

## Task Skijanje

Skier Mia spent a day at an unusual ski resort. The resort consists of  $n$  apres-ski locations (hereafter: apres) connected by slopes such that they form a connected tree rooted at the apres labeled 1. Each slope is directed from the apres with a smaller number to the apres with a larger number.

The tree is defined as follows: for each apres  $i > 1$ , it is known from which apres  $p_i$  ( $p_i < i$ ) one arrives at it, i.e., its parent in the tree is known. This uniquely determines all slopes (slope  $i$  leads to the apres labeled  $i$ ).



During the day, Mia skied each slope exactly once and for each slope remembered its fun factor  $z_i$  and speed  $b_i$ .

At the end of the day, Mia wants to ski down once more. Since Mia is very tired from skiing all day, she will choose a run consisting of at most  $k$  consecutive slopes. The run must follow the direction of the slopes (from apres with smaller numbers to those with larger numbers). After finishing the run, a helicopter will pick her up and take her home.

For any chosen run, we define its hecticness as follows. Let:

- $z_{\text{first}}$  be the fun factor of the first slope in the run
- $z_{\text{last}}$  be the fun factor of the last slope in the run
- $b_i$  be the speeds of all slopes in that run

Then the hecticness of the run is:  $z_{\text{last}} \cdot (z_{\text{last}} + \sum b_i) + z_{\text{first}}^2$ . In the case  $k = 1$ , the formula remains unchanged, and  $\text{first} = \text{last}$  holds.

Your task is to determine the maximum hecticness of a run that Mia can ski.

### Input

The first line contains natural numbers  $n, k$  ( $1 \leq k \leq n \leq 3 \cdot 10^5$ ), as described in the problem statement.

The second line contains  $n - 1$  integers, where the  $i$ -th number represents from which apres one can reach the apres labeled  $i + 1$  ( $1 \leq p_i \leq i$ ).

The third line contains  $n - 1$  integers, where the  $i$ -th number represents the fun factor of the  $(i + 1)$ -th slope ( $1 \leq z_i \leq 10^5$ ).

The fourth line contains  $n - 1$  integers, where the  $i$ -th number represents the speed of the  $(i + 1)$ -th slope ( $-10^5 \leq b_i \leq 10^5$ ).

### Output

In the first and only line, output a single number - the maximum hecticness of a run that Mia can ski.

### Scoring

Subtask	Points	Constraints
1	14	$n \leq 1000$
2	23	For each $1 \leq i < n$ it will hold that $z_i = 1$ and $b_i > 1$ .
3	35	$n \leq 50000$
4	38	No additional constraints.



## Examples

**input**

```
5 1
1 2 2 1
5 4 8 7
6 3 9 3
```

**output**

```
200
```

**input**

```
9 2
1 2 1 1 4 3 6 5
1 3 7 8 4 1 8 2
1 -7 -1 -6 3 8 -1 6
```

**output**

```
120
```

**Clarification of the first example:** Since  $k = 1$ , it follows that the maximum hecticness of a run is equal to the maximum hecticness among the individual slopes. The slopes have hecticness values of 80, 44, 200, and 119. The maximum hecticness is 200.