Parentheses Tree

Problem Background

Here's the definition of a **legal parentheses string** :

1. '()' is a legal parentheses string.
2. If 'A' is a legal parentheses string, then '(A)' is a legal parentheses string
3. If 'A' and 'B' are legal parentheses strings, then 'AB' is a legal parentheses string.

Here's the definition of a **substring** and a **different substring**:

1. A substring of a string 'S' is a string of **consecutive** characters in 'S'. The substring of 'S' could be represented by the start l and the end r, denoted as S (l, r) ($1 \le l \le r \le |S|$, $|S|$ represents the length of S).
2. Two substrings of 'S' are considered different **if and only if** they have different positions in 'S', i.e., different l or different r.

Problem Description

A tree of size n contains n nodes and n−1 edges, each edge connecting two nodes, and there is **only** one simple path between any two nodes that is reachable to each other.

Q is a curious child. One day he met a tree of size n on his way to school. The nodes on the tree are numbered from 1 to n, and node 1 is the root of the tree. Except for node 1, each node has a father node, the father of node u ($2 \le u \le n$) is node f_u ($1 \le f_u < u$).

Q finds that each node in the tree has **exactly** one parenthesis, which may be '(' or ')'. Q defines s_i as: a string of parentheses along a simple path from the root node to node i, in the order of passing the node.

Obviously, s_i is a parentheses string, but not necessarily a legal parentheses string, so now Q wants to find out for all i ($1 \le i \le n$), how many **distinct substrings** of s_i are **legal parentheses strings**.

Q is not able to answer this question, so he has to ask you for help. Let s_i have a total of k_i distinct substrings which are legal parenthesis strings, you just need to tell Q the xor sum of all $i \times k_i$, i.e.:

$(1 \times k_1)$ xor $(2 \times k_2)$ xor $(3 \times k_3)$ xor...xor $(n \times k_n)$

Where xor is the exclusive OR operation.

Input

The first line is an integer n, representing the size of the tree.

The second line is a string of parentheses of length n, made up of '(' and ')', with the i^{th} parentheses representing the parentheses on node i.

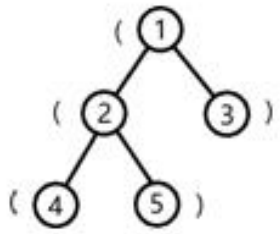
The third line contains n−1 integers, with the i^{th} ($1 \le i < n$) integer representing the number of the father of node i+1, f_{i+1}.

Output
Just one line which contains one integer for the answer.

Sample Input
5
(()()
1 1 2 2

Sample Output
6

Hint
[Explanation of Sample 1]
The shape of the tree is as the following figure:



The string formed by the parentheses from the root node to node 1 in an order of passing is '(', and the number of substrings that are legal parenthesis strings is 0.

The string from the root node to node 2 is '((', and the number of substrings that are legal parenthesis strings is 0.

The string from the root node to node 3 is '()', and the number of substrings that are legal parenthesis strings is 1.

The string from the root node to node 4 is '(((', and the number of substrings that are legal parenthesis strings is 0.

The string from the root node to node 5 is '(()' and the number of substrings that are legal parenthesis strings is 1.

[Data Range]

Test Point	$n \leq$	Special Qualities
$1 \sim 2$	8	$f_i = i - 1$
$3 \sim 4$	200	
$5 \sim 7$	2000	
$8 \sim 10$		None
$11 \sim 14$	10^5	$f_i = i - 1$
$15 \sim 16$		None
$17 \sim 20$	5×10^5	