

Short Quiz on Trees (cont'd.)

Given the tree to the right, identify the ff.:

- Children of node 16.
- Parent of node 1.
- Siblings of 23.
- Ancestors of 9.
- Descendants of 16.
- Leaves.
- Non-leaves.

```
graph TD; 22((22)) --- 16((16)); 22 --- 7((7)); 16 --- 13((13)); 16 --- 6((6)); 16 --- 60((60)); 7 --- 12((12)); 7 --- 1((1)); 13 --- 23((23)); 60 --- 21((21)); 12 --- 20((20)); 12 --- 4((4)); 4 --- 9((9));
```

Short Quiz on Trees (cont'd.)

Given the tree to the right, identify the ff.:

- Depth of node 4.
- Degree of the tree.
- Height of the tree.
- Weight of the tree.
- Is the tree a binary tree?

```
graph TD; 22((22)) --- 16((16)); 22 --- 7((7)); 16 --- 13((13)); 16 --- 6((6)); 16 --- 60((60)); 7 --- 12((12)); 7 --- 1((1)); 13 --- 23((23)); 60 --- 21((21)); 12 --- 20((20)); 12 --- 4((4)); 4 --- 9((9));
```

Short Quiz on Trees (cont'd.)

Given the tree to the right, identify the ff.:

- Removing 6, is the tree a full binary tree?
- Removing 6, is the tree a complete binary tree?
- Is a full binary tree complete?

```
graph TD; 22((22)) --- 16((16)); 22 --- 7((7)); 16 --- 13((13)); 16 --- 6((6)); 16 --- 60((60)); 7 --- 12((12)); 7 --- 1((1)); 13 --- 23((23)); 60 --- 21((21)); 12 --- 20((20)); 12 --- 4((4)); 4 --- 9((9));
```

Short Quiz on Trees (cont'd.)

Given the tree to the right, identify the ff.:

- Is a complete binary tree full?
- How many leaves does a complete n -ary tree of height h have?
- What is the height of a complete n -ary tree with m leaves?
- What is the number of internal nodes of a complete n -ary tree of height h ?
- What is the total number of nodes a complete n -ary tree of height h have?

```
graph TD; 22((22)) --- 16((16)); 22 --- 7((7)); 16 --- 13((13)); 16 --- 6((6)); 16 --- 60((60)); 7 --- 12((12)); 7 --- 1((1)); 13 --- 23((23)); 60 --- 21((21)); 12 --- 20((20)); 12 --- 4((4)); 4 --- 9((9));
```

6. Children of node 16?

ANS:

Nodes=13, 6, 60

7. Parent of node 1?

ANS:

Nodes=7

8. Siblings of node 23?

ANS:

Nodes=

9. Ancestors of node 9?

ANS:

Nodes=4, 12, 7, 22

10. Descendants of node 16?

ANS:

Nodes=13, 23, 6, 60, 21

11. Leaves.

ANS:

Nodes=23, 6, 21, 20, 9, 1

12. Non Leaves.

ANS:

Nodes=13, 16, 60, 12, 7, 22

13. Depth of node 4?

ANS: 3

14. Degree of the tree?

ANS: 3

15. Height of the tree?

ANS: 4

16. Weight of the tree?

ANS: 6

17. Is the tree a binary tree?

ANS: If the node 16 has a degree/no. of children of 3, then the answer is NO.

18. Removing 6, is the tree a full binary tree?

ANS: No, for the reason that nodes 13 and 60 only have 1 child or a degree of 1

19. Removing 6, is the tree a complete binary tree?

ANS: No, because leaf node 1 has a depth of two, leaf nodes 23, 21, and 20 each have a depth of 3, and leaf node 9 has a depth of 4.

20. Is a full binary tree complete?

ANS: No, because while all nodes in a full binary tree have exactly 2 degrees, this does not meet the other condition for a tree to be deemed a complete k-ary tree, namely the fact that all leaf nodes have a similar depth.

21. Is a complete binary tree full?

ANS: Yes, as all of the non-leaf nodes in a complete 2-ary tree must have a degree of two, and a complete 2-ary tree must contain leaf nodes of the same depth.

22. How many leaves does a complete n-ary tree of height h have?

ANS: The formula n^h may be used to determine how many leaves are in a certain tree.

23. What is the height of a complete n-ary tree with m leaves?

ANS: We can find the height of the tree by using the formula $\log_{\mathbf{n}}(\mathbf{m})$

24. What is the number of internal nodes of a complete n-ary tree of height h?

ANS: The formula $(\mathbf{n}^{\mathbf{h+1}})/(\mathbf{n-1})$ can be used to find the number of internal nodes of the tree.

25. What is the total number of nodes a complete n-ary tree of h have?

ANS: The formula $(\mathbf{n}^{\mathbf{h+1}-1})/(\mathbf{n-1})$ can determine the number of nodes in the tree.