Composition

Announcements

Linked Lists

Linked List Structure

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3 , 4 , 5

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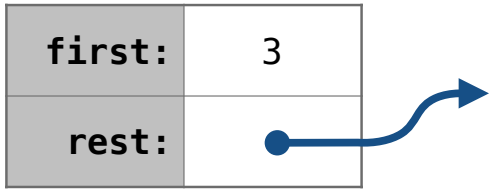
Link instance



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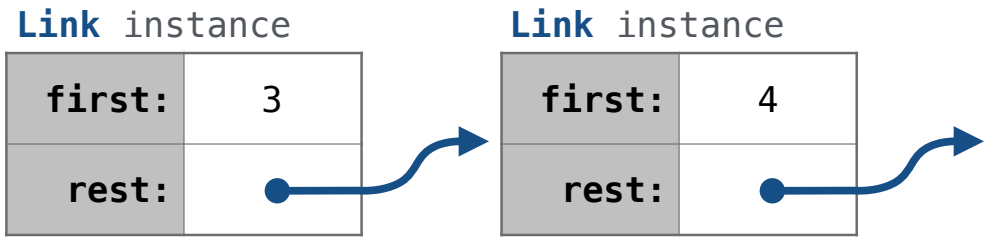

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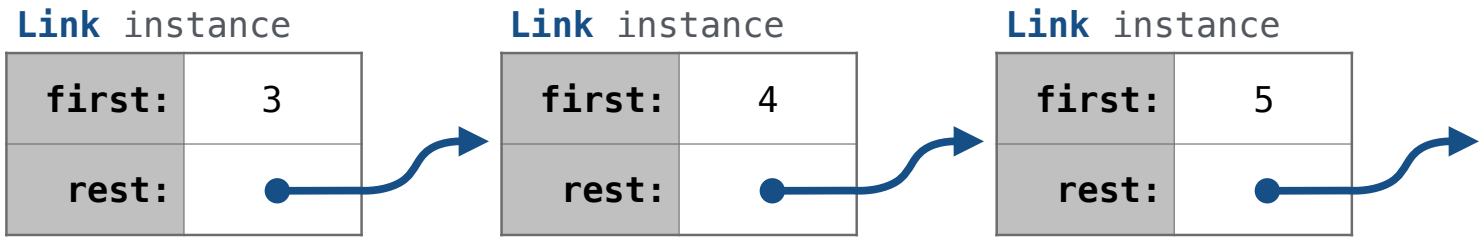

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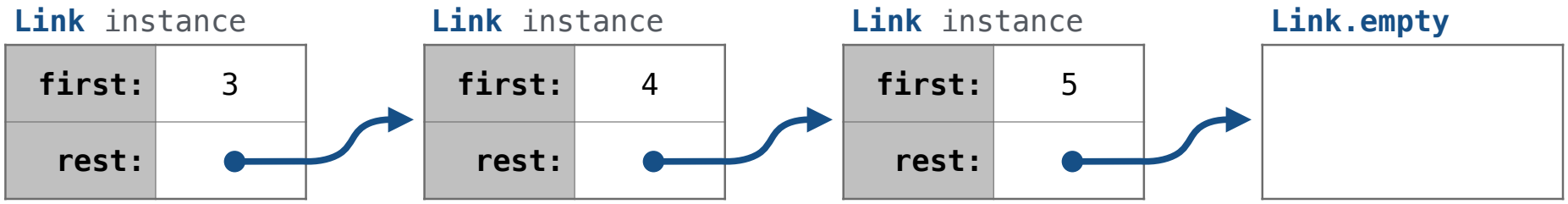

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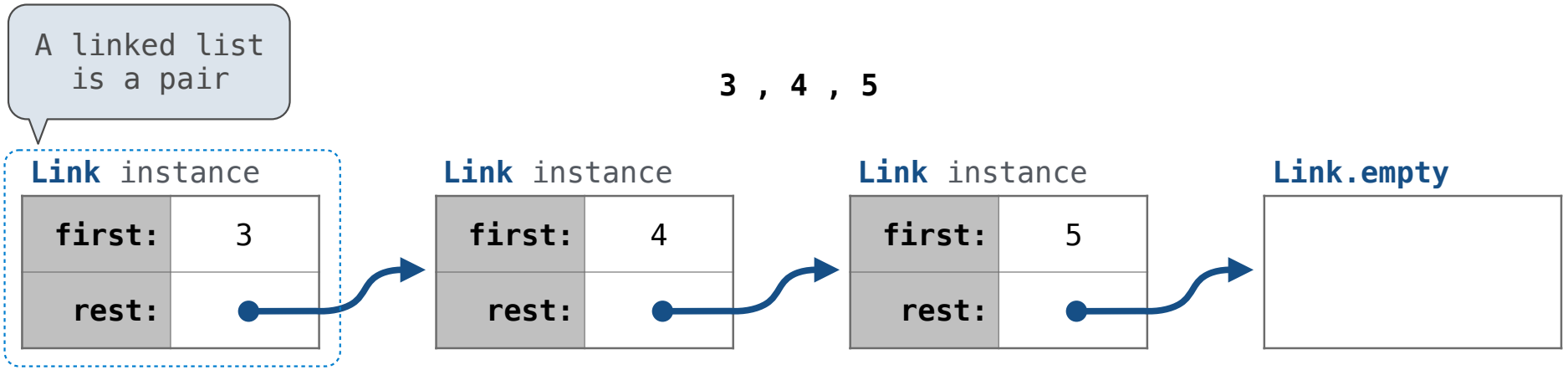

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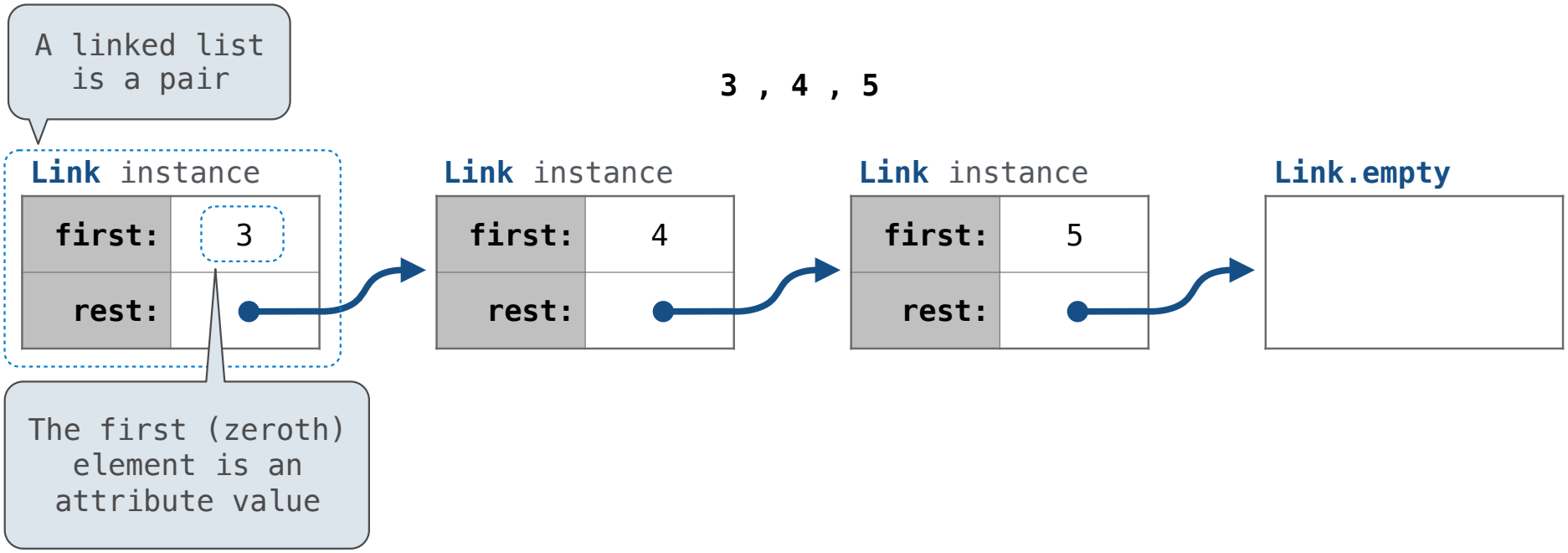

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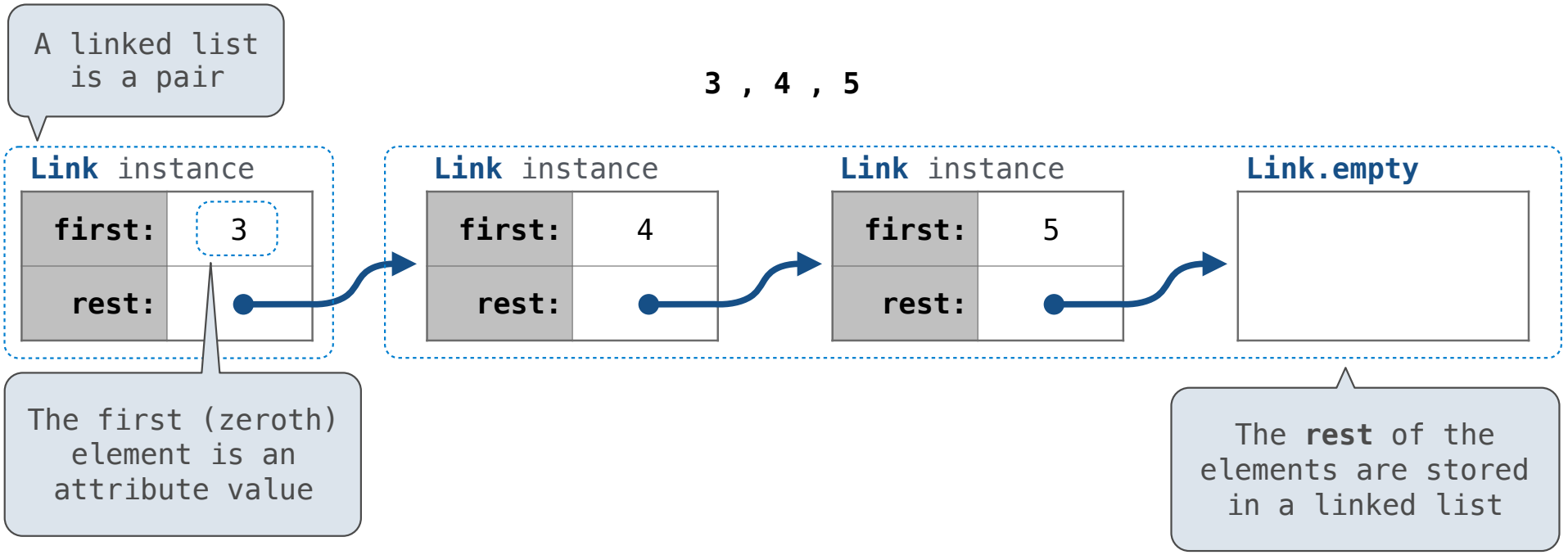

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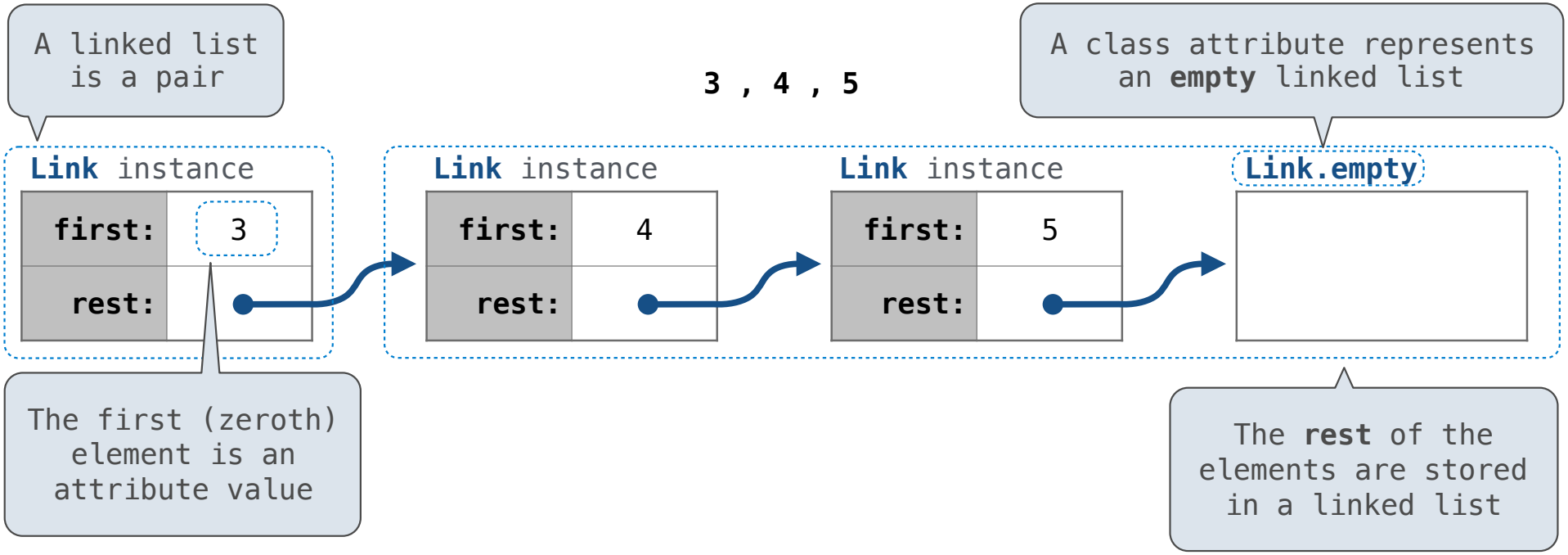

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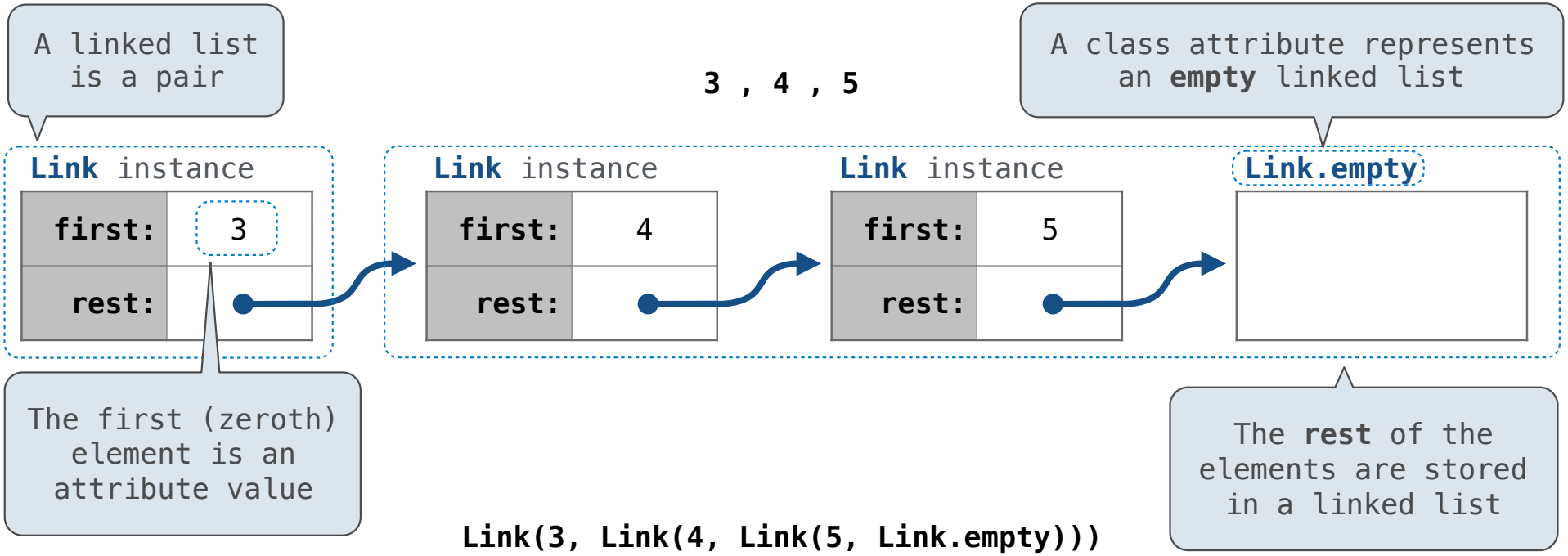

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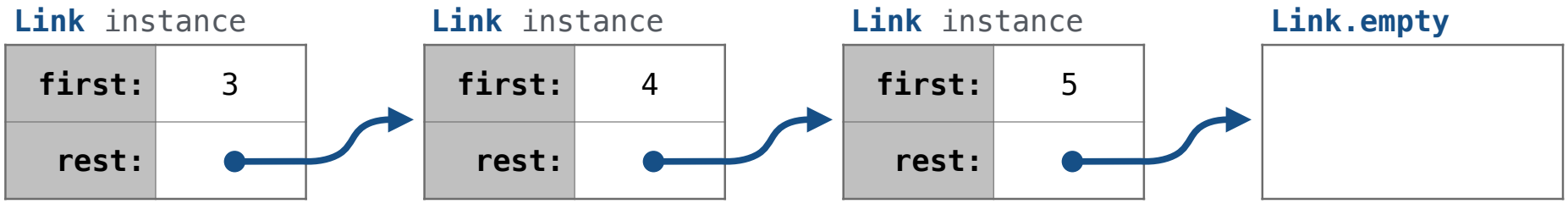


```
Link(3, Link(4, Link(5, Link.empty)))
```

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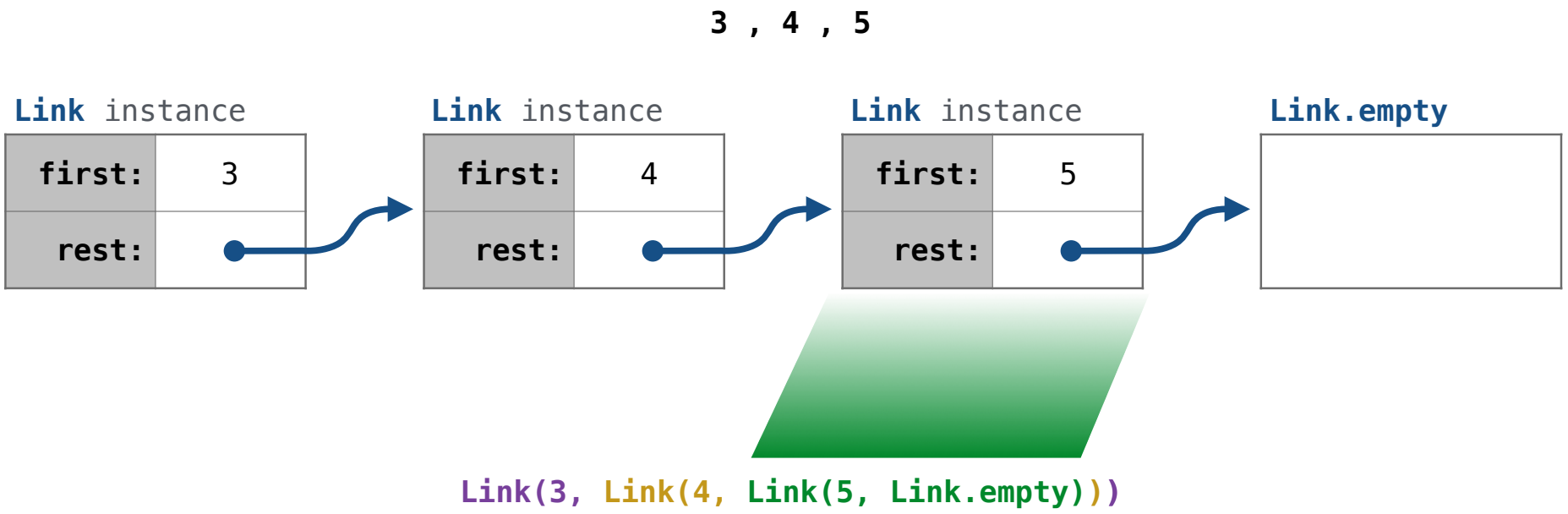

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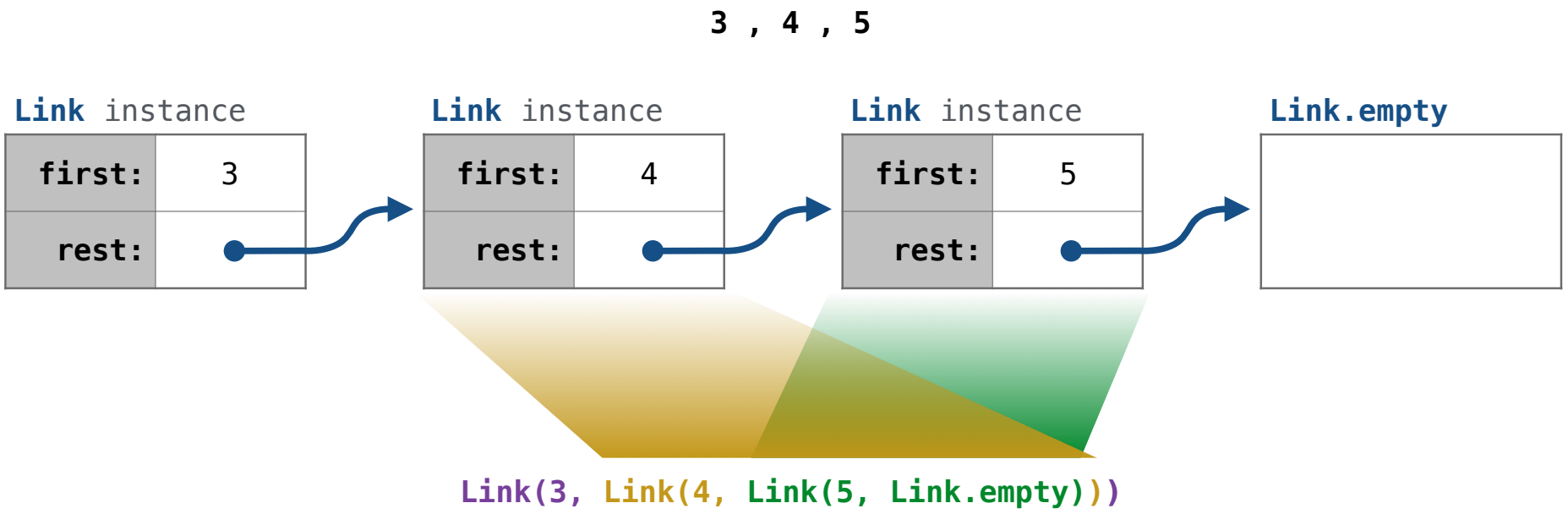

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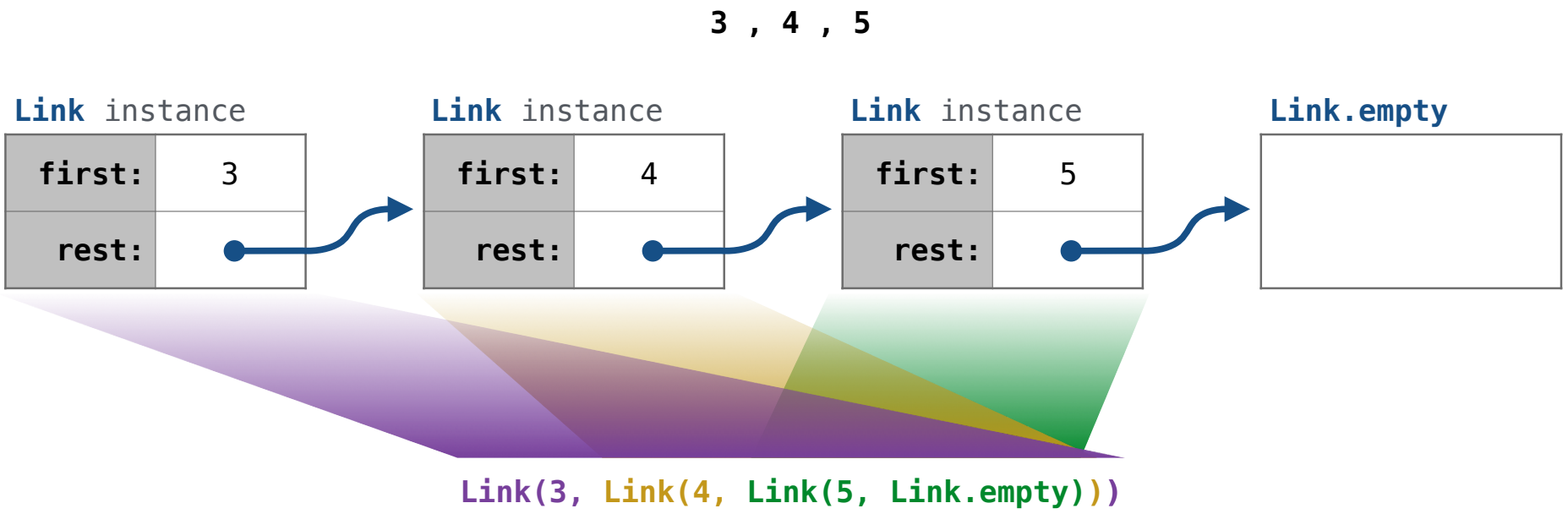

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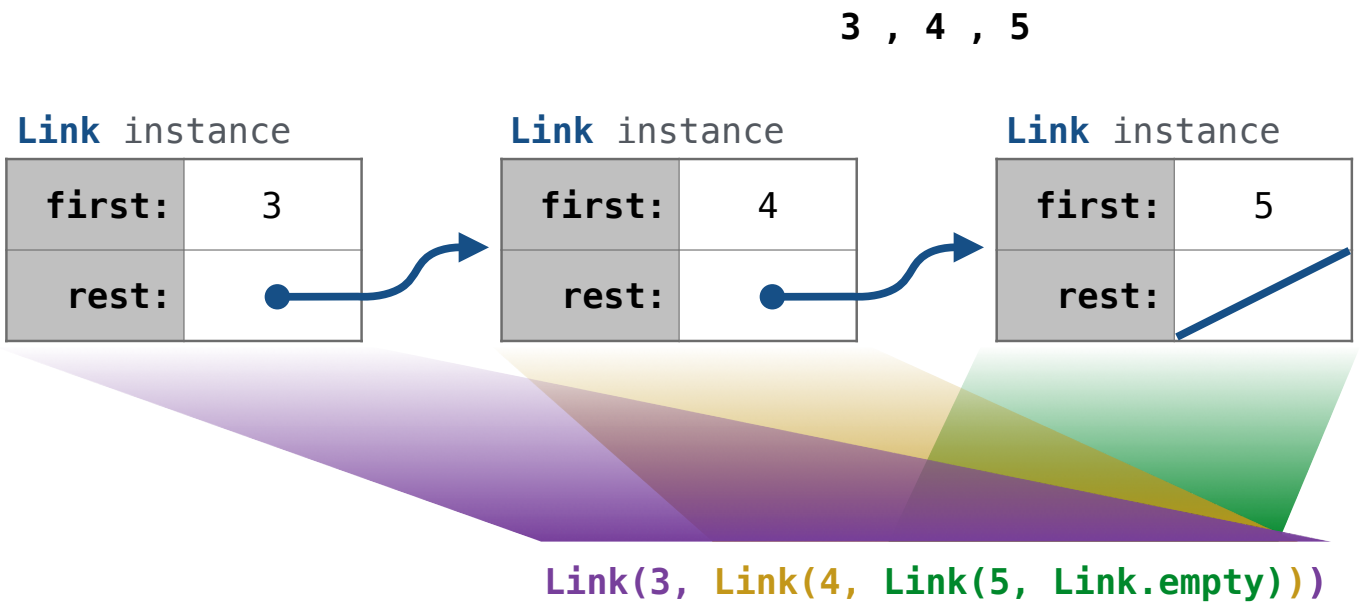

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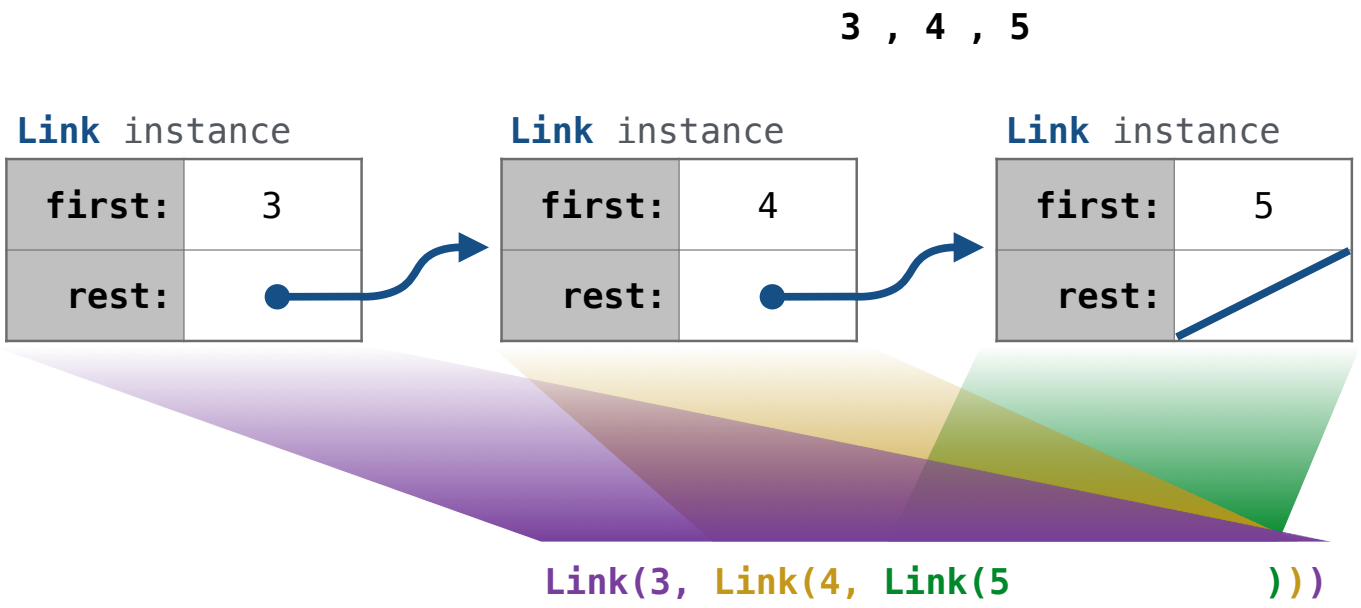

Linked List Class

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Link(3, Link(4, Link(5            )))
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Linked List Class

Linked list class: attributes are passed to `__init__`

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class Link:
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Linked List Class

Linked list class: attributes are passed to __init__

```
class Link:

    def __init__(self, first, rest=empty):
```

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Link(3, Link(4, Link(5            )))
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Linked List Class

Linked list class: attributes are passed to __init__

```
class Link:


    def __init__(self, first, rest=empty):
        assert rest is Link.empty or isinstance(rest, Link)
```

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Link(3, Link(4, Link(5            )))
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Linked list class: attributes are passed to __init__

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class Link:


    def __init__(self, first, rest=empty):
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        self.first = first
        self.rest = rest
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Linked list class: attributes are passed to `__init__`

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class Link:

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Returns whether rest is a Link

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Returns whether rest is a Link

`help(isinstance)`: Return whether an object is an instance of a class or of a subclass thereof.

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Link(3, Link(4, Link(5            )))
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class Link:

    empty = ()

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Some zero-length sequence

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(Demo)

Property Methods

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For example, if we want to access the second element of a linked list

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>>> s = Link(3, Link(4, Link(5)))
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In some cases, we want the value of instance attributes to be computed on demand

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```
>>> s = Link(3, Link(4, Link(5)))
>>> s.second
4
```

Property Methods

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For example, if we want to access the second element of a linked list

```
>>> s = Link(3, Link(4, Link(5)))
>>> s.second
4
>>> s.second = 6
```

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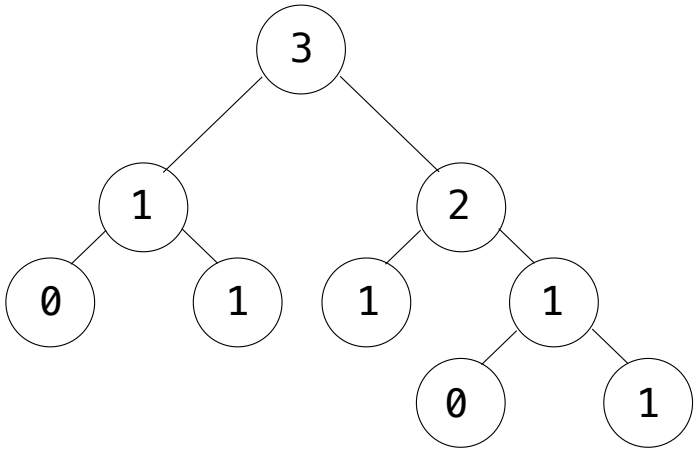
(Demo)

Tree Class

Tree Abstraction (Review)



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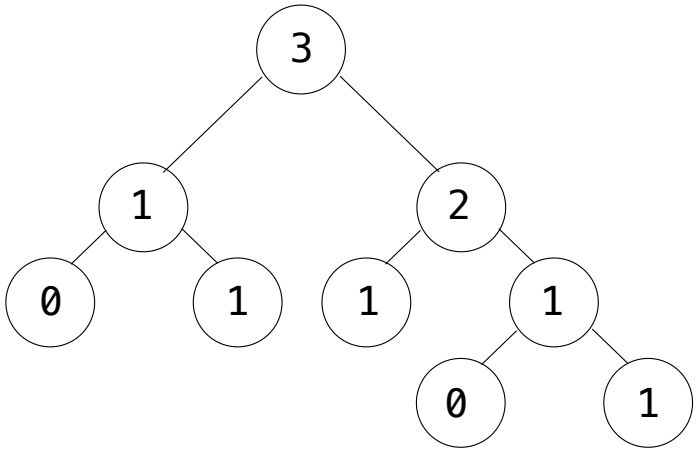
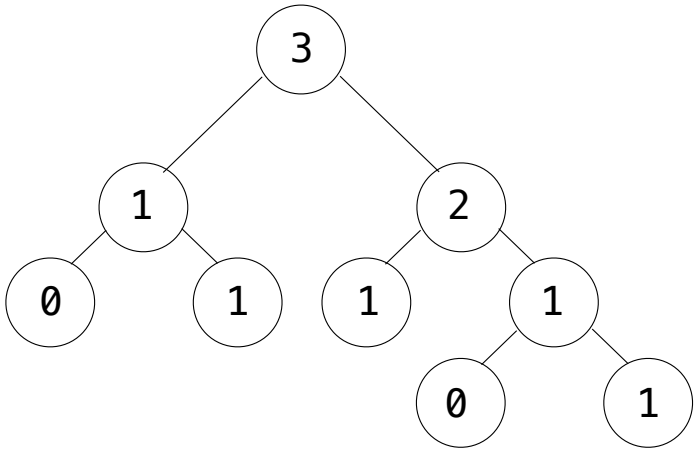


Recursive description (wooden trees):

Relative description (family trees):

Tree Abstraction (Review)



Recursive description (wooden trees):

A **tree** has a **root label** and a list of **branches**

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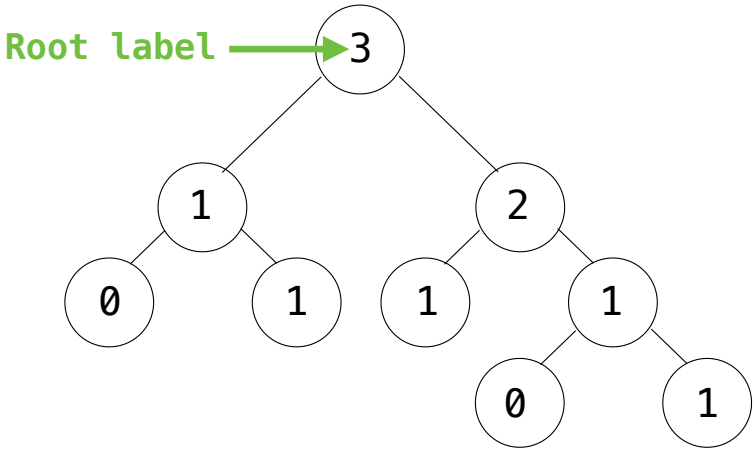

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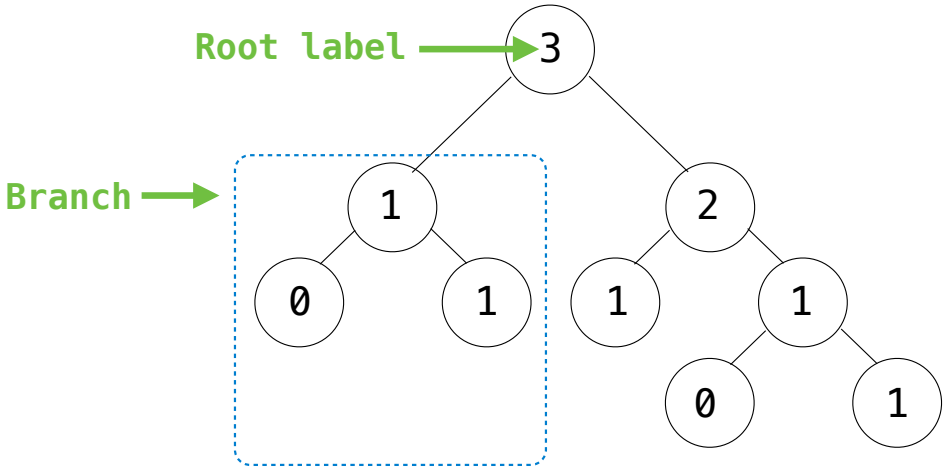

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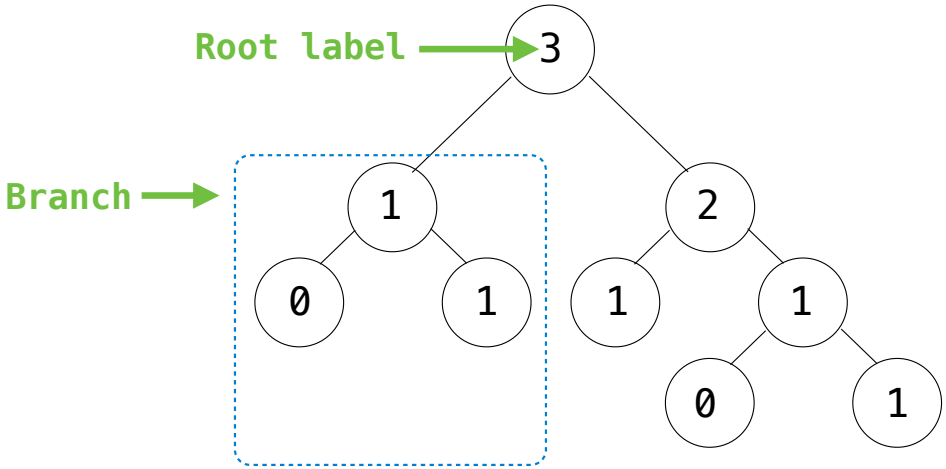

Recursive description (wooden trees):

A **tree** has a **root label** and a list of **branches**

Each **branch** is a **tree**

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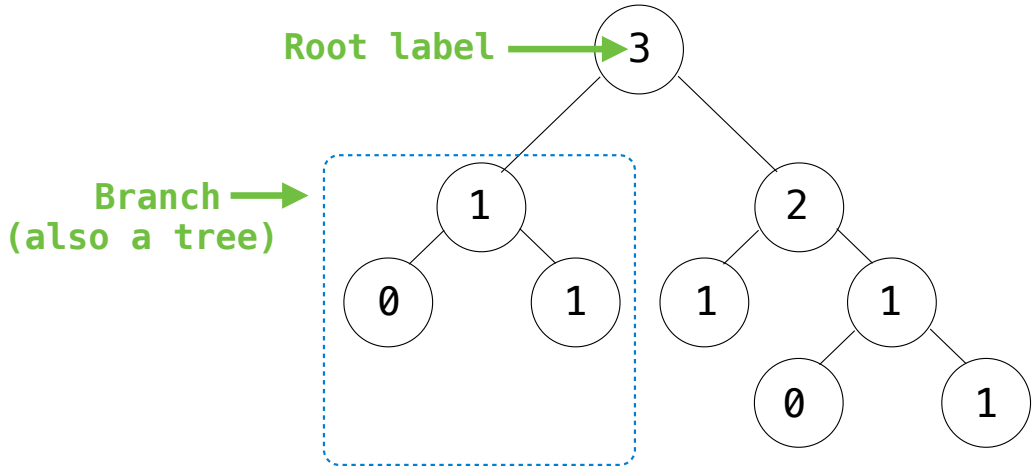

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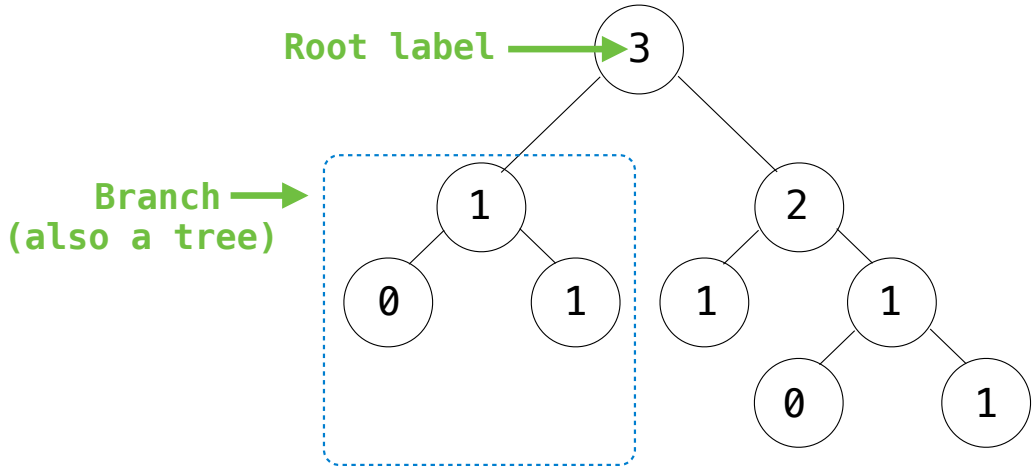

Recursive description (wooden trees):

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A **tree** with zero **branches** is called a **leaf**

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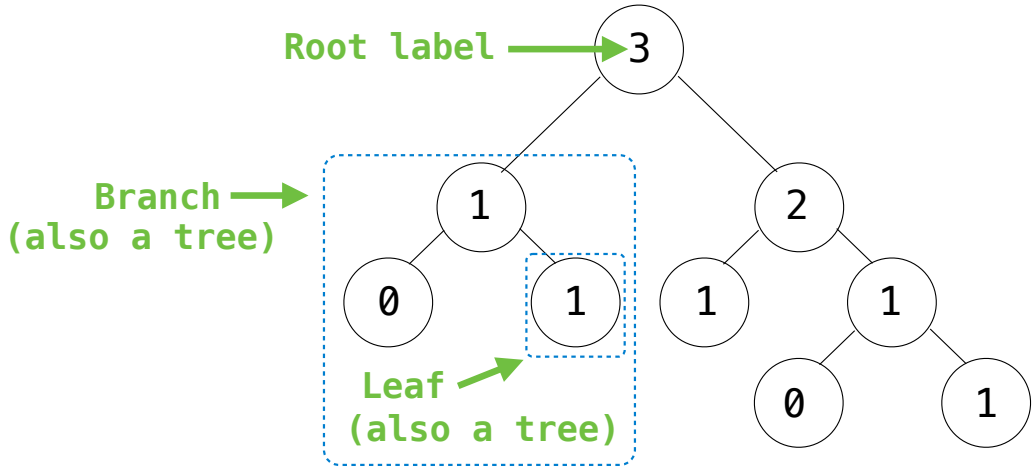

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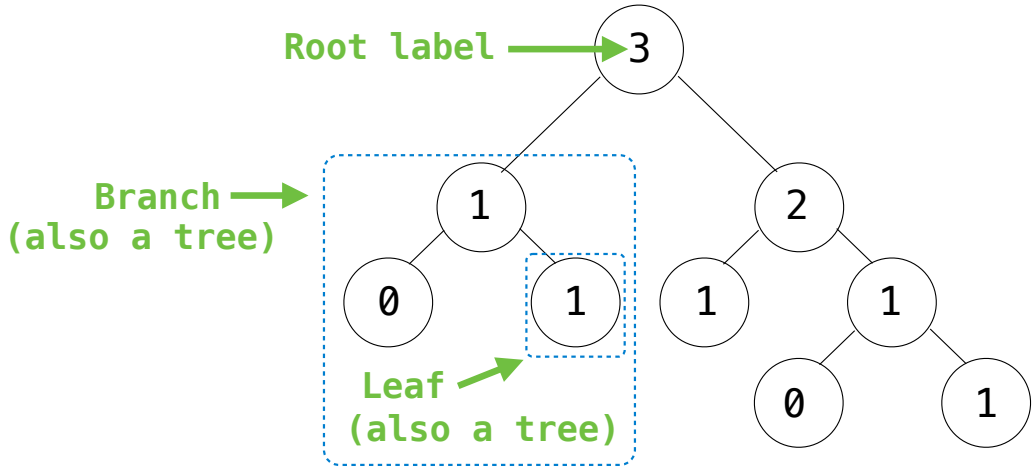

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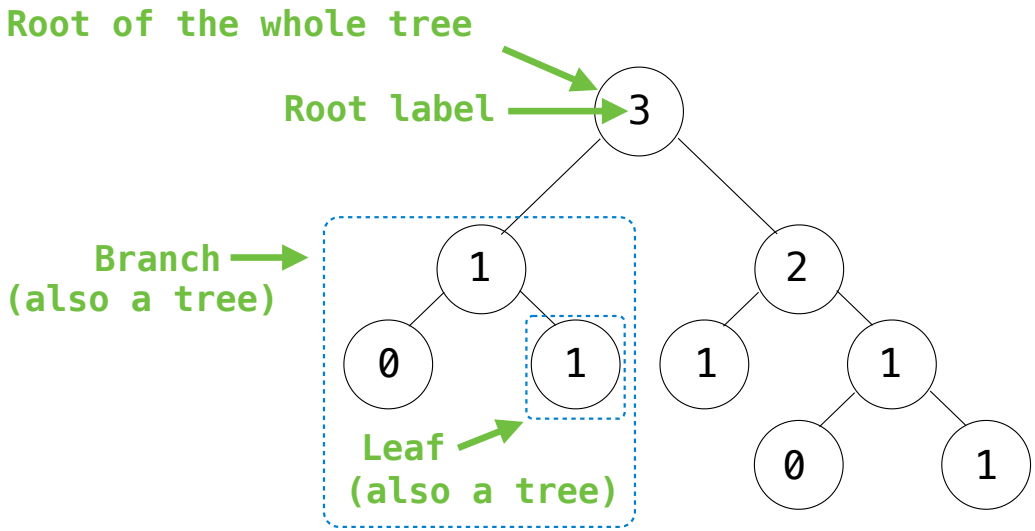

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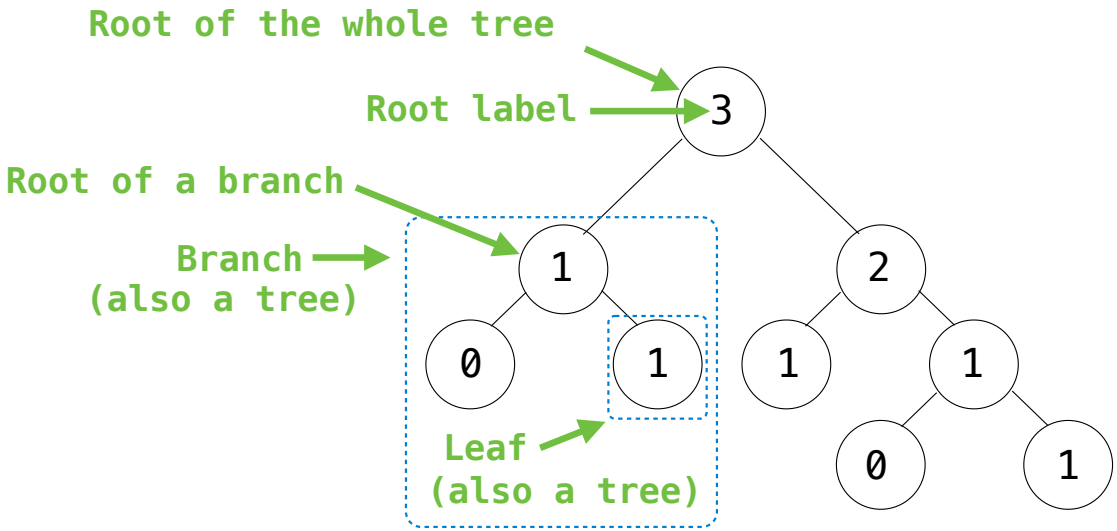

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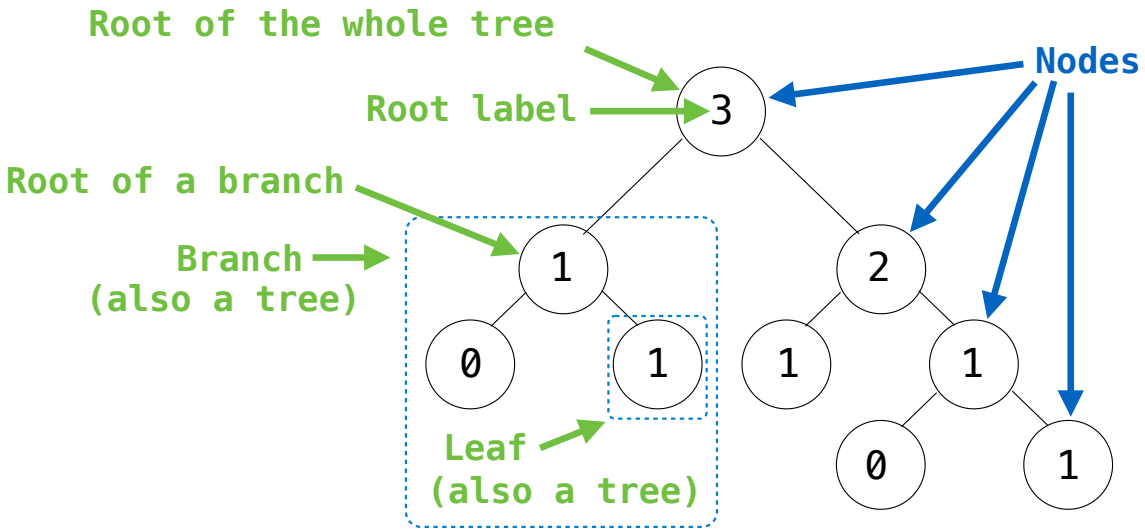

Recursive description (wooden trees):

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Each **branch** is a **tree**

A **tree** with zero **branches** is called a **leaf**

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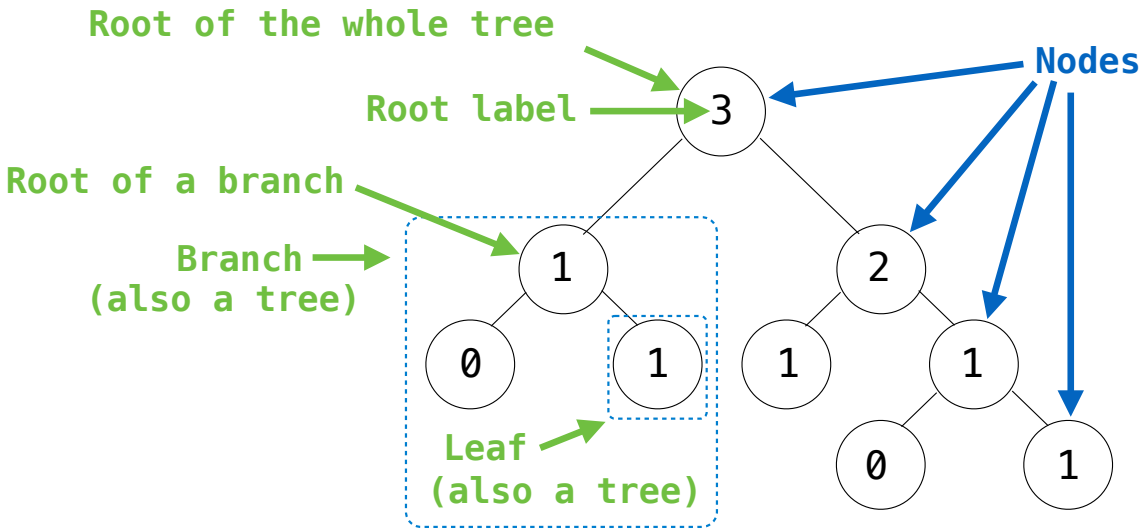
Relative description (family trees):

Each location in a tree is called a **node**

Tree Abstraction (Review)



Recursive description (wooden trees):

A **tree** has a **root label** and a list of **branches**

Each **branch** is a **tree**

A **tree** with zero **branches** is called a **leaf**

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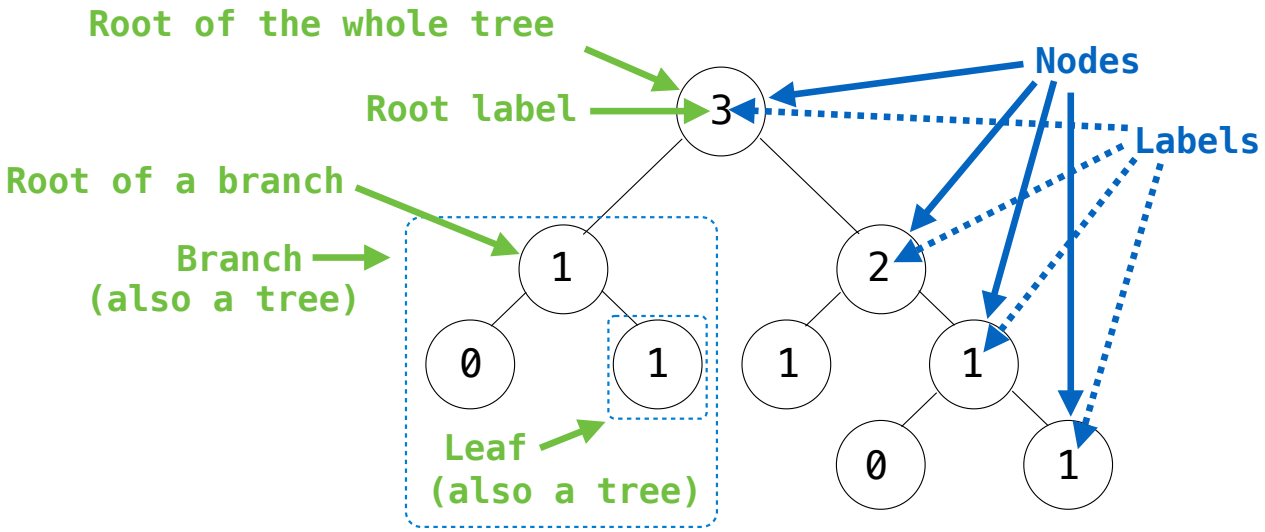
Relative description (family trees):

Each location in a tree is called a **node**

Each **node** has a **label** that can be any value

Tree Abstraction (Review)



Recursive description (wooden trees):

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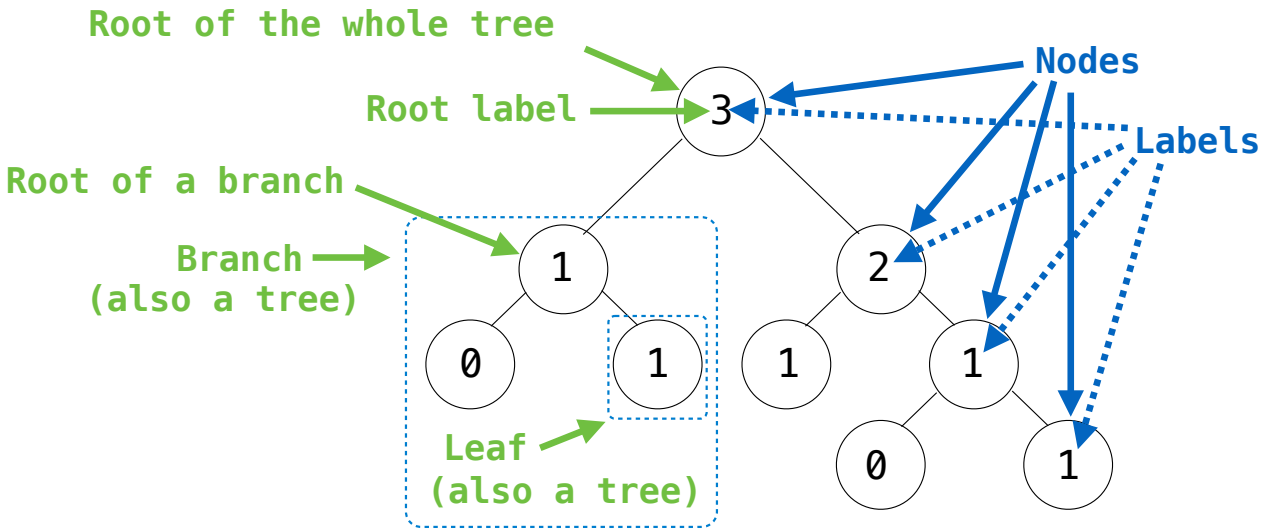

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Relative description (family trees):

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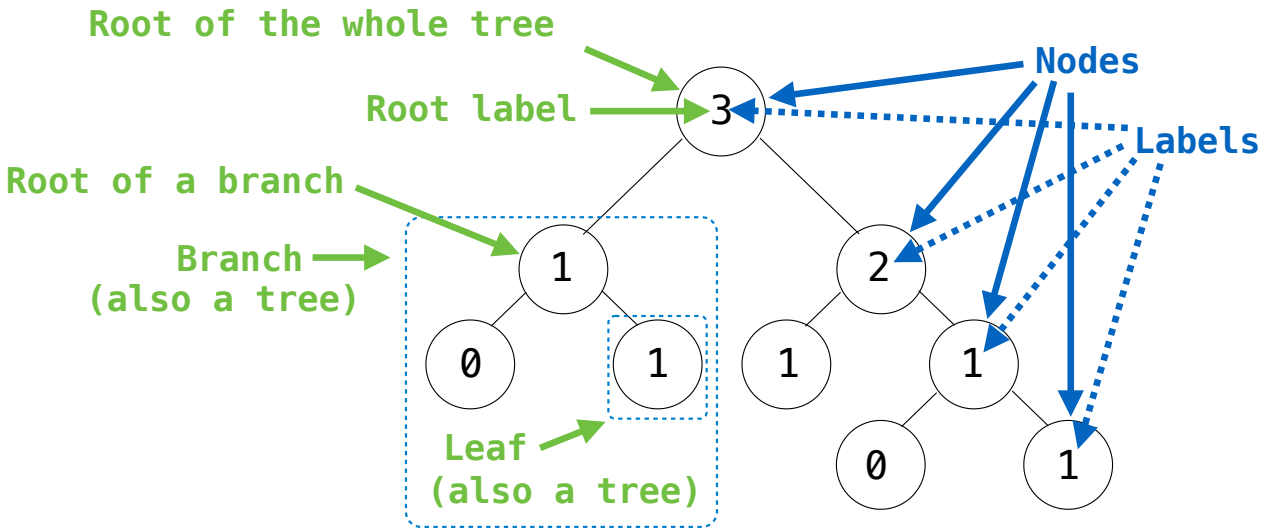
Each **node** has a **label** that can be any value

One node can be the **parent**/**child** of another

Tree Abstraction (Review)



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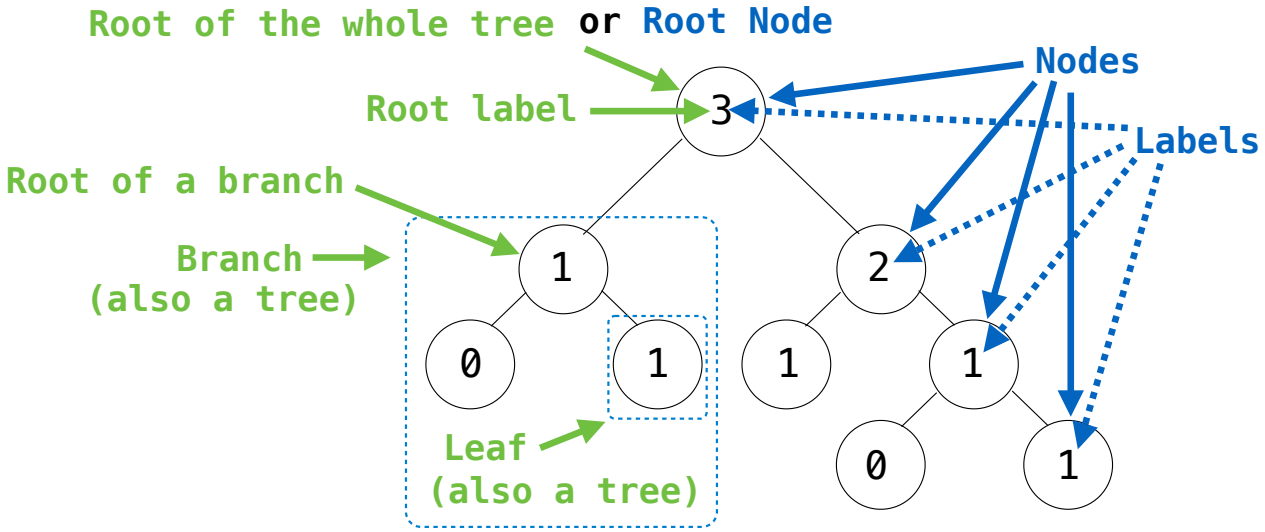
The top node is the **root node**

Tree Abstraction (Review)



Recursive description (wooden trees):

A **tree** has a **root label** and a list of **branches**

Each **branch** is a **tree**

A **tree** with zero **branches** is called a **leaf**

A **tree** starts at the **root**

Relative description (family trees):

Each location in a tree is called a **node**

Each **node** has a **label** that can be any value

One node can be the **parent**/**child** of another

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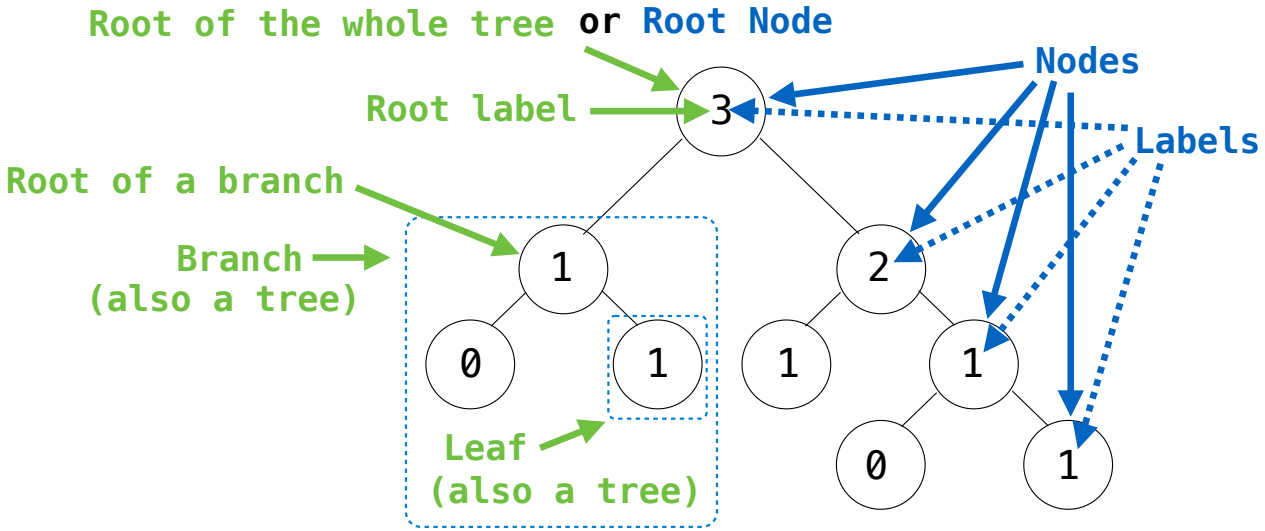

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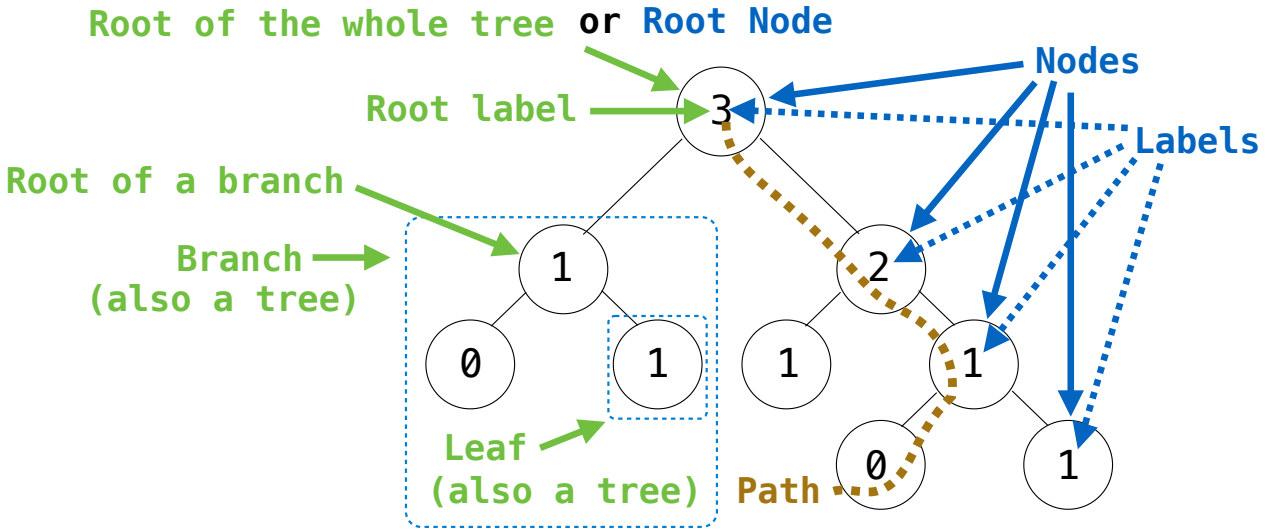

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def tree(label, branches=[]):
    for branch in branches:
        assert is_tree(branch)
    return [label] + list(branches)
def label(tree):
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def fib_tree(n):
    if n == 0 or n == 1:
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        left = fib_tree(n-2)
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        fib_n = left.label + right.label
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(Demo)