Problem A. Watching builders

Input file: `box.in`
Balloon Color: `Black`

Zakaria was watching builders working on a building right in front of his apartment when he noticed a strange procedure.

The building consist of N floors where the i_{th} floor has i stone, every morning one worker comes to the building and starts carrying stones from the first floor until the last floor (floor number N).

At floor number 1 the builder start with an empty box (to carry the stones) then start putting stones one by one into the box until they've finished. After that they move to the next floor and start removing stones from their box to the floor (adding to the existing i stones on the i_{th} floor) until they finish. After that They start putting every stone on the ground back in the box.

They repeat this procedure until they reach the last floor (floor number N).

Note that every operation with the stones (putting or removing from the box takes exactly 3 seconds) can you help Zakaria by telling him how many seconds it would take a builder to move all the stones to the last floor. As the answer may be quite large, print the answer modulo $10^9 + 7$.

Input

In first line, you will be given an integer number T represents the number of test cases.

Then for each test case, you will be given one integer N the number of boxes where $1 \leq N \leq 10^9$

Output

For each test case you should print a single line containing the answer (total seconds needed to move all stones to the last floor) modulo $10^9 + 7$.

Example

box.in	standard output
4 1 5 10 20	6 210 1320 9240

Problem B. Absent Students

Input file: `students.in`
Balloon Color: `Pink`

There are N students registered in the class, but only M students showed up today. Naseem, who is the teacher in the class, wants to find the number of students who are absent today. Can you help him?

Input

The first line of the input contains a single integer number T. The number of testcases.

The first line of each testcase contains two integer numbers N and M ($1 \leq M \leq N \leq 10^9$). The number of students in the class and the number of students that showed up today.

Output

For each testcase print a single line containing a single integer number. The number of students that are absent today.

Example

students.in	standard output
3 10 5 3 0 1 1	5 3 0

Problem C. Reduced Array

Input file: `reduced.in`
Balloon Color: `Purple`

You are given a set of integer numbers. in one operation you can divide the set into subsets where two conditions have to be met:

- Any two numbers with the same number of ones in their binary representation are in the same subset.
- No two numbers with different number of ones in their binary representation are in the same subset.

After dividing the set into subsets, you have to replace each subset by the bitwise XOR of all integers in it.

You have to repeat this operation until the set is not changed. i.e. You stop when each subset contains a single number in it.

You have to find the remaining numbers in the set after all the operations.

Input

The first line of the input contains a single integer number T. The number of testcases.

The first line of each testcase contains a single integer number N ($1 \leq N \leq 10^5$). The size of the set.

The second line of each testcase contains n integer numbers A_i ($1 \leq A_i \leq 10^5$), where A_i is the i_{th} integer number in the set.

It is guaranteed that the sum of all N in the input is less than or equal to 10^6

Output

For each testcase print a single line containing the remaining integer numbers in the set in ascending order.

Example

reduced.in	standard output
3 4 1 2 4 8 2 1 1 9 1 2 3 4 5 6 7 8 9	15 0 7 9 15

Note

Recall that the bitwise XOR is the Exclusive OR logical operation. The XOR of two numbers is a new number where the i_{th} bit equals 0 if the corresponding bits in the two numbers are equal, 1 otherwise.

Problem D. Making The Array Equal Again

Input file: `equal.in`
Balloon Color: `Cyan`

You are given an array of N integer numbers. You want to make all the numbers in that array equal. You can only apply one type of changes. A change consists of chossing exactly $N-1$ numbers from the array and increase each of them by 1.

You have to find the minimum number of changes needed to make all the numbers in the array equal.

Input

The first line of the input contains a single integer numbers T. The number of testcases.

The first line of each testcase contains a single integer number N ($1 \leq N \leq 10^5$). The length of the array.

The second line of each testcase contains n integer numbers ($1 \leq A_i \leq 10^5$), where A_i is the i_{th} integer number in the array.

It is guaranteed that the sum of all N in the input is less than or equal 10^6

Output

For each testcase print a single line containing a single integer number. The minimum number of changes needed to make all the numbers in the array equal.

Example

equal.in	standard output
4 3 1 3 3 1 7 4 1 2 4 8 7 11 22 33 44 55 66 77	4 0 11 231

Problem E. Max Radius of a circle

Input file: `circle.in`
Balloon Color: `White`

Alice has a polygon P. You are given the vertices of the polygon. Bob has a Point C. Bob wants to draw a circle where C is the centre of the circle. Find the the maximum radius of the circle so that the circle doesn't intersect with Alice's polygon or state that is it impossible.

Input

First line of input will be T number of test cases, each test case starts by a single line with n ($1 \leq n \leq 10^5$), The number of vertices in the polygon, next n lines contain a pair of integers X_i, Y_i the coordinates of the i_{th} points, last line of each test case contain X_C, Y_C The coordinates of Bob's point. All the coordinates are in the range $[-10^9, 10^9]$.

Output

For each test case print a single real number, the maximum radius of the circle so that the circle doesn't intersect with Alice's polygon.

Note that the answer will be considered correct if its absolute or relative error doesn't exceed 10^{-6}. Formally, let your answer be P, and the judge's answer be Q. Your answer is considered correct if $\frac{|P-Q|}{max(1,|Q|)} \leq 10^{-6}$.

Example

circle.in	standard output
3 5 0 0 0 2 2 4 4 2 3 0 6 0 4 1 1 1 5 5 5 5 1 3 3 6 0 0 4 1 4 3 0 4 6 4 6 0 1 2	2.6832815730 2.0000000000 1.6977493753

Problem F. Make It Palindrome

Input file: `palindrome.in`
Balloon Color: `Blue`

You are given a string of lowercase English letters. In one operation, you can swap any two adjacent letters.

You have to find the minimum number of operations needed to make the string palindrome or state that it is impossible.

Input

The first line of the input contains a single integer number T, The number of testcases.

The first line of each testcase contains a string S containing lowercase English letters ($1 \leq |S| \leq 10^5$), where $|S|$ is the length of the string.

It is guaranteed that the sum of $|S|$ over all testcases is less than or equal to 10^6

Output

For each testcase print a single line containing the word "Impossible" if the string cannot be made palindrome. Otherwise, print the minimum number of operations needed to make the string palindrome.

Example

palindrome.in	standard output
5 annabelle letusdoit aaaaaaaaaaaaaa aabbccddeeffgghhiijjkkllmmm aabbccadd	12 Impossible 0 168 11

Problem G. Grids Converting

Input file: `grids.in`
Balloon Color: `Brown`

Hasnaa has two grids A and B of size N rows $\times$ M columns. Each cell of each grid contains an integer number.

Hasnaa can perform the following operation as many times as he wants:

There are two types of operations:

- Select one number from grid A and replace it with one of its divisors.
- Swap any two rows in grid A

Hasnaa can make any operation any number of times in any order.

Your task is to determine if Hasnaa can make the grids A and B equal using the two types of operations. Two grids are said to be equal if for each number from the first grid is equal to the corresponding number in the second grid in the same position.

Input

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

The first line of each testcase contains two integer numbers N and M ($1 \leq N, M \leq 100$). The number of rows and columns of the grids A and B

The following N lines each contains M integer numbers $A_{i,j}$ ($1 \leq A_{i,j} \leq 100$), where $A_{i,j}$ is the integer number in the cell in the i_{th} row and the j_{th} column in grid A.

The following N lines each contains M integer numbers $B_{i,j}$ ($1 \leq B_{i,j} \leq 100$), where $B_{i,j}$ is the integer number in the cell in the i_{th} row and the j_{th} column in grid B.

It is guaranteed that the sum of $2 \times N \times M$ along all the testcases is less than or equal to 10^6.

Output

For each testcase print a single line containing the word "YES" if Hasnaa can convert grid a to grid b using the two types of operations. Otherwise, print the word "NO".

Example

grids.in	standard output
2 3 3 3 8 10 2 7 9 12 2 15 1 4 10 1 1 1 1 2 15 3 3 3 8 10 2 7 9 12 2 15 5 4 7 1 3 1 1 5 10	YES NO

Problem H. Min Max 3n+1

Input file: `minmax.in`
Balloon Color: `Silver`

Given an integer number X, you can perform two types of operations on it:

- $X := \frac{X}{2}$, if X is even.
- $X := 3 \times X + 1$, if X is odd.

Consider the vanishing value for some integer number X equals the number of operations needed to transform X into 1. It is guaranteed that every integer number in the input can reach 1 using the two types of operations.

Given two integer numbers L and R, You have to find the two numbers:

- The number $L \leq X \leq R$ with minimum vanishing value within the range. If there are multiple answers, find the smallest number of them.
- The number $L \leq X \leq R$ with maximum vanishing value within the range. If there are multiple answers, find the largest number of them.

Input

The first line of the input contains a single integer number T. The number of testcases.

Each testcase contains two integer numbers L and R ($1 \leq L \leq R \leq 10^6$).

Output

For each testcase print a single line containing two space-separated integer numbers. The integer with minimum vanishing value and the integer with maximum vanishing value.

Example

minmax.in	standard output
5 1 7 13 13 3 6 77 88 1 100000	1 7 13 13 4 6 80 83 1 77031

Problem I. Auto Correct

Input file: `corrector.in`
Balloon Color: `Green`

You are given a dictionary of N strings containing lowercase English letters. The i_{th} string has an Id equal to i.

You have to answer Q queries. In each query you are given a string S that has at most 4 distinct characters and an integer number K. You need to find the Ids of the strings that are peers with S in the dictionary.

A string A_i is said to be peer with string S if string S can be made equal to this string A_i using at most K operations.

There are two types of operations:

- Insert a new character to string S in any position.
- replace a character in string S with any other character.

Input

The first line of the input contains a single integer number T. The number of testcases.

The first line of each testcase contains a single integer number N ($1 \leq N \leq 1000$). The number of strings in the dictionary.

Then N strings A will follow describing the dictionary ($1 \leq |A_i| \leq 1000$), where $|A_i|$ is the length of string A_i.

The next line contains a single integer number Q ($1 \leq Q \leq 10$). The number of queries.

The next Q lines each contains a string S ($1 \leq |S| \leq 1000$) and an integer number K ($0 \leq K \leq 3$), where $|S|$ is the length of string S. It is guaranteed that the number of distinct characters in S is less than or equal to 4.

Output

For each testcase print Q lines each containing the answer to the corresponding query. The Ids of the strings that are peers with string S.

Example

corrector.in	standard output
2 2 abc abcd 3 ac 3 a 2 ab 3 3 abc abcd ab 5 c 2 c 1 ab 2 abc 2 abcda 0	0 1 0 0 1 0 2 -1 0 1 2 0 1 -1

Problem J. Bakery Chief

Input file: `chief.in`
Balloon Color: `Orange`

Let's say that a bakery chief is cutting dough to make bread from it.

Initially, the dough weighs K grams. Each time, the bakery flattens it and cuts N grams to make 1 piece of bread. After finishing all the dough cutting the bakery can make, the bakery reforms it and flattens it again, then continues cutting until the remaining dough is not be enough to make another bread. So given K and N, how many pieces of bread can be made? and what is the weight of the remaining dough?

Input

The input will consist of several test cases while the number of testcases T is given in the first line of input then T testcases follow.

Each testcase consists of one line containing two space separated integers ($1 \leq K, N \leq 10^9$)

Output

For each testcase print one line containing two space separated integers, the number of pieces of bread that could be made and the weight of the remaining dough.

Example

chief.in	standard output
3 5 2 3 1 14 7	2 1 3 0 2 0

Problem K. OCR mistake

Input file: `ocr.in`
Balloon Color: `Gold`

Our friend Amid was always interested about OCR "Optical Character Recognition" and while he was learning more about OCR common problems he learned that most of the times OCR algorithms confuses the two letters "rn" with the letter "m".

Amid then thought of an Idea that will change the world to a better place by writing a program to detect if an OCR will recognize a string correctly or not, which will just check if the string contains "rn".

If the string contains "rn" the OCR algorithm will not be sure if it's "rn" or a regular "m".

Help Amid implement his brilliant idea.

Input

In first line, you will be given an integer number T represents the number of test cases.

Then for each test case, you will be given a string S ($1 \leq |S| \leq 100$) which is the one to be tested by your program and the OCR algorithm.

Output

For each test case you must print "sure" if the OCR algorithm will work correctly without possible issues and "not sure" otherwise.

Example

ocr.in	standard output
2 acmacpc rnabc	sure not sure

Problem L. Masha and Apple Tree

Input file: `tree.in`
Balloon Color: `Red`

Masha was looking at an apple tree (a regular tree of N apples joined together using $N-1$ branch) when she noticed that initially there were some corrupt apples, those apples were colored black and regular apples were colored green.

And there was an army of worms about to attack the tree corrupting all the apples remaining, so in order not to wait too much Masha decided to help the worms eating the apples in the shortest possible time.

In one operation Masha can choose two apples U, V from the tree and let a worm eat all the apples in the simple path from U to V coloring all the apples black (they will be corrupt).

Can you tell Masha the least amount of operations needed to mark all the apples black.

Input

In first line, you will be given an integer number T represents the number of test cases.

Then for each test case, you will be given an integer $1 \leq N \leq 10^5$ the number of apples on the tree, followed by a line of N integer describing the initial state of the apples (corrupt or not), followed by $N-1$ line each describing a branch connecting two apples U, V.

It's guaranteed that the sum of apples overall test cases is $\leq 10^5$.

Output

For each test case print one integer the answer to the problem.

Example

tree.in	standard output
2 5 0 0 1 0 1 1 2 2 3 3 4 4 5 10 1 0 1 1 0 0 0 0 1 0 1 2 1 3 2 4 2 5 3 6 3 7 3 8 6 9 6 10	1 2