P(d): In a tree of depth d, contribution of leaves to the sum $S(d) = \sum_{i=1}^{n} 2^{-d_i}$ doesn't exceed 1.

BS: In a tree of depth 0, root itself is leaf. $\sum_{i=1}^{n} 2^{-d_i} = 2^{-0} = 1$. Hence P(0) is true.

IS: Assume that the depth of the tree is $d \geq 1$. Then inductive hypothesis is P(d) is true for all trees whose depth is lesser than that of given tree. The contribution of leaves of left subtree to the sum function of the left subtree doesn't exceed 1. Since their depth in the original is increase by exactly one, their contribution to the sum function of the original tree is at most half. Similarly the contribution of the leaves in the right subtree to the sum function is almost half.

Hence $S(d) \leq 1$.