D. Ralph And His Tour in Binary Country

time limit per test: 2.5 seconds
memory limit per test: 512 megabytes
input: standard input
output: standard output

Ralph is in the Binary Country. The Binary Country consists of n cities and $(n - 1)$ bidirectional roads connecting the cities. The roads are numbered from 1 to $(n - 1)$, the i-th road connects the city labeled (here $\lfloor x \rfloor$ denotes the x rounded down to the nearest integer) and the city labeled $(i + 1)$, and the length of the i-th road is L_i.

Now Ralph gives you m queries. In each query he tells you some city A_i and an integer H_i. He wants to make some tours starting from this city. He can choose any city in the Binary Country (including A_i) as the terminal city for a tour. He gains happiness $(H_i - L)$ during a tour, where L is the distance between the city A_i and the terminal city.

Ralph is interested in tours from A_i in which he can gain positive happiness. For each query, compute the sum of happiness gains for all such tours.

Ralph will never take the same tour twice or more (in one query), he will never pass the same city twice or more in one tour.

Input

The first line contains two integers n and m ($1 \le n \le 10^6$, $1 \le m \le 10^5$).

$(n - 1)$ lines follow, each line contains one integer L_i ($1 \le L_i \le 10^5$), which denotes the length of the i-th road.

m lines follow, each line contains two integers A_i and H_i ($1 \le A_i \le n$, $0 \le H_i \le 10^7$).

Output

Print m lines, on the i-th line print one integer — the answer for the i-th query.

Examples

input
2 2 5 1 8 2 4

output
11 4

input
6 4 2 1 1 3 2 2 4 1 3 3 2 1 7

output
11 6 3 28

Note

Here is the explanation for the second sample.

Ralph's first query is to start tours from city 2 and H_i equals to 4. Here are the options:

- He can choose city 5 as his terminal city. Since the distance between city 5 and city 2 is 3, he can gain happiness $4 - 3 = 1$.
- He can choose city 4 as his terminal city and gain happiness 3.
- He can choose city 1 as his terminal city and gain happiness 2.
- He can choose city 3 as his terminal city and gain happiness 1.
- Note that Ralph can choose city 2 as his terminal city and gain happiness 4.
- Ralph won't choose city 6 as his terminal city because the distance between city 6 and city 2 is 5, which leads to negative happiness for Ralph.

So the answer for the first query is $1 + 3 + 2 + 1 + 4 = 11$.