Problem A. Tram Math

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

Cairo, 1923 — The streets buzz with the sound of tram bells and merchants shouting in the Khan el-Khalili bazaar.
Mahmoud, a sharp but famously lazy student at the Royal School of Mathematics, claims he can solve any arithmetic problem in his sleep.

One afternoon, his friend Ahmed challenges him during break under the shade of an old palm tree. He scribbles a tricky expression on a piece of paper:

$$A\ x\ B\ y\ C$$

Where A, B, and C are integers, and x and y are arithmetic operators from the set $\{+, -, *, \ /\}$.

Mahmoud squints at the paper, shrugs, and says, *"Enta shater, solve it for me ya habibi."*

Note: Division (/) in this problem refers to integer division that rounds the result down (i.e., floor division). For example, $7/3 = 2$.

Input

The input will be in the format: $A\ x\ B\ y\ C$

where: A, B, C are 3 integers ($1 \leq A, B, C \leq 10^6$) and each of x and y are one of the arithmetic operators: $+, -, *,$ and $/$

Output

Output one number: the value of the expression $A\ x\ B\ y\ C$

Examples

standard input	standard output
`2 + 3 + 4`	`9`
`5 / 2 - 5`	`-3`
`10 * 10 * 10`	`1000`

Problem B. Magical Subtrees

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Light blue`

You are given a rooted tree with n nodes, rooted at node 1. Each node has a magical value assigned to it.

For every node in the tree, you need to compute the number of non-empty subsequences of nodes in its subtree such that the GCD of the values in the subsequence is a prime number.

A subsequence here means any subset of nodes in the subtree (not necessarily connected).

The GCD of a single node is its own value.

A number is considered prime if it is greater than 1 and has no positive divisors other than 1 and itself.

Print the answer module $10^9 + 7$.

Input

The first line contains an integer n — the number of nodes in the tree ($1 \leq n \leq 10^5$).

The second line contains n space-separated integers — where the i_{th} number represents the magical value of node i ($1 \leq a_i \leq 10^6$).

The next n - 1 lines each contain two integers u and v, indicating an undirected edge between node u and node v.

Output

For each node in the tree, count the number of non-empty subsequences in its subtree such that the GCD of the magical values of the nodes in the subsequence is a prime number.

Example

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

Problem C. Wall Whisper

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

In the gardens of Madame Aziza's palace in Heliopolis, young Fatma Hanem was hired to design decorative wall patterns. But her layout was too costly — too many walls, too much chaos! Effendi Yehia, the palace architect, gave her a pinch of magic powder to remove one wall. Help Fatma Hanem choose which wall to erase to reduce the overall design cost.

Fatma has an array A consisting of N integers. She also has an array B of M integers, where each B_i marks a position after which a wall is placed in A. These M walls split A into $M + 1$ contiguous segments.

For example, if $N = 6$, $M = 2$, $A = [1, 3, 1, 3, 4, 5]$ and $B = [3, 5]$, the walls are placed after A_3 and A_5. This divides A into three segments:

1. $[1, 3, 1]$ (from index 1 to 3)
2. $[3, 4]$ (from index 4 to 5)
3. $[5]$ (from index 6 to 6)

The cost of a segment is the number of distinct integers it contains. The total cost is the sum of all segment costs.

Fatma may use her magic powder at most once to remove one wall. Your task is to compute the minimum total cost she can achieve after using it optimally.

Input

The first line contains two integers N and M ($1 \le M < N \le 10^5$).

The second line contains N integers $A_1, A_2, \ldots, A_N$ ($1 \le A_i \le 10^5$).

The third line contains M integers $B_1, B_2, \ldots, B_M$ ($1 \le B_i < N$). The values in B are distinct and sorted in increasing order.

Output

Print a single integer — the minimum possible total cost.

Example

standard input	standard output

`6 2`
`1 3 1 3 4 5`
`3 5`
	`4`

Problem D. Ancient Symmetry

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

In 1920s Cairo, a young scholar named **Layla** discovered an ancient scroll called *Al-Muqatta'at* hidden in the depths of Al-Azhar's library. The scroll described a magical string of letters from `'a'` to `'j'` whose characters could shift, twist, and transform.

To unlock the scroll's secrets, Layla must perform a series of operations on this string, as the scroll demands. She believes that the true magic lies in the palindromes that can be formed from parts of the string, but the string itself is constantly changing due to mystical forces.

You are Layla's assistant. You have the initial string s of length n, consisting of letters `'a'` to `'j'`. You must process q queries that manipulate or ask about the string according to the scroll's riddles:

Type 1: `1 l r` - From the substring $s[l..r]$, count how many distinct palindromes can be formed by rearranging its characters in any order. Two palindromes are considered different if they consist of different characters or if the same characters appear in different positions. Output the count modulo $10^9 + 7$.

Type 2: `2 a idx` - Insert character `a` at position idx. This shifts the character previously at idx and all subsequent characters one position to the right.

Type 3: `3 idx` - Delete the character at position idx. This shifts all subsequent characters one position to the left.

Type 4: `4 a b l r` - In the substring $s[l..r]$, swap all occurrences of character `a` with `b`, and all occurrences of `b` with `a`.

Type 5: `5 l r` - Reverse the substring $s[l..r]$.

Layla depends on you to perform these operations swiftly to decode the mysteries hidden within the scroll.

Input

The first line contains two integers n and q ($1 \le n \le 10^5$, $1 \le q \le 10^5$) — the length of the initial string and the number of queries. The second line contains a string s of length n, consisting of lowercase letters from 'a' to 'j'. Each of the next q lines contains a query in one of the formats described above.

For queries of type `1`: $1 \le l \le r \le |s|$ where $|s|$ is the current length of the string.

For queries of type `2`: a is a lowercase letter from 'a' to 'j', $1 \le idx \le |s| + 1$.

For queries of type `3`: $1 \le idx \le |s|$.

For queries of type `4`: a and b are lowercase letters from 'a' to 'j', $1 \le l \le r \le |s|$.

For queries of type `5`: $1 \le l \le r \le |s|$.

Output

For each query of type 1, output a single integer — the number of distinct palindromes modulo $10^9 + 7$.

Example

standard input	standard output
20 16 abacabadabacabadabaa 1 1 3 2 d 1 1 15 21 2 b 11 1 1 22 3 5 1 1 21 4 a c 3 8 1 1 21 4 d b 10 15 1 8 21 2 a 22 1 4 12 3 1 1 3 15 5 5 17	1 3 0 0 12600 0 0 90

Problem E. Bit Bazaar

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

In the golden age of Cairo, 1924, when trams rattled through Bab El-Louk and radios played Umm Kulthum in every café, lived a sharp young man named El-Khawaga Mahmoud. Known for solving puzzles by lantern light, he was challenged one evening at Café El-Fanous.

An old mathematician leaned over and said:

"Ya Mahmoud... I want you to find me n distinct numbers, each one of them is greater than 1 and no more than l, and most importantly — its binary representation must be **alternating**: no two identical bits in a row!"

Mahmoud immediately understood. A number is called **alternating** if its binary representation contains no two adjacent bits that are the same. Leading zeros are ignored.

Examples:

- $5 = 101_2$ is alternating.
- $6 = 110_2$ is not alternating.
- $10 = 1010_2$ is alternating.

Help Mahmoud to know if he can find n **distinct alternating numbers** such that:

- Each number is strictly greater than 1.
- Each number is less than or equal to l.
- Each number is **alternating**.

Input

The first line contains an integer t ($1 \le t \le 10^4$) — the number of test cases.

Each test case contains two integers n and l ($1 \le n \le 60$, $2 \le l \le 10^{18}$) — the required number of distinct alternating numbers and the maximum allowed value.

Output

For each test case, print YES if you can create such an array; otherwise, print NO.

Example

standard input	standard output
2 3 30 3 8	YES NO

Problem F. Papyrus Puzzle

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Light yellow`

Cairo, 1922. Amidst the sands of Giza and the bustling streets of downtown, a young mathematician named Mahmoud discovers a strange papyrus scroll while exploring an ancient crypt beneath the Great Library of Alexandria. The scroll speaks of a sacred **tree***, not of wood and leaves, but of numbers and secrets.*

The scroll describes a rooted tree with n nodes, labeled from 1 to n, where node 1 is the root. Each node i is associated with a mysterious integer a_i, written in faded ink beside strange glyphs.

The task is clear. For q different rituals — called *queries* — Mahmoud must uncover the hidden balance of power among the tree's descendants. For each query, given a node x, he must look deep into its **subtree** and find two distinct nodes i and j (where both belong to the subtree of x) such that the value $|a_i - a_j|$ is minimized. This value is said to awaken the guardian spirit of the tree.

Your mission, should you choose to aid Mahmoud, is to compute this minimum absolute difference for each of the q queries.

Input

The first line contains an integer n ($2 \le n \le 2 \cdot 10^5$), the number of nodes in the tree.

The second line contains n integers $a_1, a_2, \ldots, a_n$ ($1 \le a_i \le 10^9$), the values of the nodes.

The next $n - 1$ lines describe the tree edges. Each line contains two integers u and v ($1 \le u, v \le n$), denoting an edge between nodes u and v.

The next line contains an integer q ($1 \le q \le 10^5$), the number of queries.

Each of the next q lines contains a single integer x ($1 \le x \le n$), representing the query node.

Output

For each query, print the minimum possible absolute difference $|a_i - a_j|$ between two distinct nodes i and j in the subtree of x. If the subtree contains fewer than two nodes, output -1.

Example

standard input	standard output
5 1 10 6 20 4 1 2 2 3 3 4 4 5 5 1 2 3 4 5	2 2 2 16 -1

Problem G. The Barber's Equation

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

In 1915, at the famous barber shop of **Usta Shehata in Bab El-Louq**, no haircut came without a math riddle.
One day, he challenged the local postman: *"Solve this equation before your shave ends, or you leave with half a mustache!"*
Now it's your turn to save the postman — or witness a historic grooming disaster.

Usta Shehata will give you two positive integers a and b, he asks you to count the number of pairs of **positive** integers (x, y) such that:

$x \cdot y - a \cdot x + b \cdot y = 0.$

It can be proved that the equation always has a finite number of solutions, no matter what the values of a and b are.

Your task is to count all such valid (x, y) pairs.

Input

The first line of the input contains a single positive integer t $(1 \le t \le 100)$ — the number of test cases.

Each test case contains a single line of two positive integers a and b $(1 \le a, b \le 10^9)$ – the given integers a and b.

Output

For each test case, output the number of pairs of positive integers that satisfy the given equation.

Example

standard input	standard output
3 4 10 5 7 7 9	2 1 2

Problem H. Nile Numbers

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

In the vibrant era of 1920s Egypt, near the Nile's bustling cafes, the clever detective Ali and the brilliant mathematician Layla met often. One afternoon, Layla challenged Ali with a math puzzle that intrigued even the smartest minds of Cairo.

She defined $Mul(n, p)$ as the greatest divisor of n that is coprime with the prime number p.

She will give two integers L and R, and a prime p to Ali.

She asked him to compute this sum:

$\sum_{m=L}^{R} Mul(m!, p)$

Since the result can be very large, output the sum modulo p.

Input

The first line contains a single positive integer number $1 \le T \le 10^5$, the number of testcases.

The first line of each testcase contains three positive integers $1 \le L \le R \le 10^{18}$ and $1 \le p \le 10^6, p$ is a prime.

It is guaranteed that the sum of p over all test cases doesn't exceed 10^6.

Output

For each testcase, output in a separate line the answer described in the statement modulo p.

Example

standard input	standard output
4 533 983 661 4 14 113 1 2 17 1 1 73	660 35 3 1

Problem I. Basha's Clock

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

El Basha, proud and punctual, starts the ECPC challenge exactly on time. he is a focused participant, begins his contest at that sharp hour. But El Basha wonders, "When will this battle of minds end?"

Given the starting hour and duration of the contest (both in 24-hour format), compute the ending hour.

Time waits for no one — especially not El Basha.

Input

A single line containing the time in 24-hour format, the launching time of the contest, written as: $HH : MM$.

Output

Print the ending time of the contest, written as: $HH : MM$.

Examples

standard input	standard output
`09:15`	`14:15`
`14:00`	`19:00`

Problem J. Hagras Game

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

In 1920, at the bustling yard behind **Café El-Falaki**, **Hagras the carpenter** and **Effendi Sabet** were locked in a fierce showdown.
They took turns chopping leftover wood into perfect squares — not for profit, but for pride and tea.
With only 4 sacred cut counts allowed ({2, 3, 5, 7}), one wrong move could cost the game (and dessert).
The crowd cheered wildly — can you predict who walks away with the baklava?

You are given n rectangles lying on the ground. Each rectangle has integer dimensions $a_i \times b_i$ where $a_i \neq b_i$ and $1 \leq a_i, b_i \leq 10^9$.

Two players play alternately. In each turn, a player must:

1. Choose one rectangle from the ground such that its sides are distinct (i.e., $a \neq b$).
2. Place the rectangle on their table.
3. Choose an integer $k \in \{2, 3, 5, 7\}$.
4. Perform exactly k dissection operations.

Dissection Operation:

Given a rectangle with dimensions $a \times b$ such that $a \neq b$, a single dissection operation proceeds as follows:

- Let $s = \min(a, b)$.
- Remove a square of size $s \times s$ from the rectangle.
- The remaining shape becomes a new rectangle of size:
  - $(a - b) \times b$ if $a > b$, or
  - $a \times (b - a)$ if $b > a$.

The operation is only **valid** if $a \neq b$ and both dimensions remain positive after the cut.

Note: The player must perform exactly k valid dissection operations in one turn. If at any point the rectangle becomes a square (i.e., $a = b$), or further dissection is impossible due to a side becoming zero, the entire move is invalid.

Example: Starting with a rectangle 10×4:

- Step 1: Cut a 4×4 square, leaving 6×4
- Step 2: Cut a 4×4 square, leaving 2×4
- Step 3: Cut a 2×2 square, leaving $2 \times 2 \rightarrow$ now it's a square, further dissection is invalid.

At the end of a successful move, all remaining shapes of rectangles are returned back to the ground.

Rules:

- If a player cannot perform any valid move on any available rectangle, they lose.
- All players play optimally.

Input

The first line contains an integer n — the number of initial rectangles ($1 \le n \le 10^5$).

Each of the next n lines contains two integers a_i and b_i — the dimensions of the i-th rectangle, where $a_i \neq b_i$ and $1 \le a_i, b_i \le 10^9$.

Output

Print a single word: ‘"First„ — if the first player will win. ‘"Second„ — otherwise.

Example

standard input	standard output
2 6 4 5 2	Second

Problem K. Note Removal

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

In the early 20th century, a curious Egyptian music theorist named Youssef was obsessed with the concept of "progression— not only in melodies but also in patterns of numbers. He viewed arrays of numbers as musical scales and found beauty in strictly increasing sequences, which he called “ascending melodies.”

One day, he wrote down a sequence of n integers, representing the tones of a musical scale. Let this sequence be $a = [a_1, a_2, \dots, a_n]$.

He defined the **melodic harmony** of a sequence as the length of its **longest strictly increasing subsequence**, denoted as $LIS(a)$.

Now, he began experimenting. For each tone (element) in the scale, he wanted to imagine what the melody would sound like if that tone were removed. So for every i from 1 to n, he considered a new sequence a' obtained by removing the i-th tone from the original scale. Then, he computed the melodic harmony $LIS(a')$ of the new sequence.

Your task is to help Youssef and calculate these n values.

Input

Each test consists of multiple test cases. The first line contains a single integer t $(1 \le t \le 10^4)$ — the number of test cases. The description of the test cases follows.

The first line of each test case contains a single integer n $(1 \le n \le 10^5)$ — the length of the array a.

The second line of each test case contains n integers $a_1, a_2, \dots, a_n$ $(1 \le a_i \le 10^9)$ — the elements of the array a.

It is guaranteed that the sum of n over all test cases does not exceed 10^5.

Output

For each test case, on a single line, print the answer for the queries separated by a space.

Example

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

Problem L. Missing Digits

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

*In 1935, Professor **Taha Hussein** was reviewing exam papers when he noticed a student had skipped all numbers with* 4 *and* 7*.*
He chuckled and said, "Apparently, this boy thinks those digits are cursed — or French!"
Curious, he decided to list all numbers that avoid both 4 and 7, just to see where it leads.
Now he's asking you: what is the k-th such number?

You have to find the k-th number in the sequence of natural numbers that do **not** contain **both** digits 4 and 7 in their decimal representation.

Examples of valid numbers: $4, 7, 123, 70, 404, ...$ and not valid numbers: $47, 74, 471, 147, 742$

Input

The first line of input data contains a single integer $t (1 \leq t \leq 100)$ — the number of test cases.

In the only line of each test case, there is a single integer $k (1 \leq k \leq 10^{12})$ — the position.

Output

For each test case, print on a separate line the number k'th number.

Example

standard input	standard output
3 16 55 74	16 56 76

Note

In the second test case, the answer is 56 because there is 47 behind it .

Problem M. Khateeb Count

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

In the golden age of typewriters and ledger books — sometime in the 1920s — an accountant named *Youssef El-Khateeb* was famous for spotting errors in enormous columns of handwritten numbers. His secret? A peculiar technique he called **inversion checking**.

Instead of verifying each number's value, Youssef believed that naturally ordered digits (from left to right) indicated a more "trustworthy"number. The more the digits were out of order, the more suspicious the number seemed to him. In particular, he defined a digit **inversion** in a number as any pair of digits where a digit to the left was strictly greater than a digit to the right.

So he will give you two integers L and R, he asked you to calculate how many digit inversions exist in all numbers from L to R, inclusive. Perhaps Youssef's intuition still has something to teach us about numbers from a bygone era.

Formally:

For a given integer x, let d be the number of digits in x. A digit **inversion** is any pair of indices (i, j) such that:

- $1 \le i < j \le d$,
- the i-th digit (from left to right) is strictly greater than the j-th digit.

Input

The first line contains a single integer t ($1 \le t \le 10^5$) — the number of test cases.

Each of the next t lines contains two integers L and R ($1 \le L \le R \le 10^{16}$), denoting the bounds of the range.

Output

For each test case, output a single line containing one integer — the total number of digit inversions over all integers x such that ($L \le x \le R$).

Example

standard input	standard output
3 20 40 1 9 1 100	6 0 47

Problem N. Circle of Taste

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Lim green`

At her birthday in 1938, **Umm Kulthum** expected cake — but her band surprised her with a massive pizza instead, covered in every type of olive grown across Egypt!

She smiled, but then frowned: "I'll only sing if I find a perfect slice combo: one where *my* olives appear oddly, and the rest behave properly!"

The band was puzzled. Kalamata? Pickled mystery? It was all a blur. They need your help before the concert begins.

You are given a circular pizza with n slices, numbered from 1 to n clockwise. Each slice i has:

- A size a_i (a positive integer),
- A set S_i of k_i olive types: $S_i = \{b_{i1}, b_{i2}, \ldots, b_{ik_i}\}$.

You are also given a special set $T = \{c_1, c_2, \ldots, c_m\}$ — these are Umm Kulthum's favorite olives.

A *delicious* part of the pizza is defined as a **contiguous** sequence of slices (possibly wrapping around due to the circular nature), such that:

- Every olive type in T appears an **odd** number of times in the union of their sets.
- Every olive type **not** in T appears an **even** number of times (possibly zero).

Your task is to find the **maximum total size** of any delicious part of the pizza. If no such part exists, print 0.

Input

The first line contains an integer t ($1 \le t \le 10^5$) — the number of test cases. Each test case is structured as follows:

- First line: n ($1 \le n \le 10^5$), number of slices.
- Second line: n integers $a_1, a_2, \ldots, a_n$ ($1 \le a_i \le 10^9$), the sizes of the slices.
- Next n lines: For slice i, a line starts with k_i ($0 \le k_i \le 10^5$) followed by k_i integers $b_{i1}, b_{i2}, \ldots, b_{ik_i}$ ($1 \le b_{ij} \le 10^9$), the olive types on slice i.
- Next line: An integer m ($0 \le m \le 10^5$) followed by m integers $c_1, c_2, \ldots, c_m$ ($1 \le c_i \le 10^9$), the olive types in set T.

Constraints: The sum of n across all test cases and the sum of all k_i (i.e., total olive listings) across all test cases do not exceed 10^5.

Output

print size of the largest delicious part of pizza you can choose, If there are no delicious part, output 0.

Example

standard input	standard output
5 4 1 2 3 4 2 1 3 2 5 1 3 1 2 6 4 1000 1 2 5 2 3 5 4 1 2 3 4 2 1 3 2 5 1 3 1 2 6 4 1000 1 2 5 4 1 2 3 1000 1 999 1 999 0 3 10 20 30 2 1 2 0 3 4 5 6 1 2 3 15 10 10 3 1 10 100 3 1 10 20 2 20 100 3 1 10 100	3 7 0 0 20