

## Announcements

- Maps Project due tomorrow (turn in tonight for EC!)
- HW5 due Thurs, 10/4

## LAB 5: MUTABLE SEQUENCES & TREES

Sequence = ordered collection of values that support element selection and have length

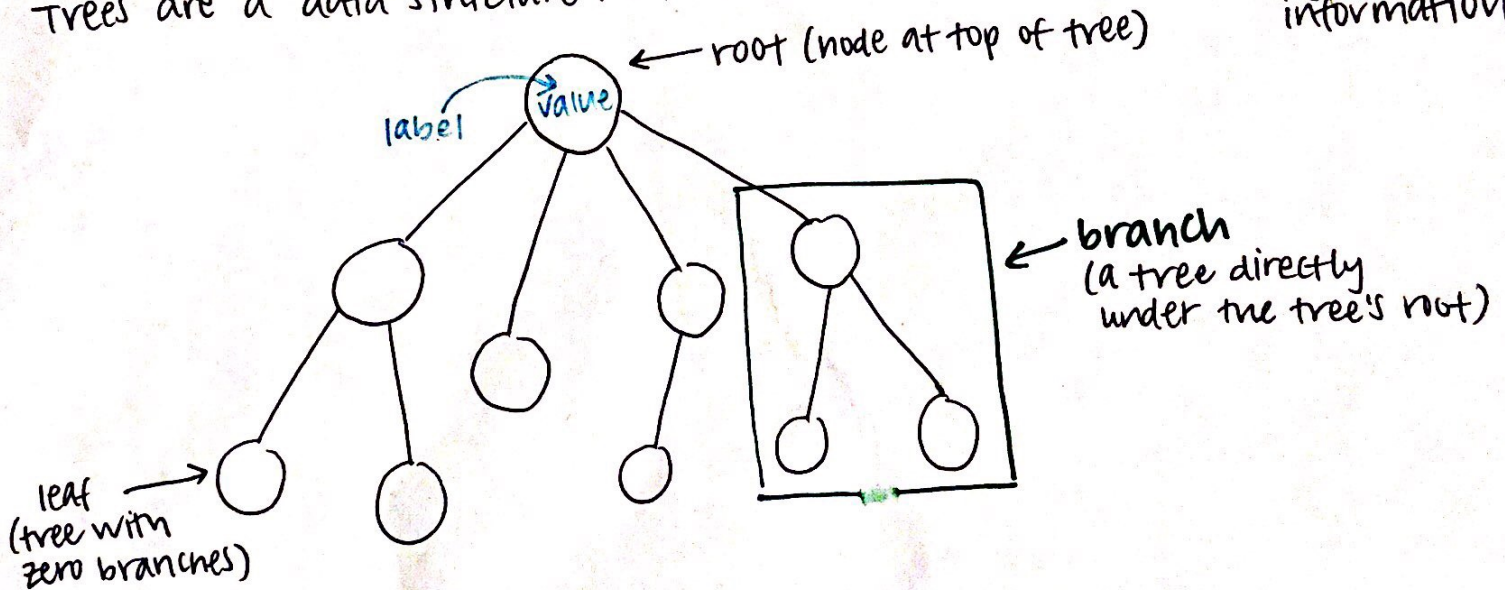
• Examples: List, String

### For Statement

for `<name>` in `<sequence>`:  
    `<code block>` } iterates thru each element in the sequence

## Trees

Trees are a data structure that allows us to have a hierarchy of information.



## CS 61A Tree Abstract Data Type

### • Constructor

`tree (label, branches = [])`  
          ↑                  ↑  
      value of          list of branches  
      root node         (optional)

### • Selectors

`label (tree)` → returns value of root node

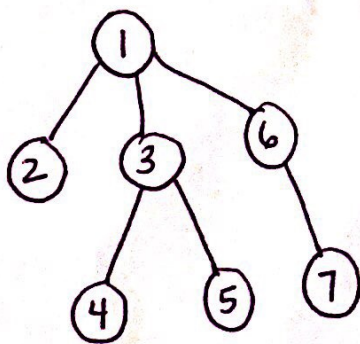
`branches (tree)` → returns list of branches

### • Convenience Function

`is-leaf (tree)` → returns True if tree has no branches

## Visualization

```
t = tree(1, [tree(2),  
             tree(3, [tree(4),  
                     tree(5)]),  
             tree(6, [tree(7)])])
```



```
>>> label(t)  
1
```

```
>>> branches(t)  
[tree(2),  
 tree(3, [tree(4),  
          tree(5)]),  
 tree(6, [tree(7)])]
```

\*Notice that `branches(t)` returns a LIST! List comprehensions / for loops iterating through this list will come very handy when doing tree problems!



## Nonlocal Assignment

The nonlocal keyword can be used to modify a binding in the parent frame in a higher-order function.

- Nonlocal is useful in maintaining state across different calls to the same function.

Example:

```
def make_withdraw(balance):  
    def withdraw(amount):  
        nonlocal balance  
        if amount > balance:  
            return 'insufficient funds'  
        balance -= amount  
        return balance  
    return withdraw
```

we want to maintain the state of our balance across every call to withdraw.

```
wd = make_withdraw(20)  
wd(5) → balance is 15  
wd(3) → balance is 12.
```

keep in mind that:

- Global names cannot be nonlocal
- Names in the current frame cannot be overridden using the nonlocal keyword (a.k.a. we can't have both a local and nonlocal binding in a frame)