Silk Road (Pancakes II)

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	256 megabytes

Edward the elephant, after hearing tales about the silk road, decided to become a merchant. The silk road has N ($1 \leq 2 \cdot 10^5 \leq N$) trading towns with $N - 1$ roads which connect two towns. It is guaranteed that every town is connected to every other town through a series of roads. However, the silk road is dangerous: There may be bandits hiding in some of the towns which makes them unsafe for travel. Luckily for him, his friend Leroy the lion can help. In one trip, Leroy can visit all towns on the shortest path (minimum number of roads traveled) from town u to v (they can potentially the same town) and banish all bandits from the unsafe towns that he visits. However, while traveling over previously safe towns, bandits emerge and they become unsafe. Edward would like to make Q ($1 \leq 2 \cdot 10^5 \leq Q$) journeys on the silk road, each between town a and b. For each journey, help Edward find the minimum number of trips Leroy must make until Edward can safely travel between towns a and b. It is guaranteed that this will always be possible after a finite number of days.

Formally, given a tree with N nodes with bit values 0 or 1, find the minimum number of range bit flips needed so it's possible to travel from a to b without visiting any nodes with a bit value of 1. Each range bit flip flips all bits (i.e., $1 \rightarrow 0$ or $0 \rightarrow 1$) on the shortest path between nodes u and v.

Input

The first line contains one integer, N, the number of towns

The second line contains a string of N characters, each 0 or 1, indicating wether the ith town is safe or unsafe respectively.

The next $N - 1$ lines contain two space-separated integers, u and v, indicating a road exists connecting between town u and town v. It is guaranteed that the towns are all reachable from one another through these roads.

The next line contains one integer Q, the number of queries.

The next Q lines each contains two separated integers, a and b, the towns that Edward wants to travel between.

Output

For each query, print the minimum number of trips Leroy must make until it's safe for Edward to travel.

Examples

standard input	standard output
2 11 1 2 2 1 1 2 1	1 1
3 011 1 2 1 3 2 1 1 2 3	0 2