Problem A. Free Subarray

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

Coach Hussien provides Abwbkr with an array $(a_1, a_2, a_3, \ldots, a_n)$ and q queries. For each query, Abwbkr is given l and r. The task is to determine whether any non-empty subarray exists within the range $[l, r]$ $(inclusive)$ that is considered $free$. A $free$ subarray is defined as a subarray where the Bitwise AND of its elements equals the Bitwise AND of the elements outside the subarray.

Note: The Bitwise AND of an empty array is zero.

Input

The first line contains one integer $n(1 \leq n \leq 2 \cdot 10^5)$.

The second line contains n space-separated integers $a_1, a_2, a_3, \ldots, a_n(1 \leq a_i \leq 10^4)$.

The third line contains one integer $q(1 \leq q \leq 10^5)$.

Next q lines contain two space-separated integers $l, r(1 \leq l \leq r \leq n)$.

Output

Print q lines. in each line, if there are subarray satisfies this condition print YES, otherwise print NO.

Examples

standard input	standard output
4 6 7 4 5 2 3 3 1 2	YES NO
2 1 2 1 1 2	YES

Note

In the first test case :

when $l = 3, r = 3$ the only non-empty subarray is [4] the bitwise AND = 4

and the bitwise AND of elements outside the subarray $[6, 7, 5] = 4$, so the answer is YES

In the second test case:

assume you chose subarray $[1, 2]$ so the bitwise AND of this subarray = 0, and there are no elements outside this subarray, The bitwise AND of the empty array equals $zero$

Problem B. Reda and The Squares

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

Reda and *Soudi* dislike perfect square numbers and want to minimize their influence by a given integer N. Unfortunately, they couldn't accomplish this independently, so they asked you for help, knowing you are a highly skilled programmer.

Given an integer N, find the minimum value of $|X^2 + Y^2 - N|$ for non-negative integers X and Y.

Input

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

Each of the next T lines describes a test case with a single integer N ($0 \leq N \leq 10^{12}$), representing the target number for which you need to minimize the discrepancy.

Output

For each test case, output a single line containing the minimum value of ($|X^2 + Y^2 - N|$), where X and Y are non-negative integers.

Example

standard input	standard output
3 5 3 10	0 1 0

Note

- For the first test case, choosing $X = 1$ and $Y = 2$ leads to $1^2 + 2^2 = 5$, which matches the given N exactly, making the absolute difference 0.
- For the second test case, the closest sum of squares to 3 can be achieved by $X = 1$ and $Y = 1$, where $1^2 + 1^2 = 2$.Thus, the minimum absolute difference is $|2 - 3| = 1$.
- For the third test case, choosing $X = 1$ and $Y = 3$ results in $1^2 + 3^2 = 10$, perfectly matching the given N and thus having a difference of 0.

Problem C. Ezzat's Coprime Subsets

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

Ezzat has given *Omar* a perplexing problem that has left him sleepless. Desperate for rest, *Omar* turns to you, a skilled programmer, for assistance.

The problem is as follows: You are given two integers n and k, followed by an array of n integers where the i_{th} integer is denoted as a_i. Your task is to find and sum up all subsets of the array that meet the following criteria:

- The subset has exactly k elements.
- The greatest common divisor (GCD) of the subset's elements is equal to 1.

Your goal is to compute the sum of all such subsets.

Input

The first line contains 2 integers N and K ($1 \leq K \leq N \leq 10^6$).

The second line contains N integers ($1 \leq A_i \leq 10^6$).

Output

The sum of all elements in these subsets **modulo** $10^9 + 7$

Example

standard input	standard output
5 3 2 3 4 5 6	108

Note

- all the possible sequences of length 3 and a coprime sequence
  1. $\{2, 3, 4\}$
  2. $\{2, 3, 5\}$
  3. $\{2, 3, 6\}$
  4. $\{2, 4, 5\}$
  5. $\{2, 5, 6\}$
  6. $\{3, 4, 5\}$
  7. $\{3, 4, 6\}$
  8. $\{3, 5, 6\}$
  9. $\{4, 5, 6\}$
- The sum of all elements in these subsequences is 108.

Problem D. Eslam and Photos

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

Eslam has a unique way of taking photos of his friends. He arranges them in a row and performs the following operations repeatedly:

- He selects one of his friends and either moves them anywhere within the row or keeps them away from the row.
- He takes a photo of the row.

Two photos are considered different if the number of friends in the row is different, or if at least one friend is in a different position in each photo.

Given N, the number of Eslam's friends, your task is determining the number of distinct photos Eslam can take using this method **modulo** 998244353.

Input

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

Each test case consists of a single integer N ($1 \leq N \leq 2 \times 10^5$) representing the number of Eslam's friends.

Output

For each test case, Print a single integer representing the number of distinct photos Eslam can take modulo 998244353.

Example

standard input	standard output
3 1 2 550	1 4 475947916

Problem E. Ismail and XOR

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

Ismail is given an array a consisting of n integers. The task involves processing a series of queries on this array:

- 1 l r: For specified indices l and r, compute the minimum XOR result that can be obtained between any two elements within this range of the array. The array is divided into equal segments based on the length $r - l + 1$, and you must report the result for one specific segment.
- 2 idx val: Modify the integer at a specified index idx in the array to a new value val.

Input

- The first line contains n ($1 \leq n \leq 2^{15}$), indicating the number of elements and **n is always a power of 2**.
- The second line has n integers a_i ($1 \leq a_i \leq 10^9$) the initial values of the elements.
- The third line presents ($1 \leq q \leq 2^{15}$), the number of queries.
- The next q lines describe the queries, formatted as:
  - 1 l r for minimal XOR queries, ensuring ($1 \leq l < r \leq n$).
  - 2 idx val for updates, with ($1 \leq idx \leq n$) and ($1 \leq val \leq 10^9$).

Output

For each type 1 query, print the minimum XOR value found in the specified range on a new line.

Example

standard input	standard output
4 1 2 5 9 3 1 1 2 1 3 4 1 1 4	3 12 3

Note

Array is divided into equal parts and only queries complete segments. For example, if the array is divided into subarrays of length 2, segments would be [(1,2), (3,4)], and there won't be queries spanning (2,3).

Problem F. New Bus System

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

Ahmed is launching a new bus-riding application in the city, where each passenger can request a bus to pick them up. Since he has no money and no experience, he needs your help to design his app.

The city can be considered as a grid, with each cell can be a pickup location for passengers. Ahmed has ready drivers in the garage at the starting cell (1, 1) to pick up passengers from their positions and take them to the final cell (n, m). Each driver can pick up any number of passengers in their bus, and each driver can stop in more than one position. However, since the drivers are inexperienced, they can only move right or down at each step.

Because it's a new app and he has no money to pay for the drivers, he wants to minimize the number of drivers sent to pick up all the passengers.

Input

The first line of the input contains two space-separated integers n and m ($1 \leq n, m \leq 1000$) — the number of rows and columns, respectively.

The next n lines contain m numbers each, where the j-th number of the i-th line is $a_{i,j}$ ($a_{i,j}$ is either 0 if the cell (i, j) is empty or 1 if the cell (i, j) has passengers.

Output

The minimum number of drivers to send to take all the passengers to the final destination.

Example

standard input	standard output
5 5 0 0 0 1 0 1 0 1 0 0 0 1 0 0 1 0 0 1 0 0 0 1 0 1 0	3

Problem G. Goat City

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

In Goat City, there are n Buildings and m bidirectional roads. You can travel from one building to another using these roads. However, there is a cost associated with walking between buildings.

The cost of a walk starting at building u and ending at building v is defined as the bitwise OR of the weights of the edges traversed during the walk. In other words, if the sequence of edge weights encountered during the walk is $w_0, w_1, w_2, \ldots, w_k$, then the cost is calculated as $w_0 \mid w_1 \mid w_2 \mid \ldots \mid w_i$, where $\mid$ denotes the bitwise OR operator.

You are given q queries, each consisting of two integers x and y. For each query, you need to find the minimum cost of walking between building x and building y.

Input

The first line contains three integers n ($2 \leq n \leq 10^5$), m ($1 \leq m \leq 2 \times 10^5$) — the number of buildings, the number of bidirectional roads respectively.

Each of the next m lines contains three integers u, v, and w ($1 \leq u, v \leq n, 1 \leq w \leq 600$), denoting a bidirectional road between buildings u and v with a weight w.

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

The next q lines each contain two integers x and y ($1 \leq x, y \leq n$), representing the buildings in each query.

Output

Output a single integer — the minimum walking cost between two buildings.

Example

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

Problem H. Pounds and Dreams

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

Shahd dreams of visiting the moon and wonders if her savings are enough. With N pounds and the exchange rate of 1 dollar being M pounds, your task is determining if she can afford the trip and how she feels about it.

- If she has 150 dollars or more, she can take her friend along and will be "VERY HAPPY".
- With less than 150 but at least 100 dollars, she goes alone and will be "HAPPY".
- With less than 100 dollars, she cannot go, making her "SAD".

Input

A single line with two integers N, M ($1 \leq N \leq 10^3, 1 \leq M \leq N$), represents Shahd's pounds and the price of a dollar in pounds.

Output

Shahd's mood: "VERY HAPPY "HAPPY or "SAD".

Examples

standard input	standard output
1000 5	VERY HAPPY
1000 10	HAPPY
1000 50	SAD

Problem I. Academic Schedule Optimization

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

Qassem is not a fan of coffee, but he's facing a challenge that might require him to drink it. He's a student in the engineering faculty, where many important lectures are scheduled. Each lecture is defined by when it starts when it ends, and the level of focus it demands. To join a lecture, Qassem needs to have a focus level at least as high as the lecture's requirement. His goal is to attend as many lectures as possible with the least amount of coffee, assuming each cup of coffee boosts his focus. Some lectures might have prerequisites, and Qassem cannot attend overlapping lectures.

Your task is to help Qassem plan which lectures to attend to maximize the total count while minimizing his coffee intake by keeping his focus level just enough to meet the lecture requirements.

Input

The first line contains an integer T ($1 \leq T \leq 100$), the number of test cases.

For each test case:

- The first line contains an integer N ($1 \leq N \leq 10^5$), representing the number of lectures.
- The next N lines describe each lecture with three integers: S, E, C ($1 \leq S \leq E \leq 10^{18}, 1 \leq C \leq 10^{18}$), representing start time, end time, and the focus level required.

It is guaranteed that the sum of N over all test cases doesn't exceed 10^5.

Output

For each test case, output a line with two integers: the maximum number of lectures Qassem can attend and the lowest focus level required to attend them. If there are multiple ways to attend the maximum number of lectures, choose the one that requires the least focus level.

Example

standard input	standard output
2 3 1 3 2 2 4 3 3 5 2 5 1 3 2 5 8 3 7 12 2 15 18 4 14 20 1	1 2 3 2

Problem J. Leen and GCD

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

Amr gives *Leen* a number n and asks her to find the smallest number m such that the greatest common divisor (GCD) between m and the sum of its digits equals n. She solves it as it is a very easy task for her, but can you solve it too?

Note: It is guaranteed that a solution always exists.

Input

The input consists of a single integer n ($1 \leq n \leq 10^3$), representing the given number.

Output

Output a single integer, the smallest number m that satisfies the condition.

Examples

standard input	standard output
5	5
14	266

Problem K. Easy Swap

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

Ayman gives *Mahmoud* a string S and an index idx and asks him to modify the string to achieve the lexicographically smallest possible string. he can perform any number of swaps between characters at the given index and all characters in the string, except for the characters that are adjacent to the index.

For example, if the given string is "*abcde*" and the index is 2, you can swap the character at index 2 with any other character in the string, but not with its adjacent characters (a and c). You can repeat this process as many times as needed to obtain the smallest possible string.

Help *Mahmoud* to find the smallest possible string that can be obtained through any number of swaps.

Input

- The input consists of multiple test cases. Each test case contains:
  - One line containing a string S of length n ($2 \leq n \leq 10^5$).
  - One line containing an integer idx ($1 \leq idx \leq n$), representing the index.

Output

- For each test case, output a single string, the lexicographically smallest possible string achievable by swapping characters, except for the character at the given index and its adjacent positions.

Example

standard input	standard output
2 adceb 2 zwxyv 3	abcde vwxyz

Problem L. Smallest Missing Value

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

Ahmed Dyab loves drawing trees. One day, he draws a tree with n nodes, where each node is numbered uniquely from 1 to n. He assigns a special number to each node, different from its node number.

Ahmed Hassan, who isn't particularly fond of trees, decides to challenge Dyab with a task. He asks Dyab to figure out the smallest non-negative integer that's missing from the sequence of special numbers along the path from node 1 to every other node i ($1 \leq i \leq n$) in the tree. This smallest missing number is known as the minimum excluded value (mex).

Dyab is currently too busy creating problems to take up this challenge, so he asks for your help.

Input

The first line contains an integer t ($1 \leq t \leq 100$), the number of test cases.

Each test case starts with a line containing a single integer n ($2 \leq n \leq 2 \cdot 10^5$), which is the number of nodes in Dyab's tree.

The next line of the test case contains n integers $a_1, a_2, ..., a_n$ ($0 \leq a_i \leq n-1$). These are the special numbers assigned to each node.

The last line lists $n-1$ integers $p_2, p_3, ..., p_n$ ($1 \leq p_i < i$). Each p_i shows that there's a connection between node p_i and node i.

Output

For each test case print one line separated by spaces, and for each node i from 1 to n within that test case, print a single number with the mex for the path from node 1 to node i.

Example

standard input	standard output
3 4 0 1 2 3 1 2 3 3 0 2 1 1 1 4 0 3 1 2 1 2 3	1 2 3 4 1 1 2 1 1 2 4

Problem M. The Mystery number X

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

Hafez has an array A of N elements and there is a Mystery number X, and Hafez has two operation:

- choose any element of the array and add x to it.
- choose any element of the array and subtract x from it.

Hafez can do those two operations any number of times.

Help Hafez to find minimum X to make all array elements equal, $X \geq 2$, if there is no answer output -1.

Input

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

Each test case is described as follows:

- The first line contains a single integer N ($1 \leq N \leq 2 \times 10^5$), indicating the number of integers in the sequence.
- The second line contains N integers a_i ($-10^{13} \leq a_i \leq 10^{13}$), representing the elements of the sequence.

It is guaranteed that the sum of N over all test cases doesn't exceed $2 \cdot 10^5$.

Output

For each test case, output minimum X that satisfies all conditions, if there is not any answer output -1.

Example

standard input	standard output
2 4 2 4 6 8 4 1 -3 5 -11	2 2

Problem N. Ideal Names

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

Consider a scenario in a game where players have to choose character names for their avatars. Each player is given a range of permissible names between s_1 and s_2, inclusive, and they also need to avoid using certain names that belong to a forbidden name.

Yasser gives you a task to determine how many valid character names each player can choose from within their assigned range, where a valid name:

- Has a length of n characters.
- Comes after or is equal to the name s_1 alphabetically.
- Comes before or is equal to the name s_2 alphabetically.
- Doesn't contain the forbidden name as a substring.

Since the number of valid names can be large, return the count modulo $10^9 + 7$.

Input

The input consists of two lines:

- The first line contains two integer n and m ($1 \leq n \leq 5 * 10^4, 1 \leq m \leq 50$) - n is the length of the strings s_1 and s_2 , m the length of forbidden name.
- The second line contains three strings s_1,s_2,f The first and second string and the forbidden name.

All strings consist of lowercase English letters.

Output

print the required answer.

Example

standard input	standard output
2 1 aa az b	25

Problem O. New Job

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

Karemo has been working recently as a delivery guy. There are N orders he has to deliver, each order is at coordinate (x_i, y_i), but he can provide at most K orders per day. He can start his journey from any position, but he must return to this position at the end of the day. The company pays him C coins for every 1 m^2 he covers. Calculate the maximum profit he can get and find any path to achieve this profit.

Input

First line contains three integers N, K, C $(3 \leq N \leq 60, 3 \leq K \leq N, 1 \leq C \leq 100)$ number of orders, the maximum number of orders per day, the profit for 1 m^2.

Next N lines contain (x_i, y_i), $(0 \leq x_i, y_i \leq 10^6)$ coordinate of the i_{th} order.

All positions are distinct.

Output

In the First line print the maximum profit he can get.

In the second line print M the path length $(M \leq K)$.

Next M lines print (x_i, y_i), the coordinates of the i_{th} order, printed in the order he visited.

The answer will be considered correct if its absolute or relative error does not exceed 10^{-6}.

Example

standard input	standard output
5 3 2 5 0 1 1 6 4 2 5 4 2	17.000000 3 1 1 5 0 6 4

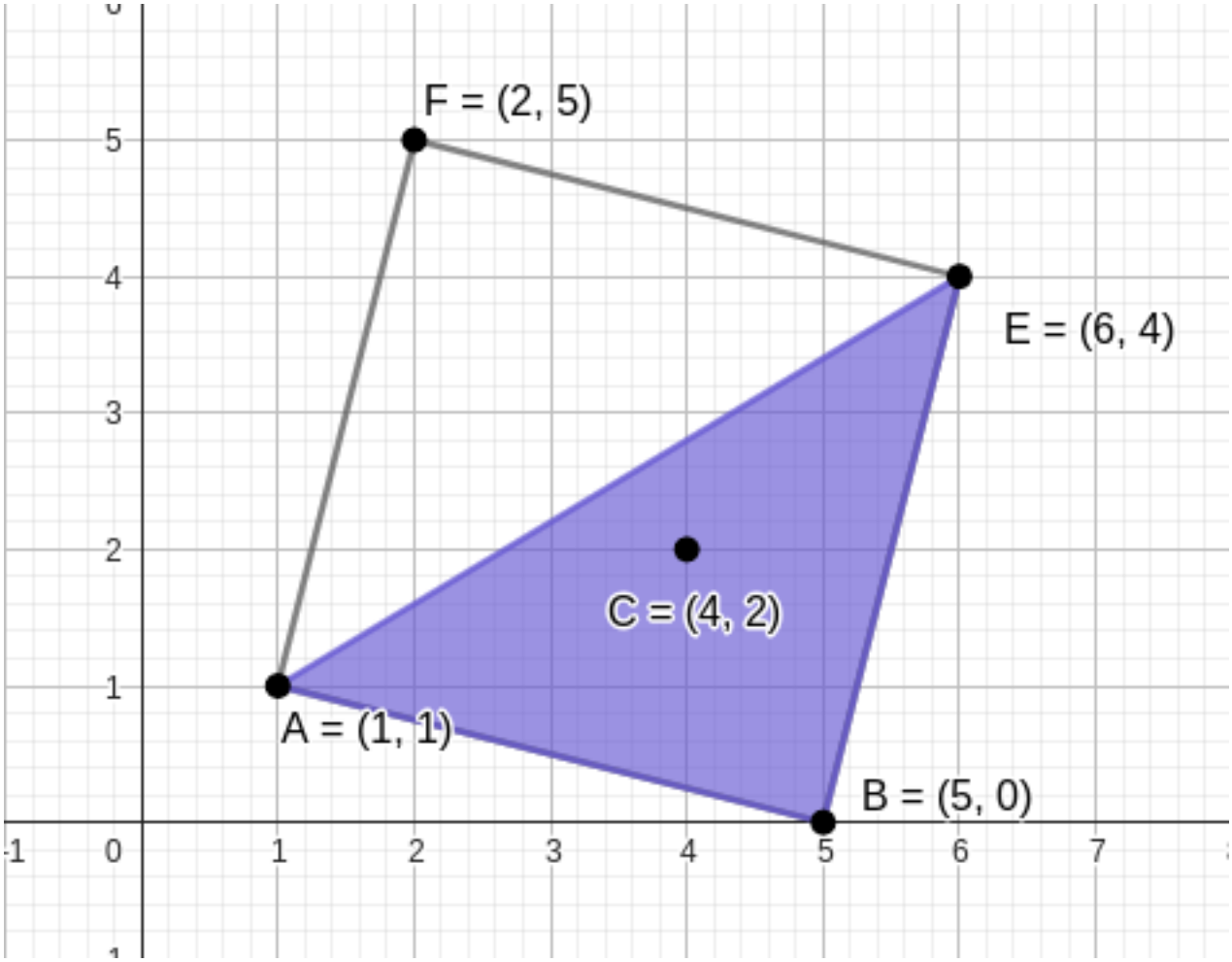
Note

In the first test case: Assume he decided to start at point $A(1, 1)$ and deliver orders in that order

$(1, 1) \rightarrow (5, 0) \rightarrow (6, 4)$

then return to the first point $(1, 1)$.

The total area is the blue area in the photo $= 8.5$, profit $= 8.5 \times 2 = 17$.


F = (2, 5)
E = (6, 4)
C = (4, 2)
A = (1, 1)
B = (5, 0)