DMOPC '20 Contest 4 P4 - Javelin Throwing

Time limit: 2.0s **Memory limit:** 512M

Alice is training for an upcoming javelin-throwing competition! The javelin-throwing field can be modelled as a 1-D line, with Alice standing at the coordinate 0.

Alice throws N javelins in the positive direction. When she throws a javelin, it lands at some real-valued point on the field, making a hole there. It's possible for the javelin to land exactly in a previously made hole, in which case no new hole is made. Holes are permanent, and there are initially no holes in the field.

Right after the i^{th} throw, Alice counts a_i and b_i, the number of holes strictly behind and strictly in front of the javelin she just threw (respectively). She then tells you a_i. You don't know anything else about her throws.

Given the information you have right after the i^{th} throw, what is the minimum possible value of $\sum_{j=1}^{i} b_j$?

Constraints

$0 \leq a_i < i$

Subtask 1 [15%]

$1 \leq N \leq 5000$

Subtask 2 [85%]

$1 \leq N \leq 2 \times 10^6$

Input Specification

The first line contains an integer N, the number of throws.

The second line contains N space-separated integers, $a_1, a_2, \ldots, a_N$.

Output Specification

Output N space-separated integers. The i^{th} integer should be the minimum possible value of $\sum_{j=1}^{i} b_j$, given that you know a_1 through a_i.

Sample Input 1

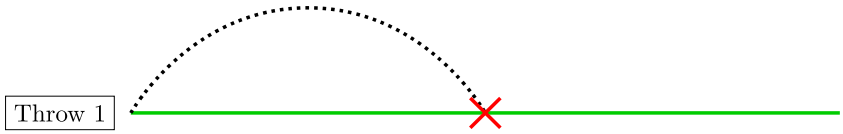
```
3
0 0 2
```

Sample Output 1

```
0 0 1
```

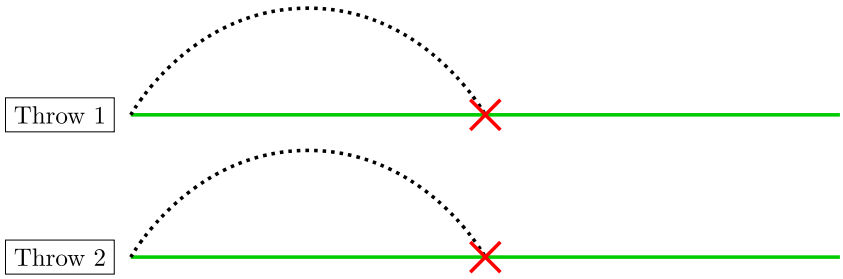
Explanation for Sample 1

There are no holes in front of throw 1:



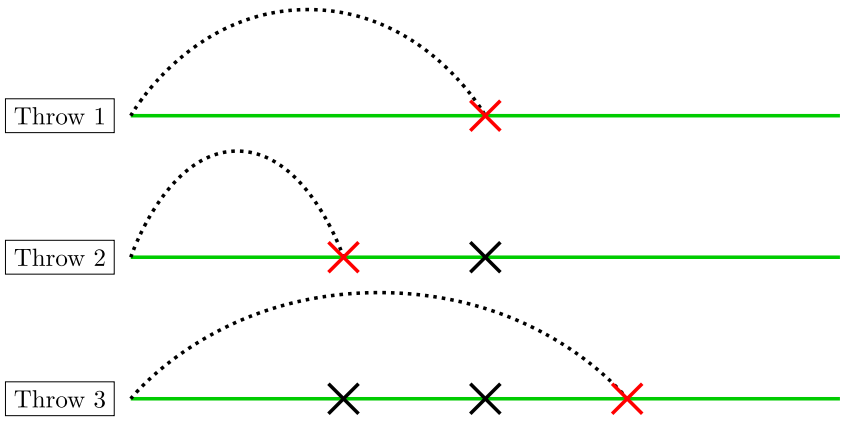
So the first answer is 0.

On throw 2, you know that $a_1 = a_2 = 0$. It's possible that both throws landed at exactly the same point, in which case there would be no holes in front of either throw:



So the second answer is $0 + 0 = 0$.

However, you then learn that there were 2 holes behind throw 3. So the second throw must have landed behind the first, and the only solution would be



for an answer of $0 + 1 + 0 = 1$.

Sample Input 2

```
6
0 1 0 3 0 2
```

Sample Output 2

```
0 0 1 2 5 6
```

Sample Input 3

```
5
0 1 2 1 2
```

Sample Output 3

```
0 0 0 1 1
```