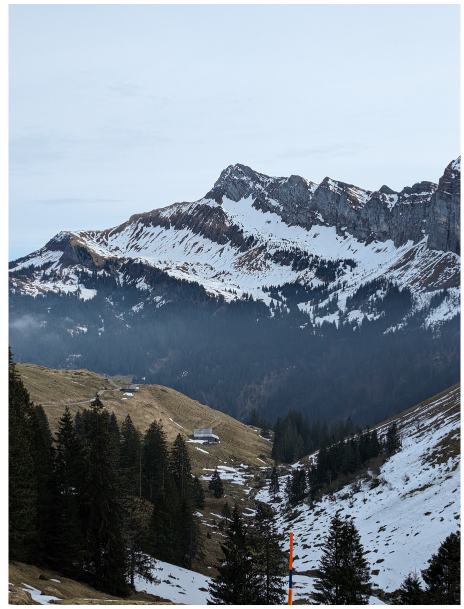
Problem C – O Passado dos Onimalaias

The Onimalaya mountain range is of great geological and anthropological importance. It is famous both for its rugged relief and for the people who lived there about 2500 years ago: the Onilonian civilisation.



The Chain Science Department (CSD) is a scientific association responsible for many geological studies. It now faces a new challenge: to reconstruct the geological and topographic history of the Onimalayas and decide whether certain regions were *mountains* or *ridges*.

For their research they have *topographic records*. A topographic record is a sequence of $\boldsymbol{N}$ non-negative integers $\boldsymbol{a_1}, \boldsymbol{a_2}, \ldots, \boldsymbol{a_N}$ representing the elevations (in metres) of some region of the Onimalayas. We know that:

- A record is a mountain if it is either of the form $1, 2, 3, \ldots, k-1, k, k-1, \ldots, 3, 2, 1$ or of the form $1, 2, 3, \ldots, k-1, k, k, k-1, \ldots, 3, 2, 1$ for some $k \geq 1$.
- A record is a ridge if it is the concatenation of the records of several mountains (note that every mountain starts and ends at height 1 metre).

Over time the terrain of the Onimalayas has been eroded, causing some areas to lose elevation. The CSD wishes to study what the relief looked like in the past.

Given a topographic record $\boldsymbol{a_1}, \boldsymbol{a_2}, \ldots, \boldsymbol{a_N}$, a *possible past record* is a sequence of $\boldsymbol{N}$ positive integers $\boldsymbol{b_1}, \boldsymbol{b_2}, \ldots, \boldsymbol{b_N}$ such that for every $1 \leq i \leq \boldsymbol{N}$ we have $\boldsymbol{a_i} \leq \boldsymbol{b_i}$. Possible past records can themselves be classified as mountains or ridges in the same way. Given one topographic record, the aim is to find a ridge that is a possible past record and minimises the sum $\boldsymbol{b_1} + \boldsymbol{b_2} + \ldots + \boldsymbol{b_N}$.

This study needs an experienced programmer's help. Unfortunately, because of government cutbacks, the CSD has no programmers left—so they have come to *you* for answers.

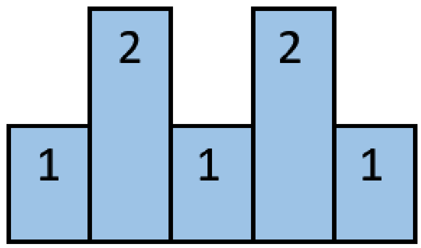
Part I

The first objective is to study the Onimalayas as they were at the start of the 20th century. Because this period is comparatively recent, there is one extra restriction: at every position, a possible past record may be at most *1 metre higher* than the current record.

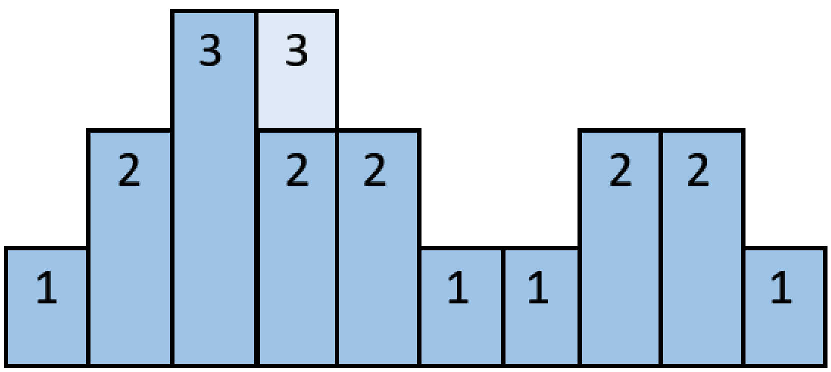
Thus, given a topographic record, output the minimum possible sum of heights of a past record that satisfies this restriction and is a ridge. If no such ridge exists, output -1.

Example

Consider the record $1, 2, 1, 2, 1$ of length 5. It is impossible to find a ridge that differs from this sequence by only 0 or 1 metres at every position.



On the other hand, for the record $1, 2, 3, 2, 2, 1, 1, 2, 2, 1$ (length 10) we can obtain $1, 2, 3, 3, 2, 1, 1, 2, 2, 1$, which is a ridge meeting all the requirements and has the minimum possible sum 18.



Constraints

The following limits hold for every test case of this part:

$1 \le \boldsymbol{N} \le 10^5$	Sequence length
$1 \le a_i \le 10^5$	Heights in the record
$1 \le T \le 5$	Number of records to analyse

The test cases for this part are divided into two groups:

Subtask	**Points**	**Additional Constraints**
1	10	$\boldsymbol{N} \le 100$
2	30	No additional constraints

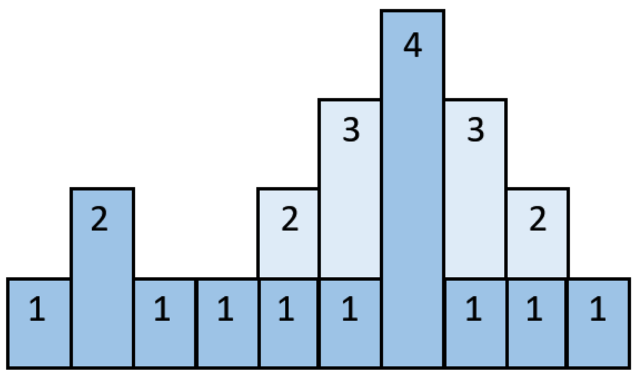
Part II

The main goal is to study what the Onimalayas looked like about 2500 years ago, during the Onilonian occupation. Given the millennia that have passed—and the floods that struck the region during that time—there is now *no upper bound* on the height difference between a topographic record and its possible past records.

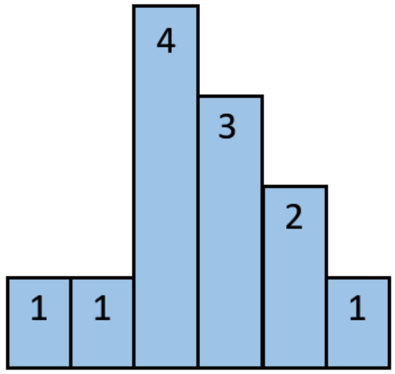
Thus, given a topographic record, output the minimum sum of heights of a possible past record that is a ridge. If no such ridge exists, output -1.

Example

For the record $1, 2, 1, 1, 1, 1, 4, 1, 1, 1$ (length 10) we can form $1, 2, 1, 1, 2, 3, 4, 3, 2, 1$—the ridge with minimal total height 20 that dominates the original record.



However, for the record $1, 1, 4, 3, 2, 1$ (length 6) it is impossible to find a ridge of length 6 that is a possible past record.



Constraints

The following limits hold for every test case of this part:

$1 \leq \boldsymbol{N} \leq 10^5$	Sequence length
$1 \leq a_i \leq 10^5$	Heights in the record
$1 \leq T \leq 5$	Number of records to analyse

The test cases for this part are divided into three groups:

Subtask	Points	Additional Constraints
3	10	$\boldsymbol{N} \leq 100$
4	20	$\boldsymbol{N} \leq 1\,000$
5	30	No additional constraints

Summary of Subtasks

All test cases are divided into five groups:

Subtask	Points	Part	Additional Constraints
1	10	Part I	$\boldsymbol{N} \leq 100$
2	30	Part I	No additional constraints
3	10	Part II	$\boldsymbol{N} \leq 100$
4	20	Part II	$\boldsymbol{N} \leq 1\,000$
5	30	Part II	No additional constraints

Input Format

The first line contains an integer $\boldsymbol{P}$ indicating the part of the problem (1 for Part I, 2 for Part II).

For both parts, the next line contains an integer $\boldsymbol{T}$, the number of test cases.

Then follow T pairs of lines, one per test case:

1. The first line has an integer N, the length of the sequence.
2. The second line contains N space-separated integers $a_1, a_2, \ldots, a_N$ — the topographic record.

Output Format

Part I

Output T lines, each with a single integer: the minimum possible sum of heights of a ridge that is a past record differing by at most 1 metre at every position. If no ridge exists, output -1.

Part II

Output T lines, each with a single integer: the minimum possible sum of heights of a ridge that is a past record. If no ridge exists, output -1.

Example 1 Input

```
1
2
5
1 2 1 2 1
10
1 2 3 2 2 1 1 2 2 1
```

Example 1 Output

```
-1
18
```

Example 1 Description

This example corresponds to the example from Part I in the statement.

Example 2 Input

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

Example 2 Output

```
20
-1
```

Example 2 Description

This example corresponds to the example from Part II in the statement.

Example 3 Input

```
1
3
13
1 2 2 4 3 2 1 1 2 3 2 2 1
27
1 1 2 3 5 5 6 8 6 6 4 4 2 2 1 1 2 2 4 4 3 1 1 1 2 2 1
28
1 1 2 1 1 1 1 2 3 1 5 5 7 7 7 4 4 4 3 1 1 1 1 1 1 1 1 1
```

Example 3 Output

```
28
90
-1
```

Example 4 Input

```
2
3
23
1 2 3 2 3 4 4 1 2 3 3 1 1 1 1 2 1 1 1 1 2 1 1
24
1 2 1 2 2 7 5 3 2 7 2 2 1 3 3 2 1 1 1 1 1 3 2 1
25
1 1 2 2 1 3 2 3 2 1 1 1 1 2 3 1 1 1 2 1 1 1 1 2 1
```

Example 4 Output

```
61
-1
47
```