denoting the answer to the problem modulo $10^9 + 7$.

Example

xor.in	standard output
2 0 2 9 1 1 2 3 4 7 2 5 3 2 1 0 5	73 878691076

Problem K. Palindromic Squares

Input file:	pal.in
Output file:	standard output
Balloon Color:	Purple

A palindrome is a string that reads the same backward and forward, for example strings "z", "aaa", "aba", "abccba" are palindromes, but strings "ecpc", "enoughexamples", "ifyouarereadingthisstopwastingyourtime" are not.

You are given an $n \times m$ array of lowercase English letters, the character in the i^{th} row and j^{th} column is $s[i][j]$.

You want to choose a beautiful sub square from this array. A sub square is represented by a pair (i, j) and side length k, and it consists of all the characters $s[x][y]$ where $i \leq x \leq i + k - 1$ and $j \leq y \leq j + k - 1$.

A sub square is called beautiful if the number of palindromic columns + the number of palindromic rows in it is at least p.

Find the number of beautiful sub squares in the array.

Two sub squares (i_1, j_1, k_1) and (i_2, j_2, k_2) are different if $i_1 \neq i_2$ or $j_1 \neq j_2$ or $k_1 \neq k_2$.

Input

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

The first line of each test case consists of 3 space-separated integers n, m, and p, the number of rows and columns in the array, and the minimum number of palindromic rows/columns in a beautiful sub square respectively. $1 \leq n, m \leq 200$, $1 \leq p \leq n + m$

The following n lines consist of m lowercase English letters, the array s.

Output

For each test case, print a single line containing a single integer, the number of beautiful sub squares in the array s.

Example

pal.in	standard output
2 3 3 3 aba zca aba 1 1 2 a	1 1

Note

A column is palindromic if we take the characters in this column in increasing order of the row number, and put them in a string, the resulting string is a palindrome.

A row is palindromic if we take the characters in this row in increasing order of the column number, and put them in a string, the resulting string is a palindrome.

Problem L. Tree Converting

Input file:	`tree.in`
Output file:	`standard output`
Balloon Color:	`Red`

El-Khadrawy decided to start decorating the fountain inside his house using a paranormal tree. So, he designed a tree A that consists of N nodes and $N-1$ edges connecting these nodes. It's guaranteed that there exists a single path between any pair of nodes.

By the time he finished designing his tree, **Shiraz** (member of El-Khadrawy Group) showed him a design of another tree B consisting of M nodes ($M \leq N$). Luckily, **both trees A and B were rooted at node 1.**

El-Khadrawy likes to play games with Shiraz. So he decided to convert his tree A into the tree B that Shiraz found. To do this, he can perform any number of operations. In each operation, he chooses some node u, deletes it from his tree, and connects all the children of u to its parent.

Shiraz will only be happy if both trees completely match. In other words, both trees have to look exactly the same considering both the shape and nodes numbers.

El-Khadrawy is curious whether fulfilling Shiraz's wish is even possible. Can you help him?

Input

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

The first line of each test case contains N and M ($1 \leq M \leq N \leq 2 \times 10^5$) denoting the number of nodes in trees A and B respectively. It's guaranteed that the sum of N over all test cases doesn't exceed 10^6.

The next $N-1$ lines contain the edges of tree A. Each line contains two integers u and v ($1 \leq u, v \leq N$) denoting the endpoints of the edge.

The next $M-1$ lines contain the edges of tree B. Each line contains two integers x and y ($1 \leq x, y \leq M$) denoting the endpoints of the edge.

Output

For each test case, in a new line, print *YES* if tree A can be converted into tree B, or *NO* otherwise.

Example

tree.in	standard output
2 6 4 1 2 1 5 2 6 5 3 3 4 1 2 1 3 3 4 3 3 1 2 2 3 1 2 1 3	YES NO