USACO 2023 February Contest, Gold
Problem 2. Fertilizing Pastures

There are N pastures ($2 \le N \le 2 \cdot 10^5$), connected by $N - 1$ roads, such that they form a tree. Every road takes 1 second to cross. Each pasture starts out with 0 grass, and the ith pasture's grass grows at a rate of a_i ($1 \le a_i \le 10^8$) units per second. Farmer John is in pasture 1 at the start, and needs to drive around and fertilize the grass in every pasture. If he visits a pasture with x units of grass, it will need x amount of fertilizer. A pasture only needs to be fertilized the first time it is visited, and fertilizing a pasture takes 0 time.

The input contains an additional parameter $T \in \{0, 1\}$.

- If $T = 0$, Farmer John must end at pasture 1.
- If $T = 1$, Farmer John may end at any pasture.

Compute the minimum amount of time it will take to fertilize every pasture and the minimum amount of fertilizer needed to finish in that amount of time.

INPUT FORMAT (input arrives from the terminal / stdin):

The first line contains N and T.

Then for each i from 2 to N, there is a line containing p_i and a_i, meaning that there is a road connecting pastures p_i and i. It is guaranteed that $1 \le p_i < i$.

OUTPUT FORMAT (print output to the terminal / stdout):

The minimum amount of time and the minimum amount of fertilizer, separated by spaces.

SAMPLE INPUT:

```
5 0
1 1
1 2
3 1
3 4
```

SAMPLE OUTPUT:

```
8 21
```

The optimal route for Farmer John is as follows:

- At time 1, move to node 3, which now has $1 \cdot 2 = 2$ grass and so needs 2 fertilizer.
- At time 2, move to node 5, which now has $2 \cdot 4 = 8$ grass and so needs 8 fertilizer.
- At time 3, move back to node 3, which we already fertilized and so don't need to fertilize again.
- At time 4, move to node 4, which now has $4 \cdot 1 = 4$ grass and so needs 4 fertilizer.
- At time 5, move back to node 3, which we already fertilized.
- At time 6, move back to node 1.
- At time 7, move to node 2, which now has $7 \cdot 1 = 7$ grass and so needs 7 fertilizer.

- At time 8, return to node 1.

This route takes 8 time and uses $2 + 8 + 4 + 7 = 21$ fertilizer. It can be shown that 8 is the least possible amount of time for any route that returns to node 1 at the end and 21 is the least possible fertilizer used for any route that returns to node 1 and takes 8 time.

SAMPLE INPUT:

```
5 1
1 1
1 2
3 1
3 4
```

SAMPLE OUTPUT:

```
6 29
```

The optimal route for Farmer John is as follows:

- At time 1, move to node 2, which now has $1 \cdot 1 = 1$ grass and so needs 1 fertilizer.
- At time 2, move back to node 1.
- At time 3, move to node 3, which now has $3 \cdot 2 = 6$ grass and so needs 6 fertilizer.
- At time 4, move to node 5, which now has $4 \cdot 4 = 16$ grass and so needs 16 fertilizer.
- At time 5, move back to node 3, which we already fertilized and so don't need to fertilize again.
- At time 6, move to node 4, which now has $6 \cdot 1 = 6$ grass and so needs 6 fertilizer.

This route takes 6 time and uses $1 + 6 + 16 + 6 = 29$ fertilizer. It can be shown that 6 is the least possible amount of time for any route and 29 is the least possible fertilizer used for any route that takes 6 time.

SCORING:

- Inputs 3-10: $T = 0$
- Inputs 11-22: $T = 1$
- Inputs 3-6 and 11-14: No pasture is adjacent to more than three roads.

Problem credits: Rohin Garg

Contest has ended. No further submissions allowed.