# Wesley's Anger Contest 1 Problem 4 (Hard Version) - A Red-Black Tree Problem

**Time limit:** 0.6s **Memory limit:** 512M

It is well known that Wesley is bad at dynamic programming. Six months after the contest, Wesley learned that you can solve the original problem with a significantly better time complexity. He decided to create a new problem with tighter constraints. The only differences between this problem and the original are the bounds on N and K, as well as the time and memory limits. In addition, there will not be language specific time limits.

You are given a tree with N vertices. Recall that a tree is a connected graph where there is exactly one path between any two vertices. Each vertex in this tree is assigned a colour, red or black. You are asked to determine the number of balanced subgraphs with exactly K vertices. A subgraph is considered to be balanced if all vertices are connected and there are at least 2 red vertices and 2 black vertices.

Wesley originally wanted you to output the full answer, but he decided to be nice and only ask you to output it modulo  $998\ 244\ 353$ . It may be helpful to know that  $998\ 244\ 353$  is prime and  $998\ 244\ 353=119\times 2^{23}+1$ .

For this question, a connected subgraph is a subset of the original vertices and edges that form a tree.

#### **Constraints**

 $1 \leq K \leq N \leq 1\,000$ 

 $1 \leq u_i, v_i \leq N$ 

The graph is a tree.

#### **Input Specification**

The first line contains 2 integers, N and K.

The next line contains a string of N characters, describing the colouring of the tree. Each character is either  $\mathbb R$  or  $\mathbb B$ . If the  $i^{th}$  character is  $\mathbb R$ , then vertex i is red. Otherwise, it is black.

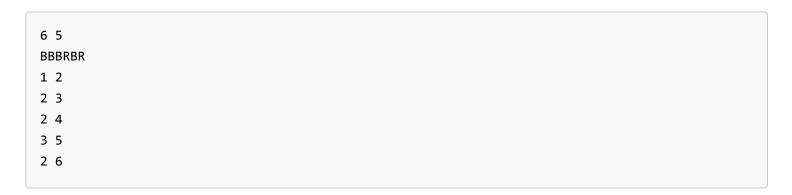
The next N-1 lines describe the edges of the tree. Each line contains 2 integers,  $u_i$ ,  $v_i$ , indicating an edge between  $u_i$  and  $v_i$ .

#### **Output Specification**

This problem is graded with an identical checker. This includes whitespace characters. Ensure that every line of output is terminated with a \n character and that there are no trailing spaces.

Output a single integer, the number of balanced subgraphs with exactly K vertices, modulo  $998\ 244\ 353$ .

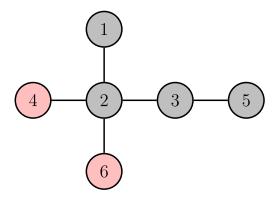
## **Sample Input 1**



## **Sample Output 1**

2

## **Sample Explanation 1**



The two balanced subgraphs of size 5 are  $\{1,2,3,4,6\}$  and  $\{2,3,4,5,6\}$ .

## **Sample Input 2**

5 4 RBRBR

1 2

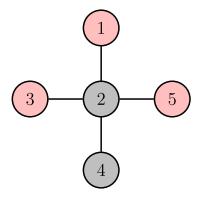
2 3

2 4

2 5

## **Sample Output 2**

## **Sample Explanation 2**



The three balanced subgraphs of size 4 are  $\{1,2,3,4\}$ ,  $\{1,2,4,5\}$ , and  $\{2,3,4,5\}.$