http://www.cs.cornell.edu/courses/cs1110/2021sp

Lecture 5: Strings

(Sections 8.1, 8.2, 8.4, 8.5,
1st paragraph of 8.9)

CS 1110

Introduction to Computing Using Python

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Announcements

- Did you try the 6 questions at the end of the slides from the previous lecture? Check answers on course website and ask at office/consulting hrs if you have questions!
- Want to find an assignment partner?
  - Make/answer a post on Ed Discussion megathread "[Where can I] find a partner for this class?"
  - Learning Strategy Center (LSC) has a study partner finding service
  - Talk to classmates in lab!
- Check out "Assignment Advice" on course website
- Note "Policies" on the course website

Today

- More about the str type
  - New ways to use strings
- More examples of functions
  - Functions with strings!
- Learn the difference between print and return

Strings are Indexed (Question 1)

- s = 'abc d'

0	1	2	3	4
a	b	c		d

- Access characters with []
  - s[0] is 'a'
  - s[4] is 'd'
  - s[5] causes an error
  - s[0:2] is 'ab' (excludes c)
  - s[2:] is 'c d'
- Called "string slicing"

- t = 'Hello all'

0	1	2	3	4	5	6	7	8
H	e	l	l	o		a	l	l

- What is t[3:6]?

A: 'lo a'
B: 'lo'
C: 'lo '
D: 'o '
E: I do not know

Strings are Indexed (Question 2)

- s = 'abc d'

0	1	2	3	4
a	b	c		d

- Access characters with []
  - s[0] is 'a'
  - s[4] is 'd'
  - s[5] causes an error
  - s[0:2] is 'ab' (excludes c)
  - s[2:] is 'c d'
- Called "string slicing"

- t = 'Hello all'

0	1	2	3	4	5	6	7	8
H	e	l	l	o		a	l	l

- What is t[:3]?

A: 'all'
B: 'l'
C: 'Hel'
D: Error!
E: I do not know

Other Things We Can Do With Strings

Operator in: s_1 in s_2

- Tests if s_1 "a part of" (or a *substring* of) s_2
- Evaluates to a bool

Examples:

```
>>> s = 'abracadabra'
>>> 'a' in s
True
>>>  'cad' in s
True
>>>  'foo' in s
False
```

Built-in Function len: len(s)

- Value is # of chars in s
- Evaluates to an int

Examples:

```
>>> s = 'abracadabra’
>>> len(s)
11
>>> len(s[1:5])
4
>>> s[1:len(s)-1]
'bracadabr'
>>>
```

Defining a String Function

Want to write function **middle**, which returns the middle 3rd of a string (length divisible by 3).

How we want it to behave:

```
>>> middle('abc')
'b'
>>> middle('aabbcc')
'bb'
>>> middle('aaabbbccc')
'bbb'
```

Important Questions:

1. What are the parameters?
2. What is the return value?
3. What goes in the body?

```
def middle(text):

        ???

    return middle_third
```

Steps to writing a program

1. Work an instance yourself
2. Write down exactly what you just did
3. Generalize your steps from 2
4. Test your steps
5. Translate to Code
6. Test program
7. Debug (if necessary)

Steps to writing a program

1. Work an instance yourself
2. Write down exactly what you just did
3. Generalize your steps from 2
4. Test your steps
5. Translate to Code

>>> ~~middle('abc')~~ middle_third = text[1] *Too easy!!*

>>> ~~middle('aabbcc')~~ middle_third = text[2:4] *Still too easy!!*

>>> middle('It was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness, it was the epoch of belief, it was the epoch of incredulity, it was the season of Light, it was the season of Darkness, it was the spring of hope, it was the winter of despair, we had everything before us, we had nothing before us, we were all going direct to Heaven, we were all going direct the other way…')

Definition of middle

```
def middle(text):
    """Returns: middle 3rd of text
    Param text: a string with
    length divisible by 3"""
```

IMPORTANT:
Precondition requires that arguments to **middle** have length divisible by 3.

If not? Bad things could happen, and we blame the user (not the author) of the function.

Advanced String Features: Method Calls

- Strings have some useful *methods*
  - Like functions, but “with a string in front”
- **Format**: *<string name>*.*<method name>*(*x*,*y*,…)
- **Example**: **upper()** returns an upper case version

```
>>> s = 'Hello World’
>>> s.upper()
'HELLO WORLD’
>>> s
'Hello World’
```

```
>>> s[1:5].upper()
'ELLO'
>>> ‘scream'.upper()
‘SCREAM'
>>> 'cs1110'.upper()
'CS1110'
```

Examples of String Methods

- s_1.index(s_2)
  - Returns position of the first instance of s_2 in s_1
  - error if s_2 is not in s_1
- s_1.count(s_2)
  - Returns number of times s_2 appears inside of s_1
- s.strip()
  - Returns a copy of s with white-space removed at ends

- s = 'abracadabra'

0	1	2	3	4	5	6	7	8	9	10
a	b	r	a	c	a	d	a	b	r	a

s.index('a')	0
s.index('rac')	2
s.count('a')	5
s.count('b')	2
s.count('x')	0
' a b '.strip()	'a b'

See Python Docs for more

String Extraction Example

```
def firstparens(text):
    """Returns: substring in ()
    Uses the first set of parens
    Param text: a string with ()"""
```

```
>>> s = 'One (Two) Three'
>>> firstparens(s)
'Two'
>>> t = '(A) B (C) D'
>>> firstparens(t)
'A'
```

Steps to writing a program

1. Work an instance yourself
2. Write down exactly what you just did
3. Generalize your steps from 2
4. Test your steps
5. Translate to Code
6. **Test program** *Think of all the corner cases*
7. Debug (if necessary) *What could possibly go wrong?*

String Extraction Puzzle

```
def second(thelist):
    """Returns: second word in a list
    of words separated by commas, with
    any leading or trailing spaces from the
    second word removed
    Ex: second('A, B, C') => 'B'
    Param thelist: a list of words with
    at least two commas """

1   start = thelist.index(',')
2   tail = thelist[start+1:]
3   end = tail.index(',')
4   result = tail[:end]
5   return result
```

Is there an error?

A: Yes, Line 1
B: Yes, Line 2
C: Yes, Line 3
D: Yes, Line 4
E: There is no error

Not All Functions Need a Return

```
def greet(n):
    """Prints a greeting to the name n

    Parameter n: name to greet
    Precondition: n is a string"""
    print('Hello '+n+'!')
    print('How are you?')
```

Displays these strings on the screen

No assignments or return (returns None)

print vs. return

- Displays a value on screen
- Used primarily for **testing**

- Sends a value from a function call frame back to the caller
- Important for **calculations**
- Does not display anything

?

```
def print_plus(n):
    print(n+1)
```

```
def return_plus(n):
    return n+1
```

```
>>> print_plus(2)
3
>>>
```

```
>>> return_plus(2)
3
>>>
```

unexpected printing courtesy of:

Python Interactive Mode

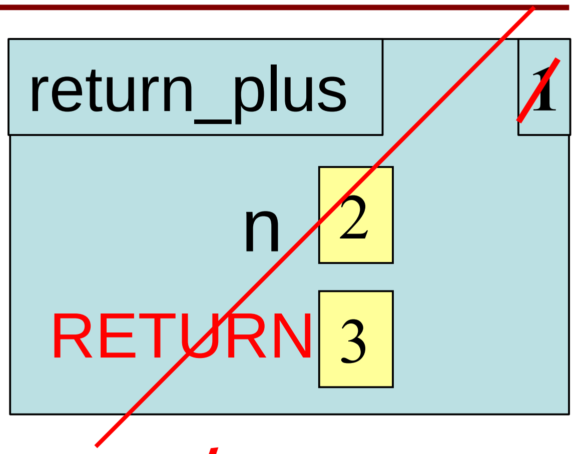
- executes both *statements* and *expressions*
- if *expression:*
  1. *evaluates*
  2. prints value (if one exists)

```
>>> 2+2              ← evaluates (performs addition)
4                    ← prints value (4)
>>> return_plus(2)   ← evaluates (makes function call,
                                  gets return value)
3                    ← prints value (3)
>>>
```

return_plus in action

```
def return_plus(n):
1      return n+1
```

call frame



Python Interactive Mode

```
>>> return_plus(2)
3
>>>
```

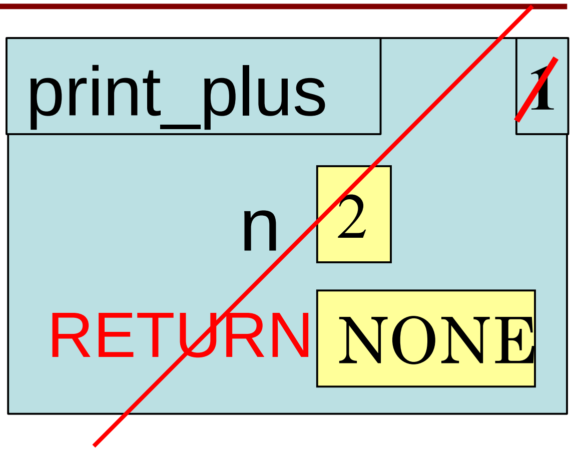
1. Evaluates : makes function call, evaluates to return value

2. Python interactive mode prints that value

print_plus in action

```
  def print_plus(n):
1     print(n+1)
```

call frame



Python Interactive Mode

```
>>> print_plus(2)
3
>>>
```

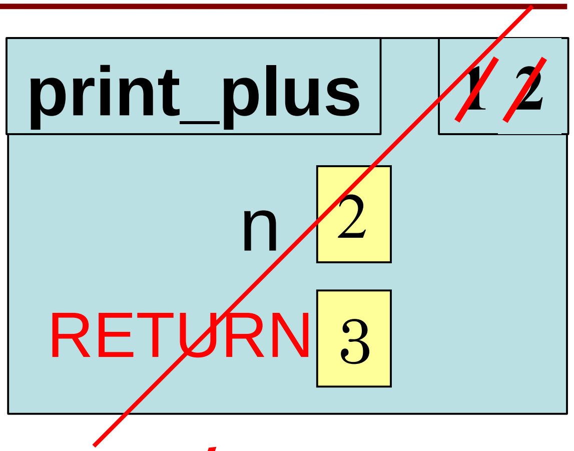
1. Evaluates :
- *makes function call*
- *prints (executes line 1)*
- *return value is* **NONE**

2. does not print that value because it's **NONE**

hybrid_plus in action

```
def hybrid_plus(n):
1    print(n)
2    return n+1
```

call frame



Python Interactive Mode

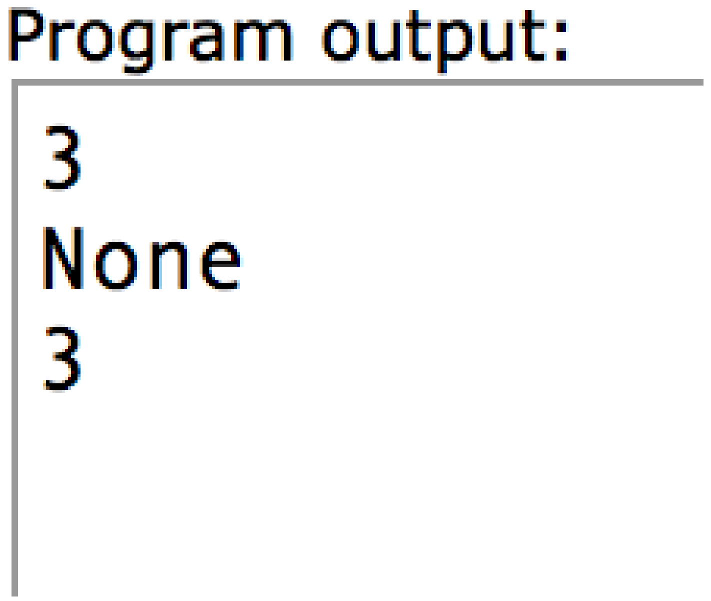
```
>>>  print_plus(2)
2
3
>>>
```

1. Evaluates : makes function call, evaluates to return value

2. Python interactive mode prints that returned value

See the difference in the Python Tutor

```
def print_plus(n):
    print(n+1)
def return_plus(n):
    return n+1
x1 = print_plus(2)
x2 = return_plus(2)
print(x1)
print(x2)
```


Program output:

```
3
None
3
```

http://cs1110.cs.cornell.edu/tutor/#mode=edit

Exercise 1

Module Text

```
# module.py

def foo(x):
    x = 1+2
    x = 3*x
```

Python Interactive Mode

```
>>> import module
>>> print(module.x)
…
```

What does Python give me?

A: 9
B: 10
C: 1
D: None
E: Error

Exercise 2

Module Text

```
# module.py

def foo(x):
    x = 1+2
    x = 3*x

y = foo(0)
```

Python Interactive Mode

```
>>> import module
>>> print(module.y)
…
```

What does Python give me?

A: 9
B: 10
C: 1
D: None
E: Error

Exercise 3

Module Text

```
# module.py

def foo(x):
    x = 1+2
    x = 3*x
    return x+1

y = foo(0)
```

Python Interactive Mode

```
>>> import module
>>> module.y
…
```

What does Python give me?

A: 9
B: 10
C: 1
D: None
E: Error

Exercise 4

Function Definition

```
def foo(a,b):
    x = a
    y = b
    return x*y+y
```

Function Call

```
>>> x = 2
>>> foo(3,4)
>>> x
…
```

What does Python give me?

A: 2
B: 3
C: 16
D: None
E: I do not know