

Circular Array

Question 1

Given a circular array A of N elements(the next element of the last element is the first element of the array), print the Next Greater Number for every element. The Next Greater Number of a number x is the first greater number to its traversing-order next in the array, which means you could search circularly to find its next greater number. If it doesn't exist, output -1 for this number.

Input

The first line contains N, the following line contains N space separated integers.

Output

Print the next greater number of each element of the array (space separated).

Sample Input

```
3
1 2 1
```

Sample Output

```
2 -1 2
```

Explanation

The first 1's next greater number is 2; The number 2 can't find next greater number; The second 1's next greater number needs to search circularly, which is also 2.

Question 2

Ninja has a circular array 'Nums' containing 'N' positive integers. An array is called circular if we consider the first element as next of the last element.

Ninja wants you to find the first greater number to the right of each element in the array, if there is no greater element to the right of an element, then output -1 for this element.

Example :

If N = 5 and the array is: [1, 6, 4, 3, 5]

We will return [6, -1, 5, 5, 6]

because 6 is the first element to the right of 1 that is greater than 1,
no element exists that is greater than 6,

5 is the first element to the right of 4 that is greater than 4,

5 is the first element to the right of 3 that is greater than 3,

6 is the first element to the circular-right of 5 that is greater than 5.

Input Format :

The first line contains a single integer 'T' denoting the number of test cases, then each test case follows:

The first line of each test case contains a single integer 'N' denoting the size of the array.

The second line of each test case contains N positive integers denoting the array elements 'Nums[i]'.

Output Format:

For each test case, print the next greater elements for each element in the circular array.

Output for each test case will be printed in a separate line.

Question 3

Given an array of n elements. Consider array as circular array i.e element after a_n is a_1 . The task is to find maximum sum of the difference between consecutive elements with rearrangement of array element allowed i.e after rearrangement of element find $|a_1 - a_2| + |a_2 - a_3| + \dots + |a_{n-1} - a_n| + |a_n - a_1|$.

Examples:

Input : arr = [4, 2, 1, 8]

Output : 18

Rearrange given array as : [1, 8, 2, 4]

Sum of difference between consecutive element

$$= |1 - 8| + |8 - 2| + |2 - 4| + |4 - 1|$$

$$= 7 + 6 + 2 + 3$$

$$= 18.$$

Input : arr = [10, 12, 15]

Output : 10

Question 4

Given a circular array arr[] of length N, the task is to find the minimum absolute difference between any adjacent pair. If there are many optimum solutions, output any of them.

Examples:

Input: arr = [10, 12, 13, 15, 10]

Output: 0

Explanation: $|10 - 10| = 0$ is the minimum possible difference.

Input: arr = [10, 20, 30, 40]

Output: 10

Explanation: $|10 - 20| = 10$ is the minimum, 20 30 or 30 40 could be the answer too.

Question 5

You are playing another computer game, and now you have to slay n monsters. These monsters are standing in a circle, numbered clockwise from 1 to n . Initially, the i -th monster has a_i health.

You may shoot the monsters to kill them. Each shot requires exactly one bullet and decreases the health of the targeted monster by 1 (deals 1 damage to it). Furthermore, when the health of some monster i becomes 0 or less than 0, it dies and explodes, dealing b_i damage to the next monster (monster $i+1$, if $i < n$, or monster 1, if $i = n$). If the next monster is already dead, then nothing happens. If the explosion kills the next monster, it explodes too, damaging the monster after it and possibly triggering another explosion, and so on.

You have to calculate the minimum number of bullets you have to fire to kill all n monsters in the circle.

Input

The first line contains one integer T ($1 \leq T \leq 150000$) — the number of test cases.

Then the test cases follow, each test case begins with a line containing one integer n ($2 \leq n \leq 300000$) — the number of monsters. Then n lines follow, each containing two integers a_i and b_i ($1 \leq a_i, b_i \leq 10^{12}$) — the parameters of the i -th monster in the circle.

It is guaranteed that the total number of monsters in all test cases does not exceed 300000.

Output

For each test case, print one integer — the minimum number of bullets you have to fire to kill all of the monsters.

Example

input

1

3

7 15

2 14

5 3

output

6

Question 6

Omkar is playing his favorite pixelated video game, Bed Wars! In Bed Wars, there are n players arranged in a circle, so that for all j such that $2 \leq j \leq n$, player $j-1$ is to the left of the player j , and player j is to the right of player $j-1$. Additionally, player n is to the left of player 1, and player 1 is to the right of player n .

Currently, each player is attacking either the player to their left or the player to their right. This means that each player is currently being attacked by either 0, 1, or 2 other players. A key element of Bed Wars strategy is that if a player is being attacked by exactly 1 other player, then they should logically attack that player in response. If instead a player is being attacked by 0 or 2 other players, then Bed Wars strategy says that the player can logically attack either of the adjacent players.

Unfortunately, it might be that some players in this game are not following Bed Wars strategy correctly. Omkar is aware of whom each player is currently attacking, and he can talk to any amount of the n players in the game to make them instead attack another player — i. e. if they are currently attacking the player to their left, Omkar can convince them to instead attack the player to their right; if they are currently attacking the player to their right, Omkar can convince them to instead attack the player to their left.

Omkar would like all players to be acting logically. Calculate the minimum amount of players that Omkar needs to talk to so that after all players he talked to (if any) have changed which player they are attacking, all players are acting logically according to Bed Wars strategy.

Input

Each test contains multiple test cases. The first line contains the number of test cases t ($1 \leq t \leq 10^4$). The descriptions of the test cases follows.

The first line of each test case contains one integer n ($3 \leq n \leq 2 \cdot 10^5$) — the amount of players (and therefore beds) in this game of Bed Wars.

The second line of each test case contains a string s of length n . The j -th character of s is equal to L if the j -th player is attacking the player to their left, and R if the j -th player is attacking the player to their right.

It is guaranteed that the sum of n over all test cases does not exceed $2 \cdot 10^5$.

Output

For each test case, output one integer: the minimum number of players Omkar needs to talk to to make it so that all players are acting logically according to Bed Wars strategy.

It can be proven that it is always possible for Omkar to achieve this under the given constraints.

Example

input
5
4
RLRL
6
LRRRRL
8
RLLRRRLL
12
LLLLRRLRRRLL
5
RRRRR

output

0
1
1
3
2

Note

In the first test case, players 1 and 2 are attacking each other, and players 3 and 4 are attacking each other. Each player is being attacked by exactly 1 other player, and each player is attacking the player that is attacking them, so all players are already being logical according to Bed Wars strategy and Omkar does not need to talk to any of them, making the answer 0.

In the second test case, not every player acts logically: for example, player 3 is attacked only by player 2, but doesn't attack him in response. Omkar can talk to player 3 to convert the attack arrangement to LRLRRL, in which you can see that all players are being logical according to Bed Wars strategy, making the answer 1.

Question 7

The round carousel consists of n figures of animals. Figures are numbered from 1 to n in order of the carousel moving. Thus, after the n -th figure the figure with the number 1 follows. Each figure has its own type — the type of the animal corresponding to this figure (the horse, the tiger and so on). The type of animal of the i -th figure equals t_i .

The example of the carousel for $n=9$ and $t=[5,5,1,15,1,5,5,1,1]$.

You want to color each figure in one of the colors. You think that it's boring if the carousel contains two different figures (with the distinct types of animals) going one right after another and colored in the same color.

Your task is to color the figures in such a way that the number of distinct colors used is the minimum possible and there are no figures of the different types going one right after another

and colored in the same color. If you use exactly k distinct colors, then the colors of figures should be denoted with integers from 1 to k .

Input

The input contains one or more test cases.

The first line contains one integer q ($1 \leq q \leq 10^4$) — the number of test cases in the test. Then q test cases follow. One test case is given on two lines.

The first line of the test case contains one integer n ($3 \leq n \leq 2 \cdot 10^5$) — the number of figures in the carousel. Figures are numbered from 1 to n in order of carousel moving. Assume that after the n -th figure the figure 1 goes.

The second line of the test case contains n integers t_1, t_2, \dots, t_n ($1 \leq t_i \leq 2 \cdot 10^5$), where t_i is the type of the animal of the i -th figure.

The sum of n over all test cases does not exceed $2 \cdot 10^5$.

Output

Print q answers, for each test case print two lines.

In the first line print one integer k — the minimum possible number of distinct colors of figures.

In the second line print n integers c_1, c_2, \dots, c_n ($1 \leq c_i \leq k$), where c_i is the color of the i -th figure. If there are several answers, you can print any.

Example

input

```
4
5
1 2 1 2 2
6
1 2 2 1 2 2
5
1 2 1 2 3
3
10 10 10
```

output

```
2
1 2 1 2 2
2
2 1 2 1 2 1
3
2 3 2 3 1
```

1
1 1 1

Reference:

1. <https://www.geeksforgeeks.org/top-50-array-coding-problems-for-interviews/>
2. <https://www.csinfo360.com/p/array-practice-problems.html>
3. <https://www.hackerearth.com/problem/algorithm/circular-nge/>
4. https://www.codingninjas.com/codestudio/problem-details/ninja-s-circular-array_2221409
5. <https://leetcode.com/problems/circular-array-loop/> (Special problem. Interesting but can not provide it due to graph knowledge limitation)
6. <https://codeforces.com/contest/1334/problem/C>
7. <https://codeforces.com/contest/1392/problem/D>
8. <https://codeforces.com/contest/1328/problem/D>
9. <https://leetcode.com/problems/median-of-two-sorted-arrays/>