

## Problem D: Do Make Segment Tree

- Time Limit: 2 sec

### Problem Statement

Given an integer sequence  $B = (B_1, B_2, \dots, B_{2^N-1})$  of length  $2^N - 1$ , define  $f(B)$  as follows:

- $f(B)$  is the minimum number of operations required to make the following condition true:
  - **Operation:** Choose one integer  $i$  such that  $1 \leq i \leq 2^N - 1$ , and either increase  $B_i$  by 1 or decrease  $B_i$  by 1.
  - **Condition:** For all  $i$  where  $1 \leq i \leq 2^{N-1} - 1$ , the condition  $B_i = B_{2i} + B_{2i+1}$  should be satisfied.

You are given a sequence  $A = (A_1, A_2, \dots, A_{2^N-1})$  of length  $2^N - 1$ .

Process  $Q$  queries. For each query  $i$  (where  $1 \leq i \leq Q$ ):

- Given integers  $x_i$  and  $v_i$ , update  $A_{x_i}$  to  $v_i$  and then output  $f(A)$ .

### Input

The input is given in the following format:

$N$   
 $A_1 \ A_2 \ \dots \ A_{2^N-1}$   
 $Q$   
 $x_1 \ v_1$   
 $x_2 \ v_2$   
 $\vdots$   
 $x_Q \ v_Q$

- $2 \leq N \leq 18$
- $1 \leq Q \leq 100,000$
- $-10^9 \leq A_i \leq 10^9$
- $1 \leq x_i \leq 2^N - 1$
- $-10^9 \leq v_i \leq 10^9$
- All input values are integers.

### Output

Output  $Q$  lines. On the  $i$ -th line, output the answer for the  $i$ -th query.

Sample Input	Sample Output
3 2 3 0 1 -5 2 1 5 3 1 5 3 6 -1 5 1 1 0	9 5 3 2 4