

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	9
2 3 0 1 -5 2 1	5
5	3
3 1	2
5 3	4
6 -1	
5 1	
1 0	