



## Problem Jump Civilization

Input file        `stdin`  
Output file      `stdout`

“Here in ~~Parkour~~ Jump Civilization, No  
One Chooses to Jump for the Beef”

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Evbo — Parkour Civilization, the movie

In jump civilization, the world consists of  $N$  floating islands, numbered 1 to  $N$ . When at island  $i$  (for  $1 \leq i < N$ ), the members of jump civilization can either take:

- an easy jump, from island  $i$  to island  $i + 1$ ; or
- a difficult jump, from island  $i$  to island  $v_i$ , where  $i < v_i \leq N$ .

In order to rank up in jump civilization, the members of jump civilization need to compute the “jumping power” of each island. The jumping power of island  $i$  is the number of islands which can be reached by starting at island  $i$  and using at most  $K$  jumps.

The previous Jump Champion, wanting to make sure that the jumping course is fair, instituted the following important rule: “Whenever  $1 \leq i < j \leq N$ , either  $v_i \leq j$  or  $v_j \leq v_i$ .”

You, as an aspiring member of jump civilization, want to find the jumping power of every island — can you do this efficiently?

### Input data

The first line of the input contains two space-separated integers  $N, K$ . The second line of the input contains  $N - 1$  space-separated integers  $v_1, \dots, v_{N-1}$ .

### Output data

Output  $N$  space-separated integers, the jumping power of the islands in order.

### Restrictions

- $1 \leq N \leq 300\,000$
- $1 \leq K \leq N - 1$
- $i < v_i \leq N$
- For  $1 \leq i < j \leq N$ , either  $v_i \leq j$  or  $v_j \leq v_i$ .
- If island  $j$  can be reached from island  $i$  in two different ways using at most  $K$  jumps, then the island is only counted once for the jumping power of island  $i$ .
- When computing the jumping power of an island, it doesn’t matter whether we use easy or difficult jumps — only the number of jumps matters.



#	Points	Restrictions
1	6	$N \leq 2\,000$
2	27	$N \leq 100\,000$ and $K \leq 50$
3	11	$v_i \leq i + 2$ for $1 \leq i < N$
4	37	$N \leq 100\,000$
5	19	No further restrictions.

### Examples

Input file	Output file	Explanations
5 1 4 3 4 5	3 2 2 2 1	From island 1, one can reach island 1 without jumping, and islands 2 and 4 with 1 jump. In total, the jumping power of island 1 is 3.
6 2 2 3 5 5 6	3 4 4 3 2 1	