Cloning + Aliasing + List Comprehensions

Guttag Chapter 5

Goals

Understand Terms

- Alias
- Mutate
- Clone
- Shallow Copy
- Deep Copy

Practice Writing List Comprehensions

Materials

Guttag Chapter 5

Jupyter Notebooks in the site code directory and linked in the site materials

Cloning + Aliasing

Alias

Definition

- When an object has more than one name, the object is said to be "aliased"

Example

- a = [1,2,3]
- b = a

b is an alias of a

Mutating Aliases

All names to aliased objects can mutate the object in memory!

Example

- a = [1,2,3]
- b = a
- a.append(4)
- print(a)
- print(b)

b is an alias of a

a and b will be the same

Clone

Definition

- the process of creating a new object that is less aliased or not aliased

Example

- a = [1,2,3]
- b = a[:] # shallow copy
- a.append(4)
- print(a)
- print(b)

The internal internal elements are simple elements, and they are copied as expected

a and b will be different

Shallow Copy

Definition

- Cloning each element, but STOPPING at the element level

Example

- a = [[1],[2],[3]]
- b = a[:] # shallow copy
- c = a.copy() # shallow copy
- a[0].append(4)
- print(a)
- print(b)
- print(c)

The internal list at a[0] is aliased!

a, b, and c will all have the same elements

Deep Copy

Definition

- Cloning each element, INCLUDING internal elements

Example

- import copy
- a = [[1],[2],[3]]
- b = copy.deepcopy(a) # deep copy
- a[0].append(4)
- print(a)
- print(b)

The internal list at a[0] is NOT aliased.

a and b will be different and the elements within a and b will be different

```
def remove_dups(L1, L2):
    """Assumes that L1 and L2 are lists.
       Removes any element from L1 that also occurs in L2"""
    for e1 in L1:
        if e1 in L2:
            L1.remove(e1)
L1 = [1,2,3,4]
L2 = [1,2,5,6]
Remove_dups(L1, L2)
print('L1 =', L1)
```

You might be surprised to discover that this prints

```
L1 = [2, 3, 4]
```

List Comprehensions

List Comprehensions

Concept

- compact way to initialize lists

Definition

- `[expr for elem in iterable if test]`

List Comprehensions

Examples

```
[e**2 for e in range(6)]
```

```
[e**2 for e in range(8) if e%2 == 0]
```