



Task Palindromi

You are given a sequence of n characters 0 or 1, indexed by numbers $1, 2, \dots, n$. Initially every character represents a string of length one. During a *concatenation* two words a and b are chosen, deleted, and replaced by the string ab such that the characters of b are written after the characters of a .

The n initial strings are concatenated to one final string using a sequence of $n - 1$ concatenations. The i -th of those concatenation is described by a pair of indexes (a_i, b_i) , which denotes that the string containing a_i -th character and the string containing b_i -th character are to be concatenated. It is guaranteed that characters with indexes a_i and b_i are not in the same string.

Palindromic value of some string w is defined as the total number of unique substrings of w which are palindromes. We define palindromes as strings that are the same when read left to right and right to left. A substring of a string is defined as a string obtained by erasing zero or more characters from the beginning and/or ending of the string.

For every concatenation print the palindromic value of the resulting string.

Input

The first line contains an integer n ($1 \leq n \leq 100\,000$), number of characters.

In the second line there is a string of n characters 0 and 1 which represent the initial strings.

The i -th of following $n - 1$ lines contains two integers a_i i b_i ($1 \leq a_i, b_i \leq n$, $a_i \neq b_i$) representing the i -th concatenation.

Output

Print $n - 1$ lines, the palindromic values of words obtained after each concatenation.

Scoring

Subtask	Points	Constraints
1	10	$1 \leq n \leq 100$.
2	20	$1 \leq n \leq 1000$.
3	30	$a_i = 1$, $b_i = i + 1$ for all $i = 1, 2, \dots, n - 1$.
4	50	No additional constraints.



Examples

input

3
010
1 2
2 3

output

2
3

input

5
00111
4 1
1 5
2 1
3 1

output

2
3
4
5

input

8
10010000
7 5
4 2
3 6
1 3
6 8
5 3
1 2

output

2
2
2
3
4
6
8

Clarification of the third example:

Newly created strings after every concatenation are: 00, 10, 00, 100, 1000, 001000 and 00100010. Their respective palindromic values are given in the example output. E. g. the palindromic value of 00100010 is 8 because the string contains 8 palindromic substring: 0, 00, 000, 10001, 0100010, 1, 010 i 00100.