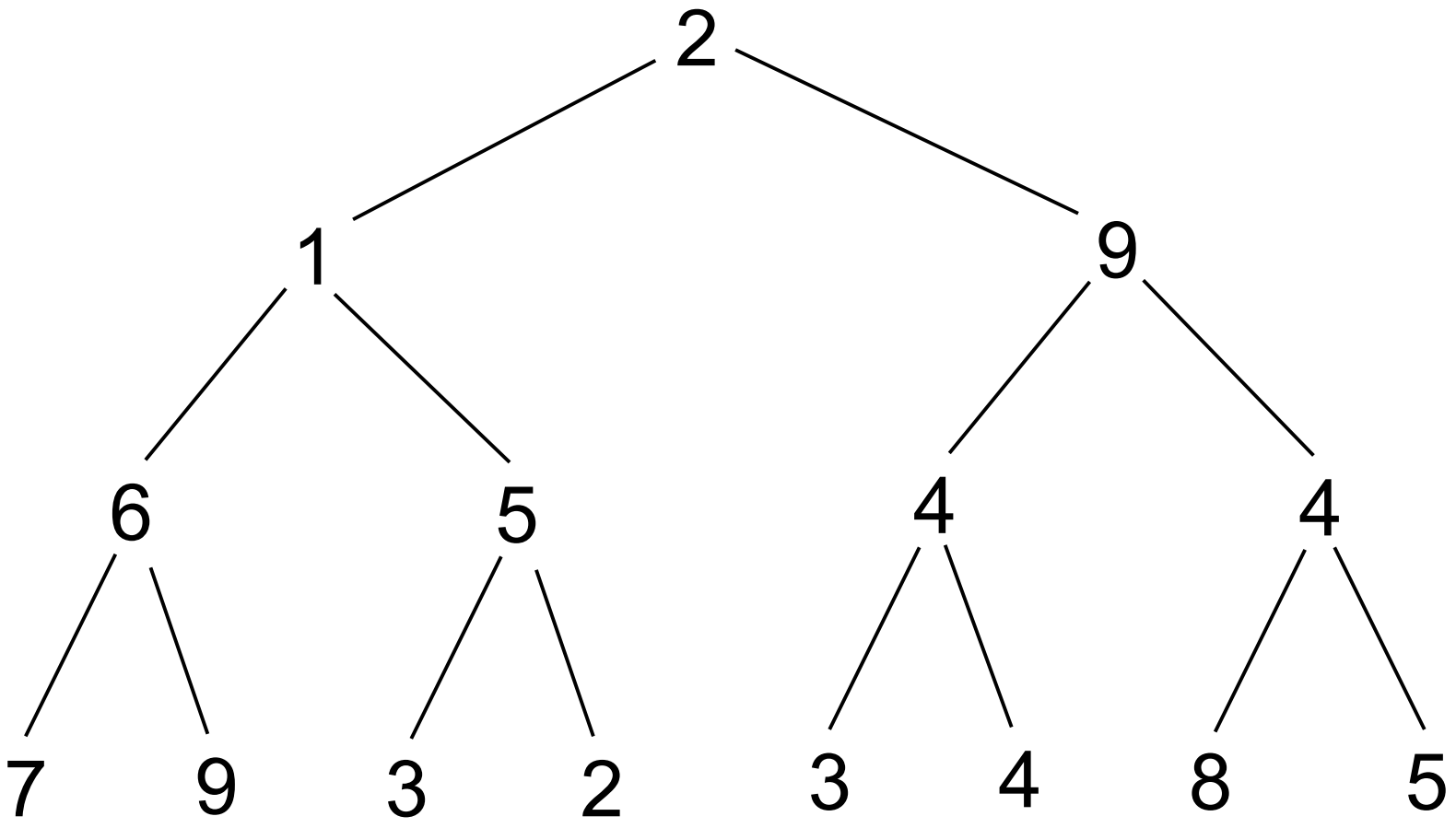
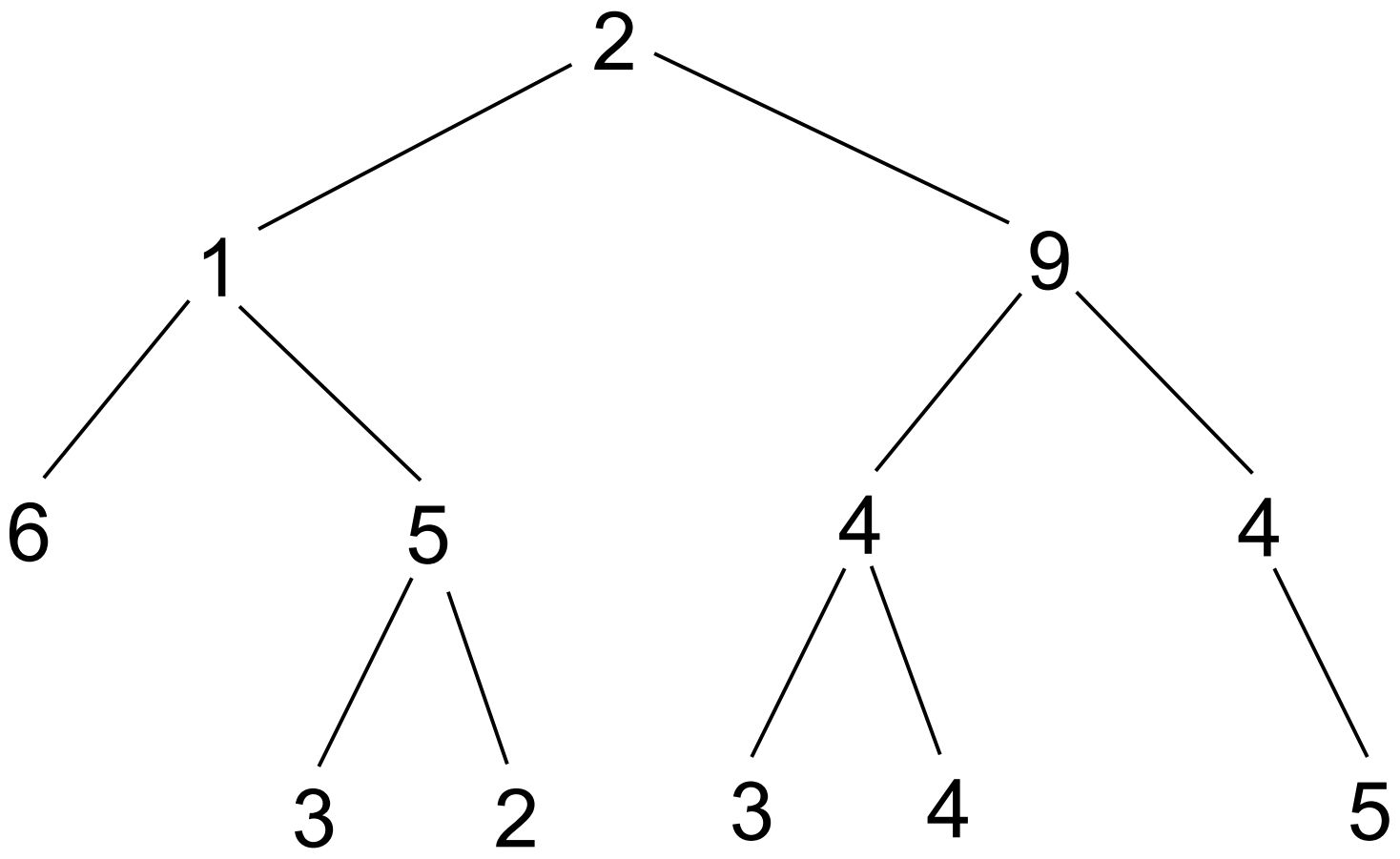
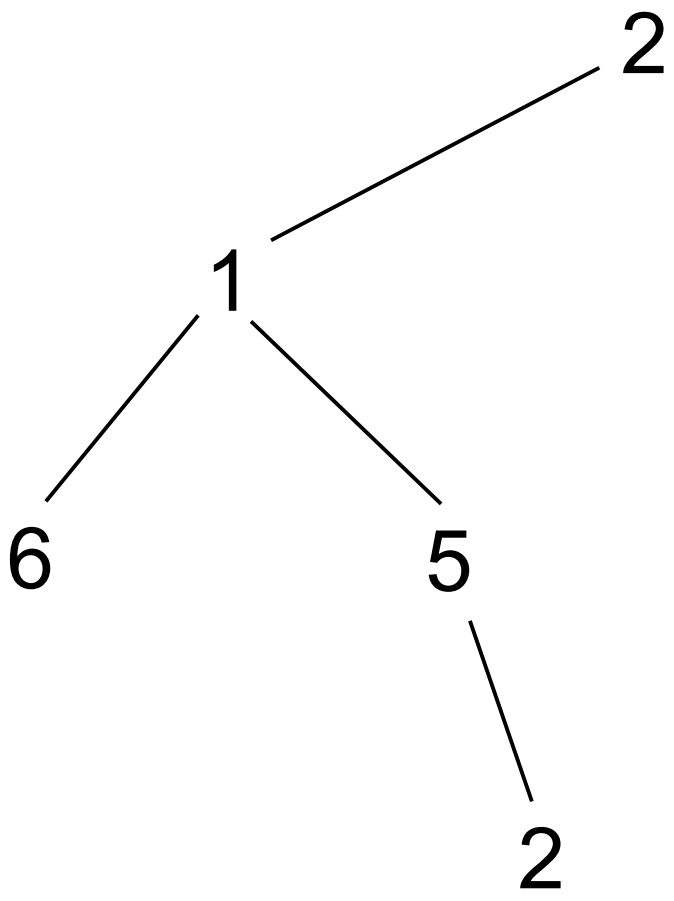
Binary Trees



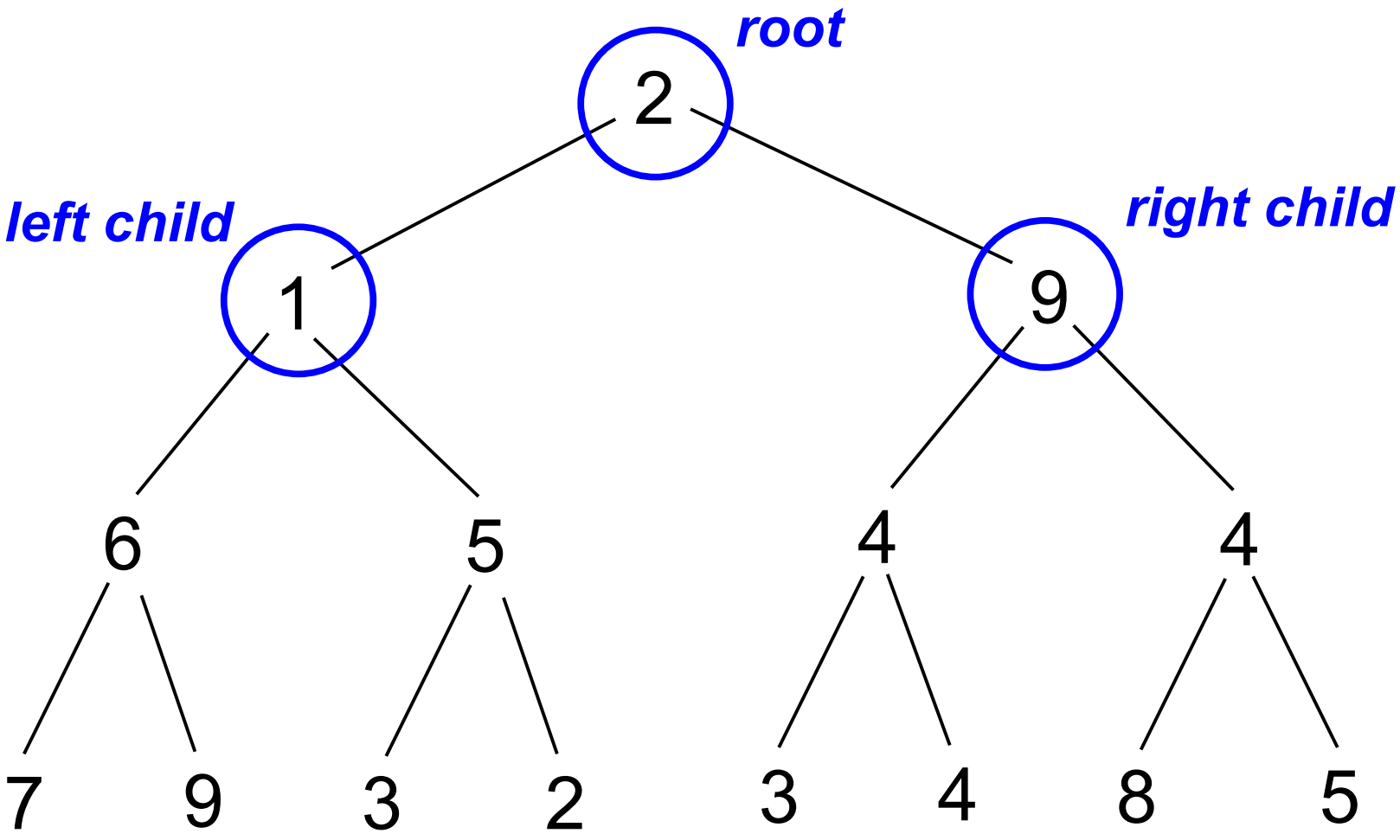
Binary Trees



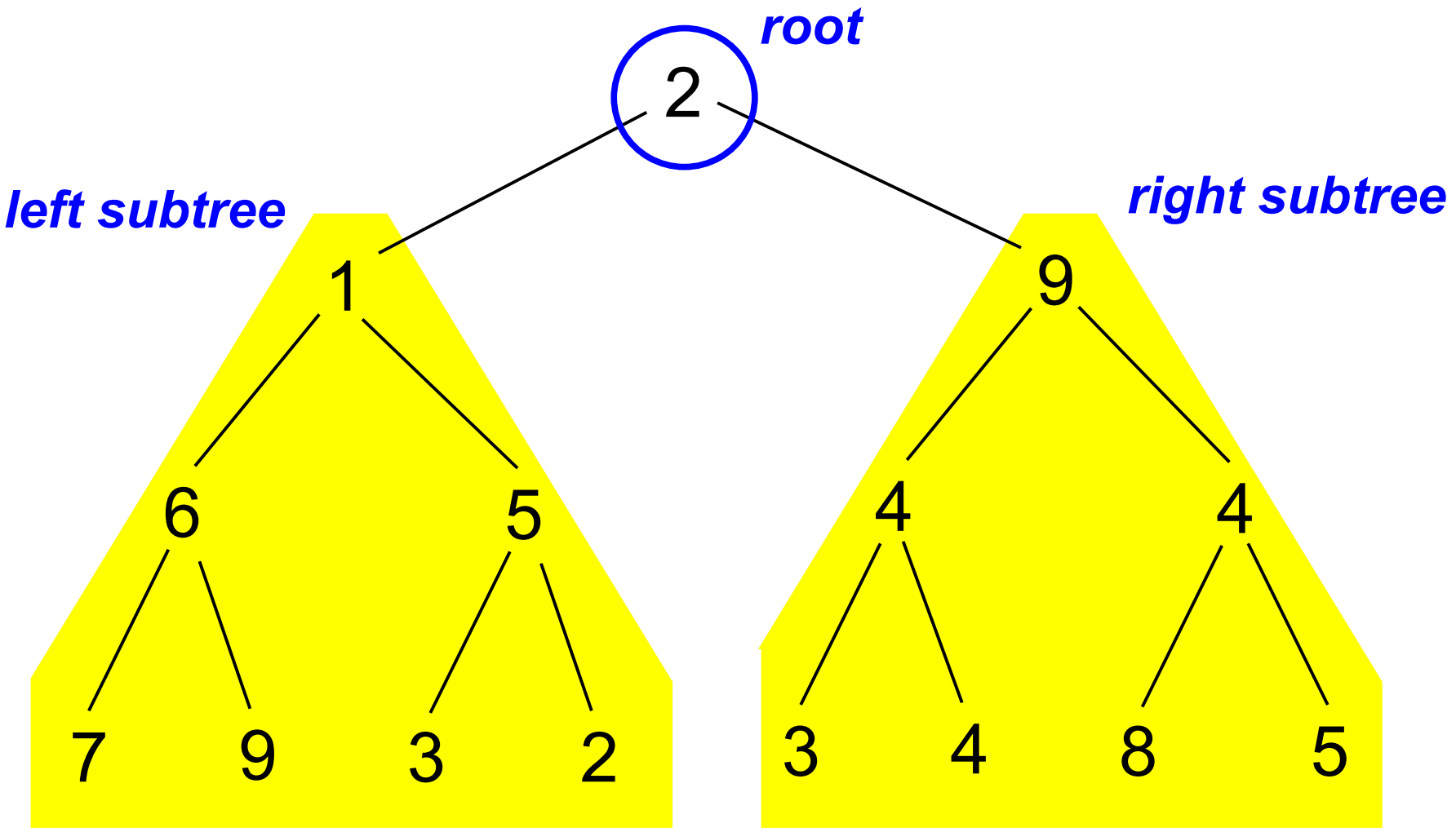
Binary Trees



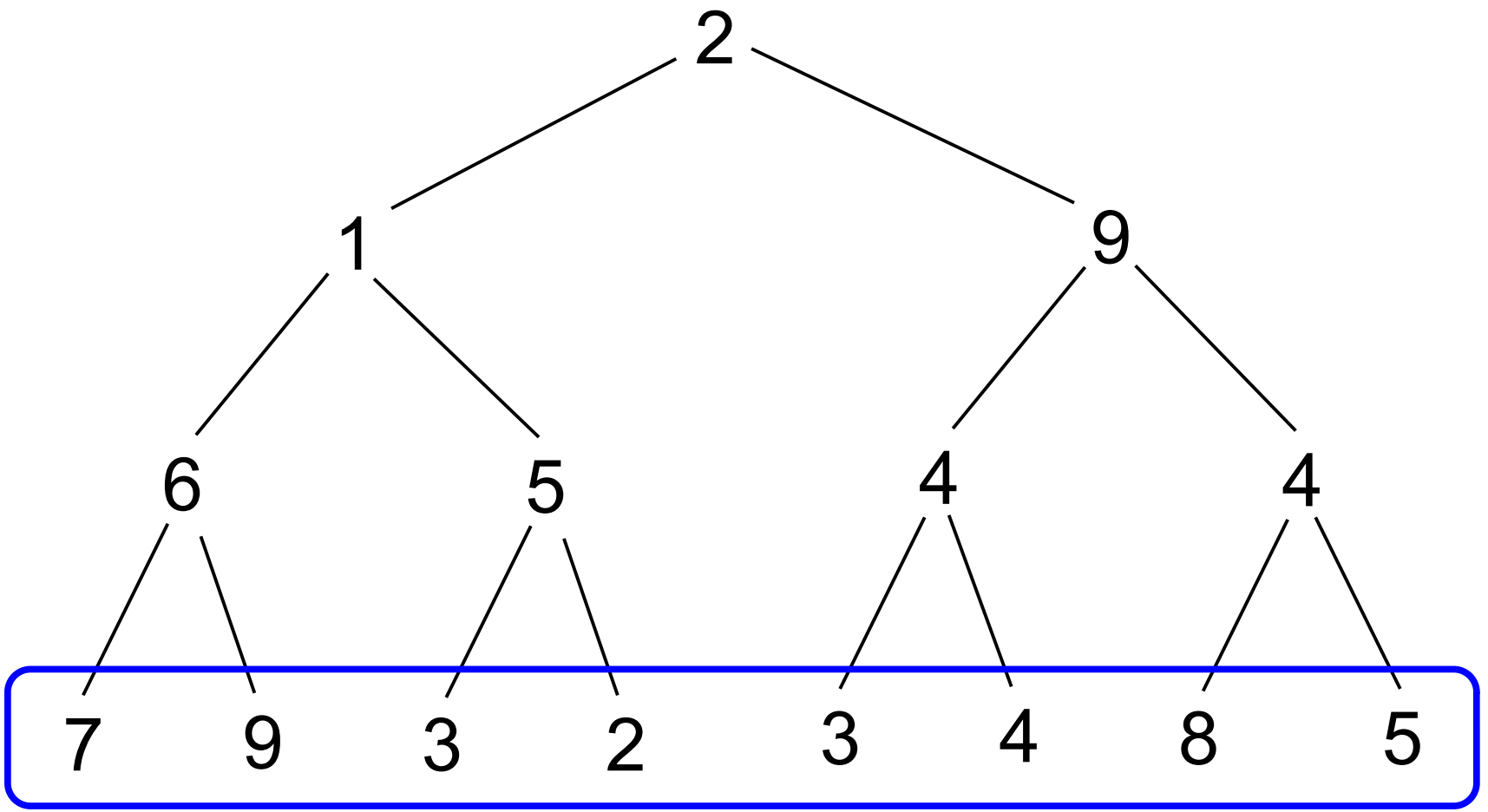
Terminology



Terminology

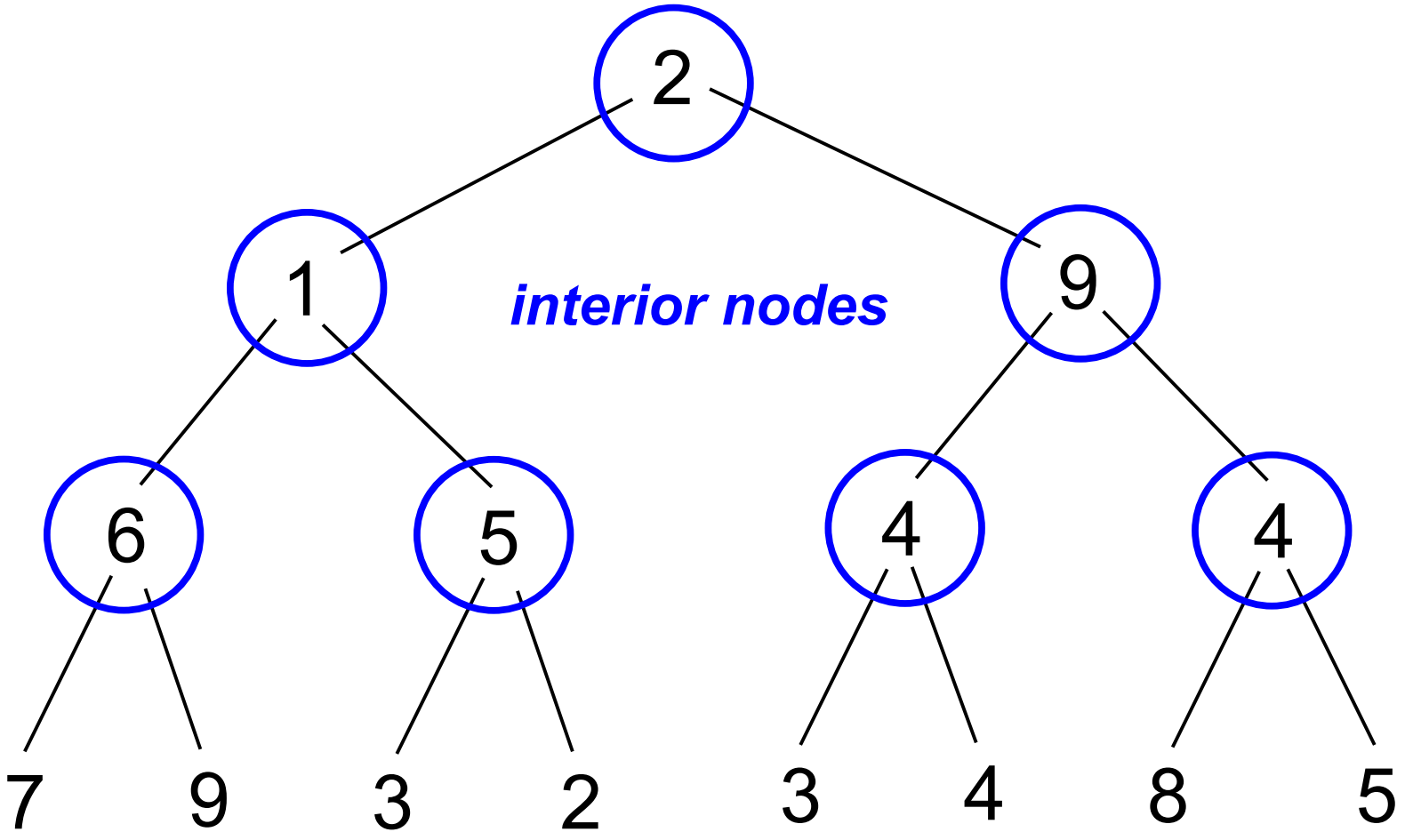


Terminology

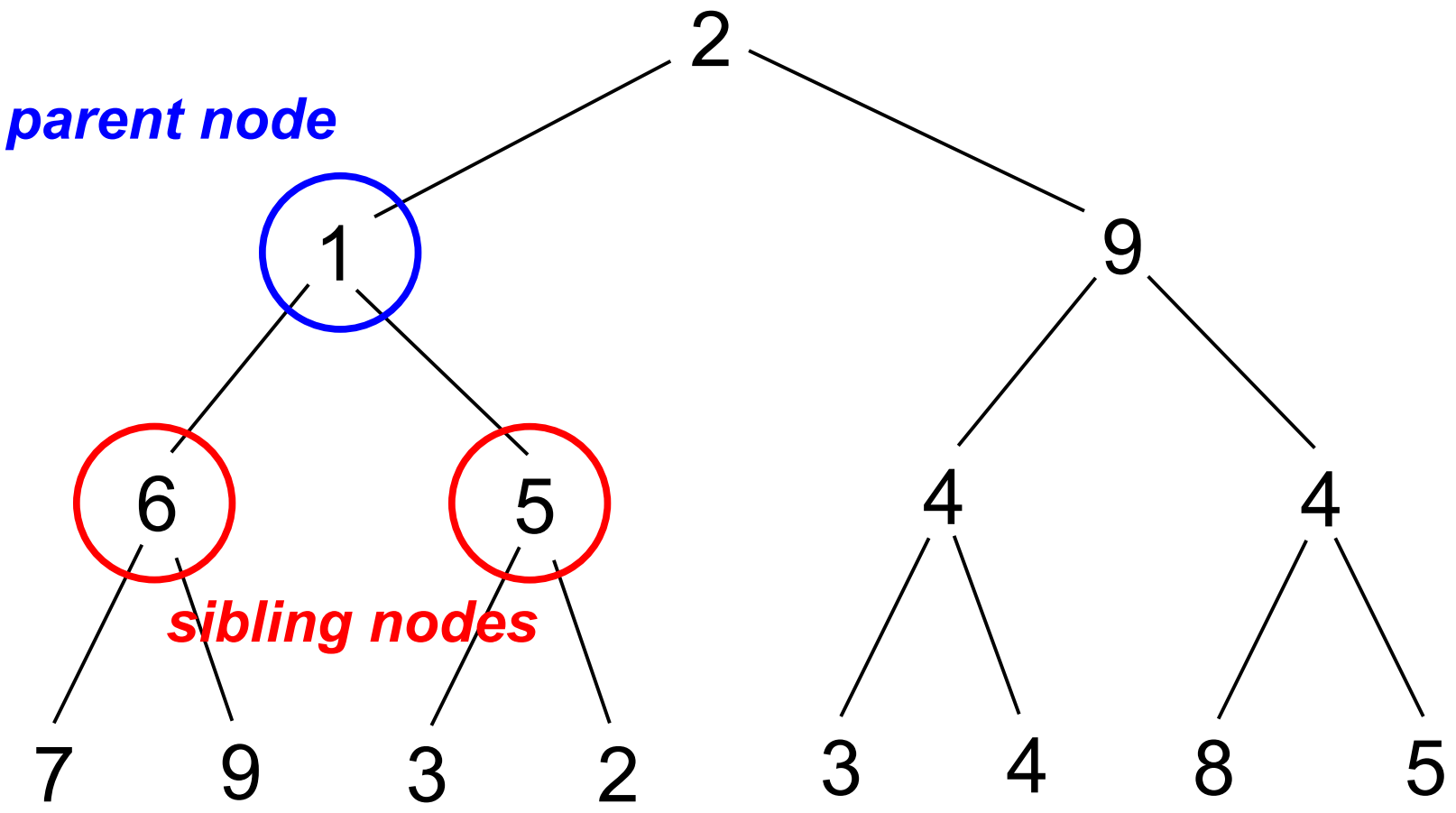


leaf nodes

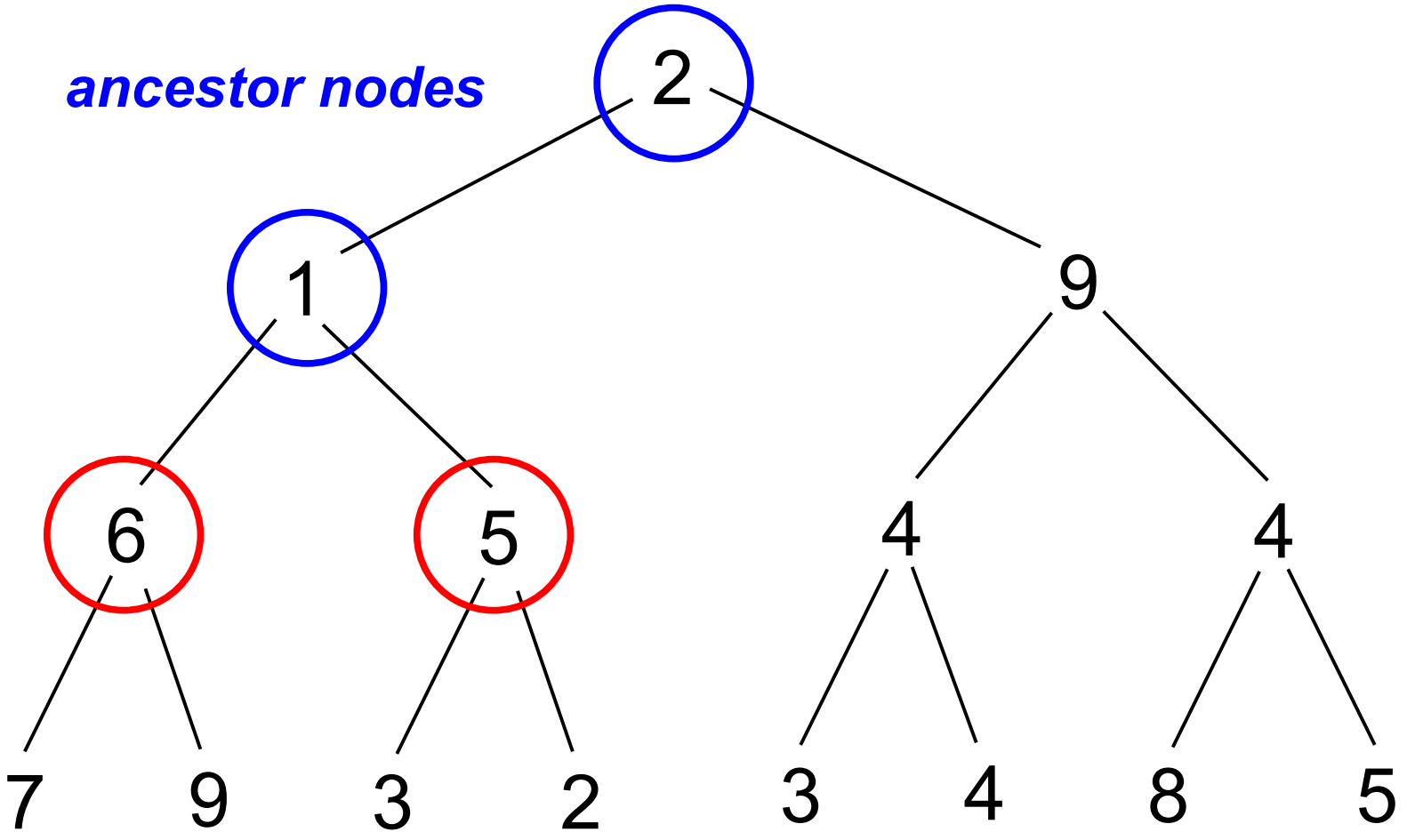
Terminology



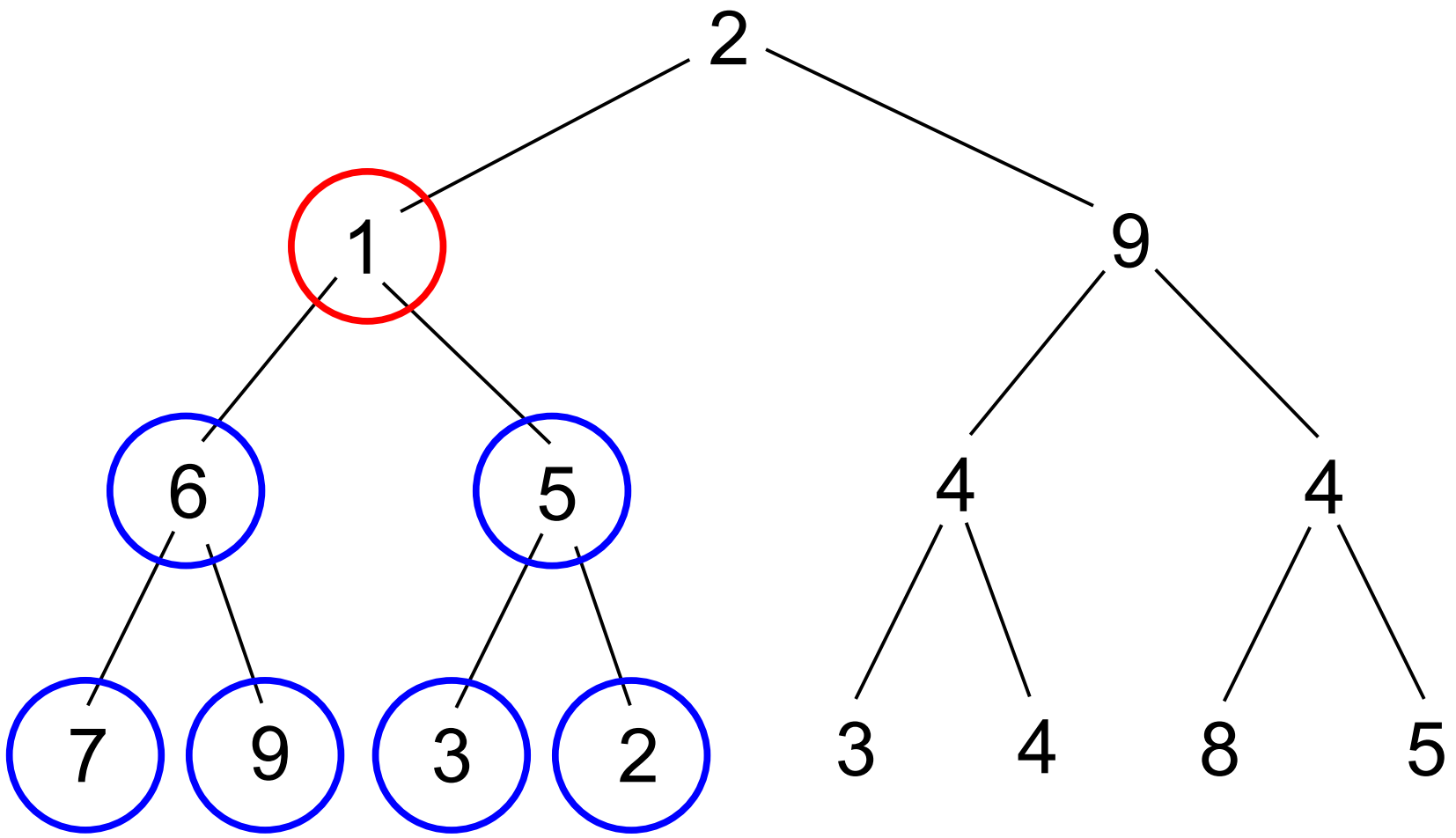
Terminology



Terminology

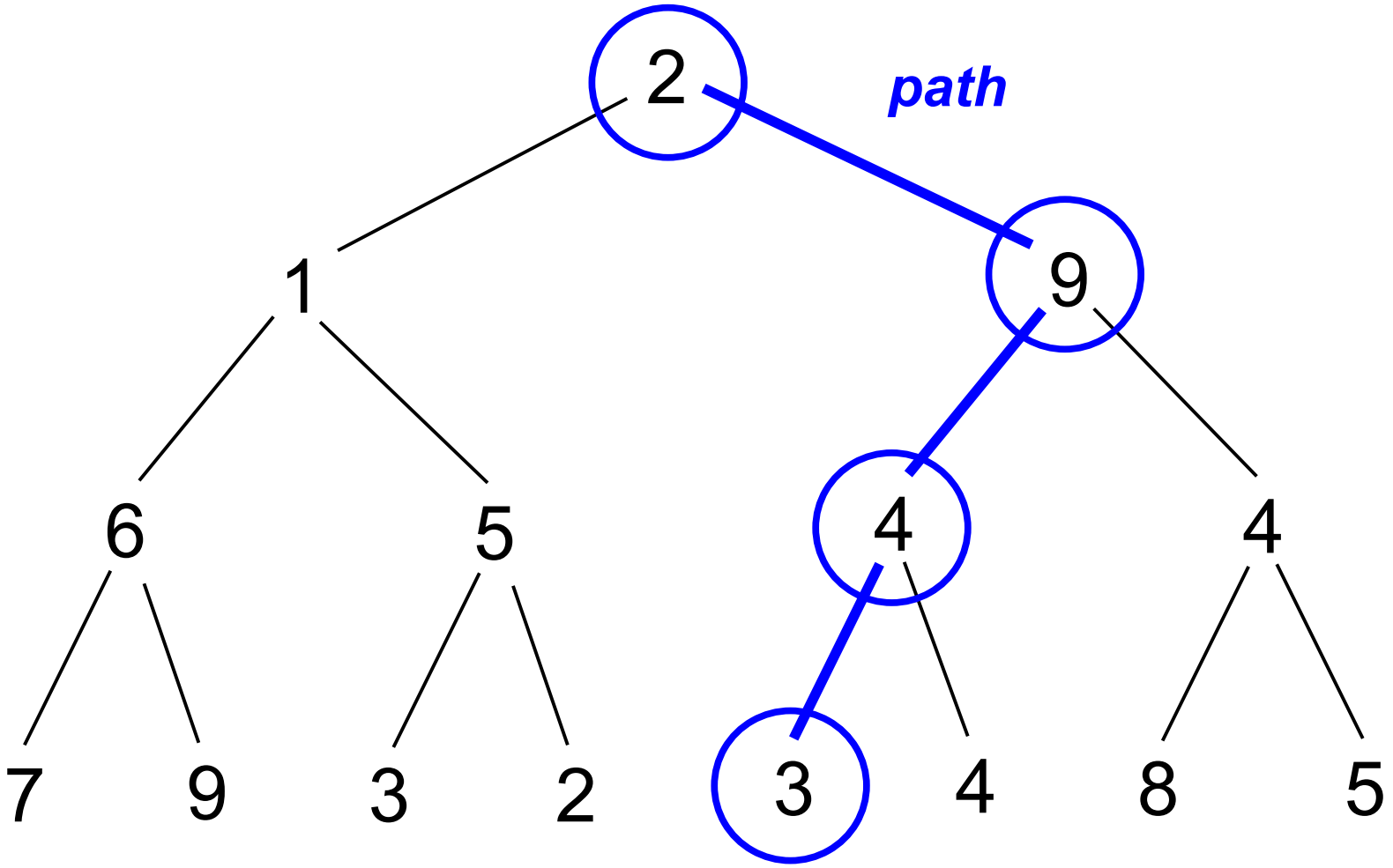


Terminology



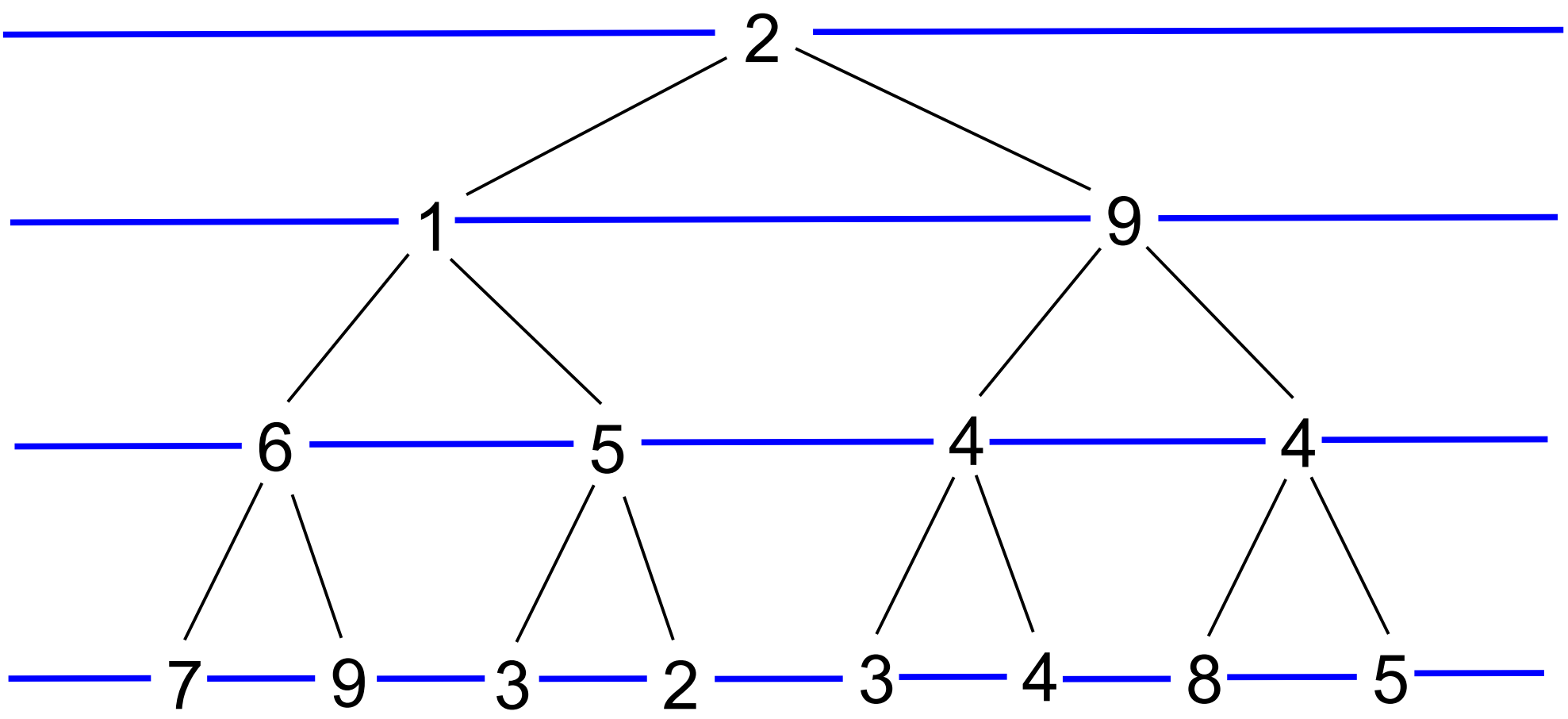
descendant nodes

Terminology

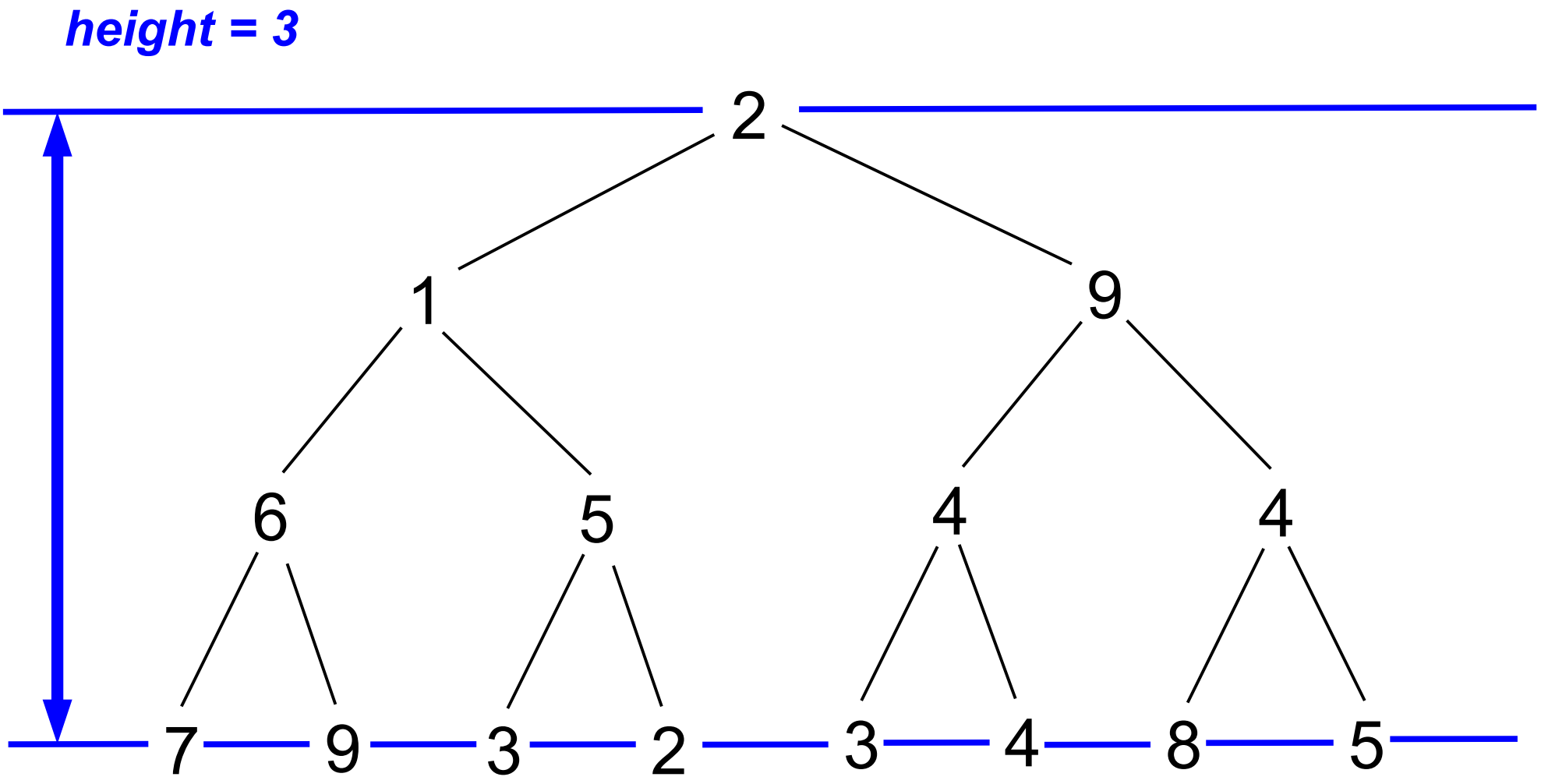


Terminology

levels

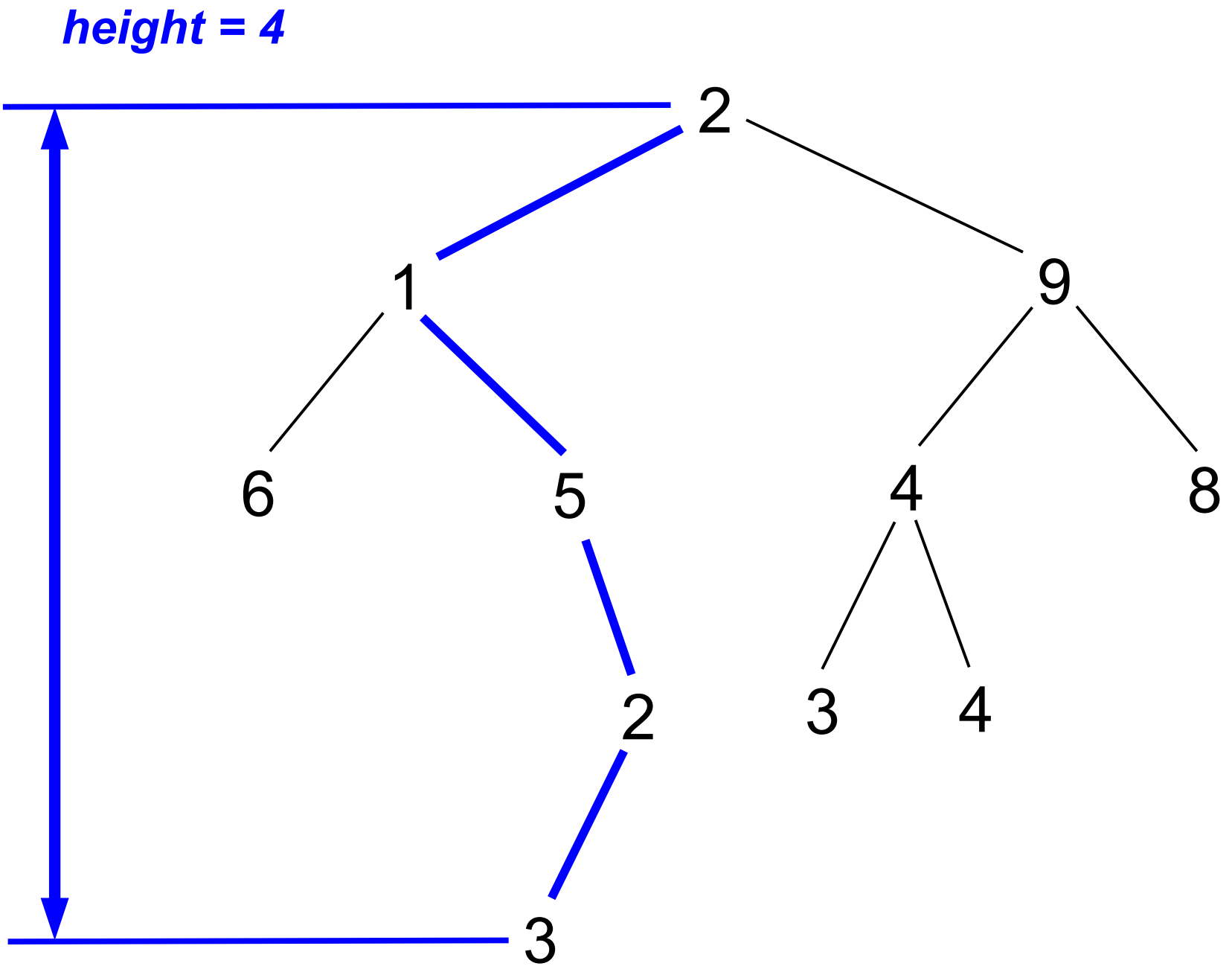


Terminology

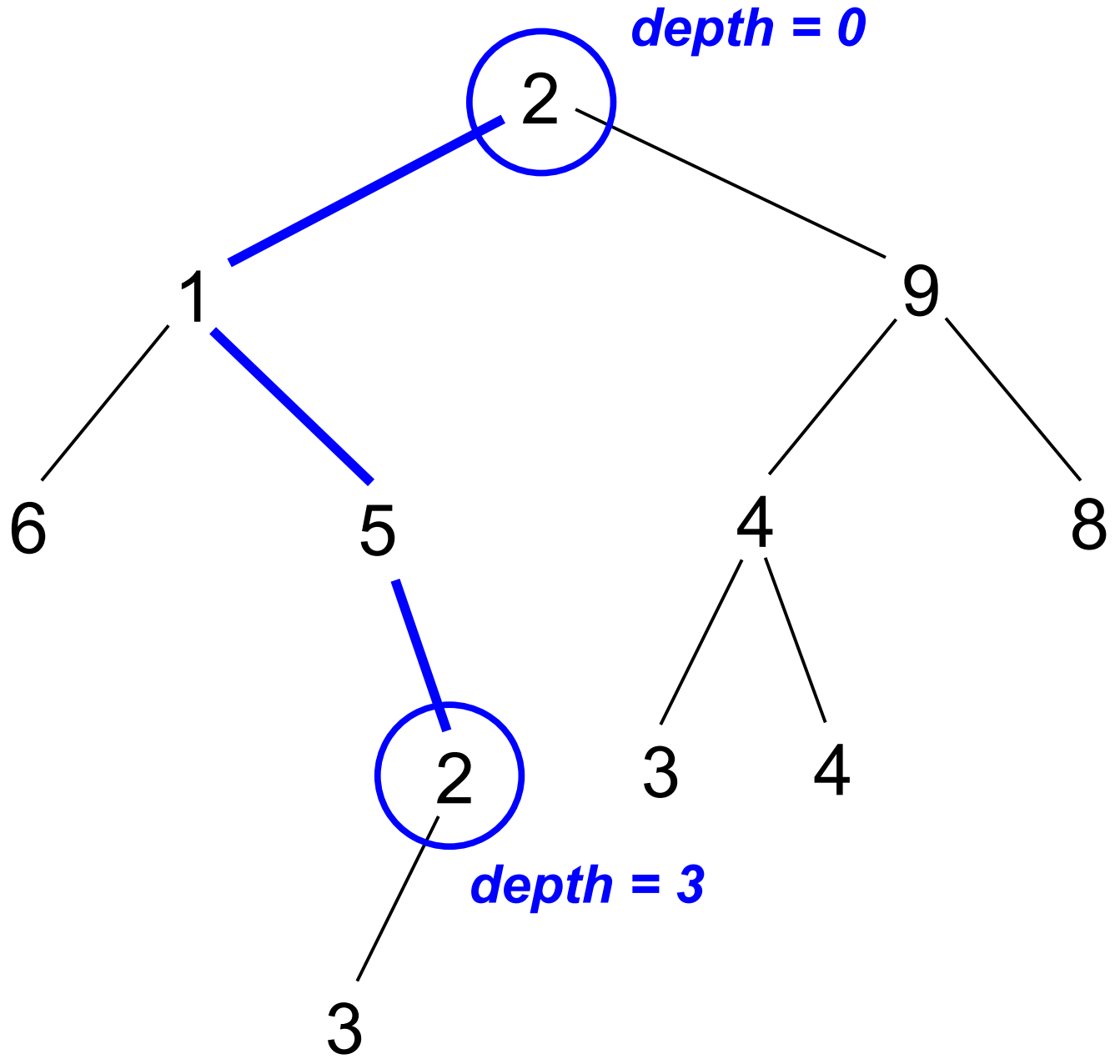


Note: this usage differs from the book's usage

Terminology

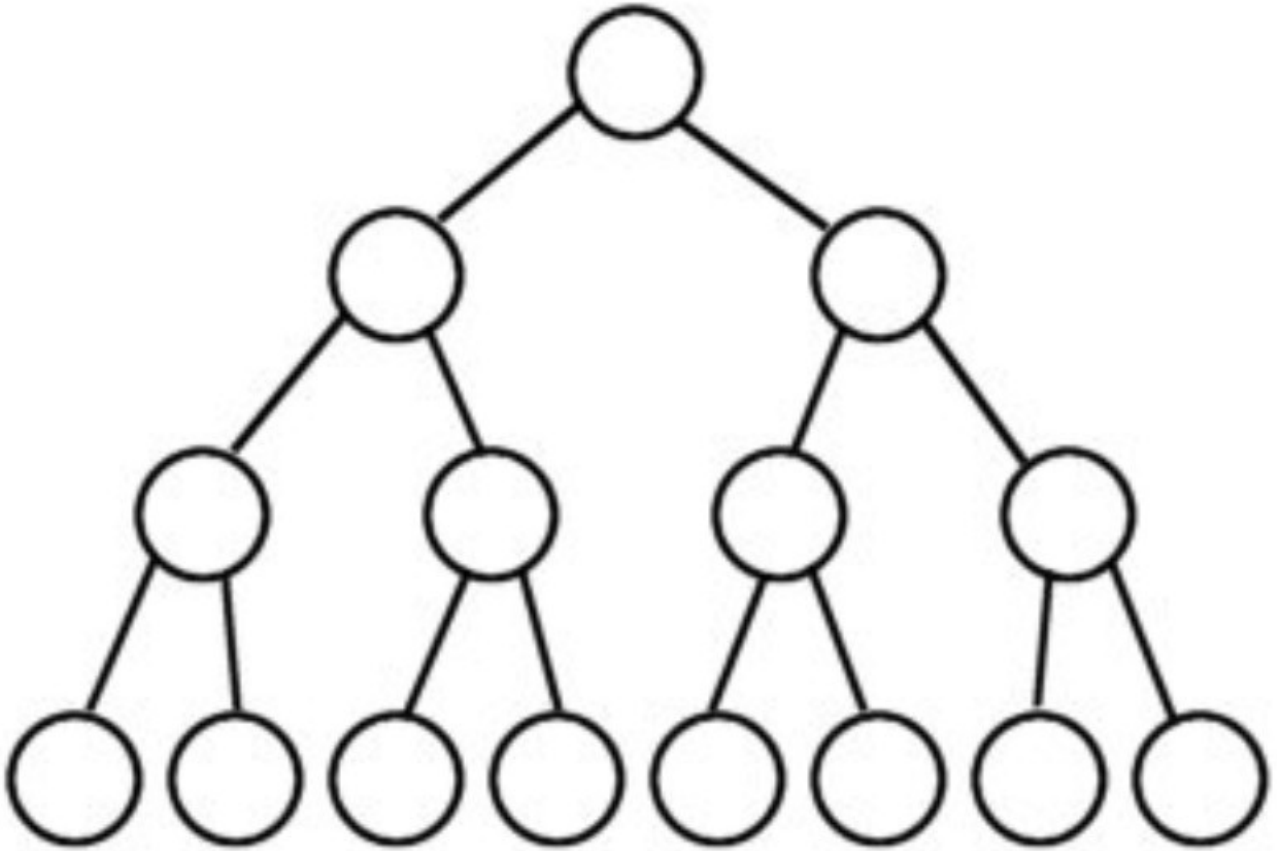


Terminology



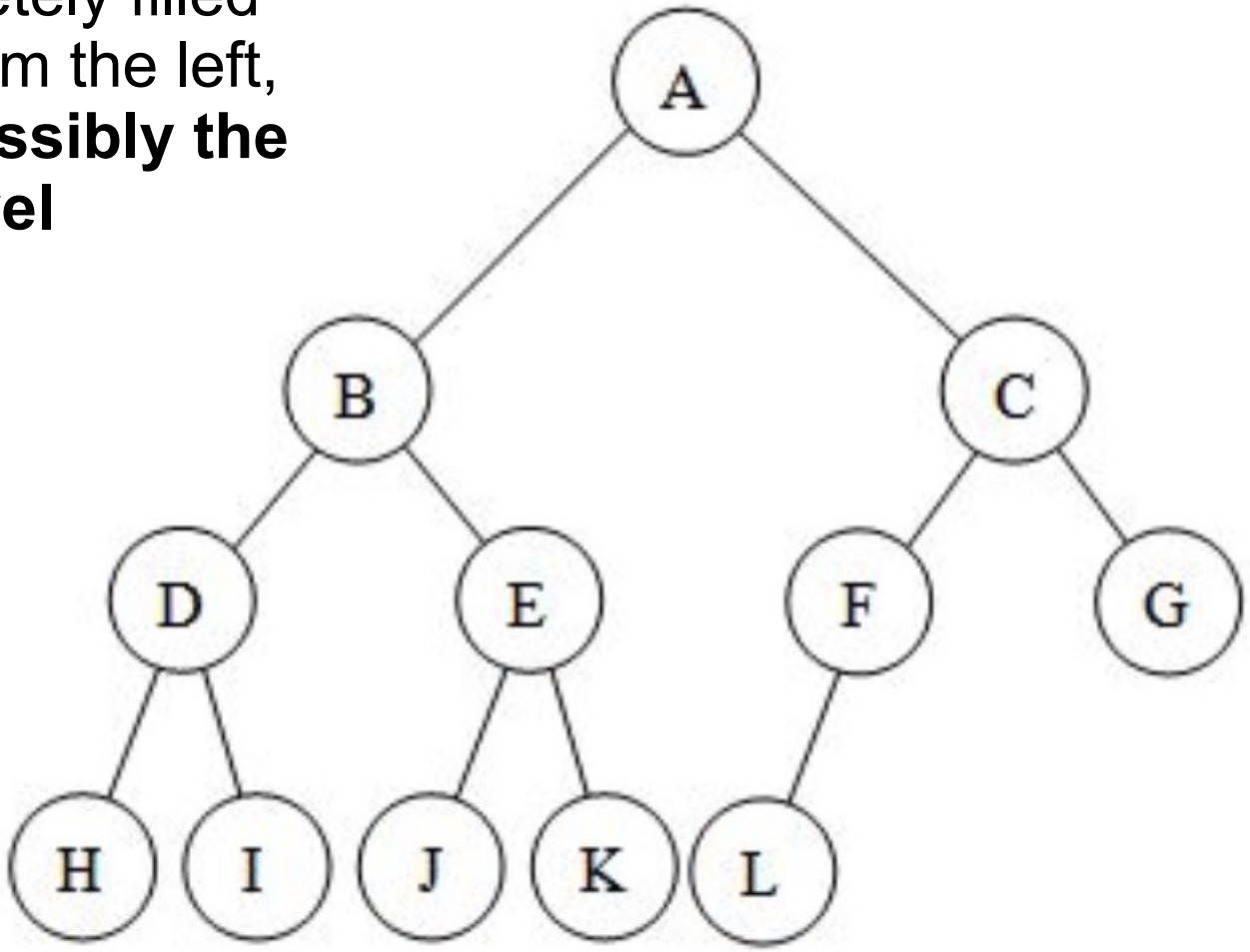
Full Binary Tree

All nodes have
either 2 or 0 children

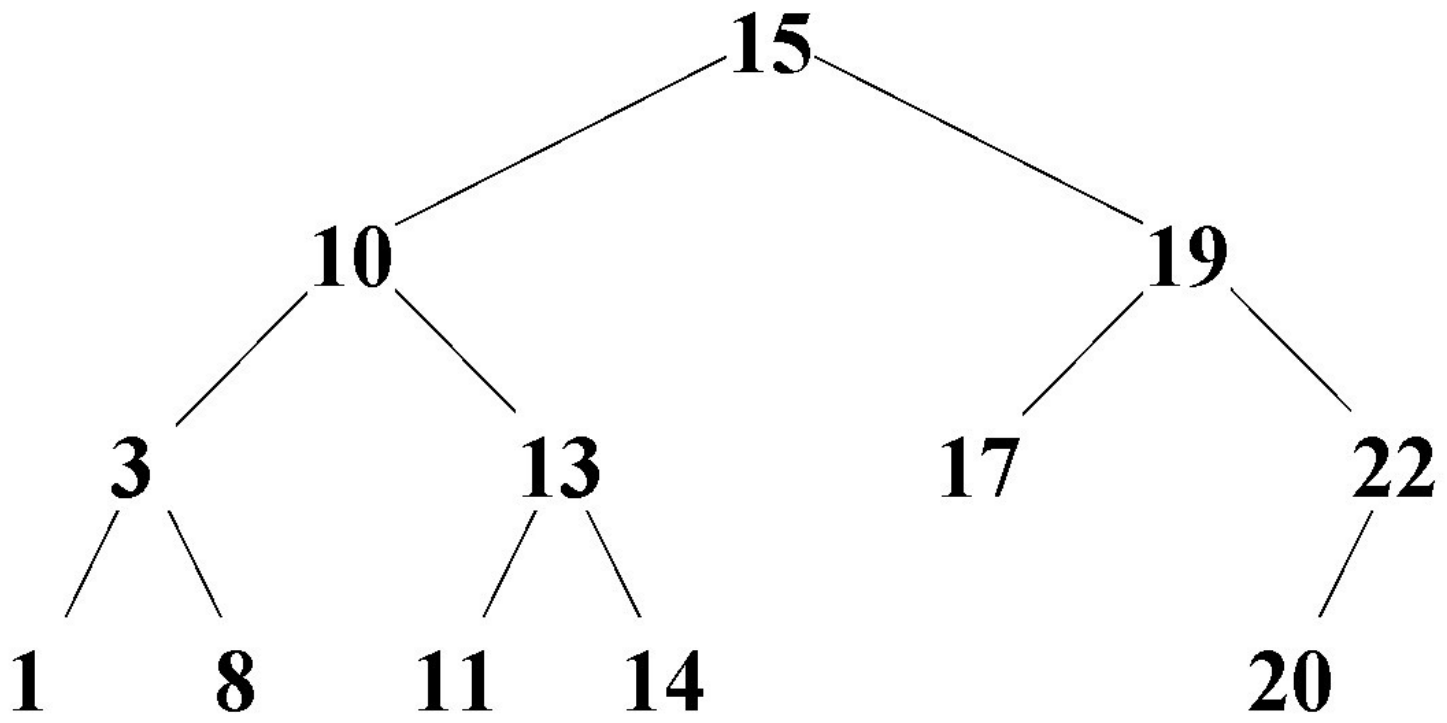


Complete Binary Tree

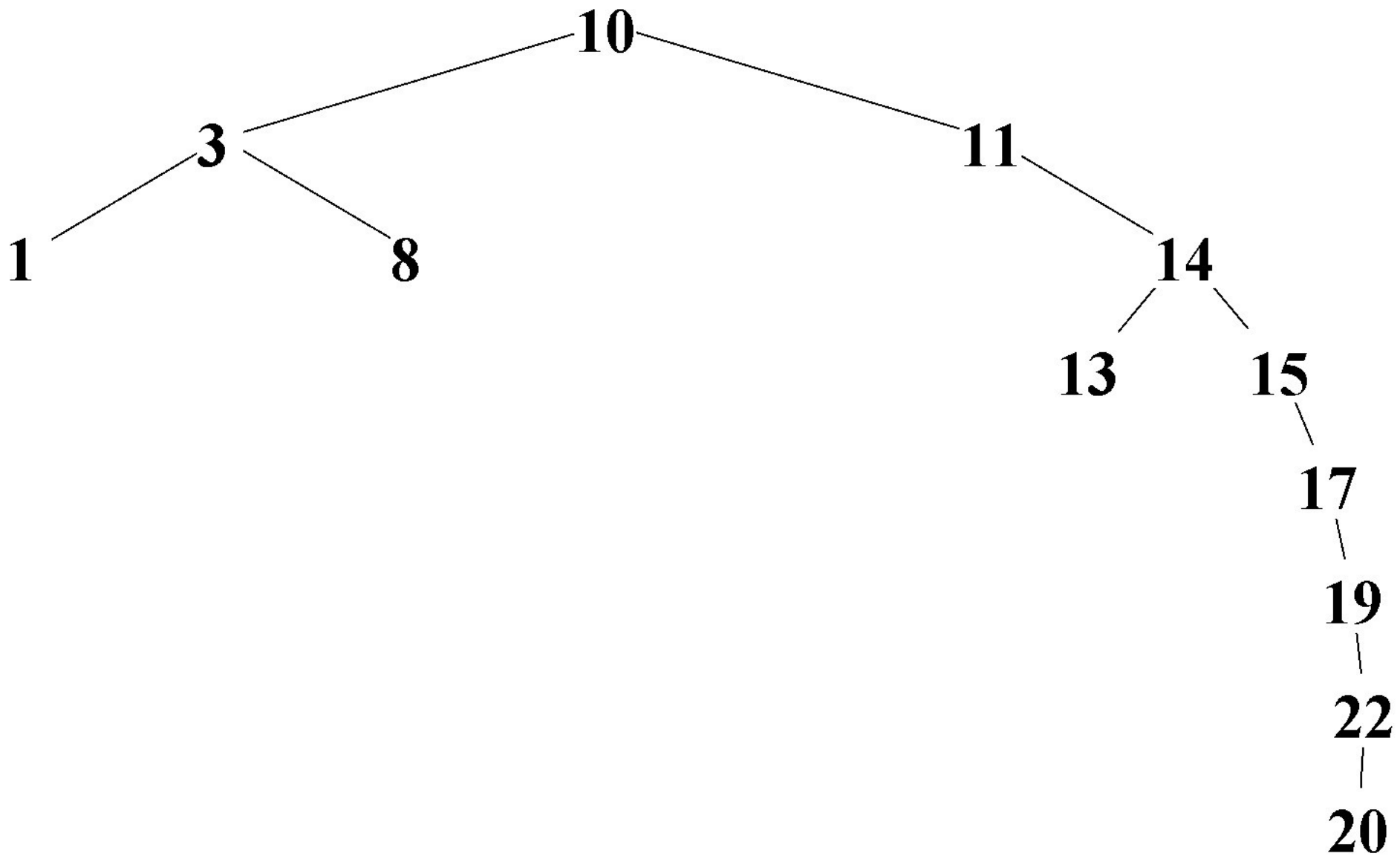
All levels of the tree are completely filled starting from the left, **except possibly the lowest level**



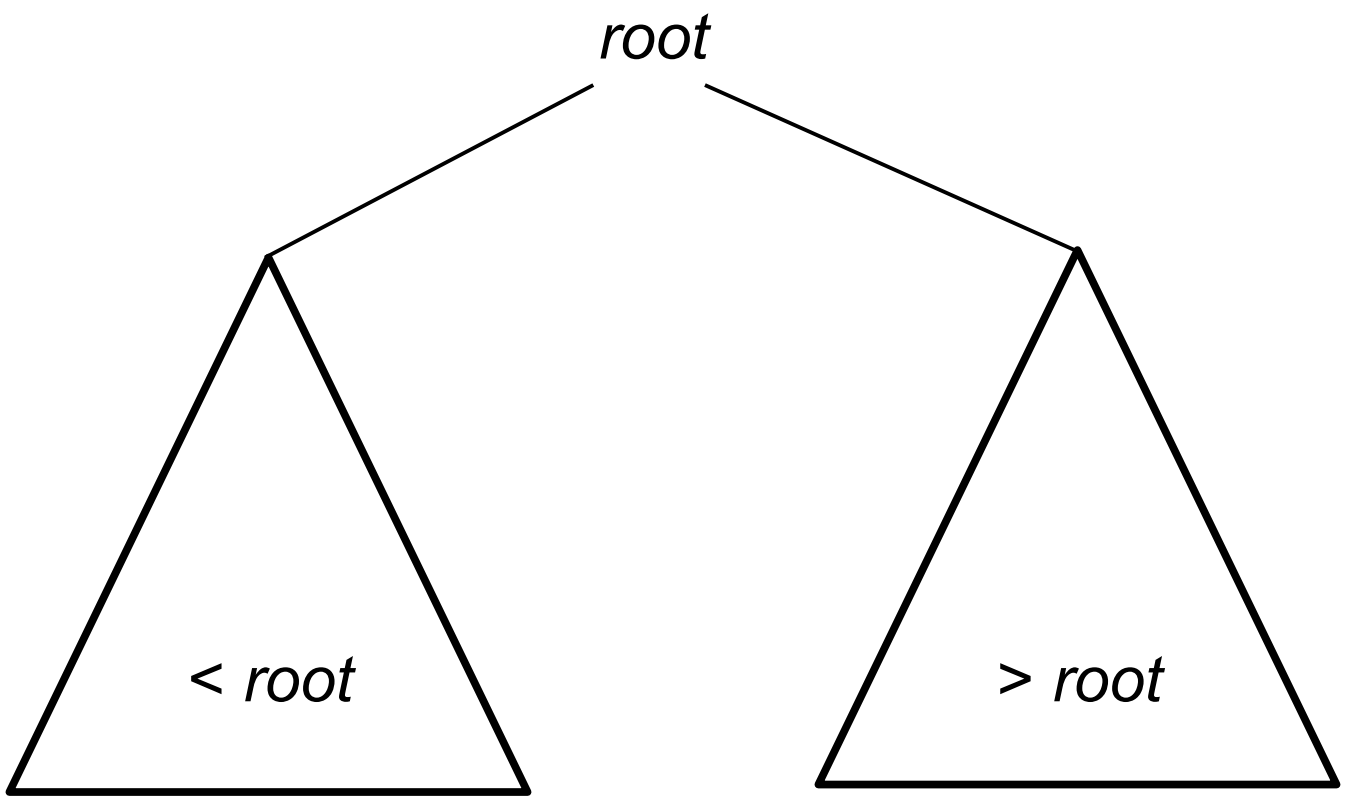
Balanced Binary Tree

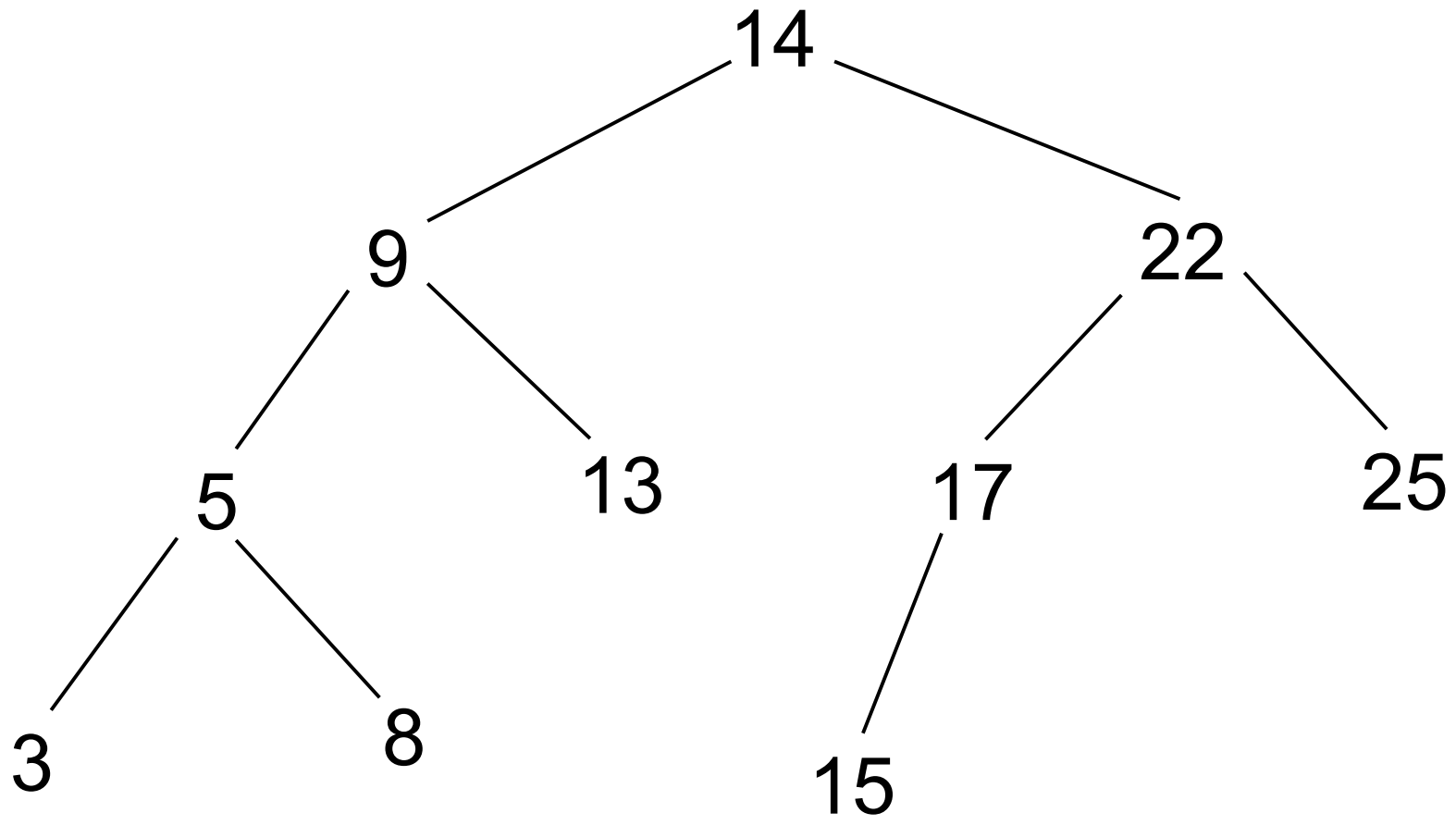


Unbalanced Binary Tree

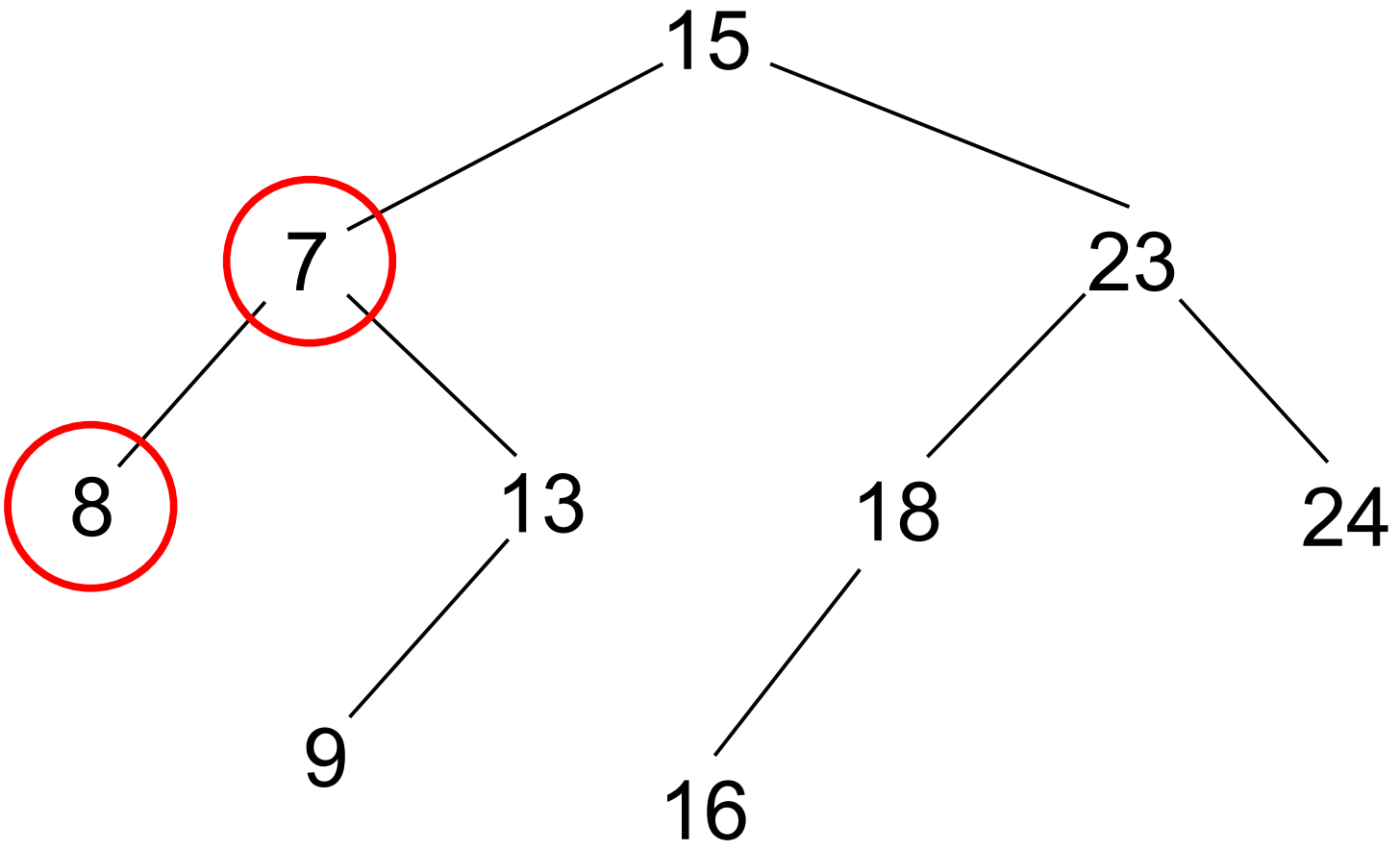


Binary Search Trees

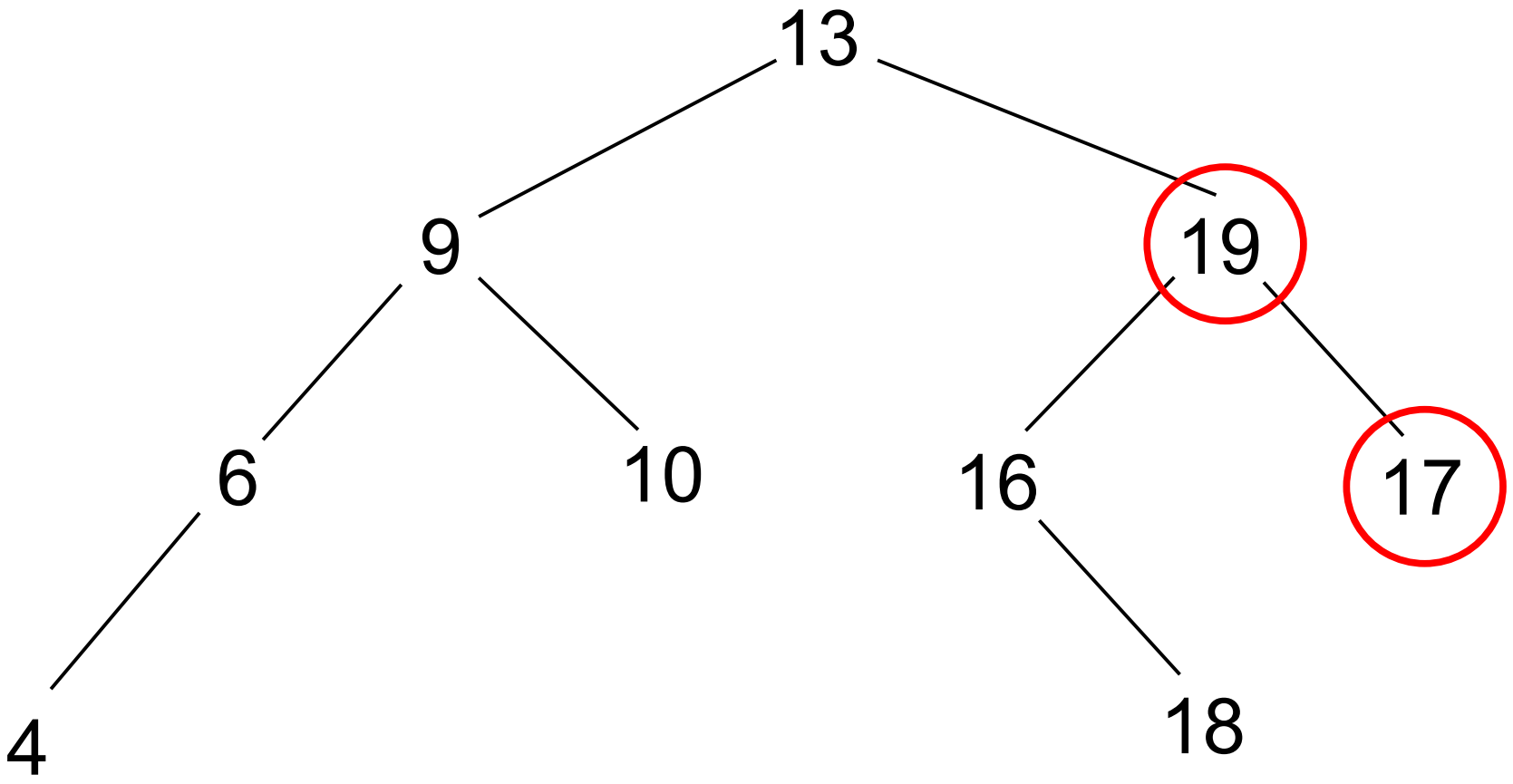




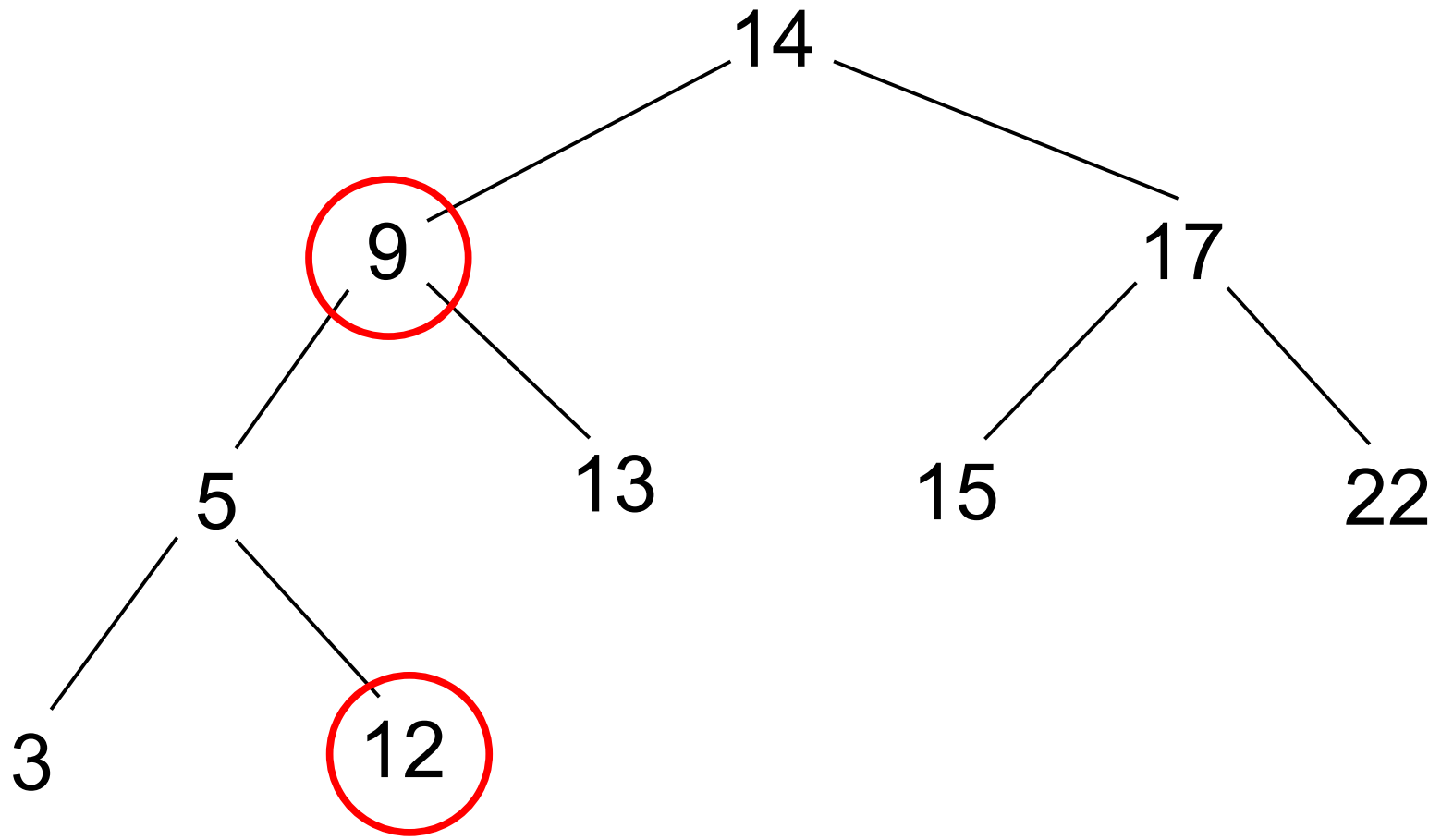
This is a valid binary search tree



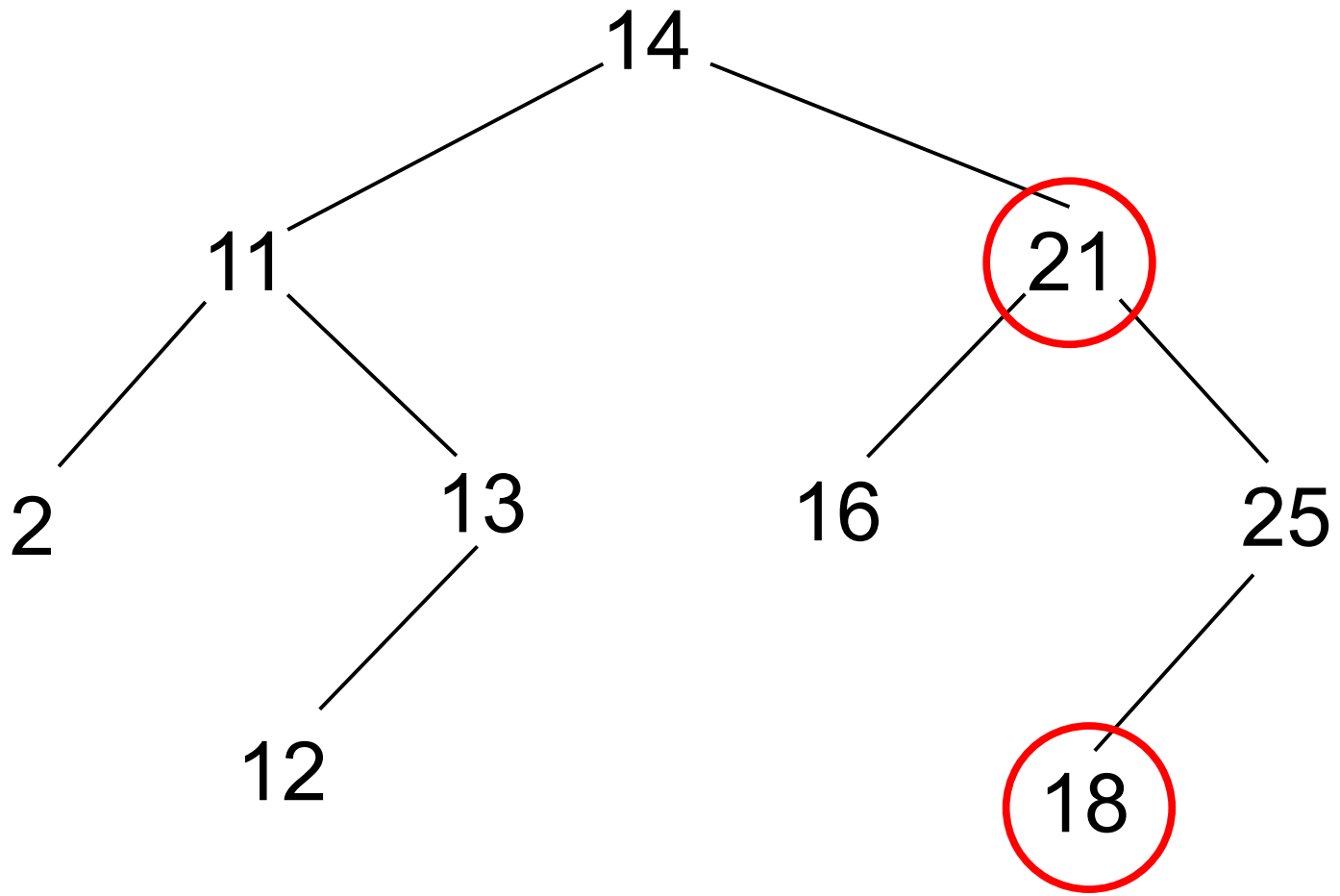
Violates BST property: 8 is not < 7



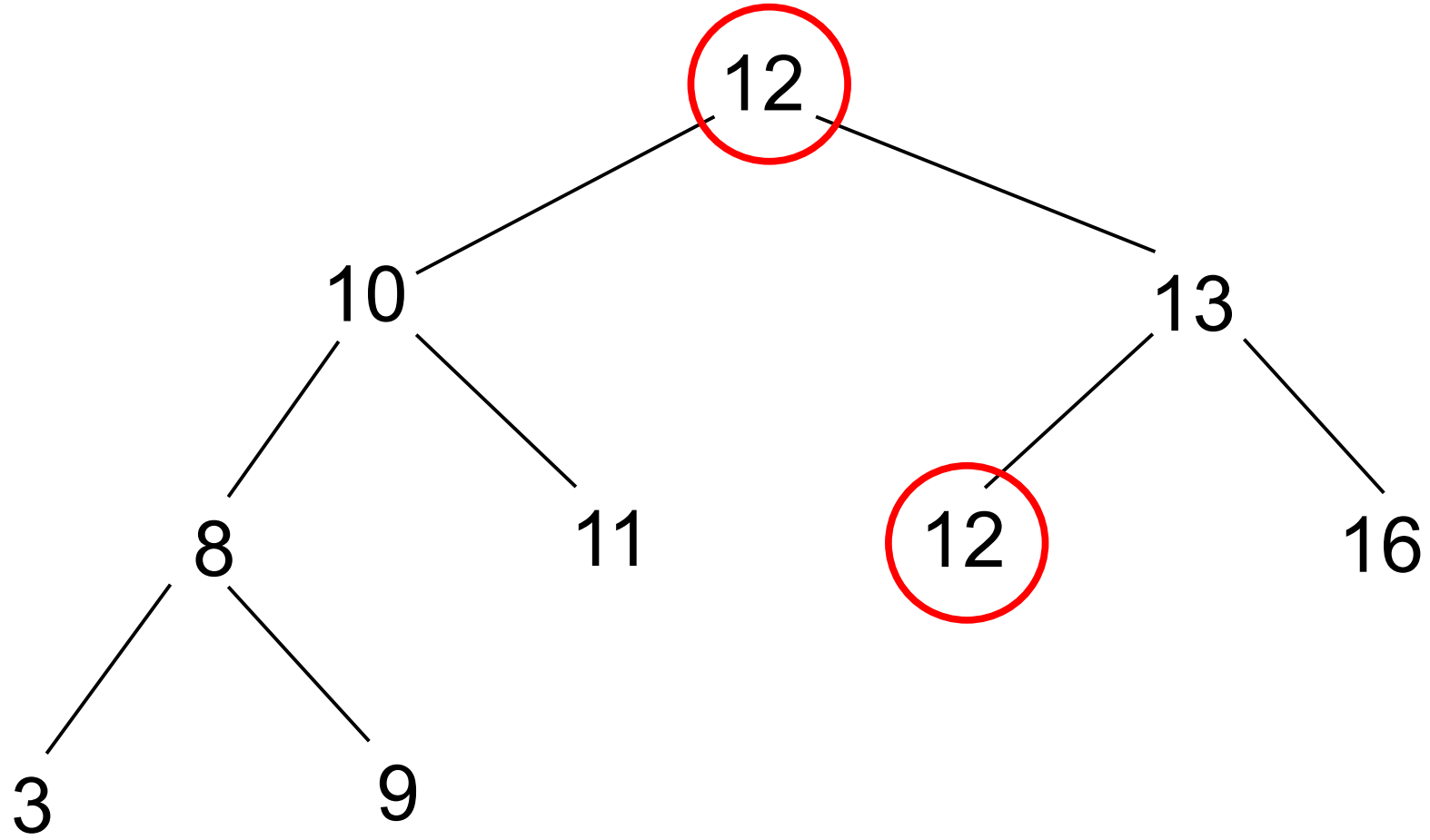
Violates BST property: 17 is not > 19



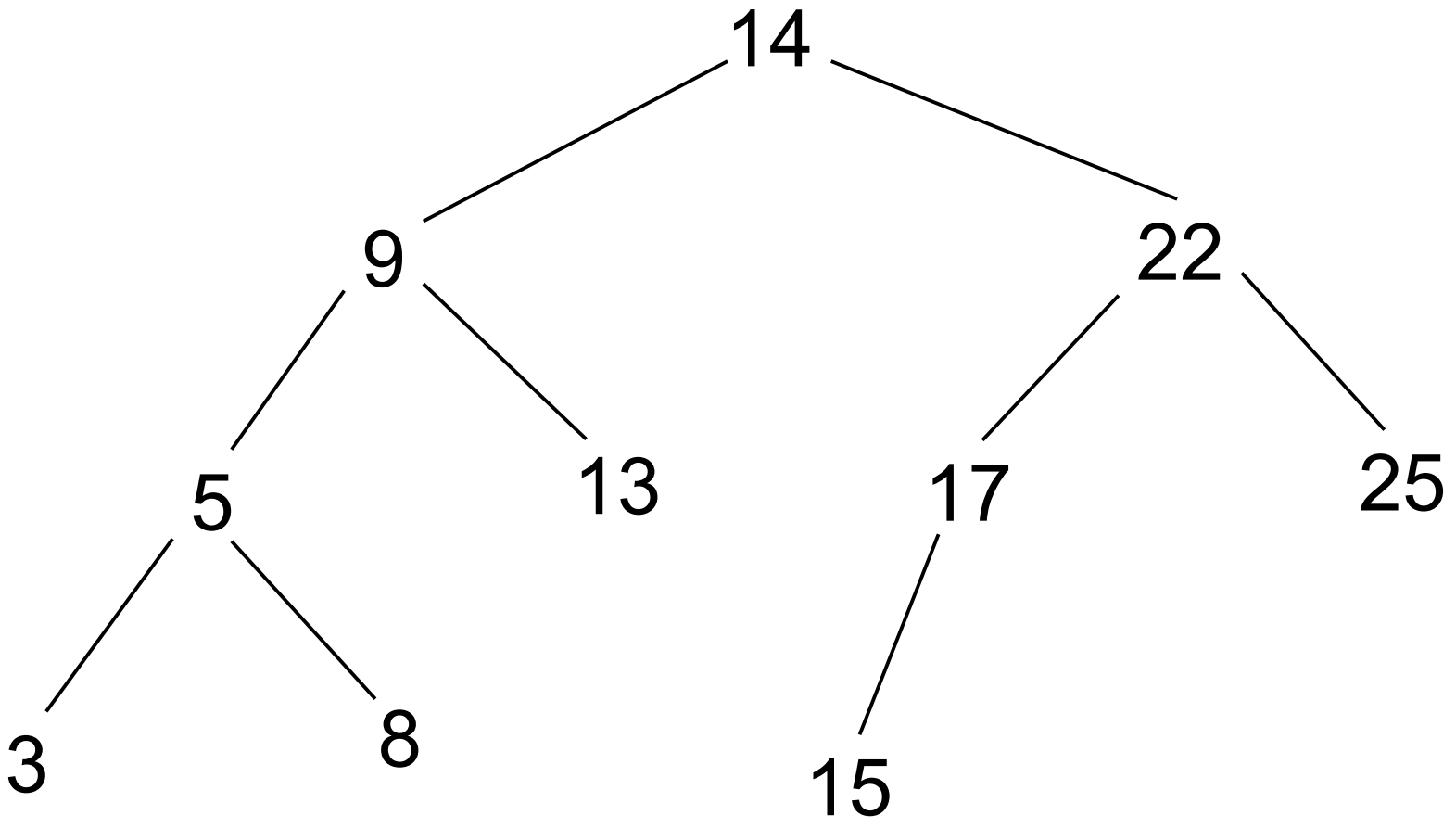
Violates BST property: 12 is not < 9



Violates BST property: 18 is not > 21



Duplicate elements are not allowed

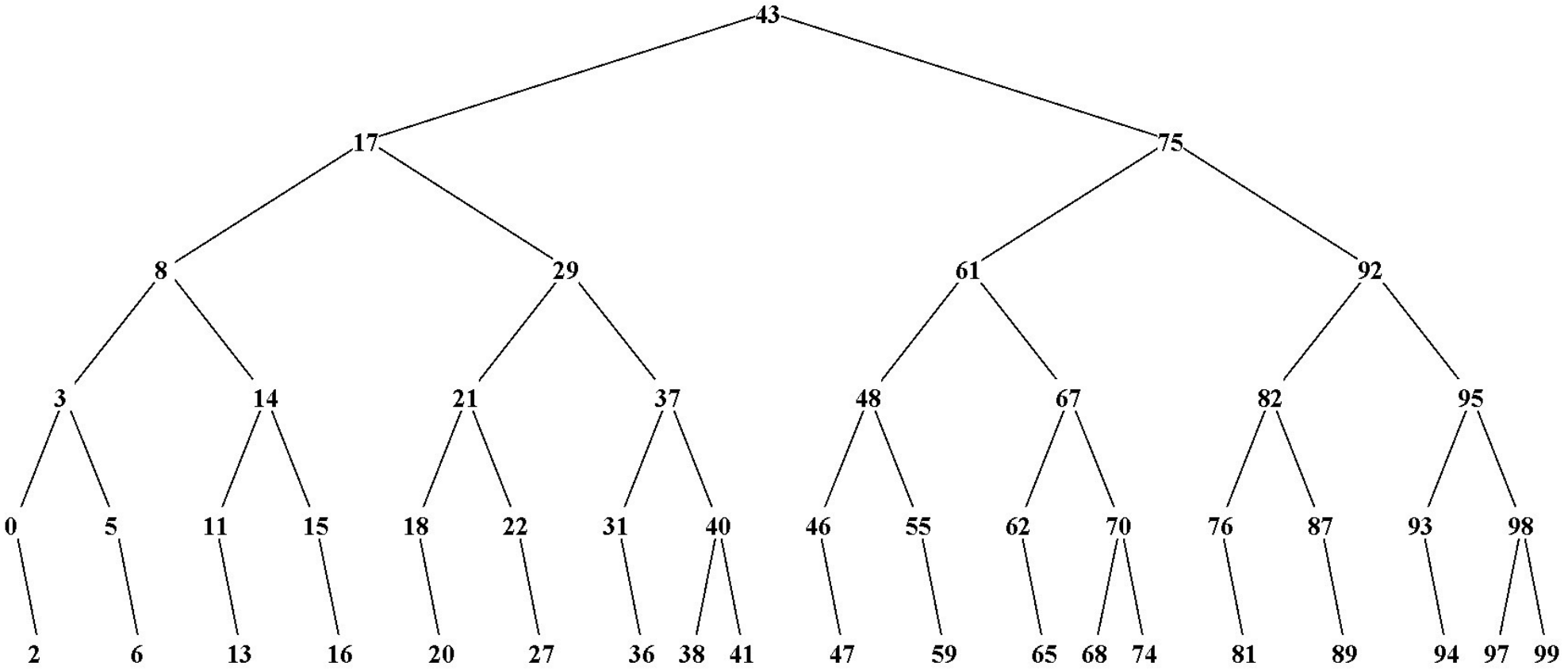


Binary search trees are good at representing **sets**

{ 3, 5, 8, 9, 13, 14, 15, 17, 22, 25 }

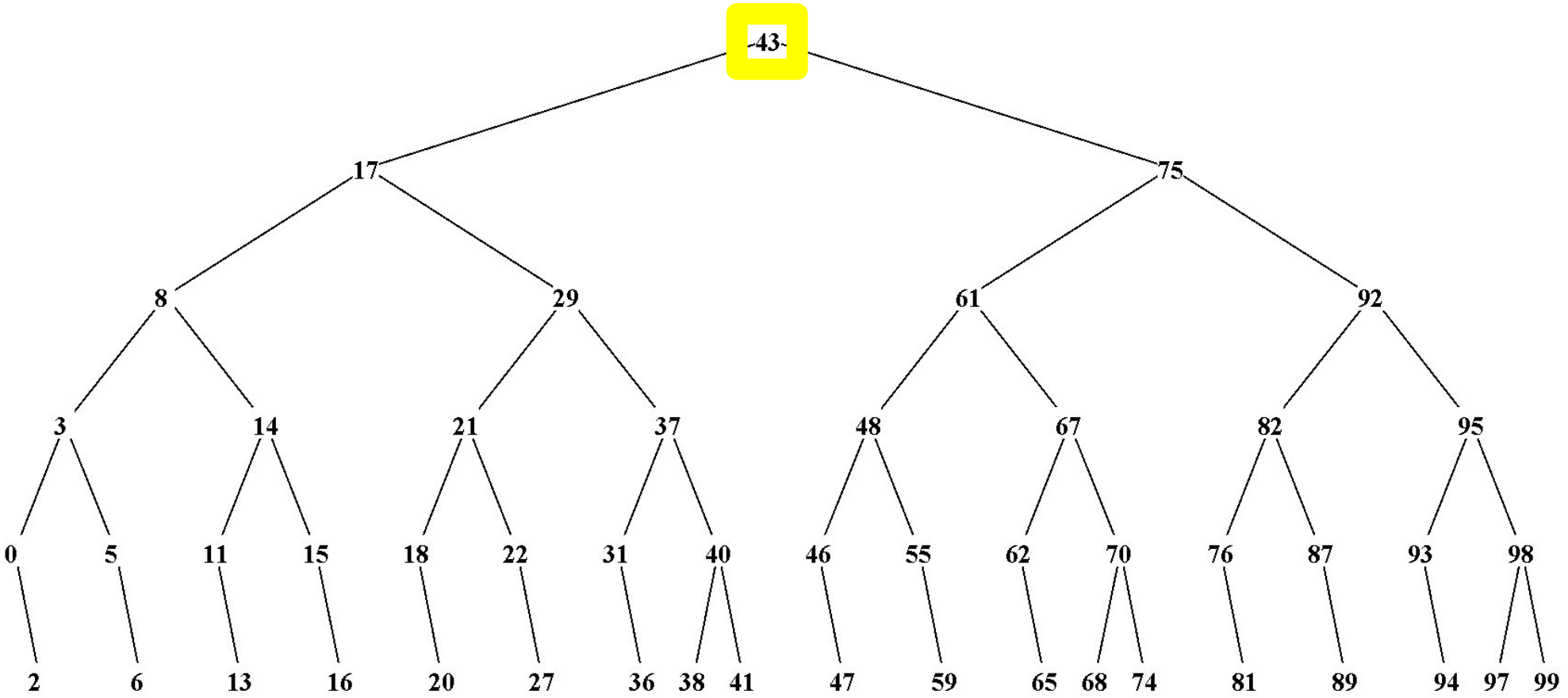
Testing for Membership

is 65 a member?



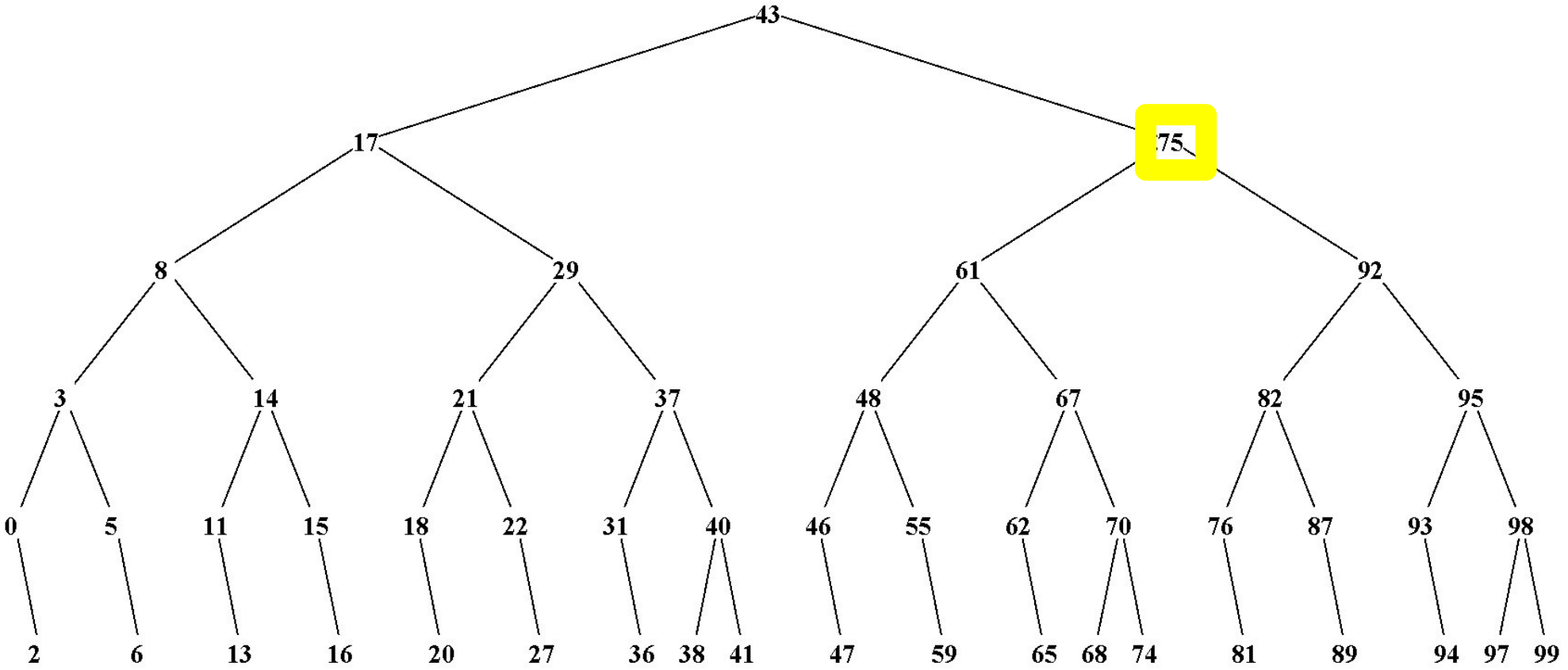
Testing for Membership

is 65 a member?



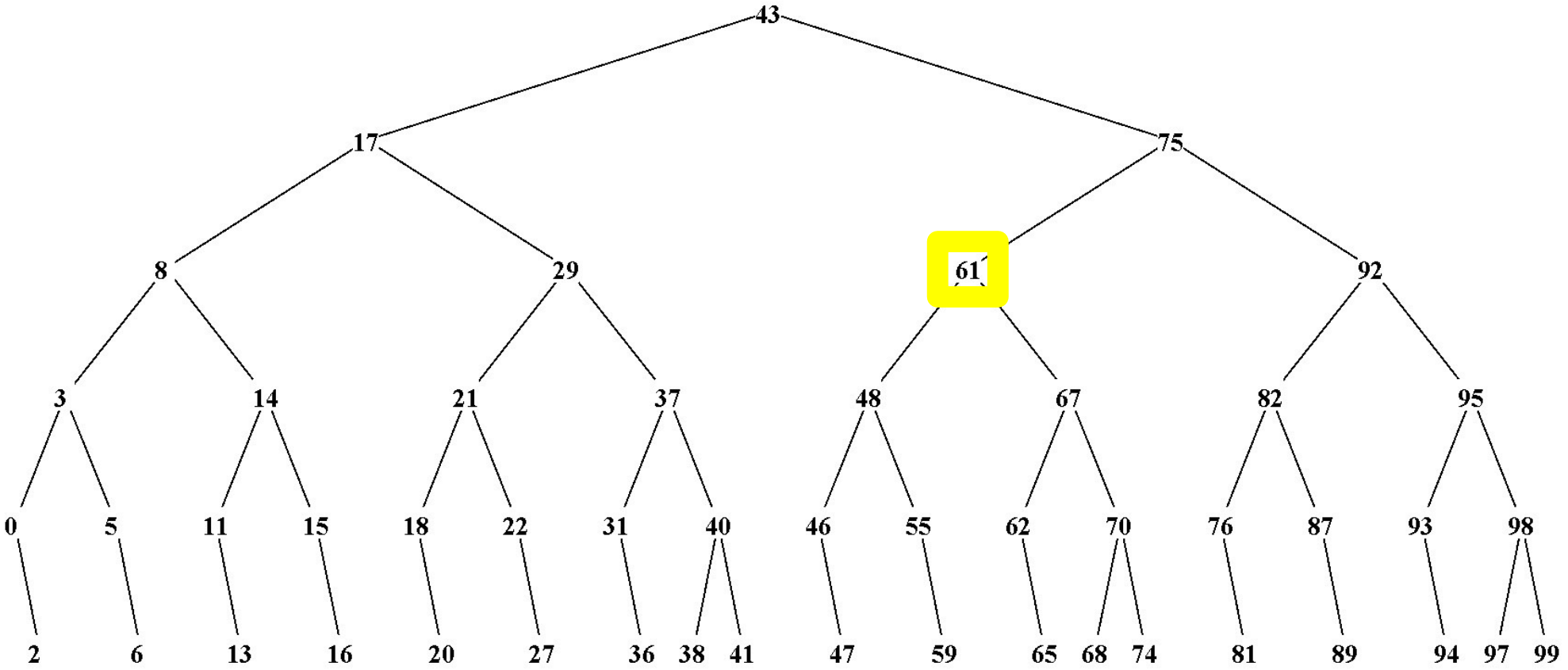
Testing for Membership

is 65 a member?



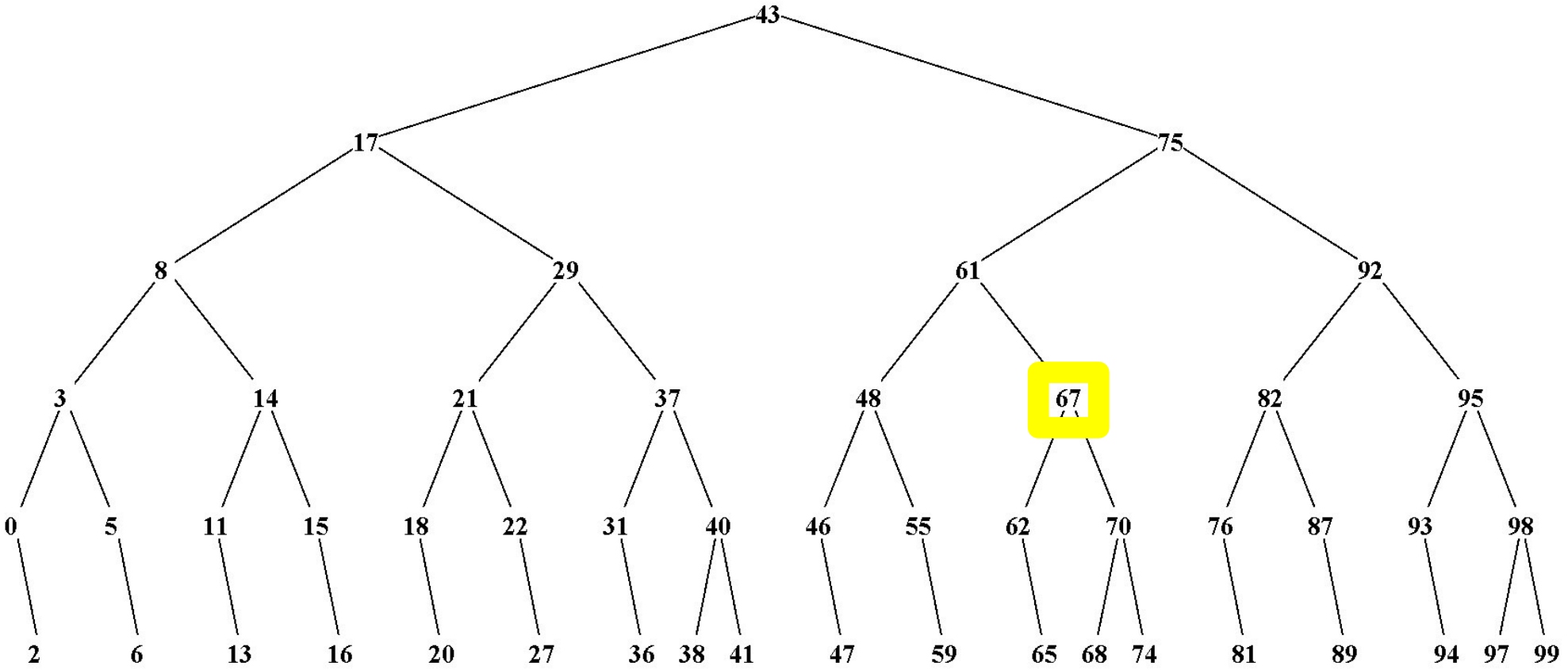
Testing for Membership

is 65 a member?



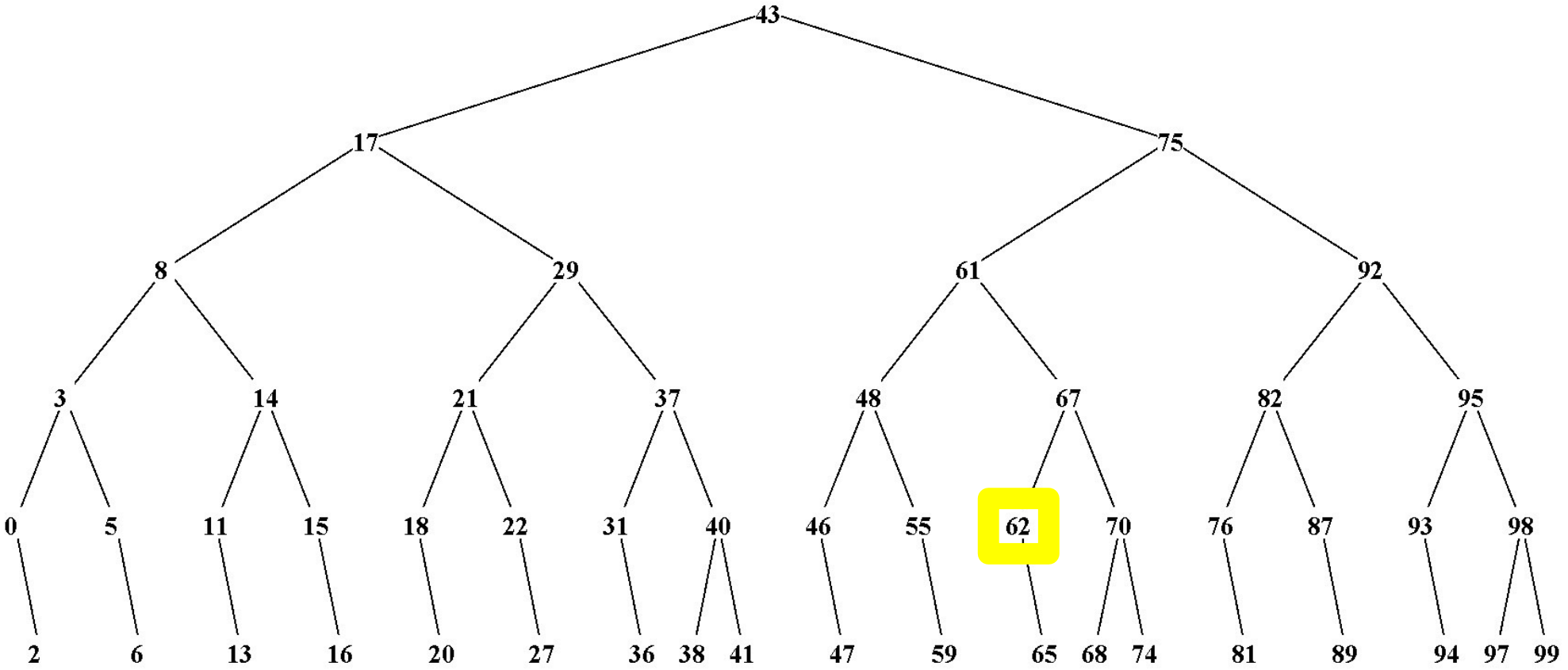
Testing for Membership

is 65 a member?



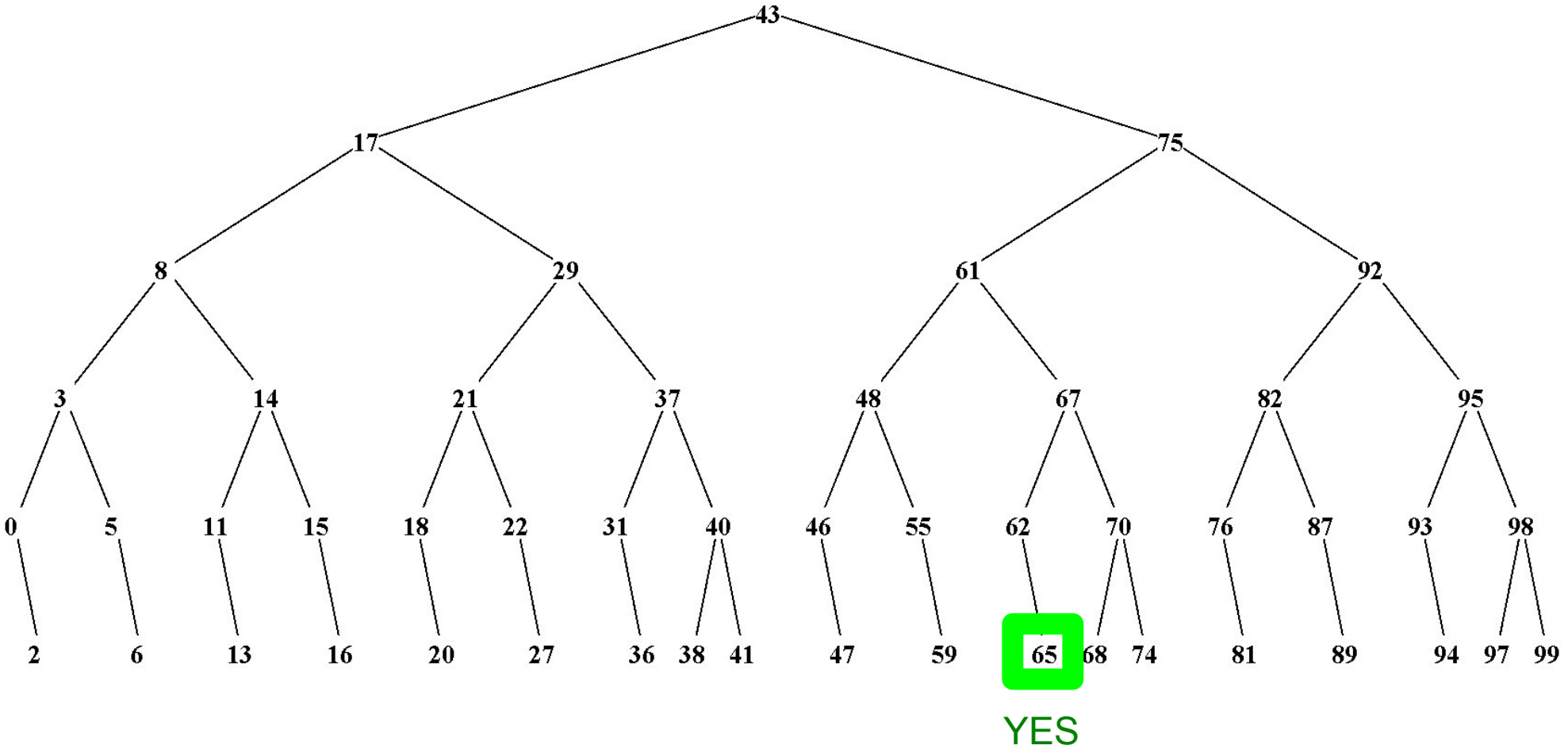
Testing for Membership

is 65 a member?



Testing for Membership

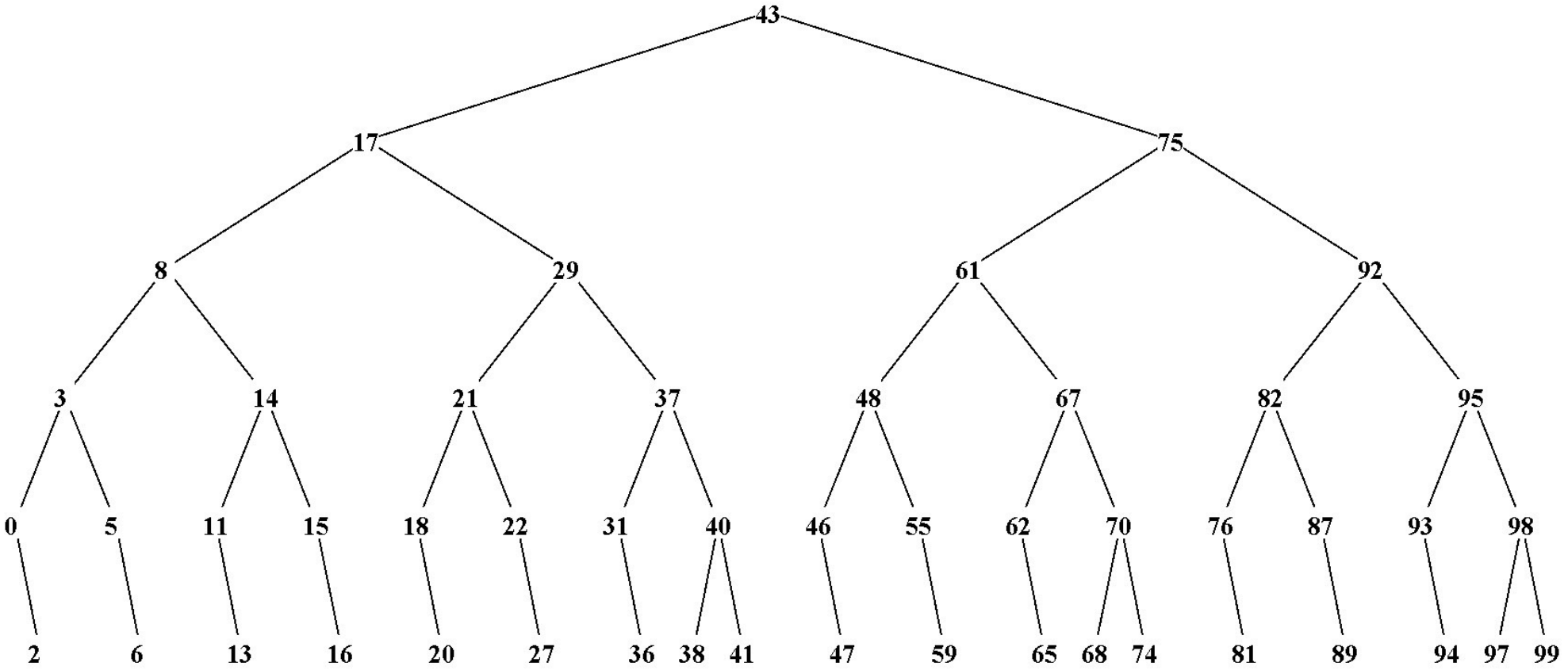
is 65 a member?



YES

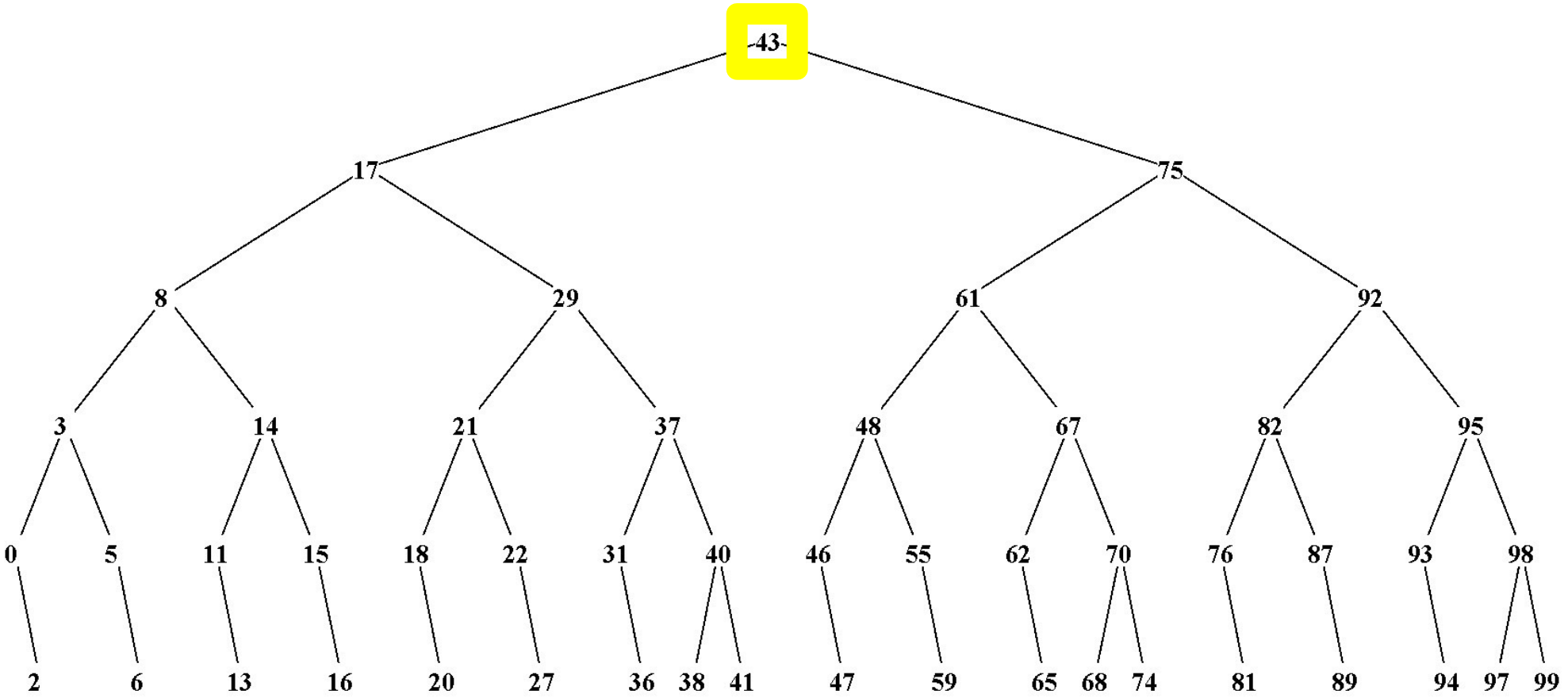
Testing for Membership

is 12 a member?



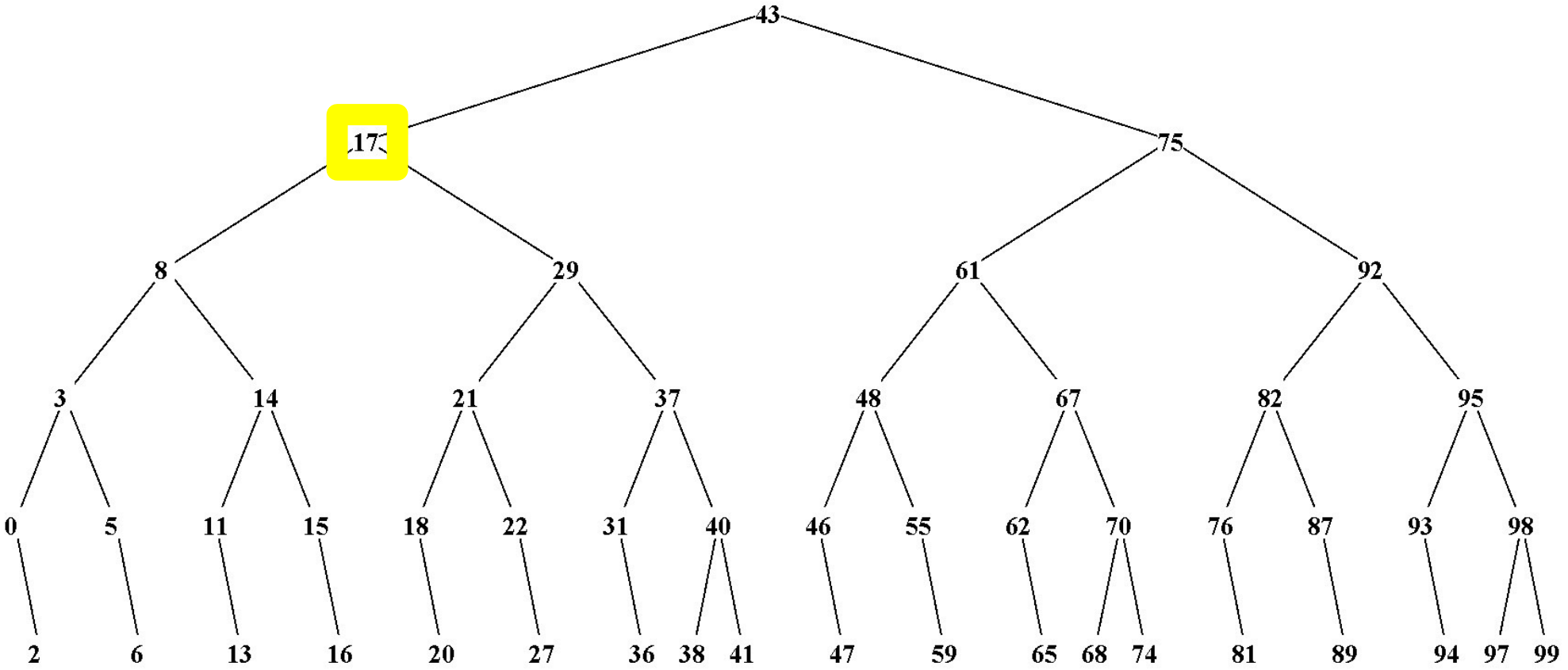
Testing for Membership

is 12 a member?



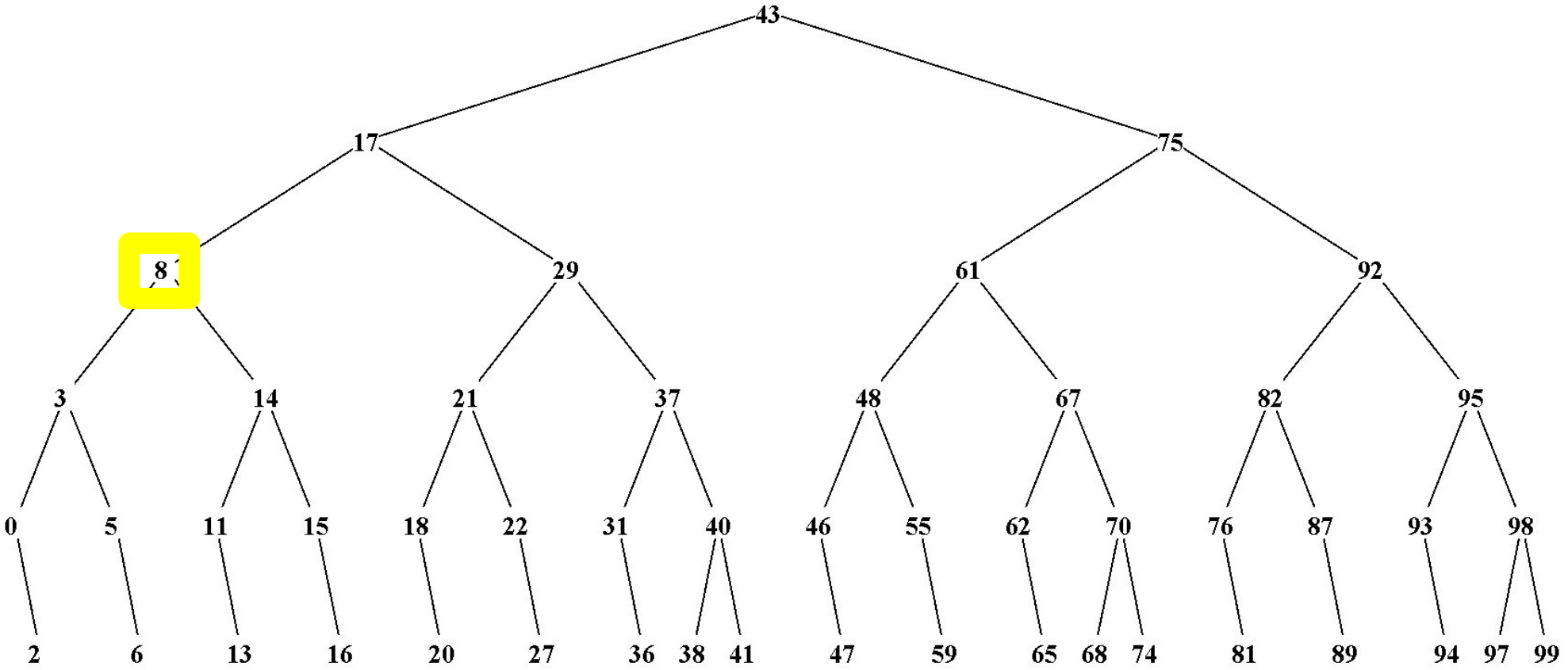
Testing for Membership

is 12 a member?



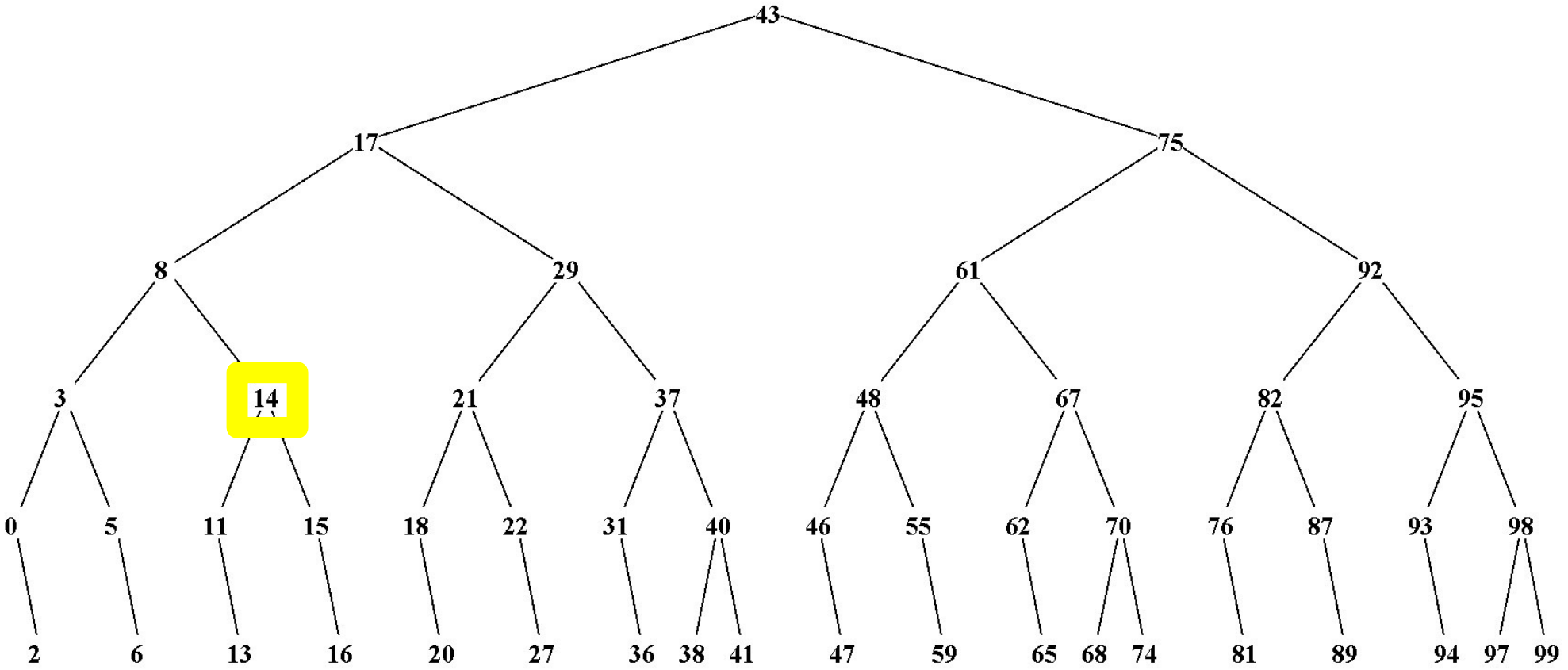
Testing for Membership

is 12 a member?



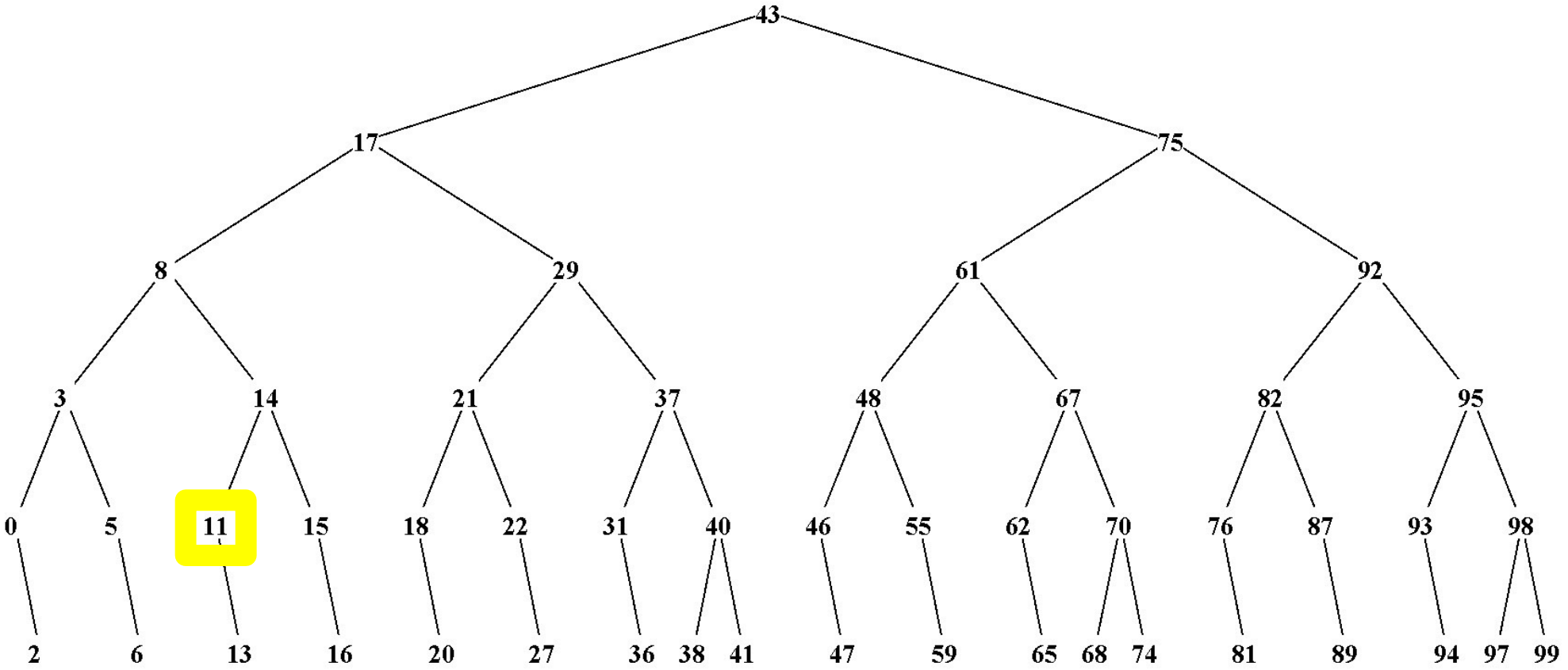
Testing for Membership

is 12 a member?



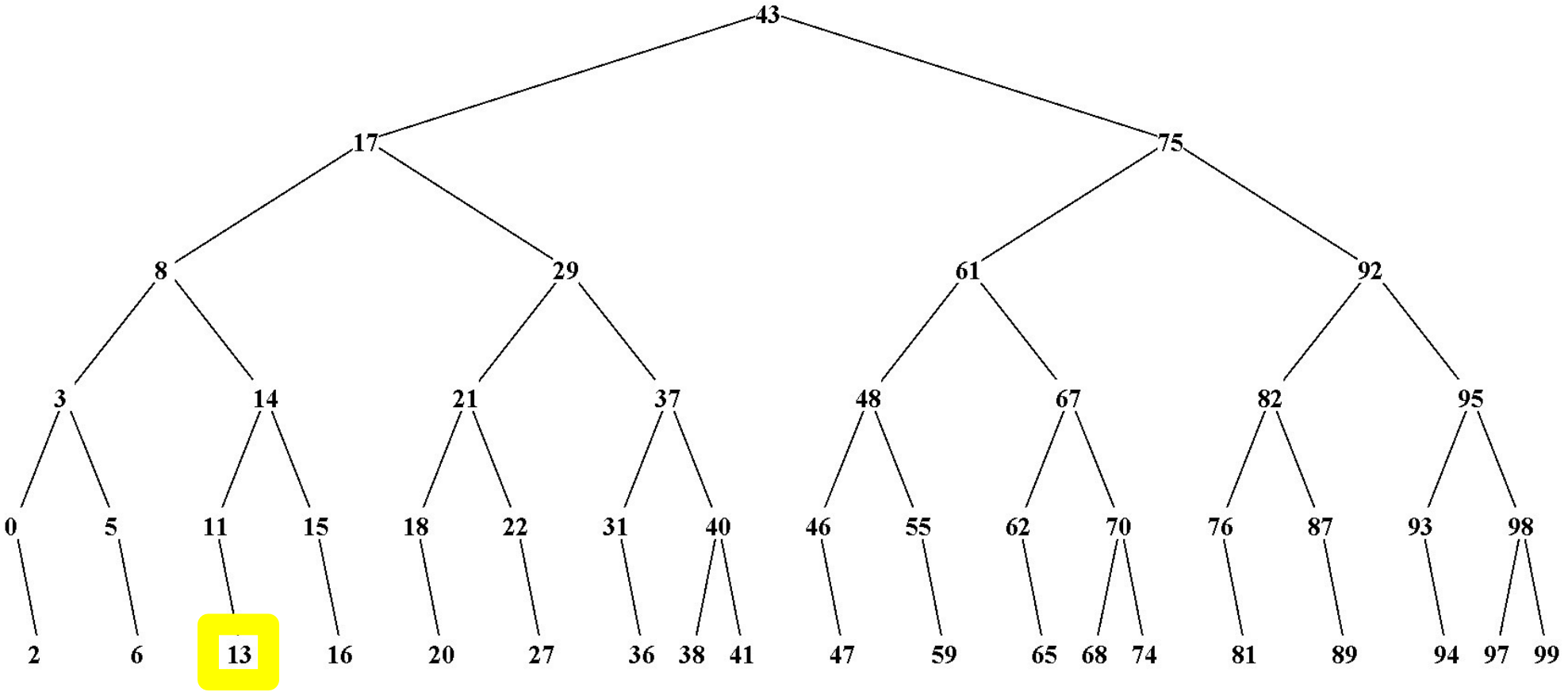
Testing for Membership

is 12 a member?



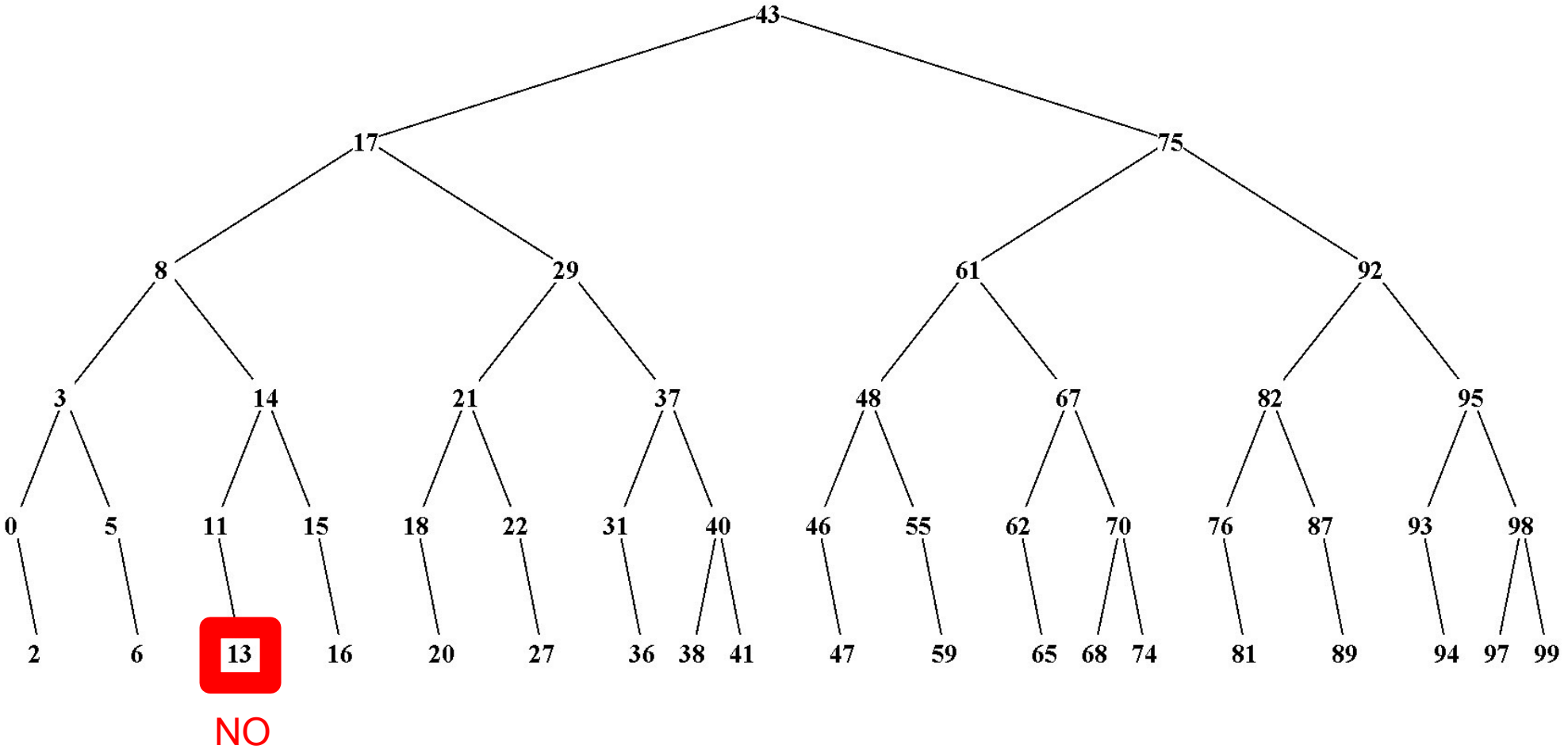
Testing for Membership

is 12 a member?



Testing for Membership

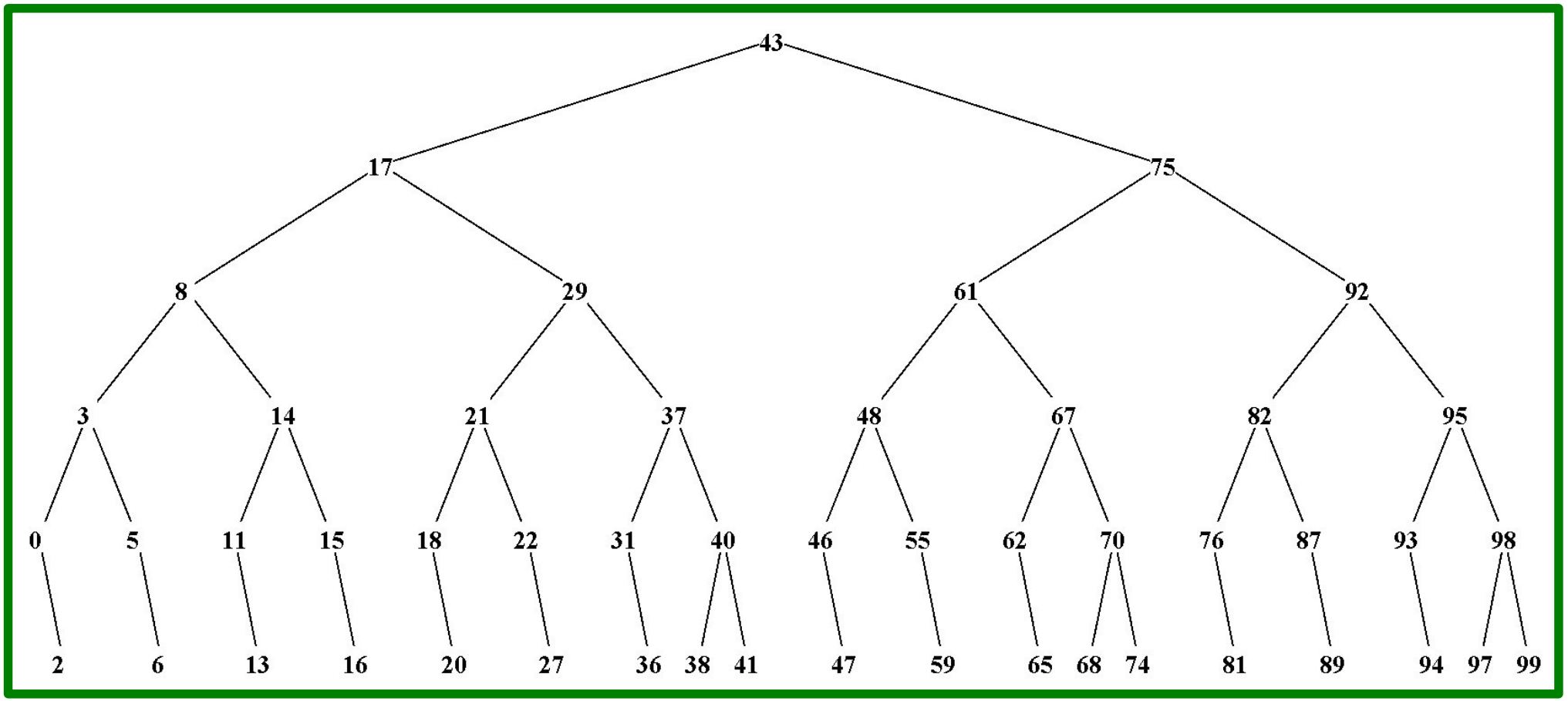
is 12 a member?



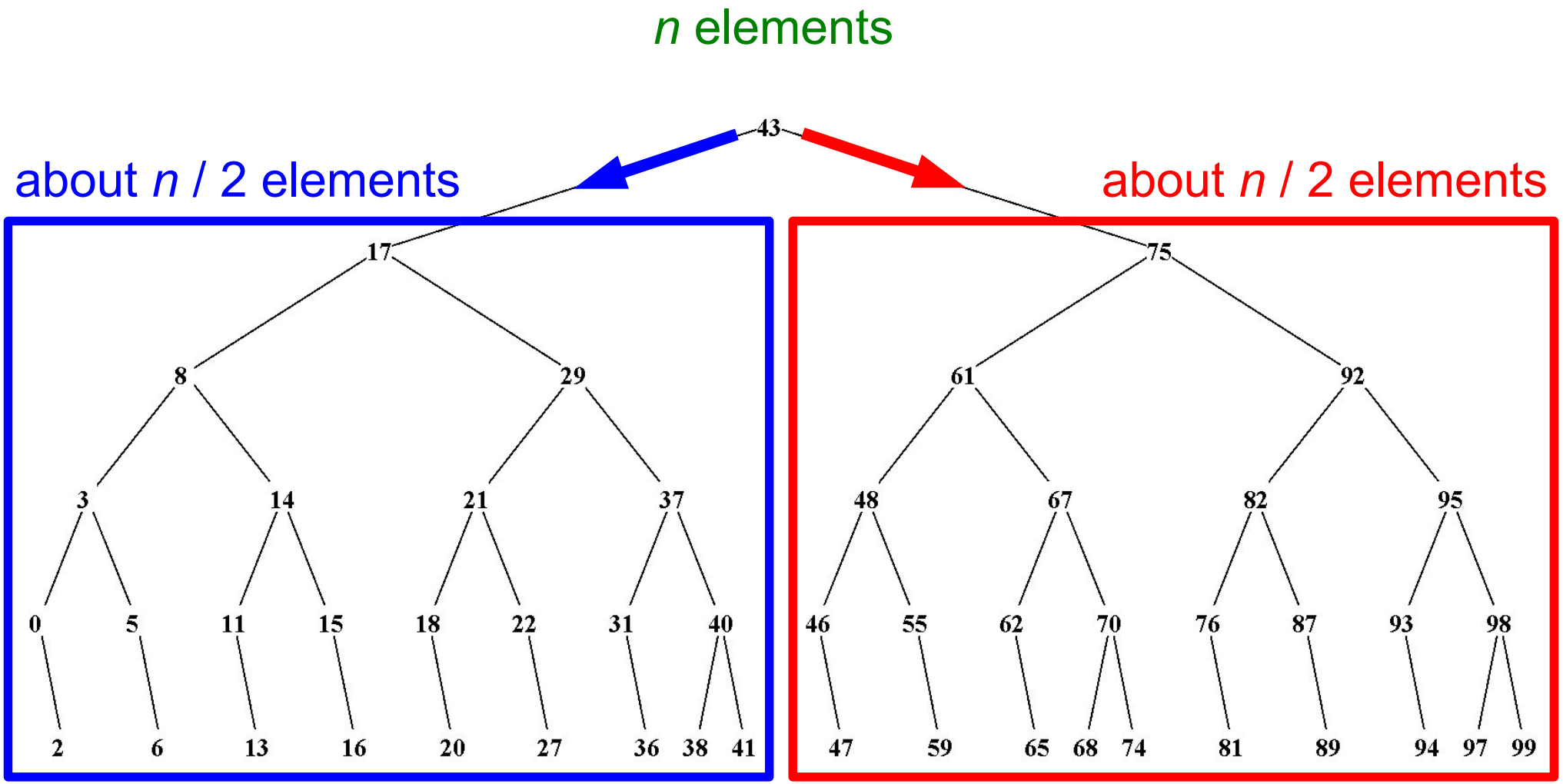
NO

If the Tree is Balanced ...

n elements

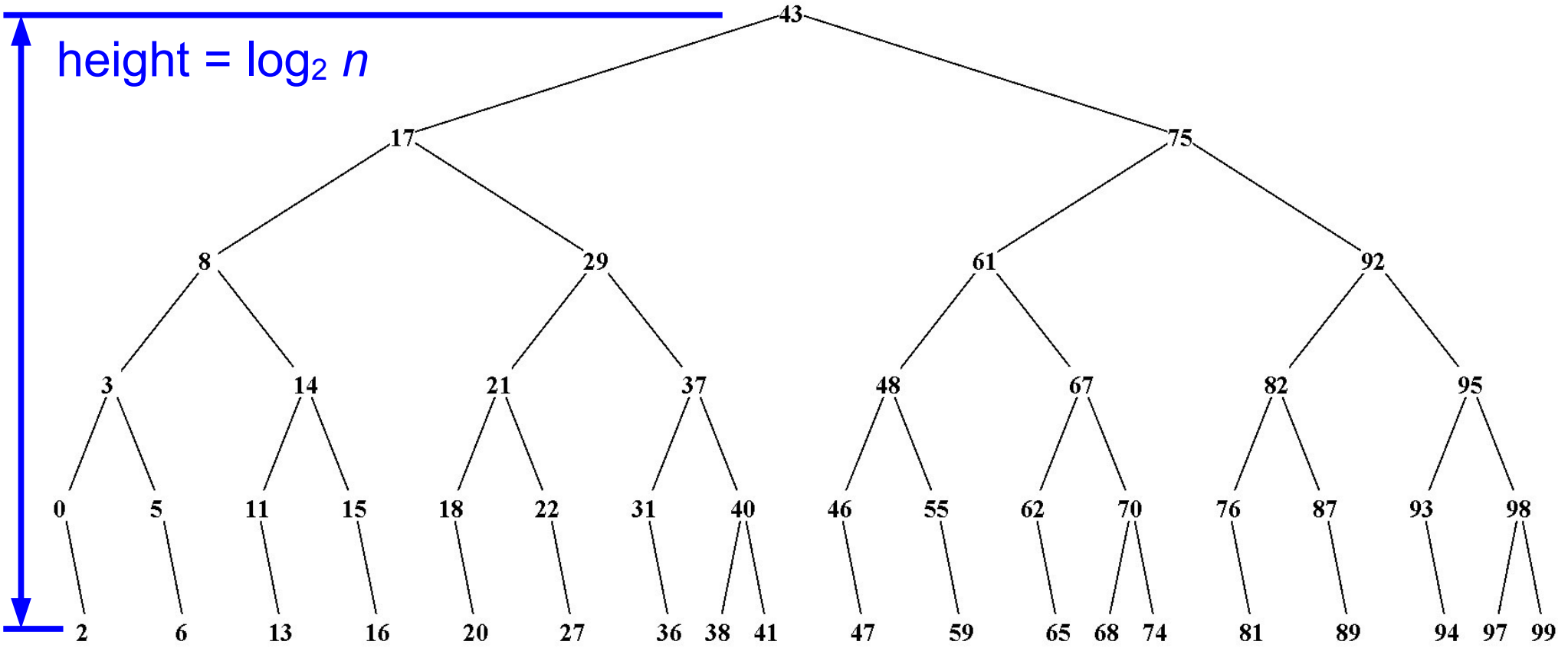


If the Tree is Balanced ...



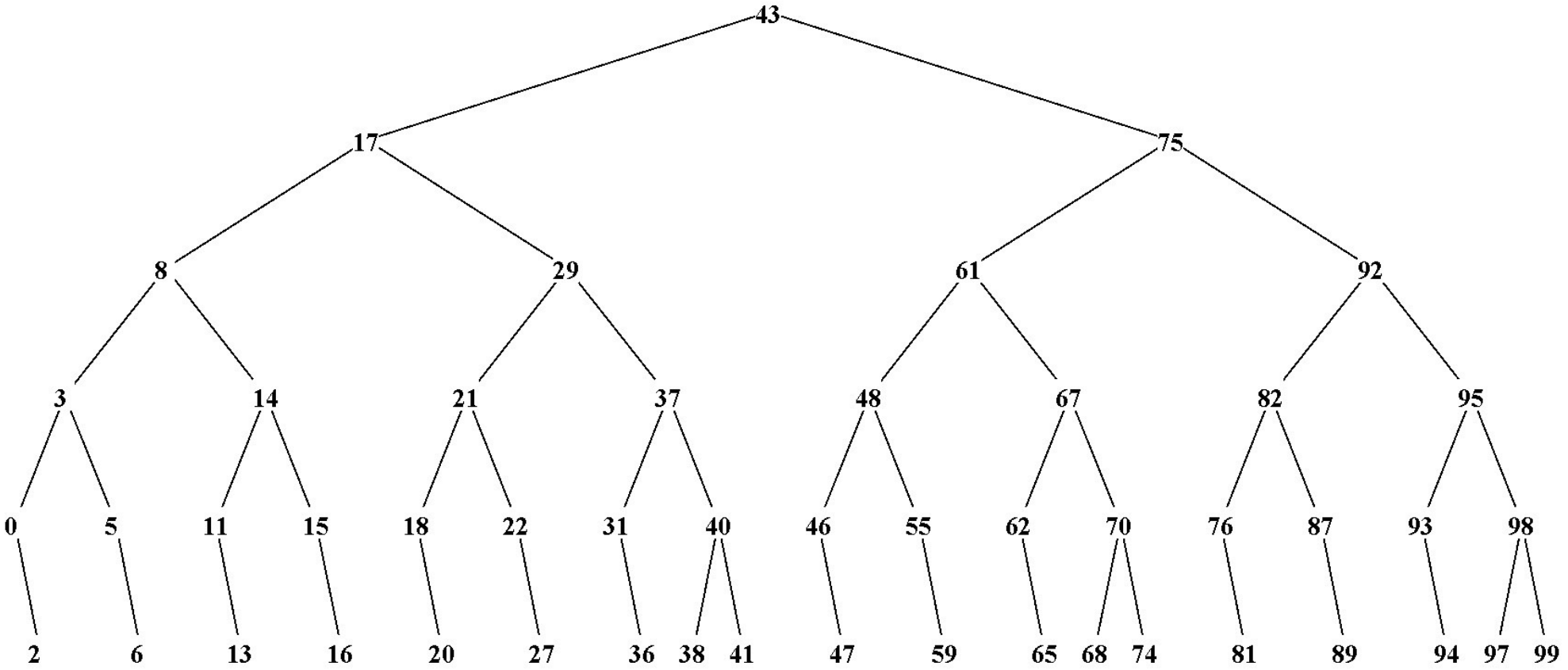
If the Tree is Balanced ...

n elements



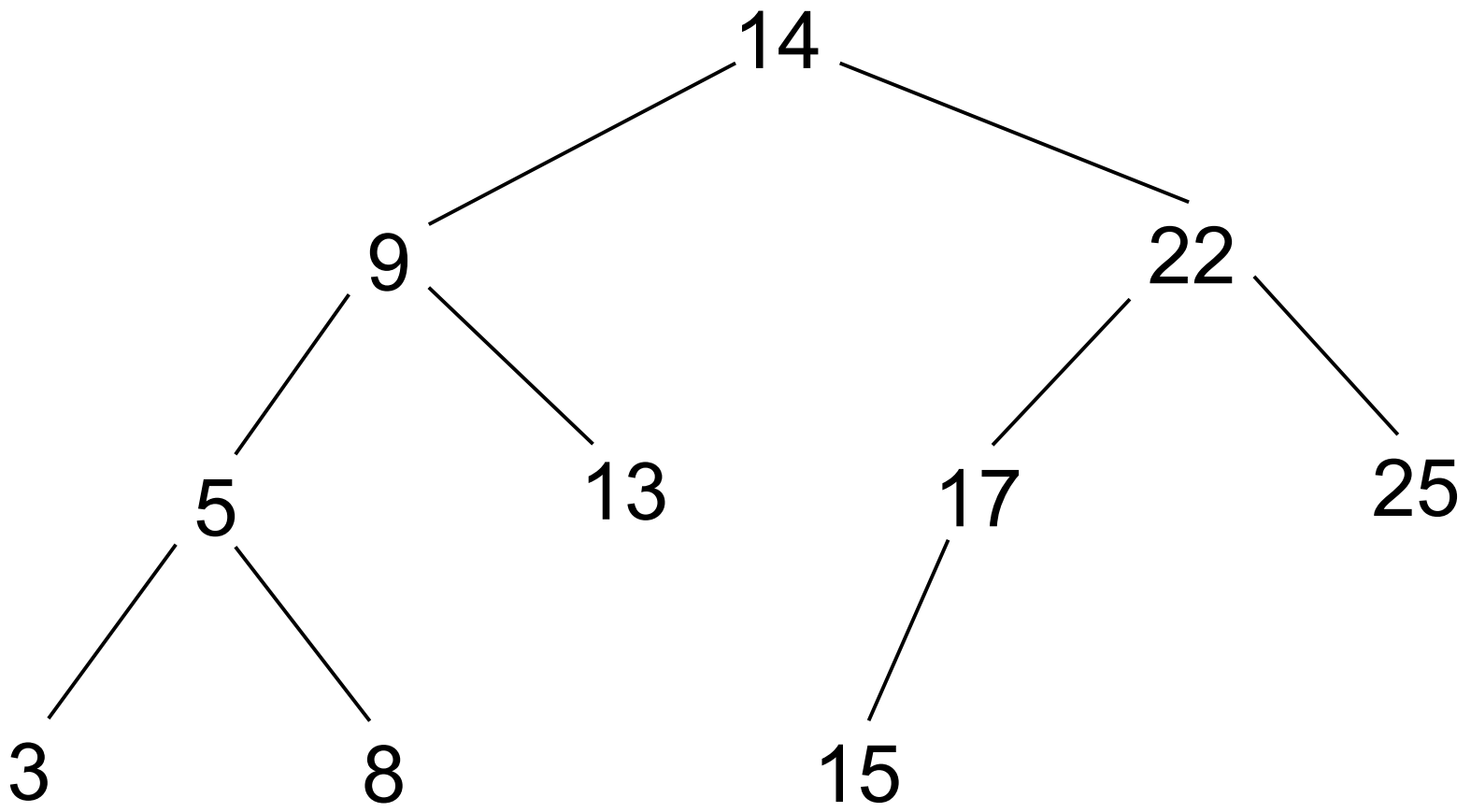
Testing for Membership

O(log *n*) time complexity

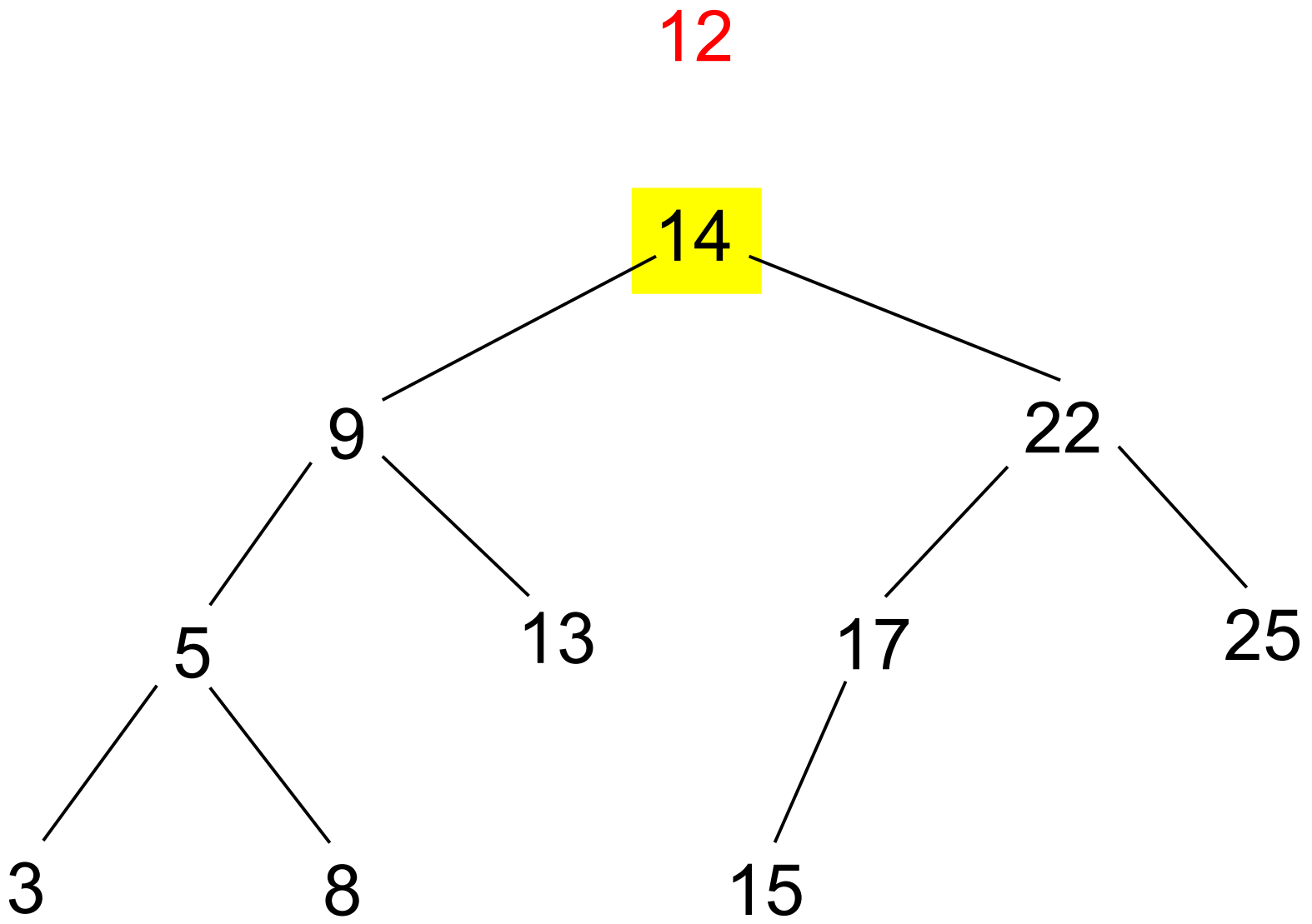


Inserting a New Element

12

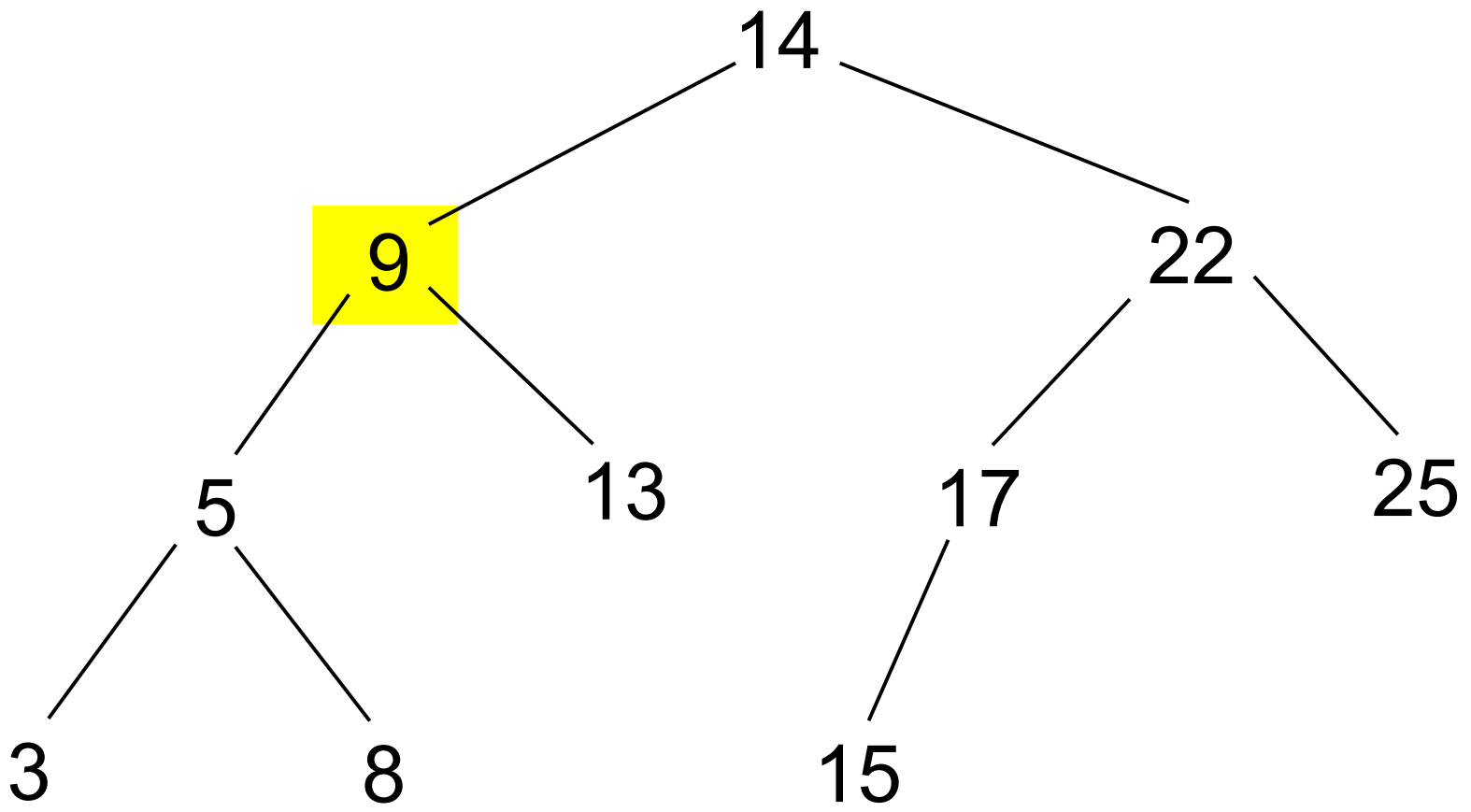


Inserting a New Element



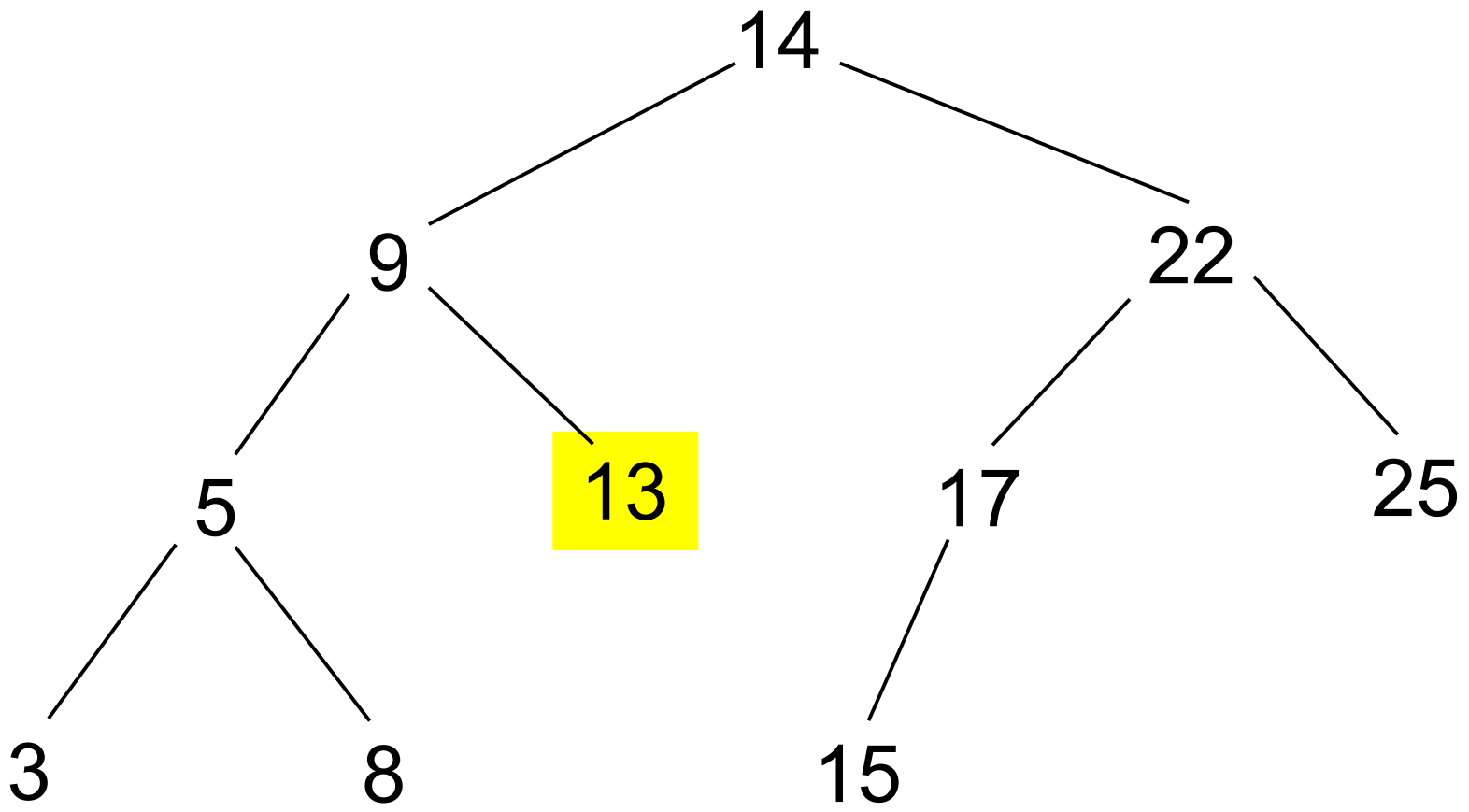
Inserting a New Element

12

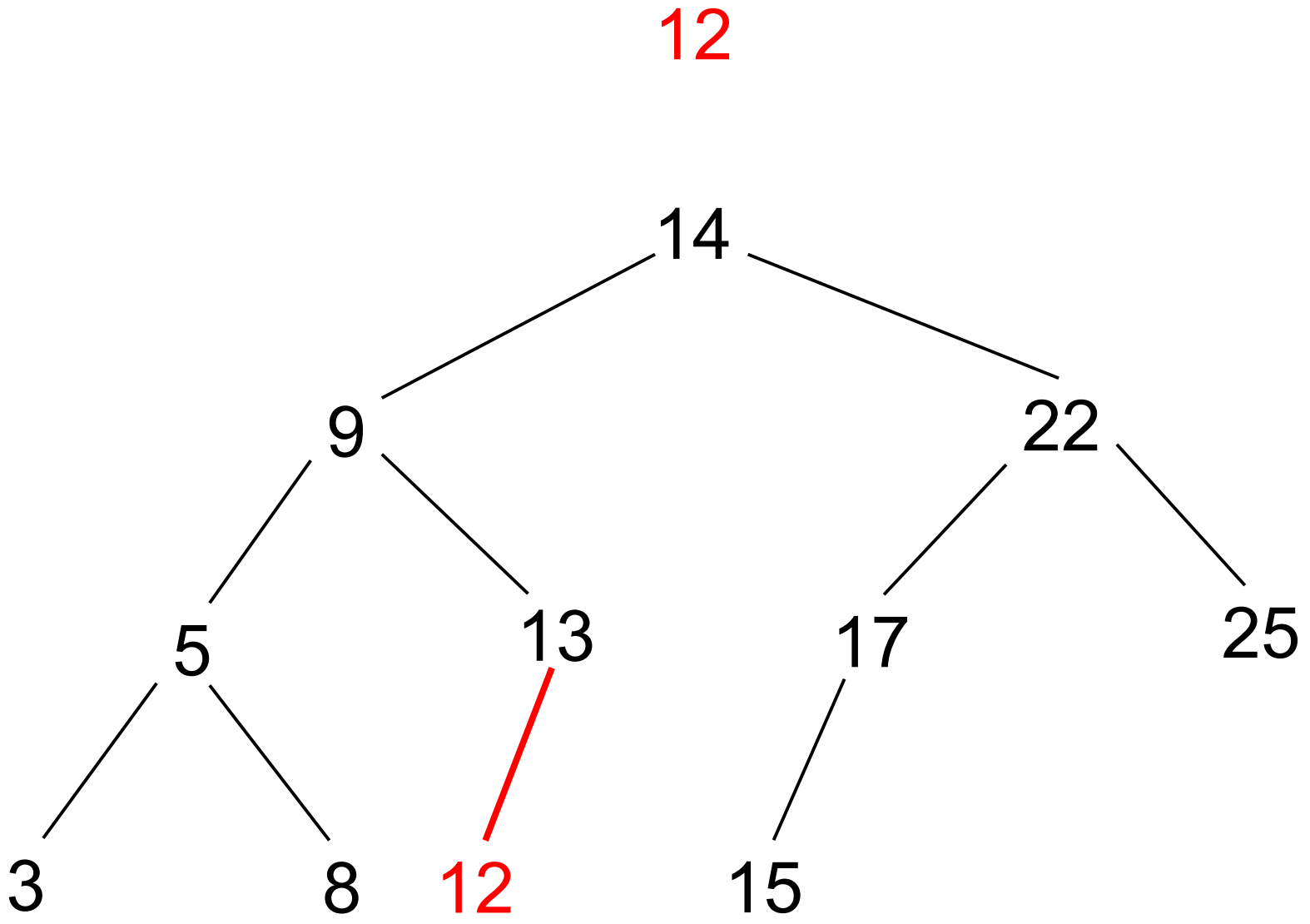


Inserting a New Element

12



Inserting a New Element



Inserting a New Element

O(log *n*) time complexity