# Discussion 05

Sequences, Data Abstraction, Trees

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#### Announcements <



Q1, Q2

# rees





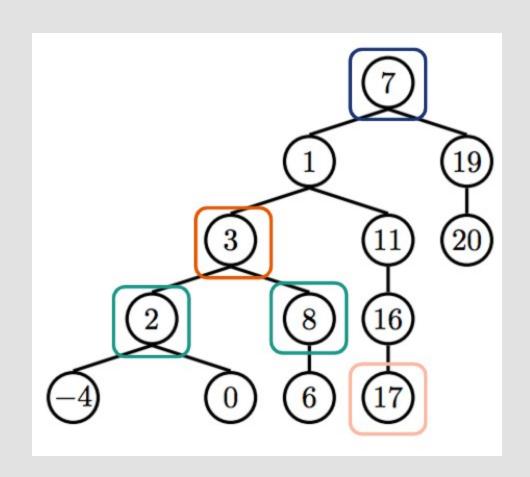


### Tree

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

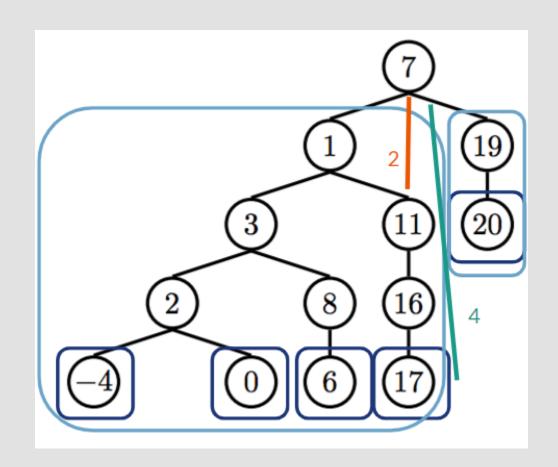
## Tree Terminology

- Parent Node
  - A node that has branches
- Child Node
  - A node with a parent
  - Can only have one parent
- Root
  - $\circ$  The top node in a tree
  - There is only one root for a tree
- Label
  - 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=[]):
    """Construct a tree with the given label value and a list of branches."""
    return [label] + list(branches)
def label(tree):
    """Return the label value of a tree."""
    return tree[0]
def branches(tree):
    """Return the list of branches of the given tree."""
    return tree[1:]
def is_leaf(tree):
    """Returns True if the given tree's list of branches is empty, and False
    otherwise.
    11 11 11
    return not branches(tree)
```

#### 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
  - o 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