Task Palindromi

You are given a sequence of n characters `0` or `1`, indexed by numbers $1, 2, \ldots, n$. 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 $i = 1, 2, \ldots, n-1$.
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`.