Problem N. Zebra Crossing

Input file: `standard input`
Output file: `standard output`

In front of Yuki is a strange zebra crossing.

This zebra crossing can be viewed as a tree with n nodes. The i-th edge connects node u_i and node v_i. Each node is colored either black or white, described by a binary string s of length n:

- If $s_i = \texttt{0}$, the color of node i is black.
- If $s_i = \texttt{1}$, the color of node i is white.

Yuki has a jumping ability k, which means that when she is at node x, she can jump to any node y such that $\text{dist}(x, y) \le k$. Here, $\text{dist}(x, y)$ denotes the number of edges on the simple path between node x and node y.

Next, Yuki will perform $n - 1$ rounds of jumping on the zebra crossing. In the i-th round, Yuki starts at node 1 and wants to reach node $i + 1$ through a sequence of jumps. At the same time, Yuki wants to minimize the number of times she lands on a black node after her jumps.

You need to help Yuki find the minimum number of times she lands on a black node for each round of jumping.

Input

This problem contains multiple test cases.

The first line contains a positive integer t ($1 \le t \le 10^5$), representing the number of test cases.

For each test case:

- The first line contains two positive integers n, k ($1 \le n \le 5 \cdot 10^5,\ 1 \le k \le n$).
- The second line contains a binary string s of length n ($s_i \in \{\texttt{0}, \texttt{1}\}$).
- The next $n - 1$ lines each contain two positive integers u_i, v_i ($1 \le u_i, v_i \le n,\ u_i \ne v_i$).

It is guaranteed that the sum of n over all test cases does not exceed $5 \cdot 10^5$.

Output

For each test case, output a single line containing $n - 1$ integers, where the i-th integer represents the minimum number of times Yuki lands on a black node during the i-th round of jumping.

Example

standard input	standard output
2 5 1 01010 3 5 2 1 1 3 3 4 9 3 100010000 1 2 2 3 2 4 3 5 3 6 4 7 6 8 7 9	0 1 1 2 1 1 1 0 1 1 1 2

Note

For the first test case:

- For the 1-st round of jumping, one valid sequence of visited nodes is $1, 2$.
- For the 4-th round of jumping, one valid sequence of visited nodes is $1, 3, 5$.

For the second test case:

- For the 4-th round of jumping, one valid sequence of visited nodes is $1, 5$.
- For the 7-th round of jumping, one valid sequence of visited nodes is $1, 5, 8$.
- For the 8-th round of jumping, one valid sequence of visited nodes is $1, 4, 9$.