Replay of AUST CSE Carnival 3.0 Programming Contest

https://toph.co/c/intra-aust-spring-23-r

Toph

Schedule

The contest will run for **4h30m0s**.

Authors

The authors of this contest are alamkhan, ashikurrahman, edge555, fahmid07, hasibhossain, ineffablekenobi, ishraqfatin7, nirjoydebnath, pz1971, rahat_chy, rithyy, SajidAbdullah, and Tash52.

Rules

This contest is formatted as per the official rules of ICPC Regional Programming Contests.

You can use Bash 5.2, Brainf*ck, C# Mono 6.0, C++11 GCC 7.4, C++14 GCC 8.3, C++17 GCC 13.2, C++20 Clang 16.0, C++20 GCC 13.2, C11 GCC 12.1, C11 GCC 9.2, Common Lisp SBCL 2.0, D8 11.8, Erlang 22.3, Free Pascal 3.0, Go 1.22, Grep 3.7, Haskell 8.6, Java 1.8, Kotlin 1.9, Lua 5.4, Node.js 10.16, Perl 5.30, PHP 7.2, PyPy 7.1 (2.7), PyPy 7.1 (3.6), Python 2.7, Python 3.11, Python 3.7, Ruby 2.7, Ruby 3.2, Rust 1.57, Swift 5.3, and Whitespace in this contest.

Be fair, be honest. Plagiarism will result in disqualification. Judges' decisions will be final.

Notes

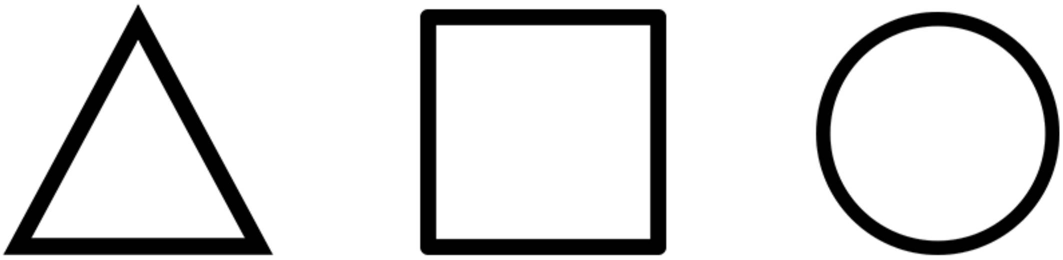
There are 13 challenges in this contest.

Please make sure this booklet contains all of the pages.

If you find any discrepencies between the printed copy and the problem statements in Toph Arena, please rely on the later.

A. Sign Based Evaluation System

The National Curriculum and Textbook Board (NCTB) has introduced a new grading system to evaluate students' performance. In this system, students are assessed based on their proficiency in various subjects using symbols representing different geometric shapes. The three geometric shapes used are a triangle (▲), a rectangle (■), and a circle (●). Let us assume that the shape 'A' represents a triangle, 'B' represents a rectangle, and 'C' represents a circle.



Despite the initial introduction of this new grading system, it faced criticism from numerous students, teachers, and parents. Responding to this criticism, Asif Fahim, a faculty member at 'X' University, introduced an unconventional ranking system. The ranking is based on the number of 'A's, 'B's, and 'C's obtained by each student. The priority is given to the number of 'A's, followed by the number of 'B's, and finally, the number of 'C's. In the case of a tie, the lexicographically smallest grade sequence will get the higher priority. Also, in a tie, if both strings are same, the student whose data appears first in the input will be ranked higher.

Given the results of n students in s subjects, your task is to determine the ranking of students based on this unconventional system.

A string a is lexicographically smaller than a string b if and only if one of the following holds:

- a is a prefix of b, but $a \neq b$;
- in the first position where a and b differ, the string a has a letter that appears earlier in the alphabet than the corresponding letter in b.

Input

- The first line of input consists of two integers, n, and s.
- Each n line contains a string of s characters, where each character is either 'A', 'B', or 'C'.
- The value of $n (1 \leq n \leq 5 * 10^5)$ represents the number of students, and $s (1 \leq s \leq 10)$ represents the number of subjects.

Output

Output a single line containing the space-separated indices of students in ascending order of their rank.

Samples

Input	Output
3 3 BAA ABC AAB	3 1 2
Students 1 and 3 both attained two 'A's and a 'B'. As “AAB“ is lexicographically smaller than “BAA“, the 3rd student ranked higher.	

B. Who Doesn't Love GCD?

You are given a special array a of length n where every element a_i is some power of 2. You are asked to process m queries. In each query, you are given an integer i $(1 \le i \le n)$ and you need to multiply a_i with 2. After processing each query you need to output the Greatest Common Divisor (GCD) of all elements of the array a.

Since the answer can be too large, you are asked to output it modulo $10^9 + 7$.

The Greatest Common Divisor (GCD) of an array a is the largest positive integer that divides all the numbers in the array.

Input

The first line contains two integers n $(1 \le n \le 10^6)$ and m $(1 \le m \le 10^6)$ — the number of elements of array a and the number of queries, respectively.

The second line contains n integers $a_1, a_2, \ldots, a_n (1 \le a_i \le 10^9)$ — the elements of the array a before the changes. It is guaranteed that a_i is some power of 2.

The next m lines contain queries in the following format: each line contains an integer $i\,(1 \le i \le n)$.

Output

Print m lines: after processing each query output the GCD of all elements modulo $10^9 + 7$ on a separate line.

Samples

Input	Output
5 3 2 1 8 16 64 1 2 2	1 2 4

C. How to Save Money 101

The author has recently joined the software industry. His dev lead, who is also from AUST, has assigned him a task. The task has a cost associated with it, and the cost is the money that the author has to treat his dev lead. The author wants to save as much as he can, so he asks you to help him with it.

You are given a string s of size n consisting only lower case letters and an array c of size n consisting integer numbers. You are also given string t of size m. You have to find the cost of the **subsequence** of s which is **equal** to t and has **minimum** cost.

The first move is free. You can pick any letter you want from s. But beware as your next picks will depend on it. Let's say you are building your desired string where the last letter you added was s_i and you want to add s_j next. The cost of appending s_j into your string would be defined as $abs(s_i - s_j) + c_j$.

Find the minimum cost of the string that is subsequence of s and the string must be equal to t. If it is impossible print -1.

Note:

A *subsequence* is a sequence that can be derived from the given sequence by deleting zero or more elements without changing the order of the remaining elements.

Input

The first line of the input is $1 \leq t \leq 10$ which specifies the number of testcases.

The first line of each test-case, you'll start with two numbers $1 \leq n \leq 1000$ and $1 \leq m \leq 1000$ specifying respectively the length of s and t.

The next line will contain a string of length n which is s.

The next line will contain a string of length m which is t.

The final line will contain the array c of length n where $1 \leq c_i \leq 10^9$ which specifies the cost associated with each addition after the first.

Output

Output a number that is the minimum cost of the subsequence of all possible subsequences of s which are equal to t.

Samples

Input	Output
2 4 2 acac ac 5 2 3 1 4 3 abcd aca 2 3 1 2	3 -1
$s_3 + s_4 =$ 'a' + 'c' = "ac" which is our desired string. First move is free. The cost of second move is $2 + 1 = 3$.	

D. Network Within Networks

In a country called Botham, the design of network connection is a bit messy. So the connection between towns in that country is very poor. There's a guy named Muichiro, and he's been asked to fix the problem. Muichiro explained to the president about the rules and regulations of the new network system he plans to introduce.

There are n towns in the country and m connecting roads between the towns. The self connecting roads are also possible in that country.

The roads are bi-directional. The cost of creating Mili network tower of n town can be represented as $A_1, A_2, \ldots An$.

The rules and regulations of the new network system are:

- A **Mega network** consists of one or multiple Mili network towers which are connected.
- A **Mili network** tower in a town T covers all the towns that are connected by a path with town T.
- If town X and town Y both individually have a Mili network tower and if the towns are connected by a path, it will cause network signal problem between the network towers. One cannot create multiple network tower in a single town.
- A Mili network tower's cost is the lowest cost among all the towns covered by that Mili network tower.
- Two Mili network tower X and Y can be connected if absolute cost difference between them is **at most** k.
- If Mili network tower X is connected to Mili network tower Y and Mili network tower Y is connected to Mili network tower Z**,** then Mili network tower X is also connected to Mili network tower Z**.**

Muichiro is a straightforward guy. He gives a condition that if you can figure out minimum number of Mega networks are needed to cover all towns without any issues, and also know the maximum number of Mili network towers a Mega network can have, then he will take care of solving the problem. Otherwise, he won't solve the network problem of that country.

So you are given this big responsibility to solve it.

Input

The first line of the input contains three integers $n, m, k (2 \leq n, m \leq 2.10^5, 1 \leq k \leq 10^9)$ - denoting the number of towns, the number of road connections and the absolute cost difference allowed to make connection between Mili network towers.

The next m lines contains u and $v (1 \leq u, v \leq n)$ - denoting the road between town u and town v.

The following line contains n integers $A_1, \ldots An (1 \leq A_i \leq 10^9)$- denoting the cost building a network tower in n towns.

Output

Print two integers - minimum numbers of Mega networks are needed to cover all towns without any issues and the maximum number of Mili network towers a Mega network can have.

Samples

Input	Output
4 2 1 1 2 3 4 5 6 7 4	1 2

Input	Output
1st town and 4th town is used to create Mili network tower. The cost of creating Mili network tower in town 1 is 5 and the cost of creating Mili network tower in town 4 is 4. The absolute cost difference between these two Mili network tower is $\|4-5\|=1$ which is at most k. There are all towns covered by that two Mili network towers and there is no collision between Mili network towers. Note that, one cannot create another Mili network tower in town 2 because there is a path between town 1 and 2. There is also connection between those two network towers which can be part of one Mega network. So there is only one Mega network and a Mega network has maximum of two Mili network towers.	

E. Prime, Not Prime...

You are given an array A of length N. Count the number of alternative prime subsequences.

A subsequence is a subset of an array that can be obtained by deleting some (or none) of the elements of an array. For example, if the array is $[2, 3, 4, 5, 6]$, some subsequences of the array can be $[2]$, $[3, 4, 6]$, $[2, 3, 4, 5, 6]$. But $[9]$, $[4, 3]$ are not valid subsequences.

A subsequence is an alternative prime subsequence when no two adjacent elements are prime or composite numbers. For example, if the array is $[2, 3, 4, 7, 10, 11, 13]$, some alternative prime subsequences of the array can be $[2]$, $[2, 4, 7]$, $[4, 7, 10]$, $[13]$, $[2, 4, 7, 10, 13]$. But $[2, 3]$, $[3, 4, 10]$ are not valid alternative prime subsequences.

Input

The first line of input contains N, the length of the array.

The next line contains N spaced integers denoting array A.

$1 \le N \le 10^4$

$2 \le A[i] \le 10^9$

Output

Print the number of alternative prime subsequences of the array in a single line. Since the answer can be large, print it modulo 1000000007

Samples

Input	Output
5 3 4 7 8 10	16

Input	Output
3 996059803 4 6	5

F. The Qubits 45

The AUST CSE Carnival 3.0 is thriving in glory. It consists of 8 amazing events. “Intra AUST Programming Contest”, “Intra AUST Code Refactoring Contest”, “Intra AUST UI/UX Design Challenge”, “Intra AUST Software Exhibition”, “Intra AUST Robo-Soccer Competition”, “Intra AUST Chess Competition”, “Intra AUST Cinematography Competition”, and “Intra AUST Quiz Competition”. Participants in all the events are chanting for the organizers. The MIGHTY QUBITS 45!

You, as a participant in the most weighted event of the week, want to take part in it. You want to do it in style by writing a code! As the batch number, you want to chant 45 times: "Qubits! "

Input

No input for this problem!

Output

Print the desired output 45 times!

G. Nice Dice Problem

Noman was going through Nilkhet for some math books for his upcoming exam, but something interesting caught his eye. A hawker was selling some dice, the kind of which he had never seen before. Each had K different sides numbered from 1 to K, rather than the regular six! He bought N dice instead of books. His sister, Nishat, was very angry upon seeing her brother's deed. He just bought some strange colorful dice instead of books! She gave Noman a task that would help him with his exam, and also be a punishment.

Nishat will give him a value, Y, and he has to tell her the number of possible ways the sum of the face-up numbers of the dice will equal Y, after rolling the N dice all at once. If he fails to give the right answer, she will inform their mother, and Noman would like to avoid that at all costs. Help Noman give the correct answer. As the answer can be very large, print the answer modulo 1000000007 ($10^9 + 7$).

Input

The first line of the input will contain an integer T, the number of test cases. Each test case will consist of one line containing three integers K, N, and Y.

- $1 \leq T \leq 1000$
- $1 \leq K \leq 3000$
- $1 \leq N \leq 3000$
- $1 \leq Y \leq 100000$

Output

For each test, output a single line "**Case P: Q**" (without quotation), where **P** is the test number (starting from 1) and **Q** is the answer modulo 1000000007 ($10^9 + 7$). (see examples for clarification).

Samples

Input	Output
5 6 2 12 4 3 8 3 2 3	Case 1: 1 Case 2: 12 Case 3: 2

Input	Output
1 1 1 7 5 40	Case 4: 1 Case 5: 0

H. Central Safety Spot

In the lively area of Cityland, there are N cities connected by a network of $N-1$ bi-directional roads where the city 0 is the capital. There is only one possible path between each pair of cities.

City officials want to boost safety by placing a new fire station at a central location. For that, the urban planning department is now analyzing which city should be the perfect spot for each pair of cities.

As a brilliant programmer in the urban planning department, you will be given M pairs of cities, and your job is to find the best spot for the fire station for those pairs of cities. Given two cities A and B in each query, your task is to discover a common city C that ensures the $distance(A, C) + distance(B, C)$ is the minimum possible. If there are multiple such cities, you have to find one that is closest to the capital.

Join this effort in "Central Safety Spot", map out the road connections, and point out the spot that will make emergency response swift and effective for all the cities in Cityland. Can you help the department do it?

Note(s):

- $distance(X, Y)$ is the number of roads on the minimum-length path from city X to city Y.
- Use faster input/output method.

Input

The first line contains one integer $N (1 \leq N \leq 2150)$ denoting the number of cities.

Each of the next $N-1$ lines contains a pair of integers U and V $(0 \leq U, V < N; U \neq V)$ which denotes that there is a bi-directional road between city U and city V.

The next line contains an integer $M (1 \leq M \leq 2400000)$ denoting the number of queries.

Each of the next M lines contains a pair of integers A and B $(0 \leq A, B < N; A \neq B)$ for which you have to output the answer.

Output

For each query, output an integer C, denoting the city where $distance(A, C) + distance(B, C)$ is the minimum possible. If there are multiple such cities, you have to find one that is closest to the capital.

Samples

Input	Output
6 0 1 0 2 2 3 2 4 4 5 5 1 2 1 5 2 4 3 2 3 5	0 0 2 2 2

Input	Output
7 0 1 0 2 1 5 1 6 2 3 2 4 10 5 6 5 2 0 3 3 4 3 1 1 2 1 4 1 5 0 4 4 5	1 0 0 2 0 0 0 1 0 0

I. X-Root Number

Given two number N and X. Find out whether N is an $X - root$ number.

If N is a $X - root$ number, then $N = P^X$ should be **possible** for an integer P.

Input

The only input line contains two integers N and X where:

$1 \le N \le 10^{18}$

$2 \le X \le 10$

Output

If the number N is a $X - root$ number, print "YES" (without quotes). Otherwise, print "NO" (without quotes).

Samples

Input	Output
`4 2`	`YES`
The number $N = 4$ can be presented as $4 = P^2$ where $X = 2$ and P is an integer (the value of P is 2). Hence, 4 is a $X - root$ number.	

Input	Output
`10 3`	`NO`
The number N = 10 can't presented as $10 = P^3$ where X = 3 and P is an integer. Hence N is not a $X - root$ number.	

J. Magic Spell

You are given a string s of length n, that consists of ‘a’ and ‘b’. Also you have a “Magic Spell” that can change a substring “bab“ to “a“. You can use the spell any number of times.

Suppose you have a string “bbabbb”.

After casting the spell first time, the string can be “babb”.

After casting the spell second time, the string can be “ab”.

You have to print the lexicographically smallest string that can be formed.

A string a is lexicographically smaller than a string b if and only if one of the following holds:

- a is a prefix of b, but $a \neq b$;
- in the first position where a and b differ, the string a has a letter that appears earlier in the alphabet than the corresponding letter in b.

Input

Each test contains multiple test cases. The first line contains a single integer $t(1 \leq t \leq 20000)$ — the number of test cases. The description of the test cases follows.

Each of the next t lines contains a single test case each, consisting of a non-empty string s. It is guaranteed that all symbols of s are either ‘a’ or ‘b’.

It is guaranteed that the sum of $|s|$ (length of s) among all test cases does not exceed 200000.

Output

For each test case, print a single string that can be formed by casting the spell zero or more times.

Samples

Input	Output
5 aaaa	aaaa aaaa

Input	Output
aaabab abababab bbbabbbbab bbbabbbbabbababababbbb	aaaa aa aaaaabbb

K. Another Bitwise AND Problem

Alam loves to play with Bitwise AND operation. Today he gives you an easy problem to solve!

Truth Table of Bitwise AND (&) Operator

X	Y	X & Y
0	0	0
0	1	0
1	0	0
1	1	1

You are given a single integer N and Q sets of queries. Each query consists of three integers L, R, and V.

Alam wants you to construct an array of N integers such that for each query in the set Q, the bitwise AND from index L to index R of your array is equal to V.

If it is possible to construct such an array print Yes in the first line and on the next line print your array consisting of N integers. If there are multiple such arrays, print any of them. Otherwise, print No in a single line.

You have to solve the problem for T test cases!

Input

The first line of input contains a single integer $T(1 <= T <= 10^5)$ denoting the number of test cases!

First line of each test case contains two integers N and Q. Then the next Q lines contain three integers L, R and V where $1 <= L, R <= N <= 10^5$ and $0 <= V <= 10^9$.

It is guaranteed that over all test cases the sum of $N <= 10^5$ and the sum of $Q <= 10^5$.

Output

For each test case, if it is possible to construct such an array print Yes in the first line, and print your N integers in the next line where each integer must be not less than 0 and not greater than 10^{12}. If multiple arrays meet the solution criteria, print any of them.

Otherwise, Print No in a single line.

See sample input/output for more details.

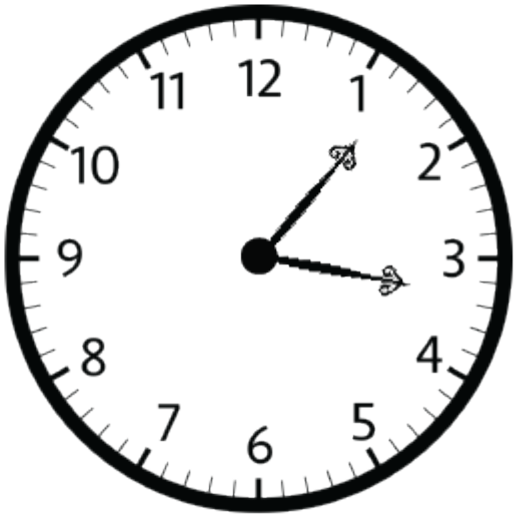
Samples

Input	Output
3 6 2 1 5 6 5 6 2 4 1 1 4 10 5 2 1 5 2 2 3 13	Yes 6 14 7 38 6 10 Yes 10 11 14 26 No

L. BiClock

There are two cities A and B located in two different time zones. City B is x hours ahead of city A.

People of City A and City B started working together remotely. To stay synced up with each other, they came up with a new type of clock - BiClock. A BiClock has two arms, one arm indicates the time of city A and the other one indicates the time of city B; and both the arms follow 12 hour format.



BiClock view for the first testcase

Given the current time of city A and x (number of hours city B is ahead of A). Find the smallest angle in degree between the two arms of BiClock at that moment.

Input

First line of the input will contain a single integer t. Then t test cases will follow.

Each of the next t lines will describe a test case containing three space separated integers: h, m and x denoting that the current time of city A is m minutes past h hours and city B is x hours ahead of city A.

Constraints:

$1 \leq t \leq 10^4$

$1 \leq h \leq 12$

$0 \leq m < 60$

$0 \leq x \leq 12$

Output

For each test case, output a single line containing the answer with precision of 2 decimal digits.

Samples

Input	Output
3 1 20 2 11 59 1 10 0 10	60.00 30.00 60.00

M. Fall 2024

Fall and **Spring** are playing a game with an array a of n integers. They will play the game for m times. The rules are as follows, Fall will be given an integer $i(1 \leq i \leq n)$ and a target x by the author. Fall will have to choose an integer $j(i \leq j \leq n)$. Spring will make operations until one **positive** integer left. In one operation, Spring will choose two integer p and $q(i \leq p, q \leq j)$ where a_p and a_q are positive integer and make $a_p = max(0, a_p - a_q)$. Spring will win if the last positive integer gets **strictly less** than x, otherwise Fall will win. You have to find how many j Fall can choose where she can win the game if they both play optimally for each given i and x.

Input

The first line contains two integer $n(1 \leq n \leq 5 * 10^5)$ and $m(1 \leq m \leq 5 * 10^5)$, the size of array a and the number of round Fall and Spring will play.

The second line contains n space-separated integers. The ith integer denotes $a_i(1 \leq a_i \leq 10^{18})$.

Each of the next m line contains two integer $i(1 \leq i \leq n)$ and $x(1 \leq x \leq 10^{18})$.

Output

Print a single integer - how many j Fall can choose where she can win the game.

Samples

Input	Output
3 2 2 1 3 1 2 2 4	1 0

In the first game,

Fall can choose $j = 1$. The subarray is $[2]$. So, the last positive integer here is 2. So Fall will win.

If Fall choose $j = 2$. The subarray is $[2, 1]$. Spring can choose $p = 1$ and $q = 2$. $a_1 = a_1 - a_2 = 2 - 1 = 1$. The subarray becomes $[1, 1]$. Again Spring can choose $p = 1$ and $q = 2$. $a_1 = a_1 - a_2 = 1 - 1 = 0$. The subarray becomes $[1, 0]$. So, the last positive integer here is 1. So Fall will lose.

Input	Output
It can be proven if Fall choose $j = 3$ she will lose again.	