

## F2. Cycling (Hard Version)

time limit per test: 5 seconds

memory limit per test: 1024 megabytes

This is the hard version of the problem. The difference between the versions is that in this version,  $1 \leq n \leq 10^6$  and you need to output the answer for each prefix. You can hack only if you solved all versions of this problem.

Leo works as a programmer in the city center, and his lover teaches at a high school in the suburbs. Every weekend, Leo would ride his bike to the suburbs to spend a nice weekend with his lover.

There are  $n$  cyclists riding in front of Leo on this road right now. They are numbered  $1, 2, \dots, n$  from front to back. Initially, Leo is behind the  $n$ -th cyclist. The  $i$ -th cyclist has an agility value  $a_i$ .

Leo wants to get ahead of the 1-st cyclist. Leo can take the following actions as many times as he wants:

- Assuming that the first person in front of Leo is cyclist  $i$ , he can go in front of cyclist  $i$  for a cost of  $a_i$ . This puts him behind cyclist  $i - 1$ .
- Using his super powers, swap  $a_i$  and  $a_j$  ( $1 \leq i < j \leq n$ ) for a cost of  $(j - i)$ .

Leo wants to know the minimum cost to get in front of the 1-st cyclist.

In addition, he wants to know the answer for each  $1 \leq i \leq n$ ,  $[a_1, a_2, \dots, a_i]$  as the original array. The problems of different  $i$  are independent. To be more specific, in the  $i$ -th problem, Leo starts behind the  $i$ -th cyclist instead of the  $n$ -th cyclist, and cyclists numbered  $i + 1, i + 2, \dots, n$  are not present.

### Input

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

The first line of each test case contains a positive integer  $n$  ( $1 \leq n \leq 10^6$ ), representing the number of the cyclists.

The second line of each test case contains  $n$  integers  $a_1, \dots, a_n$  ( $1 \leq a_i \leq 10^9$ ).

It is guaranteed that the sum of  $n$  over all test cases does not exceed  $10^6$ .

### Output

For each test case, print  $n$  integers, the answers for the array  $[a_1, a_2, \dots, a_i]$  for each  $i = 1, 2, \dots, n$  in this order.

### Example

input	Copy
4	
3	
1 2 4	
4	
1 1 1 1	
2	
1 2	
4	
4 1 3 2	
output	Copy
1 3 7	
1 2 3 4	
1 3	
4 3 6 8	

### Note

In the first test case, one possible way to move from the position behind the  $n$ -th cyclist to the position in front of the 1-st cyclist is:

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- Leo swaps  $a_2$  ( $i = 2$ ) and  $a_3$  ( $j = 3$ ), then the array becomes  $[1, 4, 2]$ ; it costs  $j - i = 3 - 2 = 1$ .
- Leo is behind the 3-rd cyclist and moves behind the 2-nd cyclist; it costs  $a_3 = 2$ .
- Leo swaps  $a_1$  ( $i = 1$ ) and  $a_2$  ( $j = 2$ ), then the array becomes  $[4, 1, 2]$ ; it costs  $j - i = 2 - 1 = 1$ .
- Leo is behind the 2-nd cyclist and moves behind the 1-st cyclist; it costs  $a_2 = 1$ .
- Leo swaps  $a_1$  ( $i = 1$ ) and  $a_2$  ( $j = 2$ ), then the array becomes  $[1, 4, 2]$ ; it costs  $j - i = 2 - 1 = 1$ .
- Leo moves ahead of the 1-st cyclist; it costs  $a_1 = 1$ .

So the total cost is  $1 + 2 + 1 + 1 + 1 + 1 = 7$ . It can be proved that 7 is the minimum cost.

In the second test case, to move ahead of the 1-st cyclist from the position behind the  $n$ -th cyclist, Leo should not swap anyone's agility value. The total cost is  $1 + 1 + 1 + 1 = 4$ .

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