

Data Structures

Binary Tree Node

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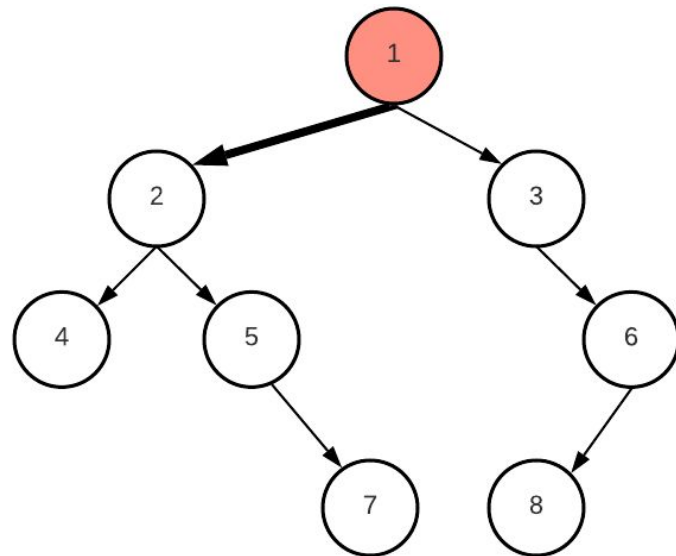
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Tree Node

- Just as in our linked list, we need our node to be able to point to other nodes
 - In a '**binary** tree', we need our node to be able to point to two other nodes: here, for convenience, we call these two nodes 'left' and 'right'

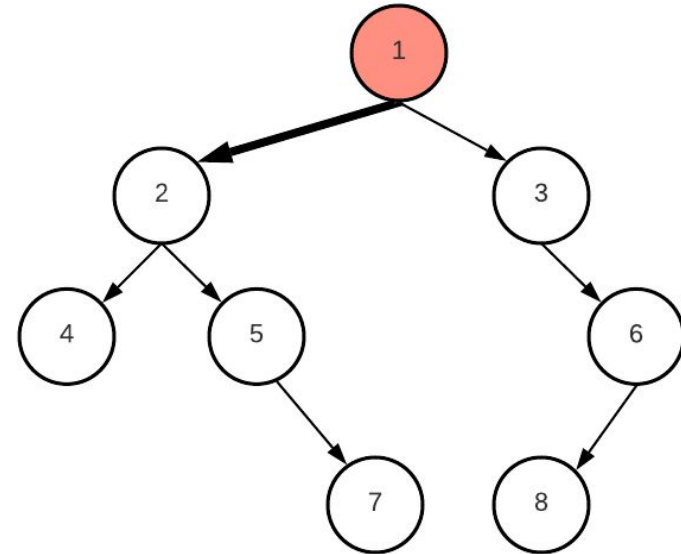
```
class Node:
    def __init__(self, data=None,
                  left=None, right=None):
        self.val = data
        self.left = left
        self.right = right
```



Node Creation

- Let's create the nodes, then link them

```
# Create Nodes  
root = Node(1)  
node2 = Node(2)  
node3 = Node(3)  
node4 = Node(4)  
node5 = Node(5)  
node6 = Node(6)  
node7 = Node(7)  
node8 = Node(8)
```



Edge Linking!

- Now we can link them. Congratulations! We built a binary tree!
- Starting from the root: *how can we print 7?*

Link them!

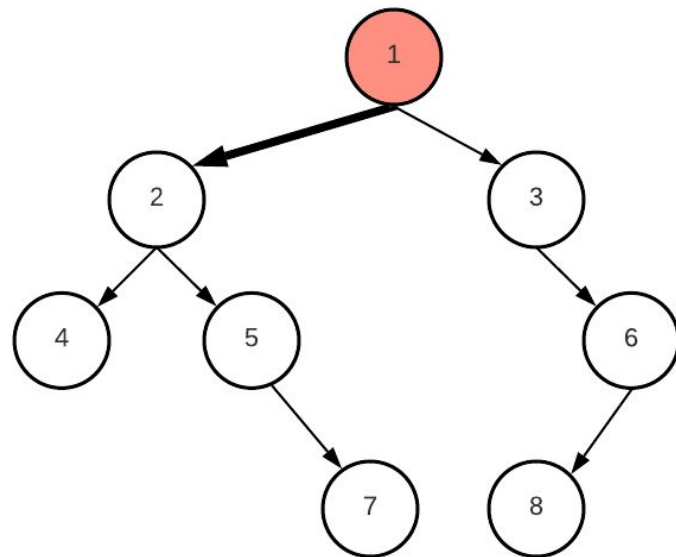
```
root.left = node2  
root.right = node3
```

```
node2.left = node4  
node2.right = node5
```

```
node5.right = node7
```

```
node3.right = node6
```

```
node6.left = node8
```

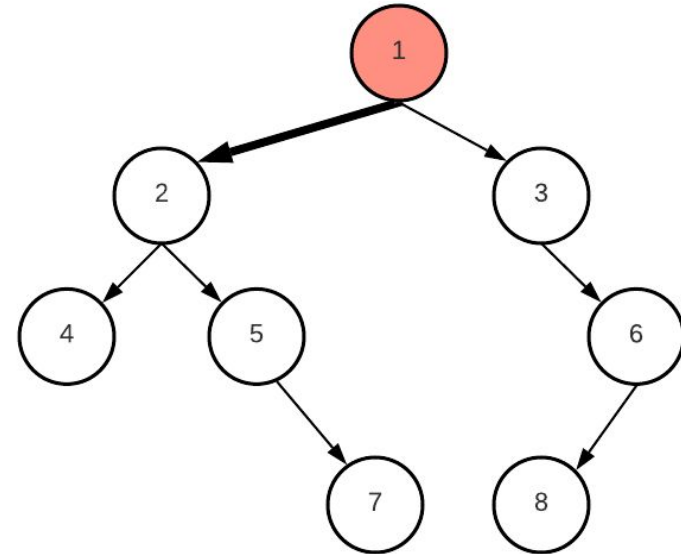


Printing paths

- A path is a chain of nodes, e.g. $[1 \Rightarrow 2 \Rightarrow 5 \Rightarrow 7]$
- As with our linked list structure, it's a common mistake to try and use/access a child node that is a **None**!

```
print(root.left.right.right.val) # 7
print(_____node2.right.right.val) # 7
print(_____node5.right.val) # 7
print(_____node7.val) # 7

print(root.right.right.val) # 6
print(root.right.right.left.val) # 8
print(root.right.right.right) # None
```



Systematic printing!

- Printing out a linked list is trivial; we simply keep going from the head straight to the tail!
- But a tree has 2 subtrees!
- To print a tree, you need to print its subtrees! Recursion!
- Your turn:
 - Implement: `def print(node)`
 - Call it with `print(root)`
 - The function should print out all values held with the nodes in our tree!

“Acquire knowledge and impart it to the people.”

“Seek knowledge from the Cradle to the Grave.”