Discussion 05

Trees

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Announcements

- Project 2 (C.A.T.S.) is due Friday 2/24.
 - \circ Early submission bonus point for finishing by Thursday 2/23.

Trees





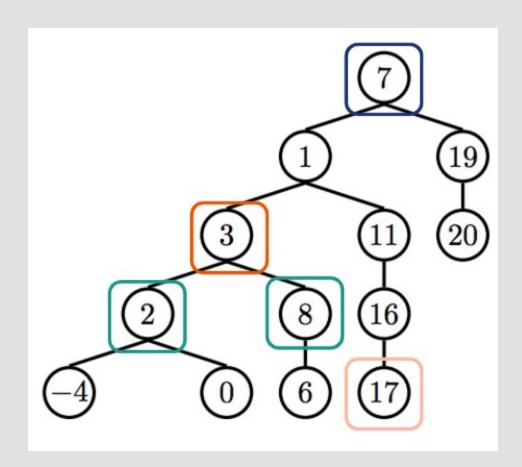


Tree

- What are they?
 - Data structure for hierarchies of data
- What should we know
 - Recursion!
 - Every subtree is also a Tree

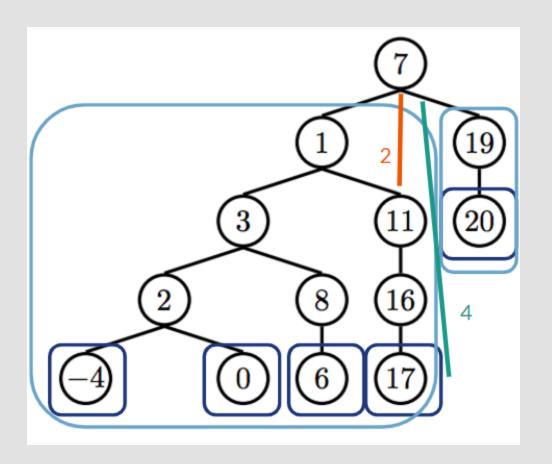
Tree Terminology

- Parent Node
 - A node that has branches
- Child Node
 - A node with a parent
 - Can only have one parent
- Root
 - The top node in a tree
 - There is only one root for a tree
- Label
 - $\circ\,$ The value of a node



More Tree Terminology

- Leaf
 - A node with no branches
- Branch
 - A subtree of the root
 - All branches are also trees
- Depth
 - How far away a node is from the root
- Height
 - The depth of the lowest leaf



ADT tree Implementation

```
def tree(label, branches=[]):
    return [label] + list(branches)
def label(tree):
    return tree[0]
def branches(tree):
    return tree[1:]
def is_leaf(tree):
    return not branches(tree)
```

cred to @Poggenkemper

tree

- Initializing a Tree
 - o tree(label, branches=[])
 - o t = tree(1, [tree(2), tree(3)])
- Accessing branches of a tree
 - o branches(t) -> [tree(2), tree(3)]
- Checking if a tree is a leaf
 - o is_leaf(t) -> False
 - is_leaf(branches(t)[0]) -> True
- Getting label of a Tree
 - o label(t) -> 1

Manipulating Trees

for b in branches(t)

- What is this?
 - IMPORTANT line for dealing with a tree
- Why use this?
 - Allows us to iterate through branches of a tree
 - Useful for calling recursive functions on all branches of a tree
- Can also be a base case
 - The for loop does not run if there are no branches to iterate over

How do I use this? (Recursion for trees)

- 1. Base Case
 - Smallest Input
 - Usually a leaf
- 2. Recursive Calls
 - Call recursive function on branches
- 3. Putting it together
 - Use recursive calls to solve problem
 - Can use max, min, sum, any, all on lists

Thank you

Anon Feedback -> https://tinyurl.com/adit-anon