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RESPECTABLE

## Peaks

START

Divide an array into the maximum number of same-sized blocks, each of which should contain an index  $P$  such that  $A[P - 1] < A[P] > A[P + 1]$ .

Programming language: C++ ▼

A non-empty zero-indexed array  $A$  consisting of  $N$  integers is given.

A *peak* is an array element which is larger than its neighbors. More precisely, it is an index  $P$  such that  $0 < P < N - 1$ ,  $A[P - 1] < A[P]$  and  $A[P] > A[P + 1]$ .

For example, the following array  $A$ :

```
A[0] = 1
A[1] = 2
A[2] = 3
A[3] = 4
A[4] = 3
A[5] = 4
A[6] = 1
A[7] = 2
A[8] = 3
A[9] = 4
A[10] = 6
A[11] = 2
```

has exactly three peaks: 3, 5, 10.

We want to divide this array into blocks containing the same number of elements. More precisely, we want to choose a number  $K$  that will yield the following blocks:

- $A[0], A[1], \dots, A[K - 1]$ ,
- $A[K], A[K + 1], \dots, A[2K - 1]$ ,
- ...
- $A[N - K], A[N - K + 1], \dots, A[N - 1]$ .

What's more, every block should contain at least one peak. Notice that extreme elements of the blocks (for example  $A[K - 1]$  or  $A[K]$ ) can also be peaks, but only if they have both

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neighbors (including one in an adjacent blocks).

The goal is to find the maximum number of blocks into which the array A can be divided.

Array A can be divided into blocks as follows:

- one block (1, 2, 3, 4, 3, 4, 1, 2, 3, 4, 6, 2). This block contains three peaks.
- two blocks (1, 2, 3, 4, 3, 4) and (1, 2, 3, 4, 6, 2). Every block has a peak.
- three blocks (1, 2, 3, 4), (3, 4, 1, 2), (3, 4, 6, 2). Every block has a peak. Notice in particular that the first block (1, 2, 3, 4) has a peak at A[3], because  $A[2] < A[3] > A[4]$ , even though A[4] is in the adjacent block.

However, array A cannot be divided into four blocks, (1, 2, 3), (4, 3, 4), (1, 2, 3) and (4, 6, 2), because the (1, 2, 3) blocks do not contain a peak. Notice in particular that the (4, 3, 4) block contains two peaks: A[3] and A[5].

The maximum number of blocks that array A can be divided into is three.

Write a function:

```
int solution(vector<int> &A);
```

that, given a non-empty zero-indexed array A consisting of N integers, returns the maximum number of blocks into which A can be divided.

If A cannot be divided into some number of blocks, the function should return 0.

For example, given:

```
A[0] = 1
A[1] = 2
A[2] = 3
A[3] = 4
A[4] = 3
A[5] = 4
A[6] = 1
A[7] = 2
A[8] = 3
A[9] = 4
A[10] = 6
A[11] = 2
```

the function should return 3, as explained above.

Assume that:

## Future training

- N is an integer within the range [1..100,000];
- each element of array A is an integer within the range [0..1,000,000,000].

## Complexity:

- expected worst-case time complexity is  $O(N \cdot \log(\log(N)))$ ;
- expected worst-case space complexity is  $O(N)$ , beyond input storage (not counting the storage required for input arguments).

Elements of input arrays can be modified.

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