5.1. A.

**Method 1: Construction. (Lengthier)**

I will show that for every tree, I can find a 2-coloring as follows:
- given a tree, pick a random node $v$ as root.
- run BFS.
- colour nodes of depth 0: black.
- colour nodes of even depth: white.

Now, I need to prove that there does not exist two adjacent nodes $u, v \in V$ such that $c(u) = c(v)$ where $c()$ is the color of a node. I can prove this by contradiction:
Assume there is $u, v \in V$, $(u, v) \in E$ and $c(u) = c(v)$.

The main idea: this is impossible because then:

a) Either $d[u] = d[v]$ in BFS and therefore there exists a cycle (needs more elaborate proof).

b) Or $d[u] = d[v] + 1$ (or vice versa) and then one is even and one odd so according to our coloring they should have different colours.

**Method 2: Induction on the number of nodes of a tree.**

Hyp: a size $m$ tree is two colorable, base for $n=2$. 

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