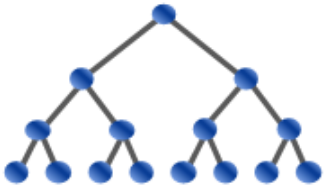

USACO 2022 US Open Contest, Platinum
Problem 1. 262144 Revisited

Return to Problem List

Contest has ended.

Log in to allow submissions in analysis mode

English (en)

Bessie likes downloading games to play on her cell phone, even though she does find the small touch screen rather cumbersome to use with her large hooves.

She is particularly intrigued by the current game she is playing. The game starts with a sequence of N positive integers $a_1, a_2, \ldots, a_N$ ($2 \le N \le 262,144$), each in the range $1 \ldots 10^6$. In one move, Bessie can take two adjacent numbers and replace them with a single number equal to one greater than the maximum of the two (e.g., she might replace an adjacent pair $(5, 7)$ with an 8). The game ends after $N - 1$ moves, at which point only a single number remains. The goal is to *minimize* this final number.

Bessie knows that this game is too easy for you. So your job is not just to play the game optimally on a, but for every contiguous subsequence of a.

Output the sum of the minimum possible final numbers over all $\frac{N(N+1)}{2}$ contiguous subsequences of a.

INPUT FORMAT (input arrives from the terminal / stdin):

First line contains N.

The next line contains N space-separated integers denoting the input sequence.

OUTPUT FORMAT (print output to the terminal / stdout):

A single line containing the sum.

SAMPLE INPUT:

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

SAMPLE OUTPUT:

```
115
```

There are $\frac{6 \cdot 7}{2} = 21$ contiguous subsequences in total. For example, the minimum possible final number for the contiguous subsequence $[1, 3, 1, 2, 1]$ is 5, which can be obtained via the following sequence of operations:

```
original    -> [1,3,1,2,1]
combine 1&3 -> [4,1,2,1]
combine 2&1 -> [4,1,3]
combine 1&3 -> [4,4]
combine 4&4 -> [5]
```

Here are the minimum possible final numbers for each contiguous subsequence:

```
final(1:1) = 1
final(1:2) = 4
final(1:3) = 5
final(1:4) = 5
final(1:5) = 5
final(1:6) = 11
final(2:2) = 3
final(2:3) = 4
```

```
final(2:4) = 4
final(2:5) = 5
final(2:6) = 11
final(3:3) = 1
final(3:4) = 3
final(3:5) = 4
final(3:6) = 11
final(4:4) = 2
final(4:5) = 3
final(4:6) = 11
final(5:5) = 1
final(5:6) = 11
final(6:6) = 10
```

SCORING:

- Test cases 2-3 satisfy $N \leq 300$.
- Test cases 4-5 satisfy $N \leq 3000$.
- In test cases 6-8, all values are at most 40.
- In test cases 9-11, the input sequence is non-decreasing.
- Test cases 12-23 satisfy no additional constraints.

Problem credits: Benjamin Qi

Contest has ended. No further submissions allowed.