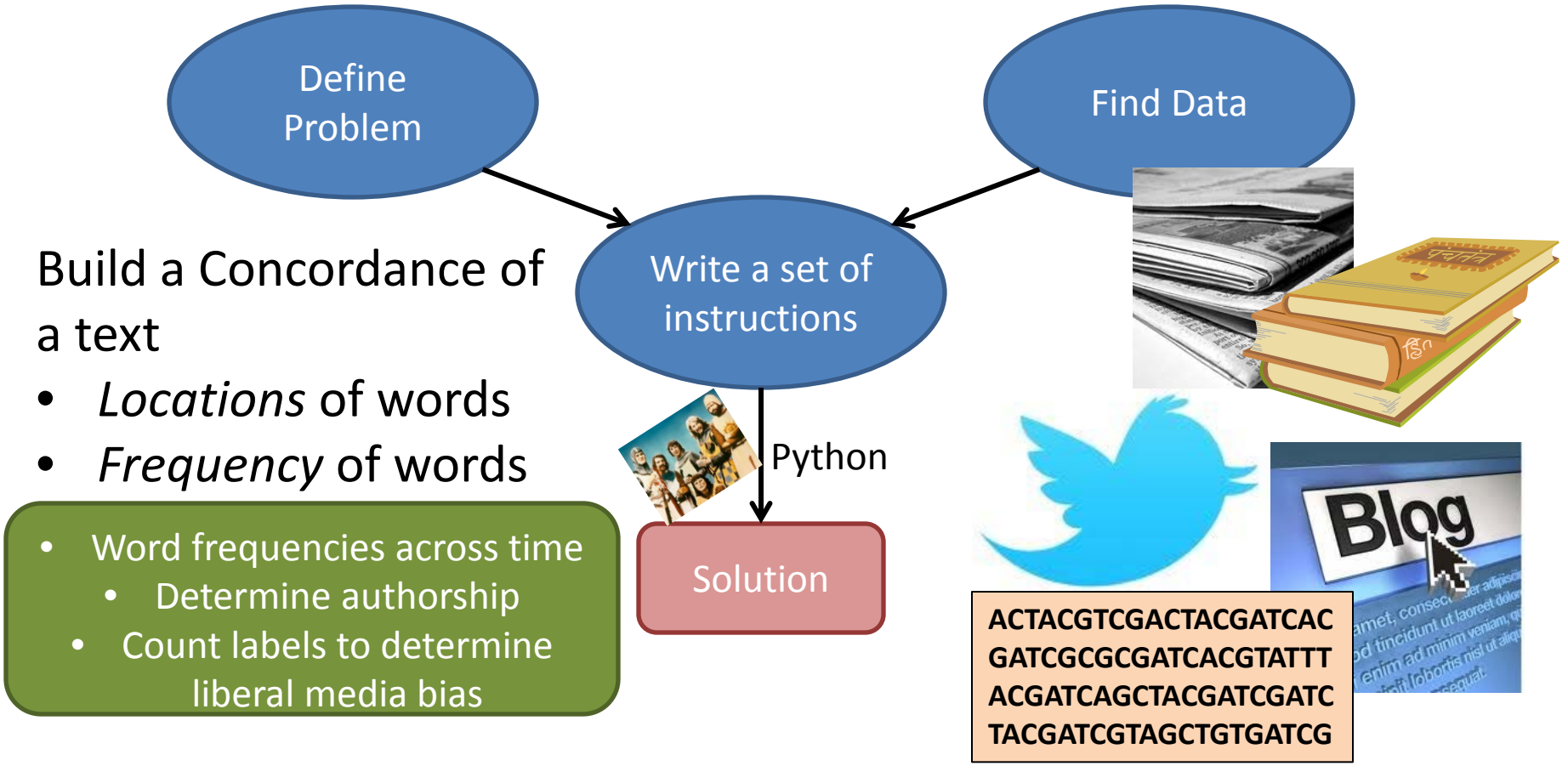
Writing your First Python Program

February 26, 2013

Textual Analysis



The Big Picture

Overall Goal

Build a Concordance of a text

- *Locations* of words
- *Frequency* of words

Today

- Briefly review expressions, assignments, & types
- Learn about defining *functions*
- Learn how to read in a text file and create a list of words
- Write a program to count the number of words in Moby Dick

Last Class

1. Expressions
   - Evaluate *input* and returns some *output* (calculator)
2. Assignments: <variable> = <expression>
   - Store the value of the expression in the variable instead of outputting the value.
   - There is *always* an equals sign in an assignment
   - Variables can be named many things
3. Types
   - Integers vs. Floats (Decimals)
   - Strings in single quotes
   - Lists are sets of other types
   - We can index into Strings & Lists
     - **Indexed starting at 0!**

General Rule: Expressions for a particular type will *output* that same type!

ACT2-1

- Do Task 1

1. Expressions
   - Evaluate *input* and returns some *output* (calculator)
2. Assignments: <variable> = <expression>
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   - There is *always* an equals sign in an assignment
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Python Functions

Functions are new commands that **we** define

- Allows us to run many statements at one time.

```
>>> myList = [2,5,9]
>>> def avg3(someList):
        s = someList[0] + someList[1] + someList[2]
        avg = s/3.0
        return avg

>>>
```

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>>> avg3(myList)
5.333333333333333
>>> myList = [1,2,3]
>>> finalValue = avg3(myList)
>>> finalValue
>>> 2.0
```

Python Functions

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>>> myList = [2,5,9]
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>>> finalValue
>>> 2.0
```

WARNING: do not name a variable `sum`. It is a predefined function (it turns purple in IDLE)

Python Functions

Variables		
Name	Type	Value

Preloaded Functions		
Name	Inputs	Outputs
type	expression	type
…		

New Functions		
Name	Inputs	Outputs

```
>>> myList = [2,5,9]
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Python Functions

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myList	list	[2,5,9]

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Name	Inputs	Outputs

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Python Functions

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Name	Type	Value
myList	list	[2,5,9]

Preloaded Functions		
Name	Inputs	Outputs
type	expression	type
…		

New Functions		
Name	Inputs	Outputs
avg3	list	float

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        avg = s/3.0
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>>> avg3(myList)
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>>> myList = [1,2,3]
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>>> finalValue
2.0
```

Input

Output

"Inputs" are also called *Arguments.*

Python Functions

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```

Invoke avg3

Python Functions

avg3 Variables

Name	Type	Value
sL	list	[2,5,9]

type	expression	type
…		

New Functions

Name	Inputs	Outputs
avg3	list	float

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>>> myList = [1,2,3]
>>> finalValue = avg3(myList)
>>> finalValue
2.0
```

Invoke avg3

Python Functions

avg3 Variables

Name	Type	Value
sL	list	[2,5,9]
s	int	16

type	expression	type
…		

New Functions

Name	Inputs	Outputs
avg3	list	float

```
>>> myList = [2,5,9]
>>> def avg3(sL):
        s = sL[0] + sL[1] + sL[2]
        avg = s/3.0
        return avg

>>> avg3(myList)
5.333333333333333
>>> myList = [1,2,3]
>>> finalValue = avg3(myList)
>>> finalValue
2.0
```

Python Functions

avg3 Variables

Name	Type	Value
sL	list	[2,5,9]
s	int	16
avg	float	5.33333

type	expression	type
…		

New Functions

Name	Inputs	Outputs
avg3	list	float

```
>>> myList = [2,5,9]
>>> def avg3(sL):
        s = sL[0] + sL[1] + sL[2]
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Python Functions

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myList	list	[2,5,9]

Preloaded Functions		
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>>> finalValue
2.0
```

Python Functions

Variables		
Name	Type	Value
myList	list	[2,5,9]

Preloaded Functions		
Name	Inputs	Outputs
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New Functions		
Name	Inputs	Outputs
avg3	list	float

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>>> avg3(myList)
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>>> myList = [1,2,3]
>>> finalValue = avg3(myList)
>>> finalValue
2.0
```

Returned value

Python Functions

Variables		
Name	Type	Value
myList	list	~~[2,5,9]~~ [1,2,3]

Preloaded Functions		
Name	Inputs	Outputs
type	expression	type
…		

New Functions		
Name	Inputs	Outputs
avg3	list	float

```
>>> myList = [2,5,9]
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Python Functions

Variables

avg3 Variables

Name	Type	Value
sL	list	[1,2,3]

type	expression	type
…		

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Name	Inputs	Outputs
avg3	list	float

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>>> myList = [2,5,9]
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>>> avg3(myList)
5.333333333333333
>>> myList = [1,2,3]
>>> finalValue = avg3(myList)
>>> finalValue
2.0
```

Invoke avg3

Python Functions

Variables

avg3 Variables

Name	Type	Value
sL	list	[1,2,3]
s	int	6

type	expression	type
…		

New Functions

Name	Inputs	Outputs
avg3	list	float

```
>>> myList = [2,5,9]
>>> def avg3(sL):
        s = sL[0] + sL[1] + sL[2]
        avg = s/3.0
        return avg

>>> avg3(myList)
5.333333333333333
>>> myList = [1,2,3]
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>>> finalValue
2.0
```

Python Functions

Variables

avg3 Variables

Name	Type	Value
sL	list	[1,2,3]
s	int	6
avg	float	2.0

type	expression	type
…		

New Functions

Name	Inputs	Outputs
avg3	list	float

```
>>> myList = [2,5,9]
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Python Functions

Variables

avg3 Variables

Name	Type	Value
sL	list	[1,2,3]
s	int	6
avg	float	2.0

type	expression	type
…		

New Functions

Name	Inputs	Outputs
avg3	list	float

```
>>> myList = [2,5,9]
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>>> avg3(myList)
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>>> myList = [1,2,3]
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>>> finalValue
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```

Python Functions

Variables		
Name	Type	Value
myList	list	[1,2,3]
finalValue	float	2.0

New Functions		
Name	Inputs	Outputs
avg3	list	float

```
>>> myList = [2,5,9]
>>> def avg3(sL):
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>>> finalValue
2.0
```

Python Functions

Variables		
Name	Type	Value
`myList`	`list`	`[1,2,3]`
`finalValue`	`float`	`2.0`

New Functions		
Name	Inputs	Outputs
avg3	list	float

```
>>> myList = [2,5,9]
>>> def avg3(sL):
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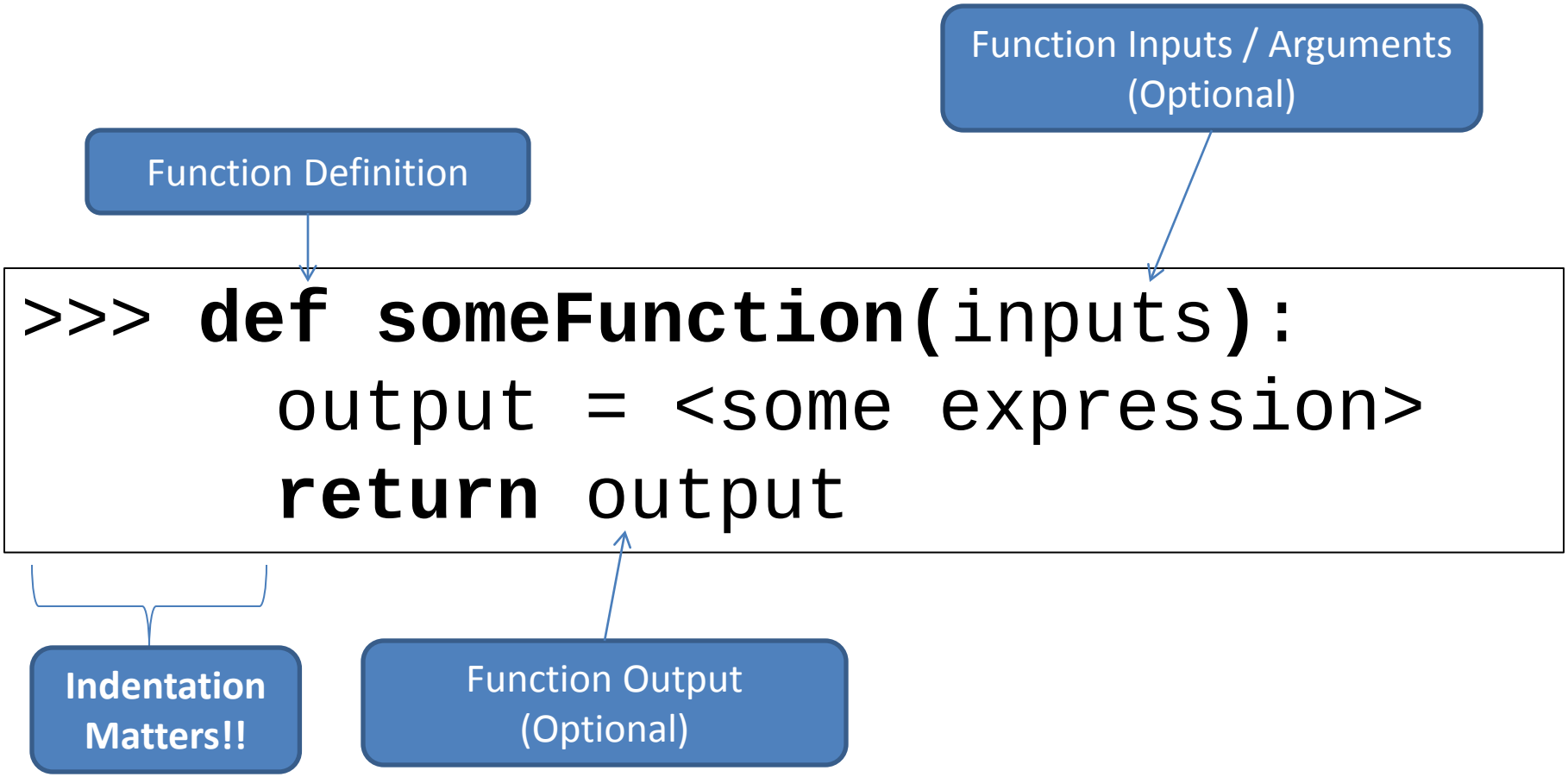
Python Functions



ACT2-1

- Do Task 2

```
>>> def someFunction(inputs):
        output = <some expression>
        return output
```

Module Files

Allow us to **save** code ('.py' extension)

- Download `ACT2-1.py` from the website and open it in IDLE. Take a moment to look at it.
- `Run…Run Module` (or press `F5`)

- To write your own file:
  - `File…New Window`
  - Write your function definitions. Save the file.
  - `Run…Run Module` (or press `F5`)

Break

The Big Picture

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Working with Files

1. Save `poem.txt` from the webpage.
2. Right-click and select 'Properties'
3. Note the file location (C:\Users\Jadrian\Desktop…)
4. In python, write an assignment statement that stores the file location as a string.

```
>>> fileName = "C:\\Users\\Jadrian\\Desktop\\poem.txt“
```

Working with Files

Preloaded Functions		
Name	Inputs	Outputs
`type`	Expression	Type Name
`open`	Two Strings 1. File Name 2. “r” for read (for now)	File

File is a NEW Type

```
>>> fileName = "C:\\Users\\Jadrian\\Desktop\\poem.txt"
```

Working with Files

Preloaded Functions		
Name	Inputs	Outputs
`type`	Expression	Type Name
`open`	Two Strings 1. File Name 2. “r” for read (for now)	File

File is a NEW Type

```
>>> fileName = "C:\\Users\\Jadrian\\Desktop\\poem.txt"
>>> fileHandle = open(fileName,"r")
```

Working with Files

Preloaded Functions		
Name	Inputs	Outputs
`type`	Expression	Type
`open`	Two Strings 1. File Name 2. “r” for read (for now)	File
`read` (On a File)	none	String

```
>>> fileName = "C:\\Users\\Jadrian\\Desktop\\poem.txt"
>>> fileHandle = open(fileName,"r")
```

Working with Files

Preloaded Functions		
Name	Inputs	Outputs
`type`	Expression	Type
`open`	Two Strings 1. File Name 2. “r” for read (for now)	File
`read` (On a File)	none	String

```
>>> fileName = "C:\\Users\\Jadrian\\Desktop\\poem.txt"
>>> fileHandle = open(fileName,"r")
>>> fileString = fileHandle.read()
```

Working with Files

Preloaded Functions		
Name	Inputs	Outputs
`type`	Expression	Type
`open`	Two Strings 1. File Name 2. “r” for read (for now)	File
`read` (On a File)	none	String
`close` (On a File)	none	none

```
>>> fileName = "C:\\Users\\Jadrian\\Desktop\\poem.txt"
>>> fileHandle = open(fileName,"r")
>>> fileString = fileHandle.read()
>>> myFile.close()
```

Working with Files

```
>>> fileString
'Sarah Cynthia Sylvia Stout\nWould not take the garbage
out!\nShe\'d scour the pots and scrape the pans,\nCandy
the yams and spice the hams,\nAnd though her daddy would
scream and shout,\nShe simply would not take the garbage
out.\nAnd so it piled up to the ceilings:\nCoffee grounds,
potato peelings,\nBrown bananas, rotten peas,\nChunks of
sour cottage cheese.\nIt filled the can, it covered the
floor,\nIt cracked the window and blocked the door\nWith
bacon rinds and chicken bones,\nDrippy ends of ice cream
cones,\nPrune pits, peach pits, orange peel,\nGloppy
glumps of cold oatmeal,\nPizza crusts and withered
greens,\nSoggy beans and tangerines,\nCrusts of black
burned buttered toast,
...
Because the hour is much too late.\nBut children, remember
Sarah Stout\nAnd always take the garbage out!'
```

- Shel Silverstein

Working with Files

```
>>> fileString
'Sarah Cynthia Sylvia Stout\nWould not take the garbage
out!\nShe\'d scour the pots and scrape the pans,\nCandy
the yams and spice the hams,\nAnd though her daddy would
scream and shout,\nShe simply would not take the garbage
out.\nAnd so it piled up to the ceilings:\nCoffee grounds,
potato peelings,\nBrown bananas, rotten peas,\nChunks of
sou                                                    the
fl                                                     ith
ba                                                     eam
co
gl
gr
bu
..
Beca                                                   member
Sarah Stout\nAnd always take the garbage out!'
```

Escape Characters

'\' means interpret the NEXT character differently.

- \n : "new line"
- \' : "apostrophe"
- \t : "tab"

- Shel Silverstein

Working with Files

Preloaded Functions		
Name	Inputs	Outputs
`type`	Expression	Type
`open`	Two Strings 1. File Name 2. "r" for read (for now)	File
`read` (On a File)	none	String
`close` (On a File)	none	none
`split` (On a String)	(optional) delimiter	List of Strings

```
>>> wordList = fileString.split()
```

Working with Files

```
>>> wordList
['Sarah', 'Cynthia', 'Sylvia', 'Stout', 'Would', 'not',
'take', 'the', 'garbage', 'out!', "She'd", 'scour', 'the',
'pots', 'and', 'scrape', 'the', 'pans,', 'Candy', 'the',
'yams', 'and', 'spice', 'the', 'hams,', 'And', 'though',
'her', 'daddy', 'would', 'scream', 'and', 'shout,', 'She',
'simply', 'would', 'not', 'take', 'the', 'garbage',
'out.', 'And', 'so', 'it', 'piled', 'up', 'to', 'the',
'ceilings:', 'Coffee', 'grounds,', 'potato', 'peelings,',
'Brown',
...
'an', 'awful', 'fate,', 'That', 'I', 'cannot', 'now',
'relate', 'Because', 'the', 'hour', 'is', 'much', 'too',
'late.', 'But', 'children,', 'remember', 'Sarah', 'Stout',
'And', 'always', 'take', 'the', 'garbage', 'out!']
```

Activity

- Do Task 3

Preloaded Functions		
Name	Inputs	Outputs
`type`	Expression	Type
`open`	Two Strings 1. File Name 2. “r” for read (for now)	File
`read` (On a File)	none	String
`close` (On a File)	none	none
`split` (On a String)	(optional) delimiter	List of Strings

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- Write a program to count the number of words in Moby Dick

Python For Statements (For Loops)

"For each element in list myList, do something"

```
>>> myList = [1,2,3]
>>> for element in myList:
        print(element)


1
2
3
>>>
```

Python For Statements (For Loops)

"For each element in list myList, do something"

```
>>> myList = [1,2,3]
>>> for element in myList:
        print(element)


1
2
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```

Python For Statements (For Loops)

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2
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Python For Statements (For Loops)

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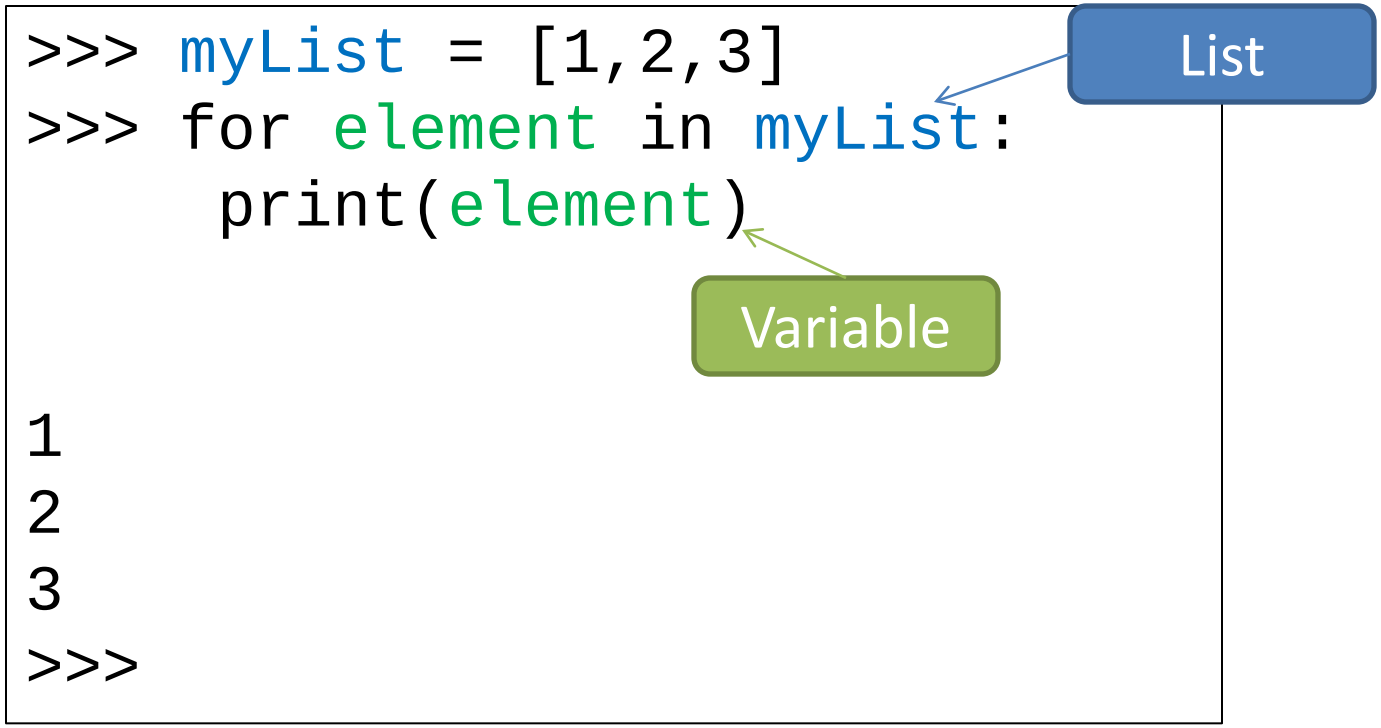
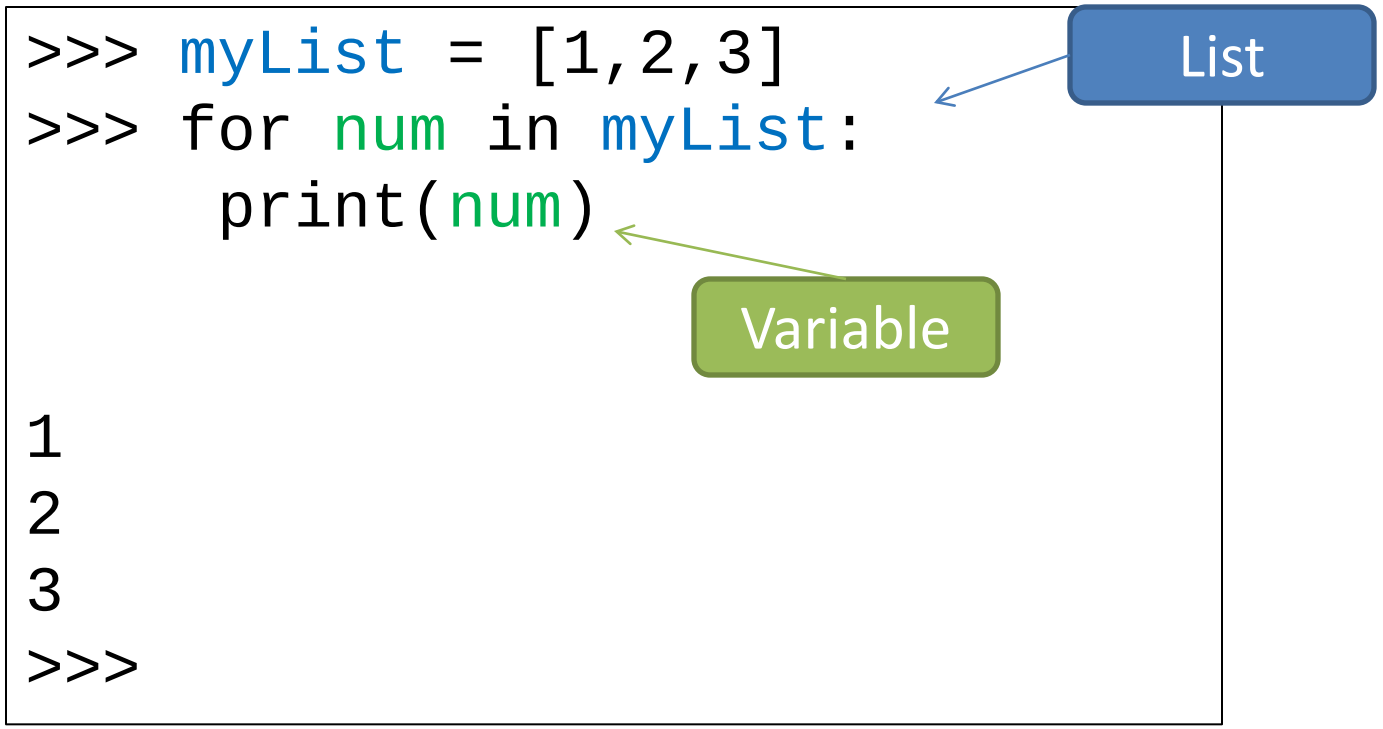


Python For Statements (For Loops)

"For each element in list myList, do something"

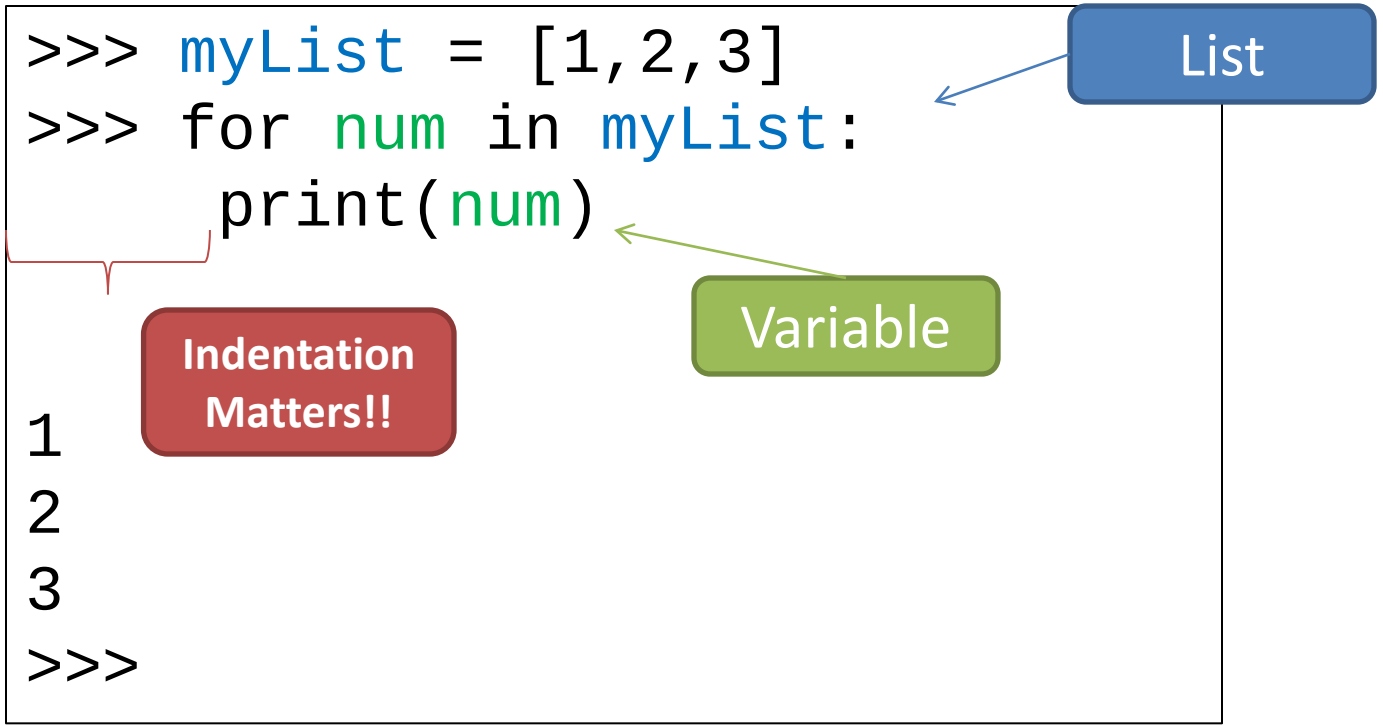
```
>>> myList = [1,2,3]
>>> for num in myList:
        print(num)


1
2
3
>>>
```



Python For Statements (For Loops)

"For each element in list myList, do something"



Word Count for Shel's Poem

```
def countWordsInShel():




    return count
```

Word Count for Shel's Poem

```
def countWordsInShel():
    '''Returns the number of words in the poem.'''
    myList = readShel()
    # the 'count' variable counts the number of words
    count = 0
    for word in myList:
        count = count + 1
    print("There are ",count," words in the poem.“)
    return count
```

Word Count for Shel's Poem

Good Programming Practices:

Documentation!

```
def countWordsInShel():
    '''Returns the number of words in the poem.'''
    myList = readShel()
    # the 'count' variable counts the number of words
    count = 0
    for word in myList:
        count = count + 1
    print("There are ",count," words in the poem.“)
    return count
```

Program Description (triple quotes)

Comment (#)

Print Function

Activity

- Do Task 4

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- There's a shortcut…

A Shortcut to List Length

Preloaded Functions		
Name	Inputs	Outputs
`type`	Expression	Type
`open`	Two Strings 1. File Name 2. "r" for read (for now)	File
`read` (On a File)	none	String
`close` (On a File)	none	none
`split` (On a String)	(optional) delimiter	List of Strings
`print`	Expression	none
`len`	List	Integer

```
>>> len(myList)
```

Python For Statements (For Loops)

"For each element in list myList, do something"

```
>>> myList = [1,2,3]
>>> for i in range(0,3):
     print(myList[i])


1
2
3
>>>
```

Python For Statements (For Loops)

"For each element in list myList, do something"

```
>>> myList = [1,2,3]
>>> for i in range(0,3):
        print(myList[i])


1
2
3
>>>
```

Preloaded Functions		
range	Two Integers 1. Start Index (Inclusive) 2. End Index (Exclusive)	List of Integers

Python For Statements (For Loops)

"For each element in list myList, do something"

```
>>> myList = [1,2,3]
>>> for i in range(0,3):
        print(myList[i])


1
2
3
>>>
```

List
[0,1,2]

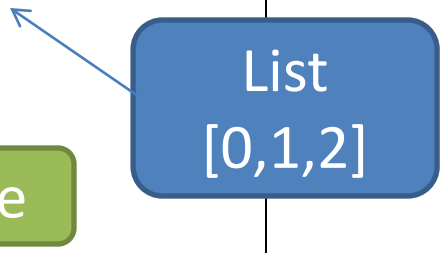
Preloaded Functions		
range	Two Integers 1. Start Index (Inclusive) 2. End Index (Exclusive)	List of Integers

Python For Statements (For Loops)

"For each element in list myList, do something"

```
>>> myList = [1,2,3]
>>> for i in range(0,3):
        print(myList[i])


1
2
3
>>>
```



Python For Statements (For Loops)

"For each element in list myList, do something"

```
>>> myList = [1,2,3]
>>> for i in range(0,3):
        print(myList[i])


1
2
3
>>>
```

List [0,1,2]

Variable

Q: What if we don't know the length of the list?

Python For Statements (For Loops)

"For each element in list myList, do something"

```
>>> myList = [1,2,3]
>>> for i in range(0,len(myList)):
      print(myList[i])


1
2
3
>>>
```

List [0,1,2]

Variable

Q: What if we don't know the length of the list?

Python For Statements (For Loops)

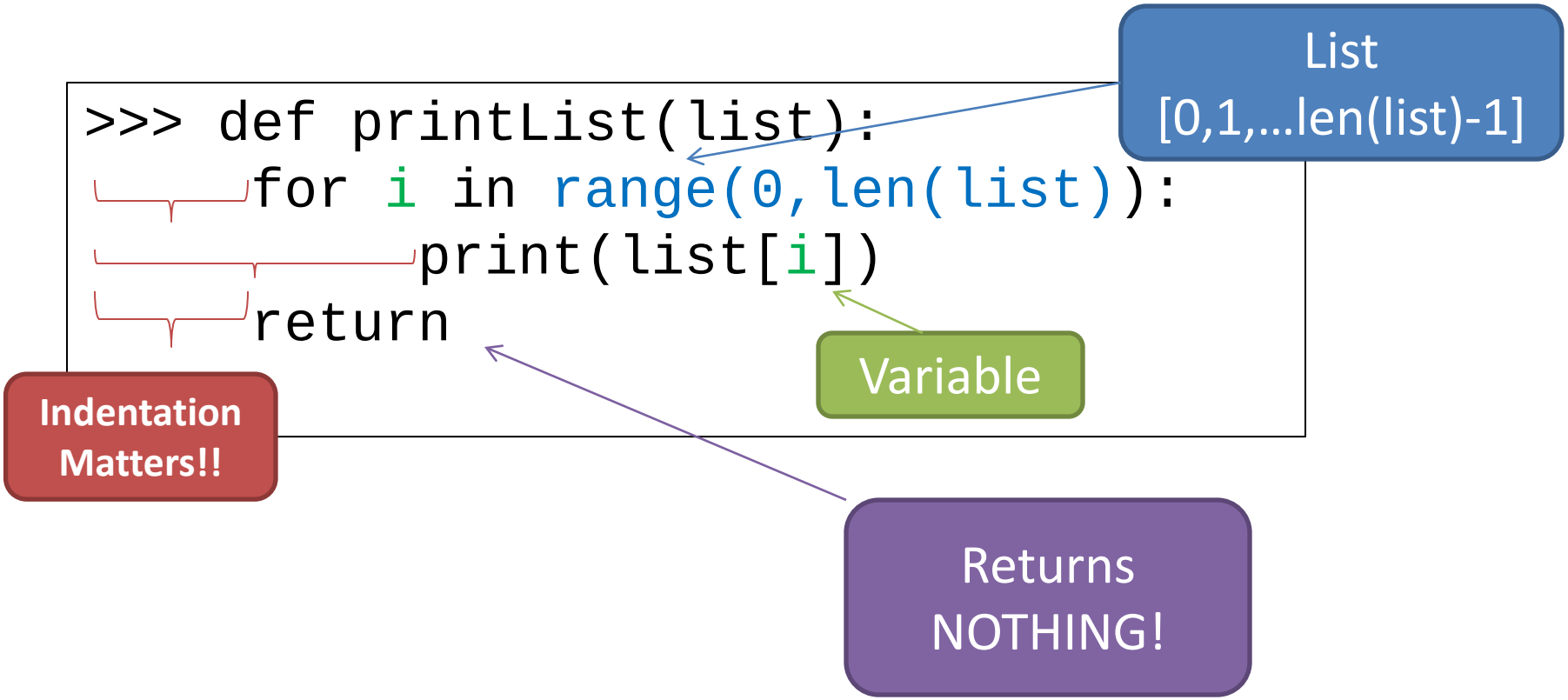
"For each element in list myList, do something"

```
>>> def printList(list):
      for i in range(0,len(list)):
            print(list[i])
      return
```

Preloaded Functions		
range	Two Integers 1. Start Index (Inclusive) 2. End Index (Exclusive)	List of Integers

Python For Statements (For Loops)

"For each element in list myList, do something"



Python Summary

1. Statements
   - Expressions: evaluates *input* and returns some *output*
   - Assignments: <variable> = <expression>
   - Print Statements
   - For Statements
2. Types
   - Integers & Floats
   - Strings
   - Lists
   - Files
3. Function Definitions

Function Summary

"Inputs" are also called *Arguments*.

Preloaded Functions		
Name	Inputs	Outputs
`type`	Expression	Type
`open`	Two Strings 1. File Name 2. "r" for read (for now)	File
`read` (On a File)	none	String
`close` (On a File)	none	none
`split` (On a String)	(optional) delimiter	List of Strings
`len`	List	Integer
`print`	Expression	none
`range`	Two Integers 1. Start Index (Inclusive) 2. End Index (Exclusive)	List of Integers

General Rules for Writing Functions

- Variables used within function definitions should be one of two things:
  1. An input (also called an argument)
  2. Previously assigned *within* the function def.
- Do not modify arguments within a function definition (define new variables instead)
- Do not have nested function definitions.
- Use only the returned values outside the function definition.