Shaastra Programming Contest Prelims

A. CPL auction

1 second, 256 megabytes

*Problems from A to I are **not** sorted based on the order of difficulty*

The Spicy auction for the cricket tournament Cosmos Premier Legue-2023 (CPL) is about to take place. All the players (total n in number) and their initial values (in crores) are listed in a row. The worth of players is known to increase unusually, with a player having a non-zero value increasing the value of surrounding players by 2 crores each day.

For example, if the value of i^{th} player is non-zero, then the value of $(i-1)^{th}$ player will get incremented by 2 crores as well the value of $(i+1)^{th}$ player will get incremented by 2 crores(if they exist).

Let's call the initial day of the auction day 0. And after that, each consecutive will be referred to as day 1, day 2, and so on.

Now you have to find the total extra value (in crore) of all players that would have been increased on the day p compared to day 0.

Input

The first line contains a single integer $t(1 \le t \le 10^3)$— the number of test cases.

The first line of each test case contains two integers $n(1 \le n \le 10^5)$ and $p(0 \le p \le 10^9)$.

The second line contains n non-negative integers - the initial value of each player in crore on day 0.

The Sum of n over all test cases does not exceed 10^6

Output

For each case output a single integer - total extra value (in crore) of all players that would have been increased on day p compared to day 0

input
2 5 2 0 5 0 4 0 1 9 5
output
24 0

In the first case, the the value distribution of player will be,

-	Player 1	Player 2	Player 3	Player 4	Player 5	Total Value
Day 0	0	5	0	4	0	9
Day 1	2	5	4	4	2	17
Day 2	4	9	8	8	4	33

Note that from day 0 to day 1, for player 3, 2 crores will be increased due to player 2, and 2 crores will be increased due to player 4. Hence total of 4 cores will be added.
Hence the total extra value will be $33 - 9 = 24$ crores

B. Sponsor

1 second, 256 megabytes

OIJ, a giant company, plans to sponsor CPL this year. The amount of money they will invest is equal to the maximum points that can be scored in the following problem.

- Given the number of Instagram followers of n teams in the CPL, you are allowed to choose any $i(1 \le i \le n-1)$ teams of your choice among them.
- Let the number of instagram followers of i teams you chose be $a_1, a_2, a_3, \ldots, a_i$ and the followers of rest of the teams be $b_1, b_2, .., b_{n-i}$.
- Then points are calculated using the formula
  - $f(a_1, a_2, a_3, \ldots, a_i) + f(b_1, b_2, .., b_{n-i})$
- where $f(d_1, d_2, .., d_m) = d_1 \oplus d_2 \oplus .. d_{m-1} \oplus d_m$ and $\oplus$ represents the bitwise XOR operator

Your task is to find the amount of money that OIJ will sponsor. You will need to use **long long** as answer can be out of bound of int.

Input

The first line contains a single integer $n(2 \le n \le 10^5)$— the number of teams in the CPL

The second line contains n integers $c_1, c_2, \ldots, c_n$ $(1 \le c_j \le 10^{18})$ — number of instagram followers of each team.

Output

Print the amount of money that will be sponsored by OIJ ,that is the maximum possible points one can score. You will need to use **long long** as the answer can be out of bound of int.

input
4 2 5 7 4
output
10

input
3 4 4 4
output
4

input
3 90413825674767126 70258219014609588 49358208343180731
output
209427676301511009

In the first sample, the maximum possible points one can score is 10 and is obtained by choosing 2 teams with followers 2 and 5, so now using the formula, points will be equal to $f(2,5) + f(7,4)$ = $(2 \oplus 5)$ + $(7 \oplus 4)$ = 7 + 3 = 10.

In the second sample, the maximum possible points one can score is 4, obtained by choosing any one of the teams.

C. Weird Vendors

1 second, 256 megabytes

After a year of anticipation, the first CPL match is set to begin today. Priya is very excited to go to the stadium to watch the game that she even forgot to eat. She felt hungry in the middle of the game at the stadium. The vendors over there were little strange where they offered eatables for solving a problem given by them rather than for money.

They give a sequence of n integers a_1, a_2, a_3,..., a_n, Your task is to do a certain number of operations to convert the given sequence into a popcorn sequence.
Here, a sequence b is a popcorn sequence if, for each element x in b, the value x occurs exactly x times in b.

In one operation, you can do either of the following:

- you can add an element to the sequence which already exists. formally, if you are adding element x, then x must be present in the sequence before addition.
- you can replace that particular element with an element already present in the sequence.

The vendors want you to find the **minimum** number of operations required to make it a popcorn sequence(possibly 0). If it is impossible to make it a popcorn sequence, then output -1. Can you help Priya in solving this problem?

Input

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

The first line of each test case contains a single integer $n(1 \leq n \leq 100)$ — the length of the array.

The second line of each test case contains n integers $a_1, a_2, \ldots, a_n (1 \leq a_i \leq 100)$— the elements of the array.

Output

For each test case, Print the minimum number of operations required to turn a given sequence into a popcorn sequence(possibly 0). If it's impossible to turn the given sequence into a popcorn sequence, then print -1

input
4 3 1 2 3 4 1 1 3 1 4 2 2 2 2 7 20 85 100 41 76 49 36
output
1 2 -1 19

1. In the first test case, you can replace 3 with 2, and the sequence becomes $[1, 2, 2]$, which is a popcorn sequence.
2. In the second test case, you can replace the first two 1s with 3, and the sequence becomes $[3, 3, 3, 1]$, which is a popcorn sequence.
3. In the third test case, replacing 2 with 2 doesn't cause any change, and the addition of 2 to the sequence increases the count of 2s in the sequence, so it's impossible to turn the given sequence $[2, 2, 2, 2]$ into a popcorn sequence.

D. Meet the Squad

1 second, 256 megabytes

The CPL-2023's fifth game, one of the most awaited games, ended with Kennai Cuper Kings turning out to be the winners. After the match, a certain number of the audience (say n) wanted to see the squad. When they approached their (players') room, a guard stopped the crowd and arranged them in line.

He then gave each individual a positive integer number. People wearing the identical color shirt received the same number from him (one for yellow shirt, two for green shirt, and so on). He is aware that there are atmost p distinct colored shirts in total among the crowd. Now he chose to pick exactly one **continuous** group of people from the line, with the requirement that at least one of them wear a yellow shirt and that the group has **exactly** $(p - 2)$ distinct shirt colors. He just wanted only those folks to be able to view the team. Determine the largest audience that can meet the squad.

NOTE: Each distinct color shirt has a unique number given by the guard.

Input

The first line contains a single integer $t(1 \leq t \leq 10^3)$ — the number of test cases.

The first line of each test case contains two integers $n(3 \leq n \leq 10^5)$ - the number of audience who wants to see the squad and $p(3 \leq p \leq 10^5)$ - maximum possible number of distinct colors of shirts worn by them.

The second line contains n integers - the number given by the guard to each of n individuals in the line based on the shirt color they wear.

It is guaranteed that the sum of n over all test cases does not exceed 10^6

Output

For each test case, print one integer - The maximum number of people who get to see the squad.

input
3 5 3 2 2 3 4 3 6 4 2 3 2 1 4 2 8 5 4 4 3 3 3 3 3 2
output
0 2 0

input
1 12 5 3 3 1 1 2 3 2 3 1 3 5 1
output
10

For the first sample input:

1. In the first case, yellow shirt (number one) is absent. Hence answer will be 0.
2. In the second case, the audience set $\{2, 3, 2\}$ can't be the maximum with 2 distinct colors because there should be at least one yellow shirt (i.e., number 1 in the set). Therefore the set $\{2, 1\}$ or $\{1, 4\}$ will be the maximum with 2 distinct colors as well as having at least one yellow shirt. Hence the answer will be 2.

E. Jersey

2 seconds, 256 megabytes

Harry is a massive fan of CPL. For the first time, he will watch the match at the stadium. Harry is so excited, and before entering the stadium, he sees people buying jerseys. He decides to buy one. He has m rupees in his wallet. There are n cloth outlets outside the stadium, and the price at i^{th} store is a_i rupees. Harry can buy a jersey at j^{th} store only if $a_j \leq m$. Print "YES"(without quotes) if Harry can buy a jersey at any of the outlets. Else, Print "NO" (without quotes)

Input

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

The first line of each test case contains two integers $n (1 \leq n \leq 10^3)$ and $m (1 \leq m \leq 10^5)$ — the number of outlets and the money in rupees in Harry's wallet.

The second line of each test case contains n integers $a_1, a_2, \ldots, a_n (1 \leq a_i \leq 10^5)$— the elements of the array.

It is guaranteed that the sum of n over all test cases does not exceed 10^6

Output

For each test case, Print "YES"(without quotes) if Harry can buy a jersey at any of the outlets. Else, Print "NO" (without quotes)

You may print every letter in any case you want (so, for example, the strings "yEs", "yes", "Yes" and "YES" will all be recognized as positive answers).

input
3 3 5 4 5 6 4 3 4 5 6 7 3 5 5 5 5
output
YES NO YES

In the first test case, Harry has 5 rupees, so he can buy the jersey at the 1^{st} outlet or at the 2^{nd} one

In the second test case, Harry has 3 rupees, and prices at all the stores are at least 4, so he cannot afford it.

In the third test case, Harry has 5 rupees, and prices at all the stores are equal to 5, so Harry can get a jersey at any of the stores.

F. Help Pishabh Rant

1 second, 256 megabytes

At Kennai, a heated semifinal match between Celhi Dapitals (Short form CD) and Lumbai Mindians (Short form LM) is set to happen. As a result, the Celhi Dapitals team needs to travel to Kennai from Celhi.

Pishabh Rant, the captain of CD, made a tree with the towns (total n in number) between Celhi and Kennai as a node. He has given each town a unique positive integer number (1 for Celhi, 2 for Lumbai, and so on). Additionally, it is known that the majority of residents in any town can support either CD (represented by "C"), LM (represented by "L"), or none (represented by "N"). Also, it is guaranteed that at least one town supports CD and at least one town supports LM in the tree made by him. He is considering dropping one edge, which would divide the tree into two components, one of which would have no town that supports CD, while the other would contain no town that supports LM. Determine the total number of such edges in the tree.

NOTE: Here, it implies that if most residents in a town support a team, then the town itself supports the team.

Input

The first line contains a single integer $n (2 \leq n \leq 10^5)$ - number of towns

The next $n - 1$ line contains two integers $u (1 \leq u \leq 10^5)$ and $v (1 \leq v \leq 10^5)$ - which represents the edges.

The last line contains n characters (consisting of 'C','L' or 'N'), in which the i^{th} character corresponds to i^{th} numbered town.

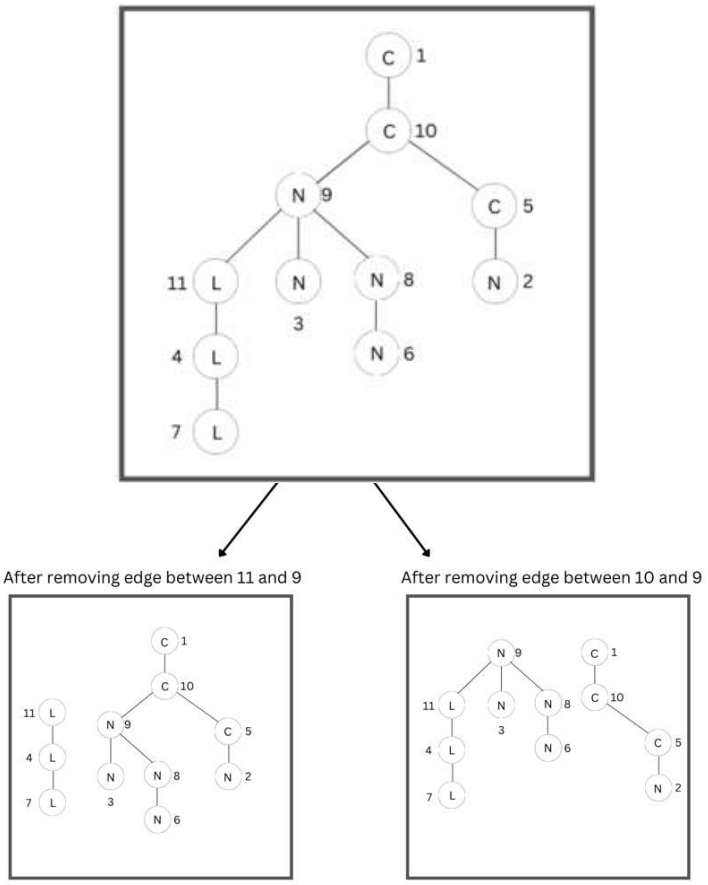
It its guaranteed that the given edges form a tree.

Output

Print one integer - the total number of possible edges, whereby removing an edge splits the tree into two components such that there are no supporters of LM in one component. At the same time, there are no CD supporters in the other.

input
11 10 9 10 5 1 10 9 11 9 8 5 2 11 4 4 7 9 3 8 6 C N N L C N L N N C L
output
2

The above input can be represented in the tree form as shown below:



After removing the edge (11,9) from the main tree, three towns support LM in one component, and no town supports CD. Similarly, in the second component, three towns support CD, and no town support LM. Hence removing the edge (11,9) satisfies the given condition, and hence this edge can be counted for the answer.

Another option is to remove the edge (10,9), which would leave one component with three towns supporting LM, none supporting CD, and the other with three towns supporting CD and none supporting LM. This again fits the requirement, so the edge (10,9) can also be included in the answer.

There is no other edge apart from these two that satisfies the required condition. Hence the answer is 2.

G. Password

1 second, 256 megabytes

It's time to put your powerful eyes to use

— Authors

CPL board members created a website to let people buy final match tickets online. Jack is a massive fan of cricket. Just after he got to know about the website, he opened it in the browser, and it asked him to sign up, and now he needs to create a password.
Jack has a password generator that takes an integer n as input and displays a string s of length n consisting of lowercase Latin letters. He sets the password as string s. He is not very good at remembering passwords, so he thinks of writing them on paper, so he doesn't miss out on them.

Since it is accessible to login into his account if someone finds out about that piece of paper, he thought of another way of not missing out on his password. He comes up with a unique way of storing passwords.

Jack will do the following operation n times while maintaining a string p (which is initially empty):

In $i^{th}(1 \leq i \leq n)$ operation:

- He picks i^{th} character from string s from the left and appends it to string p.
- If i is an odd integer, he reverses the string p.

After performing n operations he writes p on the paper

Input

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

The first line of each test case contains a single integer $n(1 \leq n \leq 10^6)$ — the length of the string.

The second line of each test case contains a string s of length n, consisting of lowercase Latin letters.

Sum of n over all test cases does not exceed 10^6

Output

For each test case, output the string p after performing n operations.

input
3 3 abc 4 efgh 5 jklmn
output
cba gfeh nmjkl

In the first test case p which is an empty string initially becomes "a" after first operation, "ab" after second operation, "cba" after final(3^{rd}) operation

In the second test case p which is an empty string initially becomes "e" after first operation, "ef" after second operation, "gfe" after third operation and "gfeh" after final(4^{th}) operation

H. Final Match

1 second, 256 megabytes

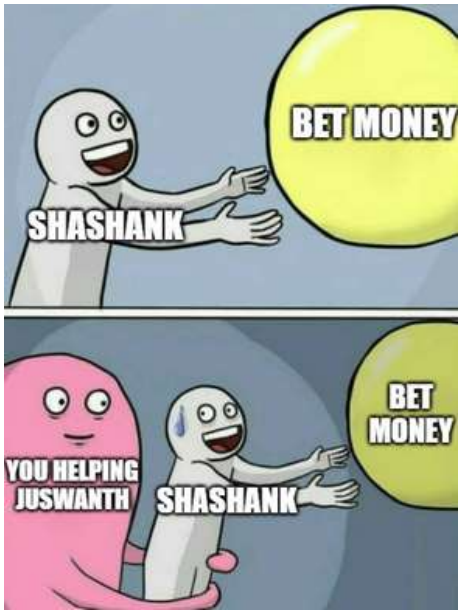
The final match of the CPL 2023 has arrived, and as a result, ticket prices have been elevated. Juswanth and Shashank purchased tickets online and were waiting for the game to begin at the stadium.

They were bored, so they decided to play a short bet game with a bet as the ticket price. Juswanth wins if he solves the problem given by Shashank. Otherwise, he loses. Shashank gives Juswanth two integers n and k and asks Juswanth to create a set of characters S by choosing k different characters(possibly from different languages) and compute the number of strings that satisfy the following properties.

1. The length of the string is n
2. The string must be a **magical palindrome**.
3. Each character in the string must be present in S. In other words, if 'z' is a character of the string, then 'z' must be present in the set S as well

A **magical palindrome** is a string that reads the same forward and backward, either directly or in any rotation of the string. For instance, "dedcbaabc" is a magical palindrome because if the last three letters at the end of the string are rotated to the beginning of the string, it becomes "abcdedcba"

The match has begun surprisingly, and Juswanth can't hold his excitement to watch it. So he wants you to solve the problem.



As the result can be very large, you should print the value modulo $10^9 + 7$ (the remainder when divided by $10^9 + 7$).

Input
The first and the only line of input consists of two integers $n(1 \leq n \leq 10^9)$ and $k(1 \leq k \leq 10^9)$

Output
Print the number of the strings that satisfy the conditions for given n and k values mentioned above modulo $10^9 + 7$

input
4 2
output
6

input
1 9
output
9

input
6 3
output
75

In the first case, k = 2 so let's assume the set S of 2 different characters created by you is {a,b} and length of string is 4 so all the strings that satisfy the given conditions are "aaaa", "abba" "aabb" "bbaa" "baab" "bbbb". So the answer is 6.

In the second test case, K = 9, so let's assume the set S of 9 different characters created by you is {a,b,c,d,e,f,g,h,i} so all the strings which satisfy the given conditions are "a", "b", "c", "d", "e", "f", "g", "h", "i"

I. Fours and Sixers

1 second, 256 megabytes

CPL 2023 has ended with a great shout-out from its audience. After analyzing all the matches, the CPL committee came up with two crazy equations. They are:

1. $x = a \text{ ^ } b$
2. $y = a \mid b$

where,

- x - Total number of catches a batsman makes while fielding in the tournament.
- ^ - Bitwise XOR operator.
- y - Total number of "man of the match" awards he won in the tournament.
- | - Bitwise OR operator.

Also, the committee informed that, for a given x, y of a player, the **maximum value** of 'a' which satisfies the above equation, and the corresponding value of 'b' is the total number of fours and sixers hit by the batsman in the tournament respectively.

Find the batsman's total number of fours and sixers in the tournament (If they exist) using the given inputs x and y.

Input
The first line consists of a single integer $t(1 \leq t \leq 10^3)$ - the number of test cases.

For each test case two positive integers $x, y(0 \leq x, y \leq 10^9)$ is given.

Output
For each test case print the **maximum** value of 'a' and the corresponding value of 'b' repectively. Print -1 if they don't exist.

input
3 5 4 8 14 10 1
output
-1 14 6 -1

In the first test case, no value of 'a' and 'b' exists, which satisfies the given equations.

In the second test case, the possible value of 'a' and 'b' are $(14, 6)$ and $(6, 14)$. Clearly from this the maximum value of 'a' is 14 and corresponding value of 'b' is 6.

And similar to the first test case, in the third test case, no value of 'a' and 'b' exists.
