Python Basics!

mutability, container methods

CS101 Lecture #9

2016-10-26

`for` loops

Example

```
for i in range(10):
    print(i ** 2)
```

Example

```
for i in range(10):
    print(i ** 2)
```

```
for i in range(2,10):
    print(i ** 2)
```

Example

```
for i in range(10):
    print(i ** 2)

for i in range(2,10):
    print(i ** 2)

for i in range(2,10,3):
    print(i ** 2)
```

Mutability & Aliasing

Example

```
x = 1
y = x
y = 2
# what is x? %
```

Example

```
x = 1
y = x
y = 2
# what is x? %

x = [ 1,2,3 ]
y = x
y[0] = 6
# what is x?
```

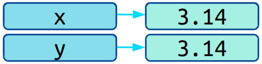
Mutability

- We distinguished *mutability* and *immutability*.
- The distinction arises from the storage in memory.

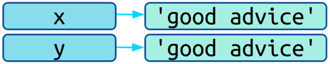
Mutability

- *Immutability* occurs when values are copies in memory.

```
x = 3.14
y = x
```



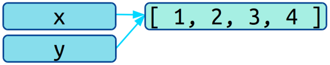
```
x = 'good advice'
y = x
```



Mutability & immutability

- *Mutability* occurs when values share the same location.
- The distinction arises from the storage in memory.

```
x = [ 1, 2, 3, 4 ]
y = x
```

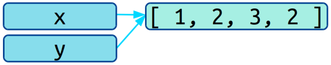


Aliasing

- *Aliasing* occurs when one memory location has two names.
- Aliasing causes mutable types to behave unexpectedly!

Aliasing

```
x = [ 1, 2, 3, 4 ]
y = x
x[-1] = 2
```



Example

```
x = [ 1,2,3 ]
y = x
y[0] = 6
# what is x?
```

Example

```
a = [ 'a', 'b', 'c', 'd' ]
b = a
b[3] = '*'
```

What is the final value of a?

- A `[ 'a', 'b', '*', 'd' ]`
- B `[ 'a', 'b', 'c', '*' ]`
- C `[ 'a', 'b', 'c', 'd' ]`
- D None of the above.

Tuples

- The immutable analogue of a `list` is a `tuple`.
- We form a tuple by using parentheses `()` instead of square brackets `[]`.

Where can I use tuples?

- `tuples` can be used to format multiple values for `print`.

```
'%i %i %i' % (1,2,3)
```

Example

```
s = ???
x = 10
y = 'Hello'
z = 3.14
print(s % x,y,z)
```

What should replace the `???`?

- A `'%i %f %s'`
- B `'%f %s %i'`
- C `'%i %s %f'`
- D None of the above.

Where can I use tuples?

- `tuples` can also be used on the left-hand side of an assignment operator.
- This lets us make *multiple assignments* at once.

```
one,pi,hello = ( 1,3.14,'Hi' )
```

Where can I use tuples?

- `tuples` can also be used on the left-hand side of an assignment operator.
- This lets us make *multiple assignments* at once.

```
one,pi,hello = ( 1,3.14,'Hi' )
x,y = y,x
```

Where can I use tuples?

- `tuples` can return *multiple values* from a function.

```
def fun():
    return 'hi', 3, 'lo'

a,b,c = fun()
```

Container Methods

Container Methods

- Because `lists` are mutable, we can change their contents.

```
x = [ 4,1,2,3 ]
x[3] = -2           # item assignment
x.append(5)         # appending items
del x[1]            # removing items
x.sort()            # changing item order
```

Container Methods

- `sort` and `append` modify the `list` itself.

Warning!
This explains why `sort` and `append` return `None`!

```
x = [ 4,1,2,3 ]
x.sort()  # This is the right way to sort a list.
print(x)
```

Container Methods

- `sort`, `reverse`, and `append` modify the `list` itself.

Warning!
This explains why `sort` and `append` return `None`!

```
x = [ 4,1,2,3 ]
x = x.sort() # MANY of you will do this wrong way!
print(x)
```

Example

```
y = [ 3,2,1 ]
x = y.append( 5 )
y[-1] = 3
```

What is the final value of `x`?

- A `[ 3, 2, 1, 3 ]`
- B `[ 3, 2, 1, 5 ]`
- C `[ 3, 2, 1 ]`
- D `None`

Container Methods

- `index` returns the index of the first occurrence of a value in a `list`.
- `count` returns how many times a value occurs.
- `in` returns membership in the `list`.
- `*` *repeats* a `list`.
- `+` *extends* a `list` (also `extend`)..
- `max`, `min`, `len`, etc.

String/List Methods

`string.split` method

- `split` returns a `list`.
- Takes a single string argument, the *delimiter*.

```
name = 'Oliver Wendell Holmes'
names = name.split(' ')
print(names[-1])
```

Example

```
x = 'A+B+C'
y = x.split()
```

What is the final value of `y`?

A `'ABC'`

B `[ 'A','B','C' ]`

C `[ 'A+B+C' ]`

D `'A','B','C'`

E `None`

Example

```
x = 'A+B+C'
y = x.split('+')
```

What is the final value of y?

A `'ABC'`
B `[ 'A','B','C' ]`
C `[ 'A+B+C' ]`
D `'A','B','C'`
E `None`

Example

```
x = 'A+B+C'
y = x.split('-')
```

What is the final value of `y`?

A `'A+B+C'`
B `[ 'A+B+C' ]`
C `( 'A+B+C' )`
D `None`

Example

```
x = '+A+B+C+'
y = x.split('+')
```

What is the final value of `y`?

A `'ABC'`

B `[ 'A','B','C' ]`

C `[ '','A','B','C','' ]`

D `[ 'A+B+C' ]`

E `None`

`string.join` method

- `join` returns a `str`.
- Takes a single `list` argument.
- Returns the `list` elements joined as a string.

```
names = [ "Geoffrey", "Richard",
          "Aloysius", "Johnston" ]
#  GOAL:  """Geoffrey Richard
#            Aloysius Johnston""" %
```

string.join method

- join returns a str.
- Takes a single list argument.
- Returns the list elements joined as a string.

```
names = [ "Geoffrey", "Richard",
          "Aloysius", "Johnston" ]
#  GOAL:  """Geoffrey Richard
#            Aloysius Johnston""" %
' '.join(names)     # note the odd syntax!
                  # join is a STRING method
```

Example

```
a = [ 'X', 'A', 'G' ]
b = a[:]
a.sort()
x = ','.join(b)
```

What is the final value of `x`?

A `'XAG'`

B `[ 'X,A,G' ]`

C `'A,G,X'`

D `',A,G,X,'`

E `'X,A,G'`

One more thing...

```
range( 0, 6, 2 )
list( range( 0, 6, 2 ) )
```

```
out: [ 0, 2, 4 ]
```

Reminders

Reminders

- Homework #3 is due Wed Oct. 26.
- Homework #4 is due Wed Nov. 4.
- Midterm #1 will be on the day of the 12th lecture (Nov. 7 Monday), covering through Lecture #11. (evening)