Problem D. Deal With Sequence

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	1024 mebibytes

Consider an integer sequence $b = (b_1, b_2, \ldots, b_{2^n-1})$ of length $2^n - 1$.

Let $f(b)$ be the minimum number of operations required to make the following condition true:

- Operation: Choose one integer i such that $1 \le i \le 2^n - 1$, and either increase or decrease b_i by 1.
- Condition: For all i where $1 \le i \le 2^{n-1} - 1$, the equality $b_i = b_{2i} + b_{2i+1}$ must hold.

You are given a sequence $a = (a_1, a_2, \ldots, a_{2^n-1})$ of length $2^n - 1$. Process q queries. For each query i (where $1 \le i \le q$): given integers x_i and v_i, make a_{x_i} equal to v_i and then output $f(a)$.

The changes to the sequence persist between queries. For example, the second query deals with the sequence changed by $a_{x_1} \leftarrow v_1$ and then by $a_{x_2} \leftarrow v_2$.

Input

The first line of the input contains a single integer n ($2 \le n \le 18$).

The second line contains $2^n - 1$ integers: the sequence a ($-10^9 \le a_i \le 10^9$).

The third line contains a single integer q: the number of queries ($1 \le q \le 10^5$).

Each of the following q lines contains two integers x_i and v_i: the parameters of the i-th query ($1 \le x_i \le 2^n - 1$, $-10^9 \le v_i \le 10^9$).

Output

Print q lines. On the i-th line, print the answer for the i-th query.

Example

standard input	*standard 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