International Collegiate Programming Contest
Africa and Arab Collegiate Programming
Championship Kickoff 2022
Virtual
June 2022

The International Collegiate Programming Contest
Sponsored by ICPC Foundation

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(Contest Problems)

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Problem A. Pizza time

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

While Yaser and Ashraf were preparing for today's contest. Yaser decided to order some food for lunch and ordered pizza for lunch. The pizza that Yaser ordered was huge on with n slices and Yaser was so hungry that he decided to eat $a (1 \leq a < n)$ slices alone and left the rest for Ashraf. Can you determine how many slices are left for Ashraf to eat?

Input

In the first line you are given an integer t $(1 \leq t \leq 10^4)$, the number of test cases.
Each test case has 2 integers n and a $(1 \leq a < n \leq 100)$, The number of slices in the pizza and number of slices Yaser ate.

Output

For each testcase,
Output 1 integer in a new line, the total number of slices are left for Ashraf.

Example

pizza.in	standard output
3 8 4 10 9 3 1	4 1 2

Problem B. Reversing Strings

Input file:	`rev.in`
Output file:	`standard output`
Balloon Color:	`Purple`

Given two strings S and Z which consist of only lowercase English letters. You can perform the following operation on the string Z infinitely many times:

- Erase the first element of string Z and reverse the entire string.

For example, if the string Z is initially 'weather', then after performing the above operation 3 times it becomes 'ehta'.

Can you obtain the string S from the string Z after performing the described operation as many times as you want (possibly zero)?

Input

The first line contains two integers n and m, $2 \le n \le 10^5$, $n \le m \le 2 \times 10^5$,the length of string S, and the length of string Z.

The second line of each test case contains the string S, and the third line contains the string Z.

Output

Output a single line containing the word 'Yes' if the string S can be obtained from the string Z after applying the above operations any number of times, and 'No' otherwise.

Example

rev.in	standard output

`1`
`3 7`
`eke`
`weekend`
	`YES`

Problem C. Ali's Schedule

Input file:	`schedule.in`
Output file:	`standard output`
Balloon Color:	`Gray`

Ali is too lazy to arrange his schedule, so he asked you to help.

There are n activities. For each activity, you will be given its number and the time at which it starts. You are asked to arrange these activities in ascending order. You can assume that all activities are completed instantaneously.

If some activities need to be done simultaneously, then Ali should do the activity with the lower number.

Input

The first line contains t, the number of test cases.

The first line of each test case will contain an integer n ($1 \leq n \leq 10^5$).

The following n lines of each test case will contain the activity number and the time at which this activity should be done at.

The time will be given in this format HH:MM:SS AM/PM.

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

Output

Print n space separated integers, the activities sorted by the time they should start at.

Example

schedule.in	standard output
1 3 1 05:01:07 AM 3 05:01:05 PM 2 05:01:06 AM	2 1 3

Problem D. Make it K-good

Input file:	`good.in`
Output file:	`standard output`
Balloon Color:	`Dark green`

You are given an integer k and a string s of length n, in one operation you can choose any letter of the string and replace it with any lowercase English alphabet letter (you can not replace the letter with itself).

Your task is to find the minimum number of operations to perform on string s to make it $k - good$.

The string is called $k - good$ if all the string letters which are at distance k from each other are equal. More formally, a string s is called $k - good$ if ($s_i = s_{i+k} = s_{i+2k} = ...$ and so on).

Can you solve this task?

Input

The first line of input contains one integer t the number of test cases.

The first line of each test case contains two integers n ($2 \leq n \leq 10^5$) the length of the string, and k ($1 \leq k < n$).

The second line of each test case contains a string s of length n that contains only lowercase English alphabet letters.

Output

For each test case print one line containing one integer, which is the minimum number of changes needed to make the string k_good.

Example

good.in	standard output
3 5 2 abcaa 8 3 aabcacbb 4 1 abcd	2 4 3

Note

In the first test case, we can change the string *abcaa* to *ababa* or *aaaaa* because both of them will cost only 2 operations which is the minimum number of operations, we can not change the string to *cacac* because this will cost 3 operations which is not the minimum.

Problem E. Wonder City

Input file:	`wonder.in`
Output file:	`standard output`
Balloon Color:	`Orange`

Sameer lives in Wonder City. The year in Wonder City consists of n days, each of which may be sunny(S), rainy(R), or windy(W).

When one day is windy the next day can't be windy, it can only be sunny or rainy with equal probabilities.

When one day is sunny or rainy the next day can be sunny, rainy, or windy with equal probabilities.

So $SWWR$ is not possible but $SSRWR$ is possible.

Sameer loves sunny weather and he gets interested when three sunny days occur in raw. He calls such three days $LuckyTriple$.

When Mahmoud knew that information he asked Sameer to calculate the expected number of $LuckyTriple$ in one Wonder City year if the probability of the first day of the year being sunny is s, rainy is r, and windy is w.

Sameer hates expectation-related questions. Now he wants to get away from that question but Mahmoud keeps following Sameer until he gets the answer.

Note if the weather was $SSSS$, we have 2 $LuckyTriple$.

Can you help Sameer find the expected number of $LuckyTriple$ in one Wonder City year modulo 10^9+7?

Input

The first line contains one integer t, the number of test cases.

Each of the following t lines contains 7 integers n, s_1, s_2, r_1, r_2, w_1, w_2 $(1 \le n \le 10^5, 0 \le s_1 \le s_2 \le 10^5, 0 \le r_1 \le r_2 \le 10^5, 0 \le w_1 \le w_2 \le 10^5)$ where $s = \frac{s_1}{s_2}, r = \frac{r_1}{r_2}, w = \frac{w_1}{w_2}$. The number of days in Wonder City year and the probability of first day being sunny, rainy and windy respectively. It is guaranteed that $s + r + w = 1$.

Output

Print the expected number of $LuckyTriple$ in one Wonder City year modulo $10^9 + 7$.

Formally, let $M = 10^9 + 7$. It can be demonstrated that the answer can be presented as an irreducible fraction $\frac{p}{q}$, where p and q are integers and $q \not\equiv 0(\mod M)$.

Output a single integer equal to $(p \times q^{-1}) \mod M$. In other words, output an integer x such that $0 \le x \le M$ and $x \times q \equiv p(\mod M)$.

Example

wonder.in	standard output
3 3 1 3 1 3 1 3 4 1 3 1 3 1 3 3 0 7 2 4 3 6	370370373 302469138 0

Problem F. Array Erasing

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

You are given an array a of n integers. In one move, you can pick a number from the array and erase all its multiples from the array. What are the minimum moves you need to erase all the array?

Input

First line consists of one integer n the size of the array $(1 \le n \le 1000000)$.

The second line consists of n integers $a_1, a_2, ..., a_n (1 \le a_i \le 1000000)$.

Output

Output a single integer: the minimum number of moves to clear all the array.

Example

erase.in	standard output
5 2 4 6 7 3	3

Problem G. Plan the event

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

Planning the seating of attendance in some events isn't an easy task, especially when the attendance is from different groups, this even gets harder if there is a rivalry between the groups.

You are asked to plan the seating in an incoming event, after some research, you found out that some seating combinations cause trouble, this can happen if someone was sitting at seat (i, j) and there is someone else is sitting in one of these seats $(i + 1, j), (i + 1, j + 1), (i - 1, j), (i - 1, j + 1)$.

The event will be held in a rectangular $n \times m$ grid, some cells of the grid contain a broken seat, your task is to find the maximum number of attendance and plan their positions with no trouble between them.

Input

The first line of the input contains one integer t the number of test cases.
The first line of each test case contains two integers n and m $(1 \leq N, M \leq 100)$, the number of rows and columns of the grid, respectively. Then you will be given n lines with m characters each, representing the seats. A usable seat is represented by "." and a broken seat is represented by "*".

Output

For each test case, print on the first line one integer P, the maximum number of attendance who can attend the event without causing any trouble, then you should print N lines with M characters each, representing one of the optimal ways to seat the attendance. You should print:

- "." for an empty seat,
- "*" for a broken seat,
- "#" for a used seat.

If there are multiple valid solutions any one is accepted.

Example

event.in	standard output
2 3 3 .*. *.* *.. 1 1 .	4 #*# *.* *## 1 #

Problem H. Testa Road

Input file:	`troad.in`
Output file:	`standard output`
Balloon Color:	`Cyan`

You live in Testa town which is represented as n cities connected with m two-way roads of length 1 kilometer. all cars in the city are Electric vehicles. Testars (Mahmoud, Tony, Céline, and their coach Suliman) have developed an electric road called "Testa Road" that can provide electric energy wirelessly to electric vehicles driving on it so when an electric vehicle drive on it, **it does not use its battery**, and they deployed it on each public transportation path (public transportation in Testa town are moving on each cycle path).

H4k00r's car can move for k kilometers using the fully charged battery. your task is to find the number of pairs of cities i, j such that H4k00r can move from i to j using a fully charged battery and the battery dies when reaching the city j, in other words, H4k00r's car must use its battery on exactly k kilometers of the shortest path between i and j (note that i, j and j, i are considered the same).

Input

one integer t in one line denotes the number of test cases in each test case: in the first line, three integers n, m, and k $(1 \le n \le 10^5)$, $(0 \le m, k \le 10^5)$ the number of cities, number of roads, and the number of kilometers H4k00r's car can move using 100% of its battery,

Output

print a single integer in one line denotes the answer of the problem.

Example

troad.in	standard output
1 6 6 1 1 2 1 3 2 4 2 6 3 6 3 5	8

Problem I. Moving Balls

Input file:	`collisions.in`
Output file:	`standard output`
Balloon Color:	`Gold`

Red and blue balls lie on some integer positions of the OX axis. n red balls are distributed on the OX axis from position 1 to position n. There are m blue balls distributed on the OX axis from position $n+1$ to position $n+m$. All the balls will start moving simultaneously and with an equal constant velocity. The red balls will move towards the right and the blue ones will move toward the left. Each time two balls (color doesn't matter) collide, they will instantly reverse their direction of moving without affecting their velocity. It can be shown that after some number of collisions between balls there cannot be more collisions. Therefore, what will the total number of collisions happen during this experiment?

Input

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

Each test case consists of a single line. This line contains two space-separated integers n and m ($1 \leq n, m \leq 10^6$) - denotes that there are n red balls and m blue balls.

Output

For each test case, print a line with a single integer that represents the total number of collisions that will happen between balls.

Example

collisions.in	standard output
1 5 2	10

Problem J. Cubes

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

You are given n cubes, each one with a side length of l_i, where l_i is a power of two $(1, 2, 4, 8, ...)$. You can rearrange these cubes in the $3D$ space any way you like. Your task is to calculate the minimum side length of a cube that contains all the n cubes.

Input

The first line of input contains $t(1 \leq t \leq 30)$, the number of test cases.

The first line of each test case contains an integer $n(1 \leq n \leq 10^5)$, the number of cubes.

The second line contains n integers where the i_{th} integer $l_i(1 \leq l_i \leq 2 \cdot 10^4)$, the side length of each cube. It is guaranteed that l_i is a power of two.

Output

For each testcase output one integer, the minimum side length of the cube that contains all cubes.

Example

cubes.in	standard output
2 1 4 2 2 4	4 6

Problem K. Bero The Gamer

Input file:	`bero.in`
Output file:	`standard output`
Balloon Color:	`Light green`

After 3 hours of playing video games with Besho, Bero got bored of winning. So, they decided to play another game. After some search on the Internet, they found this game called $2 - Thirds - Bye - Bye$. The game consists of n boxes numbered from 1 to n. Each box contains a_i items. The game takes turns and goes as follows:

- First player chooses a box containing 3 or more items and removes some of them leaving no more than third of the items in the box.
- Now it's the second player's turn and the game goes on.
- The player who can't make a move **wins and the game ends.**

Bero and Besho liked the game and to their luck, they found n boxes of biscuits inside Bero's fridge, box number i had a_i biscuits. As soon as they wanted to start playing, Besho started wondering and asked Bero q queries of two types:

- *`1 ind val` Besho replaced box number ind with another box containing val biscuits.*
- *`2 l r` Besho asked Bero who would win if they played $2 - Thirds - Bye - Bye$ on boxes from box number l to box number r and Bero is the First player.*

Can you help Bero answer Besho's hard questions?

Input

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

Then the descriptions of t testcases follow.

The first line of each testcase contains two integers n and q $(1 \le n, q \le 200000)$ — the number of boxes and the number of queries respectively.

The second line consists of n integers $a_1, a_2, ..., a_n$ where a_i denotes the number of biscuits that box number i had initially $(1 \le a_i \le 10^{18})$.

The next q lines consist of three integers each. The first integer of the $i - th$ line is t_i, the query type on the $i - th$ query (t_i=1 or t_i=2).

If t_i=1, the next two integers are ind and val $(1 \le ind \le n; 1 \le val \le 10^{18})$, which is Besho replacing box number ind with another box containing val biscuits.

If t_i=2, the next two integers are l and r $(1 \le l \le r \le n)$, the two indices Besho asked Bero about for the $i - th$ query.

It's guaranteed that there is at least one query of the second type, and the sum of all n and q over all testcases is less than 4×10^5

Output

Print in a single line for every query of type $t_i = 2$ the name of the winner if Bero starts the game. Print "Bero"if Bero wins, otherwise, print "Besho".

Example

bero.in	standard output
2 3 3 1 5 10 2 1 3 1 1 30 2 1 3 1 1 2 2 1 1	Bero Besho Bero

Problem L. Purple Points

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

You are given n blue lines **(n is odd)** and m red lines **(m is odd)** each line is given in the following form $ax + by + c = 0$, every red line intersects with every blue line in a Purple Point. You have to find the coordinates of the magic point MP such that the sum of manhattan distances of all purple points to the magic point is minimum.

The Manhattan distance between two points, where the first point p_1 is (x_1,y_1) and the second point p_2 is (x_2,y_2) is calculated with the following formula: $dist(p_1, p_2) = |x_1 - x_2| + |y_1 - y_2|$

Input

Each test contains multiple test cases. The first line contains the number of test cases t. Description of the test cases follows.

Each test case consists of multiple lines , the first line contains two integers $(n, m)(1 \leq n, m \leq 10^5)$.

Followed by n lines, the i_{th} line contains three integers a_i, b_i, c_i $(-1000 \leq a_i, b_i, c_i \leq 1000)$. the description of the i_{th} blue line.

Followed by m lines, the i_{th} line contains three integers a_i, b_i, c_i $(-1000 \leq a_i, b_i, c_i \leq 1000)$. the description of the i_{th} red line.

The sum of n over the test cases is less than 3×10^5, and the sum of m over the test cases is less than 3×10^5.

It's guaranteed that **NO** two lines in the input are parallel, and there is no vertical nor horizontal line in the input.

Output

For each test case print one line with two real numbers (x_{mp}, y_{mp}), the coordinates of the magic point. Your answer is considered correct if the absolute or relative error doesn't exceed 10^{-4}. If there are multiple answers, print any.

Example

points.in	standard output
1 3 3 1 1 3 2 -1 4 -2 4 5 2 3 0 1 12 33 3 -5 123	-2.571429 -0.714286

Problem M. New Sorting Algorithm

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

You are given an array a of n integers. You must perform the following operation exactly once: choose a non-negative integer X and replace each a_i with $a_i|X$, where $|$ denotes the bitwise OR. Print the minimum value of X so that the resulting array is ascending: $a_1 \leq a_2 \leq ... \leq a_n$.

Input

The first line contains a single integer t $(1 \leq t \leq 50)$ — the number of test cases. The description of the test cases follows.

The first line of each test case contains an integer $n (1 \leq n \leq 10^5)$, the length of the array.

The second line of each testcase contains n integers where the i_{th} integer $a_i (1 \leq a_i \leq 10^9)$ denotes the i_{th} integer in the array a.

Output

Print the minimum value of X.

Example

sort.in	standard output
2 2 1 2 3 1 3 2	0 1

Problem N. K-Subarrays

Input file:	`sub.in`
Output file:	`standard output`
Balloon Color:	`Silver`

Given an array a of length n, you are allowed to split the array into k non-empty non-overlapping subarrays such that each element in a belongs to exactly one subarray. Each subarray is then sorted separately in non-decreasing order, then all the subarrays are concatenated once again in their original order to form a new array.

An array a is good iff after splitting it into k subarrays and sorting, the result array is sorted in non-decreasing order.

Print "YES"if array a is a good array, or "NO"otherwise.

Input

First line contains integer t ($1 \le t \le 10$). Number of testcases. For each testcase, a line contains integer n ($1 \le n \le 10^5$) number of elements in array and integer k ($1 \le k \le N$) followed by a line of N integers where ($1 \le a_i \le 10^9$).

Output

For each testcase output YES if array A is good, otherwise output NO.

Example

sub.in	standard output
2 3 2 3 2 1 3 2 2 1 3	NO YES

Note

A = [1, 3, 2, 3], K = 2 only way to split A into K subarrays to make a good array is by taking [1, 3, 2] and [3]. After sorting each subarray we have [1, 2, 3] and [3]. concatenating the subarrays gives [1, 2, 3, 3] which is a sorted array.

Problem O. Ziko The Rabbit

Input file:	`ziko.in`
Output file:	`standard output`
Balloon Color:	`Brown`

Ziko is an interesting rabbit. He keeps jumping by twice the number of steps he jumped in the previous jump.

Ziko starts his journey by jumping 1 step in the first jump, then 2 steps in the second jump, then 4 steps in the third jump, and so on. Given n, the number of steps *Ziko* jumped in the last jump before he stops, what is the total number of steps *Ziko* has jumped?

It is guaranteed that n is a power of 2

Input

In the first line you are given an integer t $(1 \leq t \leq 10^5)$, the number of test cases.

Each test case has 1 integer n $(1 \leq n \leq 10^9)$, The number of steps *Ziko* has jumped in the last jump.

Output

For each testcase,

Output 1 integer in a new line, the total number of steps *Ziko* has jumped in all jumps.

Example

ziko.in	standard output
3 1 2 8	1 3 15