MCPC2016

A. A Galaxy far, far away

time limit per test: 3 seconds
memory limit per test: 64 megabytes
input: agalaxy.in
output: standard output

On a newly discovered planet, there is a city called Treegaron. The city of Treegaron contains N houses, all of them are connected by $N - 1$ roads, where each road r has a value E_r .

There is only one person living in each of the houses. Whenever one person X wants to visit another person Y he should pay the government a fee equals to

$$max(E_a, E_b, ...) - min(E_a, E_b, ...)$$

where $E_a, E_b, ...$ are the values of the roads that X needs to use in order to go from his house to Y's house on a simple path (There's a unique such path).

The people of Treegaron like to be socially active, but they don't like paying too much, so they ask you to find out the total amount of money they need to pay the government so that each pair of people meet exactly once separately.

Input

The first line contains a single integer T, the number of test cases. In each test case, the first line contains one integer N ($1 \le N \le 10^4$) the number of houses in Treegaron. Each of the next $N - 1$ lines contains three space separated integers A, B, E ($1 \le A, B \le N$, $1 \le E \le 10^9$), which includes a road between house A and house B with a value of E.

Output

For each test case output a single line containing the amount of money the people of Treegaron need to pay the government so that each pair of people in the city meet exactly once.

Example

input
1 5 1 2 10 2 3 7 2 4 1 5 1 12
output
36

Note

From house 1 to house 2, it costs 10 - 10 = 0. From house 1 to house 3, it costs 10 - 7 = 3. From house 1 to house 4, it costs 10 - 1 = 9. From house 1 to house 5, it costs 12 - 12 = 0. From house 2 to house 3, it costs 7 - 7 = 0. From house 2 to house 4, it costs 1 - 1 = 0. From house 2 to house 5, it costs 12 - 10 = 2. From house 3 to house 4, it costs 7 - 1 = 6. From house 3 to house 5, it costs 12 - 7 = 5. From house 4 to house 5, it costs 12 - 1 = 11.

After summing that up, the final result = 36.

B. Bill the Science Guy

time limit per test: 1 second
memory limit per test: 64 megabytes
input: bill.in
output: standard output

With every passing day, scientists discover new stars and planets. Our universe is expanding as our knowledge grows, more scientific discoveries are occurring every minute. One morning in the 22nd century, scientist and astrophysicist Bill DeGrass Fryson made a huge breakthrough that changed the way humans perceived the universe.

Bill discovered that whenever the distance of two planets to the black hole 'V4641 Sgr' sums up to be a Fibonacci number, this pair of planets can be used for interstellar travel, and he called them *multi-dimensional twins*. Note that 'V4641 Sgr' is the nearest black hole in the center of our galaxy.

Bill got so excited and he started preparing for the conference where he will reveal this discovery. However, he needs some examples and he is too overwhelmed to extract them. He needs your help!

Given N planets, and the distances of each planet from the black hole, can you figure out how many pairs of planets are *multi-dimensional twins* (distances sum is a Fibonacci Number)?

The Fibonacci numbers are defined by the sequence $1, 1, 2, 3, 5, 8, 13, \ldots$ (each element is the sum of the previous two elements)

Input
The first line contains a single integer T, the number of test cases. In each test case, the first line contains one integer N $(1 \le N \le 10^4)$ the number of planets in the galaxy. The second line contains N space separated integers which are the distances d_i of the i-th planet from the black hole $(0 \le d_i \le 10^9)$.

Output
For each test case output a single line containing the number of pairs of planets that are *multi-dimensional twins*.

Example

input
1 5 3 5 6 7 0
output
4

C. Cool Future

time limit per test: 1 second
memory limit per test: 64 megabytes
input: cool.in
output: standard output

In the year 3000 life has developed greatly on Planet Earth 2.0. Humans have evolved, races have fused together so much that the entire species is one common race, and the languages unified into one united language. World and Universe peace was achieved and with Earth joining the Intergalactic Federation it became a grand tourist attraction from all aliens visiting from neighboring galaxies and local groups.

Human intelligence has evolved greatly, and the hardest problems in the old ages (2000s) were riddles given to the third millennium kids for fun.

One of the riddles in the 2nd grade math book was the following: Suppose we have a lost list of integers a_i (for $1 \le i \le N$), where N is it's size. Let's write a $N \times N$ matrix consisting of all pairwise xor values $X_{ij} = a_i$ xor a_j. Now given the $N \times N$ matrix of some lost list, restore the original list or determine if it is impossible to restore the lost list. In the case of multiple solutions write the lexicographically smallest one, and if it's impossible, then the output should be -1.

Input

The first line of the input contains an integer T, the number of test cases. In each test case, the first line contains an integer N ($1 \le N \le 200$) the size of the lost list, then followed by the matrix on N lines, such that the i-th line contains N space separated integers which are the values X_{ij} for all j from 1 to N. The values a_i of the lost list satisfy $0 \le a_i \le 10^9$.

Output

The output for each test case will be a line that contains either N space separated integers that are the lost list, or a single integer -1 if it's impossible to solve.

Example

input
2 3 0 2 1 2 0 3 1 3 0 3 0 65 1 65 0 1 1 1 0

output
0 2 1 -1

D. Dealing with the Future

time limit per test: 1 second
memory limit per test: 64 megabytes
input: dealing.in
output: standard output

In the future, Earth was not only visited by Alien Tourists, Earthlings also got to visit other planets and enjoy some interstellar tourism!

You were one of the lucky ones who were cryogenically frozen and then unfrozen in the year 3000. You were welcomed as a citizen of the past and assigned a job immediately. They analyzed your characteristics using advanced tests and assigned you a job in a tourism company. It was pretty ironic to assign such a job to a citizen of the past, but the advanced technology of the future is never mistaken. It was the best job for you as you managed to use your mathematical skills in setting up the best interstellar tours in the observable (and multidimensional) universe.

You used a simple algorithm for your tours. You assigned a fun value for each planet and chose a circle of planets for a specific tour. You will start from a certain planet, then go along the circle (in a fixed direction, left or right) where the fun value is non-increasing along the tour, until all planets are visited.

Given the fun values of planets you chose. Can you output the planet index that you will start from and the direction (L for left, or R for right) you will take?

In case there is more than one valid planet to start from, output the planet with the lowest index. In case that you can go left and right output *Left*.

Input

The first line contains a single integer T, denoting the number of test cases. In each test case, the first line contains a single integer N ($1 \le N \le 10^5$) the number of planets in the circle, and the second line contains N space separated integers f_i ($0 \le f_i \le 10^9$) representing the fun values of the planets.

Output

For each test case print the $index$ ($1 \le index \le N$) of the planet you've chosen to start from, followed by a space then either L or R. If it's impossible to visit all the planets, print NO on a single line.

Example

input
4 5 25 12 50 44 31 4 1 2 1 2 3 1 2 3 4 8 20 10 9

output
3 R NO 3 L 2 R

E. Encrypted Mystery

time limit per test: 15 seconds
memory limit per test: 64 megabytes
input: encrypted.in
output: standard output

Bill Fryson is a big fan of the astrophysist Carl Seagull. He was his mentor and he was devastated when Carl passed away. Carl left all his old books and memoirs to Bill. Every weekend Bill used to go through them looking for unfinished research or any clues hidden between the lines.

One day Bill noticed strange patterns in Carl's original blue print of his famous book "Contract", he found some binary strings in the notes and he is convinced that a hidden message is encrypted in the anti-symmetric substrings of these binary strings.

Given a binary string can you help Bill and determine how many substrings are anti-symmetric?

Note that a string is called anti-symmetric if you reverse its digits and flip them it will remain the same string. for example:

0011 —> reverse —> 1100 —> flip —> 0011, therefore it's anti-symmetric.

0001 —> reverse —> 1000 —> flip —> 0111, therefore it's not anti-symmetric.

Input

The first line contains a single integer T, the number of test cases. In each test case, the first contains a single integer N ($1 \le N \le 5 \cdot 10^5$) the number of characters in the string, and the second line contains a binary string of length N.

Output

For each test case print an integer in a single line, that represents the number of anti-symmetric substrings in the test case.

Example

input
3 4 1100 6 111000 6 111001
output
2 3 3

F. Federation Rules

time limit per test: 1 second
memory limit per test: 64 megabytes
input: federation.in
output: standard output

When Earth 2.0 joined the Intergalactic Federation in the year 3000, tourism became very active. Humans had to organize extraterrestrial beings and lifeforms entering earth. They set some new rules for Earth tourist visa. If you are an alien who wishes to obtain the tourist visa you need to follow these rules.

First, all aliens from fellow planets that belong to the Federation are welcome and they obtain the visa on arrival. However, if you are from a planet that doesn't belong to it you need to have an amount of Shleems (Earth Unified Currency) that is larger than (or smaller than) a certain number that changes according to your planet of origin.

To make things easier, you suggested a program to validate that airport officers don't make errors in accepting applications.

This program will take as input the amount of money an alien has X and the amount he needs to pay for his visa Y, it also takes a less-than $<$ or greater-than $>$ symbol. If the symbol is less-than, then the officer thinks that X is less than Y; and if it's greater-than, then the officer thinks X is greater than Y.

If the officer is correct, print **Yes**, else print **No**

Input

The first line contains a single integer T, the number of test cases. In each test case, there's a single line, containing X, Y ($1 \le X, Y \le 10^9$) and either $<$ or $>$, all space separated.

Output

For each test case, print a single line containing either **Yes** or **No**

Example

input
3 1 4 > 9 3 > 1 2 <

output
No Yes Yes

G. Going to FlatLand

time limit per test: 1 second
memory limit per test: 64 megabytes
input: going.in
output: standard output

One of the most fascinating newly discovered planets was called FlatLand. As the name implies, the planet was a 2 dimensional planet inhabited by flat beings like squares, circles, triangles and many more.

FlatLand is a relatively new planet, it isn't very evolved yet, they have just begun installing antennas for their new TV network and want to cover all of the houses in any given city. Each of their antennas' covering range can cover a circular area around the antenna's position, but they have to build all of the antennas with the same power so they will all have the same covering radius. Knowing that in each city, all of the houses are collinear (lie on a the same line), and the antennas can be put anywhere, and knowing how many antennas they intend to build; they want to minimize the covering radius of the antennas, in order to minimize the cost. Can you help them?

You are given the location of each house in the city, and given the number of antennas to be placed. Can you calculate the shortest possible covering radius for the antennas?

Input

The first line contains a single integer T, the number of test cases. In each test case, representing a city, the first line contains two space separated integers N, K ($1 \le K \le N \le 10^5$), where N is the number of houses in the city and K is the number of antennas they intend to build, the second line contains N space separated integers L_i (for $1 \le i \le N$ and $1 \le L_i \le 10^9$) representing the location of the houses in this city.

Output

For each test case, print the answer with 3 decimal digits in its fractional part, which is the minimum covering radius of the antennas.

Example

input
2 4 2 1 10 15 20 6 2 1 5 5 10 20 30
output
4.500 5.000

Note

In the first sample: The antennas are placed at points 5.5 and 16.

In the second sample: The antennas are places at the points 5 and 25.

H. Hope in Humanity

time limit per test: 15 seconds
memory limit per test: 64 megabytes
input: hope.in
output: standard output

On Earth 2.0, in order to graduate from kindergarten kids are required to pass a set of few tests. One of the most difficult tests (by our current standards) was Math. Humans evolved greatly and they knew that science is the solution for any problem they might face, and accordingly the average IQ level got higher and higher. For you to be able to picture how the situation is in the future, we have written this problem which is a question in the math test that the future kids take to graduate kindergarten.

In this question you are given a number X (where $X > 1$), and asked to find the largest power among all of its divisors. Where the power of a divisor d (where $d > 1$) is the maximal k such that X is divisible by d^k.

To make things a bit challenging, instead of X, you are given N integers that when multiplied together, result in X.

Can you solve this question and graduate the year 3000 kindergarten?

Input

The first line contains a single integer T, the number of test cases. In each test case, the first line contains an integer N ($1 \le N \le 700$), followed by a line that contains N space separated integers a_i ($1 \le a_i \le 10^{18}$), for $1 \le i \le N$, which multiply to X.

Output

For each test case, print a single integer in one line representing the largest power of all the divisors of X.

Example

input
2 4 2 4 8 16 3 2 7 11

output
10 1

I. Intergalactic Federation

time limit per test: 1 second
memory limit per test: 64 megabytes
input: intergalactic.in
output: standard output

In year 3000, Earth finally joined the Intergalactic Federation. It was the event of the millennium and many planets from other galaxies joined as well in a big ceremony that took place in the Phoenix Dwarf Galaxy. Countless living and bionic forms attended and it was a magnificent day.

An important part of the ceremony was announcing the new capital planet for the Intergalactic Federation, and since Universal Peace was achieved by then, electing the capital planet was based on a simple mathematical method, and you will help figuring it out!

The map of the Federation was simplified on a 2-dimensional grid, you will be given the positions (X, Y) of N planets and a constant D. The planet that has the maximum degree will be elected as the capital planet. The degree of i-th planet P_i is the number of planets whose Manhattan distance to P_i is less than or equal to the given constant D.

Can you figure out which planet will be elected the capital of the Federation?

Input

The first line contains a single integer T, the number of test cases. In each test case, the first line contains two space separated integers N, D ($1 \le N \le 1000$ and $0 \le D \le 10^9$). Each of the next N lines contain two space separated integers X, Y ($-10^8 \le X, Y \le 10^8$), the position of i-th planet.

Output

For each test case output a single line containing the index of the of the capital planet; if more than one planet can be a capital, then use the capital with the smallest index. Note that the index of the first planet is 1.

Example

input
1 3 3 1 1 2 2 3 3
output
2

Note

Manhattan distance between 2 points (x_1, y_1) and (x_2, y_2) in a 2-dimensional plane is $|x_1 - x_2| + |y_1 - y_2|$

For example, Manhattan distance between $(3, 6)$ and $(7, 2)$ is $|3 - 7| + |6 - 2| = 4 + 4 = 8$

J. Joy of the Future

time limit per test: 2 seconds
memory limit per test: 64 megabytes
input: joy.in
output: standard output

In year 3000, humans have evolved greatly. They managed to defeat every single disease and unlocked the secrets of immortality.

An annual check is required for all citizens of the Intergalactic Federation. The test takes place in the nearby Andromeda Galaxy and every living and bionic being is required to take it once a year.

The test is simple and quick, each being checks in with their name, does the test, then checks out. During learning, a list gets generated in every test center with the names checking in and out. Note that multiple beings might have the same name.

One of the beings (probably a de-frozen human from the past) checked in and never checked out, they need to know who that being is. Given the number of test takers in a center and a list of check-in and check-out events, Can you figure out who entered and never left?

Input

The first line contains a single integer T, the number of test cases. In each test case, the first line contains a single integer N ($1 \le N \le 10^5$) the number of beings that checked-in in this center, then followed by $2N - 1$ lines, each containing a name of a being denoting that this being either checked in or out. The names consist only of case-sensitive English letters and digits and each is at most 30 characters long.

Output

For each test case, print a single line with the name of the being who didn't check out.

Example

input
2 3 ghooo se7s nicole nicole ghooo 2 fegla nicole nicole

output
se7s fegla

K. Kool Kat

time limit per test: 15 seconds
memory limit per test: 64 megabytes
input: kool.in
output: standard output

Rick is a brilliant scientist who lives in the year 3000. He is considered one of the smartest people who have ever lived in our galaxy. He made so many discoveries, he even managed to make concentrated dark matter!

Concentrated dark matter is a fuel so powerful and so condensed that a very tiny bit of it can fly any spaceship very fast across the galaxies, however Rick doesn't want it in the wrong hands so he invented a way to decode the recipe for making this fuel, and you need to solve a riddle to obtain the password that decodes that recipe.

The riddle goes as follows: Given N names, where none of them is a contiguous sub-string of another. You need to construct a string that contains a total of exactly M occurrences of those names (the total number of names taken is M), knowing that you can use the same name zero or more times. Can you figure out the minimum length of this string?

Input

The first line contains a single integer T, the number of test cases. In each test case, the first line contains two space separated integers N, M ($1 \le N \le 200$ and $1 \le M \le 10^9$), then followed by N lines, each containing one string. The total length of all strings (sum of the strings' lengths) in each test case is at most 10^5.

All strings consist of lowercase English letters only.

Output

For each test case, print a single line containing an integer denoting the minimum string length for the case as described above.

Example

input
2 3 3 twilight lightning ghooooo 4 3 abc cd de zzzz
output
18 5

Note

In example 1, the minimum string is twilightninghooooo. In example 2, the minimum string is abcde.

L. Leap of Coach Academy

time limit per test: 1 second
memory limit per test: 64 megabytes
input: leap.in
output: standard output

Coach Academy has coaches all around the galaxy. Since the galaxy became really evolved in problem solving, all the other galaxies wanted to evolve from their primitive civilizations up to the standards of the MilkyWay, so they started seeking coaches. Knowing that a coach can be in exactly 1 galaxy, they contacted the Alien Coaching Processing Committee (ACPC) in order to assign them coaches from Coach Academy.

The only problem with the aliens is that, a coach can handle only up to 30 junior alien students at a time. Coach Academy needs to know how many coaches the ACPC will assign the galaxies abroad, in order to prepare the coaches. Can you help them?

Input

The first line of the input contains an integer T, the number of test cases. In each test case, the first line contains an integer N (where $1 \leq N \leq 1000$) the number of the primitive galaxies, then the second line contains N space separated integers a_i (where $1 \leq a_i \leq 10^9$), the number of junior alien students in each galaxy.

Output

For each test case, the output will be one line containing the total number of coaches that got assigned by ACPC for Coach Academy, in order to send them abroad.

Example

input
2 3 30 30 31 5 1 10 20 30 50

output
4 6