Lecture 4

Strings
Announcements For This Lecture

Readings

• Chapter 8
  ▪ 8.1, 8.2, 8.4, 8.5
  ▪ Avoid for-loop sections

Assignment 1

• Will post it on Monday
  ▪ Need one more lecture

• Due Thu, Sep. 22\textsuperscript{nd}
  ▪ Lab 4 gives time to work
  ▪ Revise until correct

• Can work in pairs
  ▪ Submit one for both

Next Lab

• More expression tables
• Testing functions

9/6/16
Purpose of Today’s Lecture

• Return to the string (str) type
  ▪ Saw it the first day of class
  ▪ Learn all of the things we can do with it

• See more examples of functions
  ▪ Particularly functions with strings

• Learn the difference between…
  ▪ Procedures and fruitful functions
  ▪ print and return statements
String: Text as a Value

• String are quoted characters
  - 'abc d' (Python prefers)
  - "abc d" (most languages)

• How to write quotes in quotes?
  - Delineate with “other quote”
  - Example: " ' " or ' " '
  - What if need both " and ' ?

• Solution: escape characters
  - Format: \ + letter
  - Special or invisible chars

<table>
<thead>
<tr>
<th>Char</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>'\ '</td>
<td>single quote</td>
</tr>
<tr>
<td>&quot;</td>
<td>double quote</td>
</tr>
<tr>
<td>\n</td>
<td>new line</td>
</tr>
<tr>
<td>\t</td>
<td>tab</td>
</tr>
<tr>
<td>\</td>
<td>backslash</td>
</tr>
</tbody>
</table>
String are Indexed

- \( s = \text{'abc d'} \)
  - 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”

- \( s = \text{'Hello all'} \)
  - What is \( s[3:6] \)?
    - A: 'lo a'
    - B: 'lo'
    - C: 'lo '
    - D: 'o '
    - E: I do not know
String are Indexed

- \( s = 'abc\ d' \)
  
  \[
  \begin{array}{ccccc}
  0 & 1 & 2 & 3 & 4 \\
  a & b & c & d \\
  \end{array}
  \]
  
  - Access characters with \([\]\)
    - \( s[0] \) is 'a'
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- \( s = 'Hello all' \)
  
  \[
  \begin{array}{cccccccccc}
  0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\
  H & e & l & l & o & a & l & l \\
  \end{array}
  \]
  
  - What is \( s[3:6] \)?
    
    A: 'lo a'
    B: 'lo'
    C: 'lo' \hspace{1cm} \text{CORRECT}
    D: 'o '
    E: I do not know

9/6/16

Strings
String are Indexed

- $s = 'abc d'$
  
<table>
<thead>
<tr>
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<th>3</th>
<th>4</th>
</tr>
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<tbody>
<tr>
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  - D: Error!
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- What is \( s[:4] \)?
  - A: 'o all'
  - B: 'Hello'
  - C: 'Hell' CORRECT
  - D: Error!
  - E: I do not know
Other Things We Can Do With Strings

- **Operation** `in`: $s_1$ in $s_2$
  - Tests if $s_1$ “a part of” $s_2$
  - Say $s_1$ a *substring* of $s_2$
  - Evaluates to a bool

- **Examples:**
  - $s = 'abracadabra'$
  - 'a' in $s$ == True
  - 'cad' in $s$ == True
  - 'foo' in $s$ == False

- **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'

9/6/16 Strings
Defining a String Function

• Start w/ string variable
  ▪ Holds string to work on
  ▪ Make it the parameter

• Body is all assignments
  ▪ Make variables as needed
  ▪ But last line is a return

• Try to work in reverse
  ▪ Start with the return
  ▪ Figure ops you need
  ▪ Make a variable if unsure
  ▪ Assign on previous line

```python
def middle(text):
    #"""Returns: middle 3rd of text
    Param text: a string"""
    # Get length of text
    size = len(text)
    # Start of middle third
    start = size/3
    # End of middle third
    end = 2*size/3
    # Get the text
    result = text[start:end]
    # Return the result
    return result
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9/6/16 Strings
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    return result
```

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

No assignments or return
The call frame is EMPTY
### Procedures vs. Fruitful Functions

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Fruitful Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Functions that <strong>do</strong> something</td>
<td>- Functions that give a <strong>value</strong></td>
</tr>
<tr>
<td>- Call them as a <strong>statement</strong></td>
<td>- Call them in an <strong>expression</strong></td>
</tr>
<tr>
<td>- Example: <code>greet('Walker')</code></td>
<td>- Example: <code>x = round(2.56, 1)</code></td>
</tr>
</tbody>
</table>

### Historical Aside

- Historically “function” = “fruitful function”
- But now we use “function” to refer to both
# Print vs. Return

<table>
<thead>
<tr>
<th>Print</th>
<th>Return</th>
</tr>
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<tbody>
<tr>
<td>• Displays a value on screen</td>
<td>• Defines a function’s value</td>
</tr>
<tr>
<td>▪ Used primarily for <strong>testing</strong></td>
<td>▪ Important for <strong>calculations</strong></td>
</tr>
<tr>
<td>▪ Not useful for calculations</td>
<td>▪ But does not display anything</td>
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```python
def print_plus(n):
    print(n+1)

>>> x = print_plus(2)
3

>>>```

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

>>> x = return_plus(2)

>>>```
Print vs. Return

**Print**

- Displays a value on screen
  - Used primarily for **testing**
  - Not useful for calculations

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

>>> x = print_plus(2)
x 3
```

**Return**

- Defines a function’s value
  - Important for **calculations**
  - But does not display anything

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

>>> x = return_plus(2)
x 3
```

Strings
Advanced String Features: Method Calls

- Methods calls are unique (right now) to strings
- Like a function call with a “string in front”
  - Usage: `string.method(x,y...)`
  - The string is an *implicit argument*
- Example: `upper()`
  - `s = 'Hello World'`
  - `s.upper() == 'HELLO WORLD'`
  - `s[1:5].upper() == 'ELLO'`
  - `'abc'.upper() == 'ABC'`

Will see why we do it this way later in course
Examples of String Methods

- \( s_1.index(s_2) \)
  - Position of the first instance of \( s_2 \) in \( s_1 \)

- \( s_1.count(s_2) \)
  - Number of times \( s_2 \) appears inside of \( s_1 \)

- \( s\.strip() \)
  - A copy of \( s \) with white-space removed at ends

- \( s = 'abracadabra' \)
- \( s.index('a') == 0 \)
- \( s.index('rac') == 2 \)
- \( s.count('a') == 5 \)
- \( s.count('b') == 2 \)
- \( s.count('x') == 2 \)
- \( ' a b '.strip() == 'a b' \)

See Python Docs for more
def firstparens(text):
    """Returns: substring in ()
    Uses the first set of parens
    Param text: a string with ()"
    # Find the open parenthesis
    start = s.index('(')
    # Store part AFTER paren
    tail = s[start+1:]
    # Find the close parenthesis
    end = tail.index(')')
    # Return the result
    return tail[:end]

>>> s = 'Prof (Walker) White'
>>> firstparens(s)
'Walker'

>>> t = '(A) B (C) D'
>>> firstparens(t)
'A'
def second(thelist):
    """Returns: second elt in thelist
    The list is a sequence of words
    separated by commas, spaces.
    Ex: second('A, B, C') => 'B'
    Param thelist: a list of words"
    start = thelist.index(',')
    tail = thelist[start+1:]
    end = tail.index(',')
    result = tail[:end]
    return result

>>> second('cat, dog, mouse, lion')
'dog'
>>> second('apple, pear, banana')
'pear'

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9/6/16
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>>> second('cat, dog, mouse, lion')
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'pear'

Where is the error?

A: Line 1
B: Line 2
C: Line 3
D: Line 4
E: There is no error
def second(thelist):
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    The list is a sequence of words separated by commas, spaces.
    Ex: second('A, B, C') => 'B'
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    start = thelist.index('','
    tail = thelist[start+1:]
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    result = tail[:end]
    return result

>>> second('cat, dog, mouse, lion')
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>>> second('apple, pear, banana')
'pear'

OR
result = tail[:end].strip()