

E. Kia Bakes a Cake

time limit per test: 6 seconds
memory limit per test: 512 megabytes

You are given a binary string s of length n and a tree T with n vertices. Let k be the number of 1s in s . We will construct a complete undirected weighted graph with k vertices as follows:

- For each $1 \leq i \leq n$ with $s_i = 1$, create a vertex labeled i .
- For any two vertices labeled u and v that are created in the above step, define the edge weight between them $w(u, v)$ as the distance* between vertex u and vertex v in the tree T .

A **simple path**[†] that visits vertices labeled v_1, v_2, \dots, v_m in this order is *nice* if for all $1 \leq i \leq m - 2$, the condition $2 \cdot w(v_i, v_{i+1}) \leq w(v_{i+1}, v_{i+2})$ holds. In other words, the weight of each edge in the path must be at least twice the weight of the previous edge. Note that $s_{v_i} = 1$ has to be satisfied for all $1 \leq i \leq m$, as otherwise, there would be no vertex with the corresponding label.

For each vertex labeled i ($1 \leq i \leq n$ and $s_i = 1$) in the complete undirected weighted graph, determine the maximum number of vertices in any nice simple path starting from the vertex labeled i .

* The distance between two vertices a and b in a tree is equal to the number of edges on the unique simple path between vertex a and vertex b .

† A path is a sequence of vertices v_1, v_2, \dots, v_m such that there is an edge between v_i and v_{i+1} for all $1 \leq i \leq m - 1$. A simple path is a path with no repeated vertices, i.e., $v_i \neq v_j$ for all $1 \leq i < j \leq m$.

Input

Each test contains multiple test cases. The first line contains the number of test cases t ($1 \leq t \leq 10^4$). The description of the test cases follows.

The first line of each test case contains a single integer n ($1 \leq n \leq 7 \cdot 10^4$) — the length of the binary string s and the number of vertices in the tree T .

The second line of each test case contains a binary string with n characters $s_1 s_2 \dots s_n$ ($s_i \in \{0, 1\}$) — the string representing the vertices to be constructed in the complete undirected weighted graph.

Each of the next $n - 1$ lines contains two integers u and v ($1 \leq u, v \leq n$) — the endpoints of the edges of the tree T .

It is guaranteed that the given edges form a tree.

It is guaranteed that the sum of n over all test cases does not exceed $7 \cdot 10^4$.

Output

For each test case, output n integers, the i -th integer representing the maximum number of vertices in any nice simple path starting from the vertex labeled i . If there is no vertex labeled i , i.e., $s_i = 0$, output -1 instead.

Example

input	Copy
<pre> 3 5 01111 1 2 2 3 3 4 4 5 17 01101011110101101 1 2 2 3 3 4 4 5 5 6 6 7 </pre>	

Codeforces Round 1024 (Div. 1)

Finished

Practice



→ Virtual participation

Virtual contest is a way to take part in past contest, as close as possible to participation on time. It is supported only ICPC mode for virtual contests. If you've seen these problems, a virtual contest is not for you - solve these problems in the archive. If you just want to solve some problem from a contest, a virtual contest is not for you - solve this problem in the archive. Never use someone else's code, read the tutorials or communicate with other person during a virtual contest.

Start virtual contest

→ Clone Contest to Mashup

You can clone this contest to a mashup.

Clone Contest

→ Submit?

Language: GNU G++23 14.2 (64 bit, ms)

Choose file: Choose File No file chosen

Submit

→ Last submissions

Submission	Time	Verdict
321900955	May/29/2025 13:11	Accepted

→ Problem tags

data structures dp greedy trees

*3100

No tag edit access

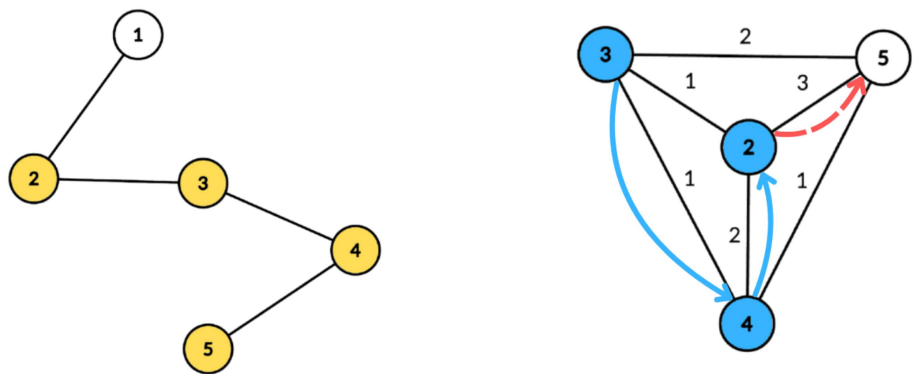
→ Contest materials

- Announcement (en)
- Tutorial (en)

```
7 8
8 9
9 10
10 11
11 12
12 13
13 14
14 15
15 16
16 17
2
01
1 2

output
-1 3 3 3 3
-1 5 4 -1 4 -1 5 5 5 -1 4 -1 5 5 -1 3
-1 1
```

Note
In the first test case, the tree T and the constructed graph are as follows:



Left side is the tree T with selected nodes colored yellow. The right side is the constructed complete graph. The nice path shown in the diagram is $3 \rightarrow 4 \rightarrow 2$. The path is nice as $w(4, 2) = 2$ is at least twice of $w(3, 4) = 1$. Extending the path using $2 \rightarrow 5$ is not possible as $w(2, 5) = 3$ is less than twice of $w(4, 2) = 2$.

In the second test case, the tree T is a simple path of length 17. An example of a nice path starting from the vertex labeled 2 is $2 \rightarrow 3 \rightarrow 5 \rightarrow 9 \rightarrow 17$, which has edge weights of 1, 2, 4, 8 doubling each time.

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