

CUCaTS Python Workshop

Lent 2015

Literacy is a bridge from misery to hope. It is a tool for daily life in modern society. It is a bulwark against poverty, and a building block of development, an essential complement to investments in roads, dams, clinics and factories. Literacy is a platform for democratization, and a vehicle for the promotion of cultural and national identity. Especially for girls and women, it is an agent of family health and nutrition. For everyone, everywhere, literacy is, along with education in general, a basic human right. . . Literacy is, finally, the road to human progress and the means through which every man, woman and child can realize his or her full potential.

– Kofi Annan

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[GCC 4.9.2] on linux
Type "help", "copyright", "credits" or "licen
>>>
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```

- ▶ Talk to the interpreter in Python.
- ▶ Changes here aren't permanent. Can close and start again.

Values

- ▶ A program processes data.
- ▶ Data such as numbers, text, images, dates/time, sound, files and so on.
- ▶ Even complex and abstract things like a road network or the structure of a protein.
- ▶ A value is a piece of data stored in a computer's memory.

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`True` and `False`

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- ▶ Numbers (integers, floats)

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`"Hello world!"`

- ▶ Booleans

`True` and `False`

- ▶ Lists

`[4, 8, 15, 16, 23, 42]`

or `["first", "second", "fourth"]`

or even `[[], "some text", 99]`

Arithmetic:

```
>>> 5 + 9  
14
```

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```
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```
>>> 7.5 * 2
```

```
15.0
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Comparisons:

```
>>> 5 > 6
False
>>> 9 == 18 / 2
True
```

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Comparisons:

```
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False
>>> 9 == 18 / 2
True
```

```
>>> "two" + "strings"
"twostrings"
```

Try it out

```
>>> "a" + "b"  
>>> "test" + "ing" == "testing"  
>>> 3 == "3"  
>>> "a" < "b"  
>>> "Na"*8 + " batman"
```


Variables

- ▶ Variables are labels put onto values. They allow us to refer to those values by a name.

```
>>> x = 5
>>> y = x+6
>>> print(y)
11
```

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```
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>>> print(y)
11
```

- ▶ They can be reassigned:

```
>>> x = 5
>>> x = 7
>>> print(x)
7
```

Accessing elements in lists

```
>>> days = ["Mon", "Tue", "Wed", "Thu",  
...         "Fri", "Sat", "Sun"]  
>>> days[1]
```

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>>> days = ["Mon", "Tue", "Wed", "Thu",  
...         "Fri", "Sat", "Sun"]  
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```

What do you get?

```
'Tue'
```

Accessing elements in lists

```
>>> days = ["Mon", "Tue", "Wed", "Thu",  
...         "Fri", "Sat", "Sun"]  
>>> days[1]
```

What do you get?

```
'Tue'
```

```
>>> days[0] == "Mon"  
True
```

Accessing elements in lists

```
>>> days = ["Mon", "Tue", "Wed", "Thu",  
...         "Fri", "Sat", "Sun"]  
>>> days[1]
```

What do you get?

```
'Tue'
```

```
>>> days[0] == "Mon"  
True
```

```
>>> days[-1]  
'Sun'
```

Errors

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 - ▶ Adding an integer to a string.

```
>>> 16 + "hello"
```

```
TypeError: unsupported operand type(s) for +: 'int' and 'str'
```

Errors

- ▶ There are rules governing what you can't do with certain types and values. For example:
 - ▶ Adding an integer to a string.
 - ▶ Indexing into something that is not a sequence.

```
>>> 9.0[1]
```

```
TypeError: 'float' object has no attribute '__getitem__'
```

Errors

- ▶ There are rules governing what you can't do with certain types and values. For example:
 - ▶ Adding an integer to a string.
 - ▶ Indexing into something that is not a sequence.
 - ▶ Asking for the sixth element of a list that only has four.

```
>>> [4, 5, 6, 7][5]
```

```
IndexError: list index out of range
```

Errors

- ▶ There are rules governing what you can't do with certain types and values. For example:
 - ▶ Adding an integer to a string.
 - ▶ Indexing into something that is not a sequence.
 - ▶ Asking for the sixth element of a list that only has four.
- ▶ Designed to help you spots problems with your code.

Try it out

```
>>> "this is a string" + 2
>>> "this is a string" - "string"
>>> 5/0

>>> list = [1, 2, 3]
>>> list[1.0]
```

The print function

```
print(value)
```

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- ▶ `print` writes things into the command prompt.
- ▶ `print` can print all kinds of values.
- ▶ A useful function to see “what’s going on” in your program.

Control flow

The order that things happen in.

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(Very) broadly:

- ▶ Loops
- ▶ Branches
- ▶ Function calls

'for' loops

Run a block of code for every element in a list. Indentation specifies the block.

```
>>> numbers = [1, 2, 3, 4, 5]
>>> total = 0
>>> for num in numbers:
...     total = total + num
```

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num		total
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15
```

num	total
	0
1	1

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```

num	total
	0
1	1
2	3

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>>> total = 0
>>> for num in numbers:
...     total = total + num
>>> print(total)
15
```

num	total
	0
1	1
2	3
3	6
4	10
5	15

Processing lists

```
>>> nums = [1, 2, 3, 4, 5]  
>>> squares = [1, 4, 9, 16, 25]
```

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```
>>> nums = [1, 2, 3, 4, 5]
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[1, 4, 9, 16, 25]
```

- ▶ Creates a new list out of another by using each element to create a corresponding new value.
- ▶ 'for' and 'in' are keywords.
- ▶ This is called a **list comprehension**.

if-else

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```
if MY_CONDITION:
    # Perform computation if
    # MY_CONDITION evaluates
    # to True.
else:
    # Perform computation if
    # MY_CONDITION evaluates
    # to False.
```

if-else examples

Let's write some code to go through a bunch of values in a list and output whether or not they are even or odd.

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```
numbers = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]

for x in numbers:
    if (x % 2) == 0:
        print(x, "is even.")
    else:
        print(x, "is odd.")
```

if-else examples

Let's write some code to go through a bunch of values in a list and output whether or not they are even or odd.

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numbers = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]

for x in numbers:
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Try it out!

Functions

A function is a reusable piece of code. It takes an input value (`parameter`), processes it and gives back an output (`return value`).

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► Definition:

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def sum(numbers):  
    total = 0  
    for num in numbers:  
        total = total + num  
    return total
```

Functions

A function is a reusable piece of code. It takes an input value (**parameter**), processes it and gives back an output (**return value**).

► Definition:

```
def sum(numbers):  
    total = 0  
    for num in numbers:  
        total = total + num  
    return total
```

► Use:

```
y = sum([1, 2, 3, 4, 5])  
# The value of y is now 15.
```

The value of the function call is specified by **return**, which ends the function.

Functions

Functions can also take multiple parameters:

```
def find(list, value):  
    for item in list:  
        if item == value:  
            return True  
  
    return False
```

```
>>> find([1, 2, 3, 4], 5)  
False
```

Try changing it to return the index, if found.

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- ▶ Note the `.py` extension!

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- ▶ We can save some Python commands in a file and then invoke the interpreter on the file.
- ▶ Write `print("Hello!")` in a file using a text editor (say, Notepad) and save it somewhere under the name `my_python_script.py`.
- ▶ Note the `.py` extension!
- ▶ Open a command prompt at the folder where you saved the script and type in the name of your script (`my_python_script.py`).
- ▶ The computer should respond: `Hello!`