

Simple Problem

Input file: **standard input**
Output file: **standard output**
Time limit: 1 second
Memory limit: 1024 megabytes

Given an undirected tree with n vertices. Each vertex v has a non-negative integer a_v recorded ($0 \leq a_v < 2^k$).

A set of vertices is called good if the bitwise OR of the values a of the vertices in this set equals $2^k - 1$.

The cost of a set is defined as the maximum of the pairwise distances between the vertices in the set, where the distance between vertices is the number of edges on the unique simple path between them.

You need to find the minimum cost of a good set or state that such a set does not exist.

Input

The first line contains two integers n and k ($2 \leq n \leq 100\,000$, $1 \leq k \leq 20$) — the number of vertices in the tree and the number k , respectively.

The second line contains n integers a_i ($0 \leq a_i < 2^k$) — the values of the vertices.

The next $n - 1$ lines describe the edges of the tree.

The i -th of them contains two integers v_i and u_i ($1 \leq v_i, u_i \leq n$) — the indices of the vertices connected by the i -th edge.

Output

If there does not exist a good set, output -1 . Otherwise, output the minimum cost of a good set in a single line.

Examples

standard input	standard output
5 3 1 2 6 0 4 1 2 2 3 1 4 3 5	2
3 3 0 1 2 1 2 2 3	-1

Note

In the first example, you can choose the set of vertices $\{1, 2, 3\}$.

In the second example, the maximum OR that can be obtained is 3.

Scoring

The tests for this problem consist of nine groups. Points for each group are awarded only if all tests of the group and all tests of some previous groups are passed. Note that passing the tests from the statement is not required for some groups. **Offline checking** means that the results of testing your solution on this group will only be available after the competition ends.

Group	Points	Constraints		Required	Comment
		n	k		
0	0	–	–	–	Samples
1	12	$n \leq 15$	–	0	
2	9	$n \leq 1\,000$	–	–	$v_i = i, u_i = i + 1$
3	14	–	–	2	$v_i = i, u_i = i + 1$
4	6	–	$k = 1$	–	–
5	10	$n \leq 1\,000$	$k = 2$	–	–
6	12	–	$k = 2$	5	–
7	9	$n \leq 100$	$k \leq 5$	0	–
8	16	$n \leq 1\,000$	–	0 – 2, 5, 7	–
9	12	–	–	0 – 8	Offline checking