Association for Computing Machinery
INSAT Student Chapter

She solves 5.0

(Contest Problems)

Tunisia

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Problem A : Sarah and the study group

Statement:

It is exams time at Insat so Sarah decided to create a study group to help her revise but they quickly encountered a problem after creating the group. They couldn't decide which subject to study first so they took a vote where each member voted on the topic he wants to study.

Help them find out the topic they will study first.

Input :

The first line contains a single integer **T** (1≤T≤100) — the number of test cases. Then the test cases follow. Each test case consists of one line.

The first line of every test case contains a single integer **n** (1≤N≤10 ^5).
The second line contains **n** caracters ci, the name of the subject the i-th member voted on. (ci is an uppercase letter between 'A' and 'Z')

Output :

For each test case, output the letter that is the name of the subject with the most votes. If there is a tie, output '#'.

Example:

Input :

```
3
5
A B C D A
4
A B A B
1
X
```

Output :

```
A
#
X
```

Problem B : Ines and summations

Statement:

Ines is very good at mathematics so her friends challenged her to a problem. They gave her an array of numbers **a** and a number **k** and allowed her to do the following operation on the array any number of times as long as there are 2 or more elements in the array :

- Take two array elements ai and aj and remove them from the array then insert the value (ai + aj) into any position of the array.

Determine if Ines can reduce the array using the operation provided to a single value that is divisble by **k**.

Input :

The first line contains a single integer **T** (1 ≤ T ≤100) — the number of test cases. Then the test cases follow. Each test case consists of one line.

The first line contains two integers **n**, **k** (1 ≤ n, k ≤ 10^5) — where n is the length of the array and k is the number described above.

The second line contains n integers ai (1 ≤ ai ≤ 10^3) describing the array a.

Output :

For each test output "YES" (all uppercase) if it is possible to obtain a value divisible by **k** and "NO" otherwise.

Example:

Input :

```
3
3 3
4 4 1
4 5
12 5 6 8
1 3
3
```

Output :

```
YES
NO
YES
```

In the first test case one possible sequence of operations is :
4 4 1 -> 8 1 -> 9

Problem C: Messi’s last world cup

Since the start of the world cup, many people started analysing Messi’s performance especially after they knew it was his last world cup, many think that it is lower than his level in 2018, but others think that it is too early to judge him. They all agreed that if he ended this season with the same average number of goals as the last time, then there is no need to worry.

Given four integers, N, M, X and Y representing his average number of goals per match in the last time, the number of goals he scored so far in the current season, the number of matches that were already played and the number of remaining matches respectively.

What is the minimum number of goals he needs to score in the remaining matches to have at least the same average number of goals as 2018?

Input:
The first line of the input is the number of test cases T. Each test case consists of four integers N, M, X, and Y, where $0 \le N,M,X,Y \le 1000$ and $X+Y > 0$.

Output:

For each test case output a single line containing the minimum number of goals or −1 if Messi can't make it.

Example:

Input:

```
4
1 1 37 1
5 1 1 37
1 0 1 0
2 6 1 2
```

Output:

```
37
189
-1
0
```

Problem D: Ice-Cream

There is a wonderful ice-cream shop in centre urbain that contains N ice-creams, such that each ice-cream is represented by two numbers Ci and Hi denoting the number of calories and the happiness value, respectively.

Amine wants to buy exactly K ice-creams such that the calories of the densest ice-cream (the one with most calories) are as minimal as possible. If there is more than one way to do that, you want to maximize the total happiness of the ice-creams you will buy, that is the sum of the happiness values of the chosen ice-creams.

Input:

The first line of the input contains a single integer T specifying the number of test cases.

Each test case begins with a line containing two integers N and K (1 ≤ K ≤ N ≤ 10^5), in which N is the number of ice-creams in the shop, and K is the number of ice-creams you want to buy.

Then a line follows containing N integers C1,⋯,CN (0 ≤ Ci ≤ 10^9), in which Ci is the number of calories in the ith ice-cream. Then a line follows containing N integers, H1,…,HN (0 ≤ Hi ≤ 10^9), in which Hi is the hapinnes value of the ith ice cream.

Output:

For each test case, print a single line containing two space-separated integers representing the calories of the densest ice-cream you will buy and the total happiness of the ice-creams you will buy, respectively.

Remember that your goal is to buy KK ice-creams such that the calories of the densest ice-cream (the one with most calories) are as minimal as possible. If there is more than one way to do that, you want to maximize the total happiness of the ice-creams you will buy.

Example:

Input:

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

Output:

```
3 12
```

Problem E : Tic Tac Toe

Statement:

Mariem has 2 younger sisters Fatma and Hiba.

Mariem wants to study but her sisters are too annoying and noisy, so Mariem decided to teach them Tic Tac Toe. Fatma and Hiba loved the game so much that they kept playing all day long. Mariem thought that they wouldn't annoy her anymore, but that wasn't the case because at the end of each day,the 2 sisters came up to her with a bunch of papers so that Mariem tells them who wins.

Mariem wants you to write a program that outputs the winner of each given paper, to save her the time so that she can study.

Notes :

- Hiba always starts first and always begins with X
- If Hiba wins you should output 1,otherwise if Fatma wins you should output 2 else you should output 0 (in the case of a tie or if the game is unfinished)
- Hiba and Fatma are new to the game so they sometimes make a mistake (for example hiba plays twice in a row), in that case you output -1

Some Examples :

```
O..
O.X
O.X

it is not correct (-1) (because Hiba(X) always start)

OX.
O.X
O.X

Fatma wins (2)

XOX
XXO
OXO

it is a tie
```

Input :

The first line contains a single integer **T** (1 ≤ T ≤ 10^5) — the number of test cases. Then the test cases follow. Each test case consists of 3 lines.

The 3 lines represent the paper given by the 2 sisters (the . means that it is empty)

Output :

For each test case, output as described above.

Example:

Input :

```
4
O..
O.X
O.X

OX.
O.X
O.X

O.X
O.X
O.X

XOX
XXO
OXO
```

Output :

```
-1
2
-1
0
```

Problem F : Raed and number transformation

Statement:

Raed wants to play a game. The Game consists of transforming a string A consisting of many digits into another string B of digits.

These digits are represented as follows :

The Game rules are as follows :

-In each operation He can:

```
-add one stick to one digit of the string so it becomes a new valid digit.

-remove one stick from one digit of the string so it becomes a new valid digit.
```

-He can perform as much operations as possible.

Raed doesn't play a game until he is sure that he can win.

Help Raed find out whether he should play the game or not.

Input :

The first line contains a single integer **T** (1≤T≤100) — the number of test cases. Then the test cases follow. Each test case consists of one line.

The first line of each test case contains an integer **n**, the number of characters in the string A.

The first line of each test case contains string A (number of digits in string A doesn't exceed 10^5).

The second line of each test case contains string B (number of digits in string B is the same as the number of digits in string A).

Output :

For each test case, output "YES" (all uppercase) if the string A can be transformed into string B. Output "NO" (all uppercase) otherwise.

Example:

Input :

```
2
3
789
798
6
146669
185654
```

Output :

```
YES
NO
```

Problem G : Mona and the treasure

Statement:

Mona has heard about a famous treasure that is hidden in the castle so naturally she wanted to claim it as her own. She went to the castle but she found that in order to get to the treasure, she first has to go through a maze in a room. However it turned out that the shape of this maze is quite easy so she wants to calculate the minimum distance she has to travel to get to the end.

The maze is an **n***m** grid consisting of walls (rows) she has to traverse one by one. Each wall has a single door she can traverse through.

The shape of the maze is given as follows :

Each line contains the description of a wall, the doors are marked with '.' and the rest of the cells of the wall are marked with '#'.

- Mona always starts at the 1st cell of the 1st wall.
- The 1st cell of the 1st wall is always a door.
- Mona has to get to the end wich is the last cell of the last wall.
- The last cell of the last wall is always a door.

Your task is to find out the minimum number of steps she has to take in order to get to the end. (Suppose that moving horizontally by a single cell counts as one move and moving vertically doesn't count as a move)

Input :

The first line contains a single integer **T** (1≤T≤100) — the number of test cases. Then the test cases follow. Each test case consists of one line.

The first line contains two integers **n**, **m** (1≤n, m≤100) — where **n** is the number of walls and **m** is the width of these walls.

Each of the next n lines contains m characters. The **i**th line describes the **i**th wall. If a character on a line equals ".", then the corresponding cell is a door and if the character equals "#", then the cell is part of the wall.

Output :

For each test case, output the minimum number of steps she has to make in order to get to the end. (Suppose that moving horizontally by a single cell counts as one move and moving vertically doesn't count as a move)

Example:

Input :

```
2
3 4
.###
###.
###.
7 7
.######
######.
#####.#
#####.#
#.#####
.######
######.
```

Output :

```
3
18
```

Problem H : Nada and her array of colors

Statement:

Nada is into painting and coloring so her friends got her a present for her birthday, a ribbon to color on. However this ribbon was divided into **n** cells and some of them had already been colored.
Nada wants to color the ribbon using the minimum number of colors in such a way that no two adjacent cells have the same color.
You are given the description of a ribbon, your task is to determine the minimum number of colors the ribbon can be colored in such that no two adjacent cells have the same color. Or print -1 if it is impossible.

Input :

The first line contains a single integer **T** (1≤T≤100) — the number of test cases. Then the test cases follow. Each test case consists of one line.

The first line contains an integer **n** (1≤ n ≤10^5) — where n is the length of the ribbon.

The next line contains n integers ai, the description of the ribbon. If the ai is -1 then it isn't colored, otherwise ai is the reference (just an integer) of the color used. (1≤ ai ≤ 10^5).

Output :

For each test case, output the minimum number of colors that can appear on the ribbon while coloring it in such a way that no two adjacent cells are the same color. Or print -1 if it is impossible.

Example:

Input :

```
4
1
1
6
1 2 -1 9 -1 1
2
1 1
```

Output :

```
1
3
-1
```

In the second test case one way to color the ribbon only using 3 colors is as follows :

```
1 2 1 9 2 1
```

Problem I : Detective Conan Nemesis

Statement:

Kaitou Kid wanted to go big in his last operation. So, he decided to steal the Monalisa from the Louvre. His plan was perfect and no one could decipher his riddles and tricks and now the masterpiece and the thief are both gone. Hopefully, Detective Conan was clever enough to solve the mystery and he is sure that his nemesis is going to escape with the painting from the roof with a helicopter. However, it took him too much time to get his answers and now Kaitou is on the run.

Given the position and speed of both Conan and Kaitou Kid on the roof, can you tell if conan can catch him before reaching the rope attached to the helicopter. The roof is an infinte 2d plan with 2 axes X and Y.

Input :

The first line contains three integers **Xc**, **Yc** and **Sc** (0 <= Xc,Yc <= 10^5, **0 < Sc**) — the position and speed of Conan.

The second line contains three integers **Xk**, **Yk** and **Sk** (0 <= Xk,Yk <= 10^5, **0 < Sk**) — the position and speed of Kaitou.

The last line contains two integers **Xh** and **Yh** (0 <= Xh,Yh <= 10^5) — the position of the Helicopter.

NOTE: Conan is tired from climbing all the way to the roof so he can't run faster than Kaitou Kid. (**Sc <= Sk**)

Output :

Print "YES" (all uppercase) if he can catch him. Otherwise, print "NO" (all uppercase).

Example:

Input :

```
0 15 5
19 20 10
5  5
```

Output :

```
NO
```

Input :

```
0 1 1
0 2 1
1 1
```

Output :

```
Yes
```

Problem J : Ironian War

Statement:

The Ironian kingdom has entered a war with the dwarfs, the emperor was afraid to lose it, that's why he summoned the skilled wizard "IronByte" from the wizards land to try the reincreate the legendary slayer "Gaya The Dragon Champion". To reinsert the legendary slayer IronByte needs to gather some ancient gems, those gems are stored in a fabled cave, this cave is protected by the legendary guardian Zoe. She sets a password to the cave to protect it, that's why he needs your help to crack it.

Zoe got an array a of numbers from 1 to n, where **a[i] = i**, (*i in [1..n]*).

He performed n operations sequentially. In the end, he received a new state of the array.

At the i-th operation, Zoe chose the first i elements of the array and cyclically shifted them to the right an arbitrary number of times (elements with indexes i+1 and more remain in their places).

One cyclic shift to the right is such a transformation that the array a=[a1,a2,…,an] becomes equal to the array a=[ai,a1,a2,…,ai−2,ai−1,ai+1,ai+2,…,an].

For example, if a=[5,4,2,1,3] and i=3 (that is, this is the third operation), then as a result of this operation, he could get any of these three arrays:

a = [5,4,2,1,3] (makes 0 cyclic shifts, or any number that is divisible by 3).
a = [2,5,4,1,3] (makes 1 cyclic shift, or any number that has a remainder of 1 when divided by 3).
a = [4,2,5,1,3] (makes 2 cyclic shifts, or any number that has a remainder of 2 when divided by 3).

Let's look at an example. Let n=6, initially a = [1,2,3,4,5,6]. A possible scenario is described below.

i = 1: no matter how many cyclic shifts Zoe makes, the array a does not change.
i = 2: let's say Zoe decided to make a 1 cyclic shift, then the array will look like a = [2,1,3,4,5,6].
i = 3: let's say Zoe decided to make 1 cyclic shift, then the array will look like a = [3,2,1,4,5,6].
i = 4: let's say Zoe decided to make 2 cyclic shifts, the original array will look like a = [1,4,3,2,5,6].
i = 5: let's say Zoe decided to make 0 cyclic shifts, then the array won't change.
i = 6: let's say Zoe decided to make 4 cyclic shifts, the array will look like a = [3,2,5,6,1,4].

You are given a final array state a after all n operations. Determine if there is a way to perform the operation that produces this result. In this case, if an answer exists, print the numbers of cyclical shifts that occurred during each of the n operations.

The cave password will be **the total number** of those cyclical shifts.

Input :

The first line of the input contains an integer **T** (1 ≤ T ≤ 500) — the number of test cases in the test.

In each test case:

The first line of the test case contains one integer **n** (2 ≤ n ≤ 10^3) — the length of the array a.

The next line contains the final state of the array a: n integers a[1],a[2],…,a[n] (1 ≤ a[i] ≤ n) are written. All **a[i]** are distinct.

Output :

For each test case, print the answer on a separate line.

Print -1 if the given final value a cannot be obtained by performing an arbitrary number of cyclic shifts on each operation. Otherwise, print the sum of the non-negative integers d1,d2,…,dn (d[i] ≥ 0), where d[i] means that during the i-th operation the first i elements of the array were cyclic shifted to the right di times.

If there are several possible answers, print the one where the total number of shifts is minimal.

Example:

Input :

```
3
6
3 2 5 6 1 4
3
3 1 2
8
5 8 1 3 2 6 4 7
```

Output :

```
8
1
18
```

Problem K : Hatem's secret recipe

Statement:

Hatem has a well-known Baklawa Shop. This is due to his great attention to quality and for never being late when it comes to orders. In fact, he and his partner had devised a recipe that made their Baklawas irresistible. However, his partner is going on a family vacation for a whole month and fearful of someone stealing his recipe Hatem chooses to do all the work by himself. And so he needs to set the ovens the night.

Mister Hatem wants to know the minimum number of oven necessary to prepare the order before **f** time.

Hatem has access to a lot of ovens that he can set up to match any order he gets where each oven has a capacity **c**. All ovens are installed beforehand. Each oven needs **k** time to cook **c** Baklawas.

NOTE:

- The time needed to take the cooked Baklawas out of the oven and start cooking the next c Baklawas **is ignored** : Mister Hatem is so quick.
- All Baklawas are ready at the same moment **k** time after they started baking.

Input :

The first line contains a single integer **t** (1 <= t <= 1000) — the number of test cases. Then the test cases follow.

Each test case consists of one line which contains integers **n**, **f**, **c**, **k**(1 <= n, f, c, k <= 10^9 , k <= f) — where :

- n is the number of ordered Baklawas.
- f is the available time to prepare the order.
- c is the capacity of one oven.
- k is the time to cook c Baklawas in one oven.

Output :

For each test case, output the minimum number of ovens that satisfies his needs.

Example:

Input :

```
2
10 10 1 1
12 4 3 2
```

Output :

```
1
2
```