3.18

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You are given a binary tree T = (V, E) (in adjacency list format), along with a designated root node r $\in V$. Recall that u is said to be an ancestor of v in the rooted tree, if the path from r to $v \in$ T passes through u.

You wish to preprocess the tree so that queries of the form "is u an ancestor of v?" can be answered in constant time. The preprocessing itself should take linear time. How can this be done?

Doing a depth first search on the tree, starting with some root, we record the pre and post numbers of every vertex on the graph. Then, we can say definitively that u is the ancestor of v if $pre(u) < pre(v) < post(v) < post(u)$.