Lecture 5

Strings

Announcements For This Lecture

Assignment 1

- Will post it on Thursday
  - Need Thurs. lecture
  - And associated lab
- Due Sun Sep. 17th
  - Revise until correct
  - Final version Sep 24th
- Do not put off until end!

Getting Help

- Can work in pairs
  - Will set up
  - Submit one for both
- Lots of consultant hours
  - Come early! Beat the rush
  - Also use TA office hours
- One-on-Ones next week

One-on-One Sessions

- Starting **Monday**: 1/2-hour one-on-one sessions
  - Bring computer to work with instructor, TA or consultant
  - Hands on, dedicated help with Labs 5 & 6 (and related)
  - To prepare for assignment, **not for help on assignment**
- **Limited availability: we cannot get to everyone**
  - Students with experience or confidence should hold back
- Sign up online in CMS: first come, first served
  - Choose assignment One-on-One
  - Pick a time that works for you; will add slots as possible
  - Can sign up starting at 5pm **THURSDAY**

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  - St
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I personally have only **96 slots**!
Leave those for students in need.

Even More Announcements

The AI Quiz

- Must finish **before** A1
  - Will reject assignment
  - Means a 0 by Sep 24th
- Current statistics
  - 116 have not passed
  - 42 have not taken
- E-mails sent tomorrow

Watching Videos?

- **Today**
  - **Lesson 6:** Strings
- Next Time
  - **Lesson 7:** Specifications
  - **Lesson 8:** Testing
  - Notice that it is a lot
  - Important for A1

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**: "Don't" or '6" tall'
  - What if need both " and ' ?
- **Solution**: escape characters
  - Format: \ + letter
  - Special or invisible chars

Char	Meaning
\'	single quote
\"	double quote
\n	new line
\t	tab
\\	backslash

```
>>> x = 'I said: "Don\'t"'
>>> print(x)
I said: "Don't"
```

String are Indexed

- 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"

- s = 'Hello all'

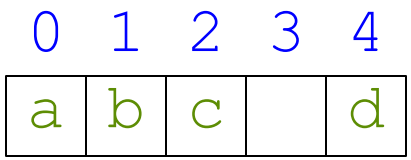
0	1	2	3	4	5	6	7	8
H	e	l	l	o		a	l	l

- 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'



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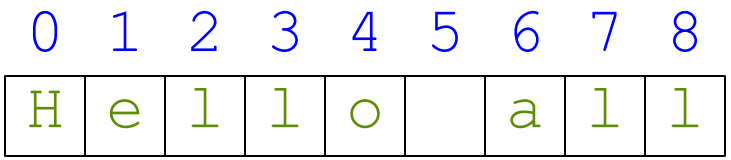

- What is s[3:6]?

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

String are Indexed

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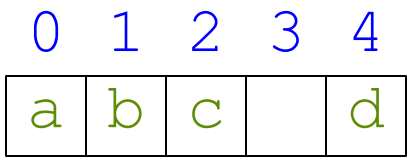

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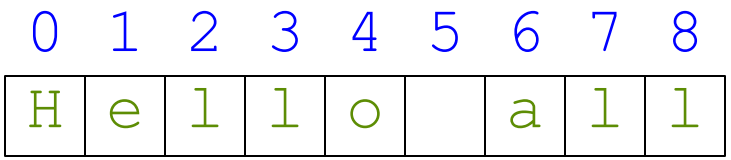

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String are Indexed

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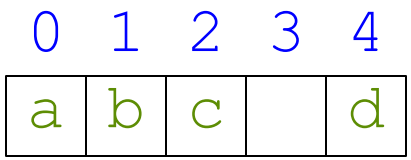

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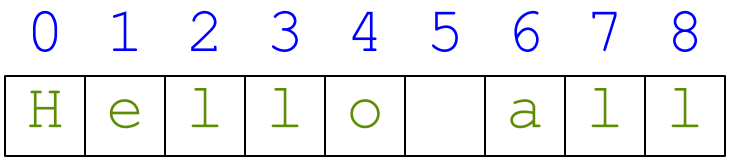

- What is s[:4]?

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'

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

```
def middle(text):
    """Returns: middle 3rd of text
    Param text: a string"""

    # Get length of text

    # Start of middle third

    # End of middle third

    # Get the text

    # Return the result
    return result
```

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    # Get the text
    result = text[start:end]
    # Return the result
    return result
```

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```
def middle(text):
    """Returns: middle 3rd of text
    Param text: a string"""

    # Get length of text


    # Start of middle third


    # End of middle third
    end = 2*size//3
    # Get the text
    result = text[start:end]
    # Return the result
    return result
```

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```
def middle(text):
    """Returns: middle 3rd of text
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    # 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
```

Defining a String Function

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

```
def middle(text):
    """Returns: middle 3rd of text
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    # 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
```

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?')
```

Note the difference

Displays these strings on the screen

No assignments or return
The call frame is **EMPTY**

Procedures vs. Fruitful Functions

Procedures

- Functions that **do** something
- Call them as a **statement**
- Example: `greet('Walker')`

Fruitful Functions

- Functions that give a **value**
- Call them in an **expression**
- Example: `x = round(2.56,1)`

Historical Aside

- Historically "function" = "fruitful function"
- But now we use "function" to refer to both

Print vs. Return

Print

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

```
def print_plus(n):
    print(n+1)
>>> x = print_plus(2)
3
>>>
```

Return

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

```
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

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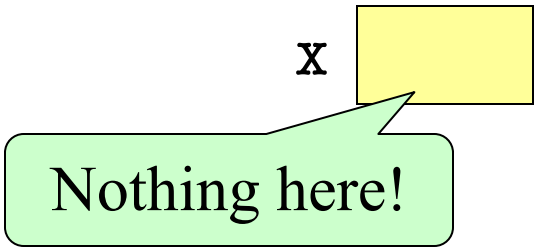

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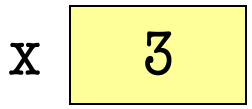
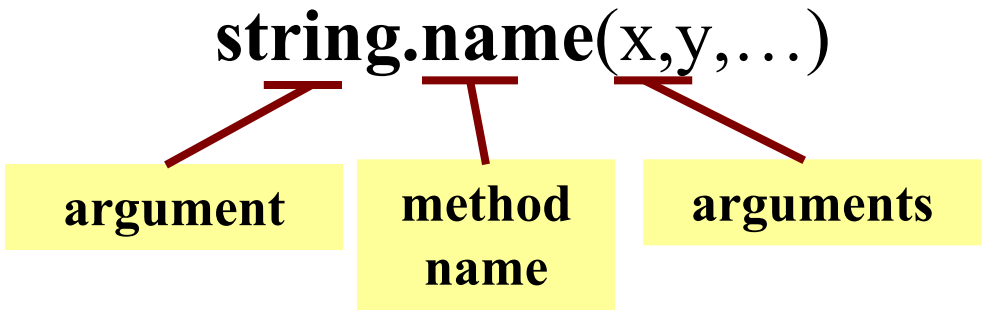


Method Calls

- Methods calls are unique (right now) to strings
  - Like a function call with a "string in front"
- **Method calls** have the form



- The string in front is an **additional** argument
  - Just one that is not inside of the parentheses
  - **Why?** Will answer this later in course.

Example: upper()

- upper(): Return an upper case **copy**

```
>>> s = 'Hello World'
>>> s.upper()
'HELLO WORLD'
>>> s[1:5].upper()    # Str before need not be a variable
'ELLO'
>>> 'abc'.upper()     # Str before could be a literal
'ABC'
```

- Notice that *only* argument is string in front

Examples of String Methods

- s_1.index(s_2)
  - Returns position of the *first* instance of s_2 in s_1
- s_1.count(s_2)
  - Returns number of times s_2 appears inside of s_1
- s.strip()
  - Returns copy of s with no white-space at *ends*

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

Examples of String Methods

- s_1.index(s_2)
  - Returns position of the *first* instance of s_2 in s_1
- s_1.count(s_2)
  - Returns how many times s_2 appears in s_1
- s.strip()
  - Returns copy of s with no white-space at *ends*

```
>>> s = 'abracadabra'
>>> s.index('a')
0
                    rac')
                    a')
5
>>> s.count('x')
0
>>> '  a b '.strip()
'a b'
```

See Lecture page for more

Working on Assignment 1

- You will be writing a lot of string functions
- You have three main tools at your disposal
  - **Searching:** The `index` method
  - **Cutting:** The slice operation `[start:end]`
  - **Gluing:** The + operator
- Can combine these in different ways
  - Cutting to pull out parts of a string
  - Gluing to put back together in new string

String Extraction Example

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

    # SEARCH for open parens
    start = text.index('(')
    # CUT before paren
    tail = text[start+1:]
    # SEARCH for close parens
    end = tail.index(')')
    # CUT and return the result
    return tail[:end]
```

```
>>> s = 'Prof (Walker) White'
>>> firstparens(s)
'Walker'
>>> t = '(A) B (C) D'
>>> firstparens(t)
'A'
```

String Extraction Puzzle

```
def second(text):
    """Returns: second elt in text
    The text is a sequence of words
    separated by commas, spaces.
    Ex: second('A, B, C') rets 'B'
    Param text: a list of words"""

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

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

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>>> second('cat, dog, mouse, lion')
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```

Where is the error?

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

String Extraction Puzzle

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5   return result
```

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

```
tail = text[start+2:]
```

OR

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