
Python DeCal
Week 2

MONDAY

Announcements

- 1st HW
- Attendance form
  - https://tinyurl.com/5tjdfqvs
- Something about advanced topics poll, and final project ideas
- Office Hour Poll
- Piazza

Command Line

- We need to understand this stuff before we can actually code in python because we need to know how to find our files in the first place
- The command lines are different in Mac and in Windows/Linux, but the general ideas are the same.

Directories (“Folders”) - Mac/Windows

Finding your current working directory: `pwd / cd`

Going into a certain directory: `cd /Your/Path`

List Files in a directory: `ls / dir`

Create a directory: `mkdir dir_name`

Move a file: `mv/move ori_path dest_path`

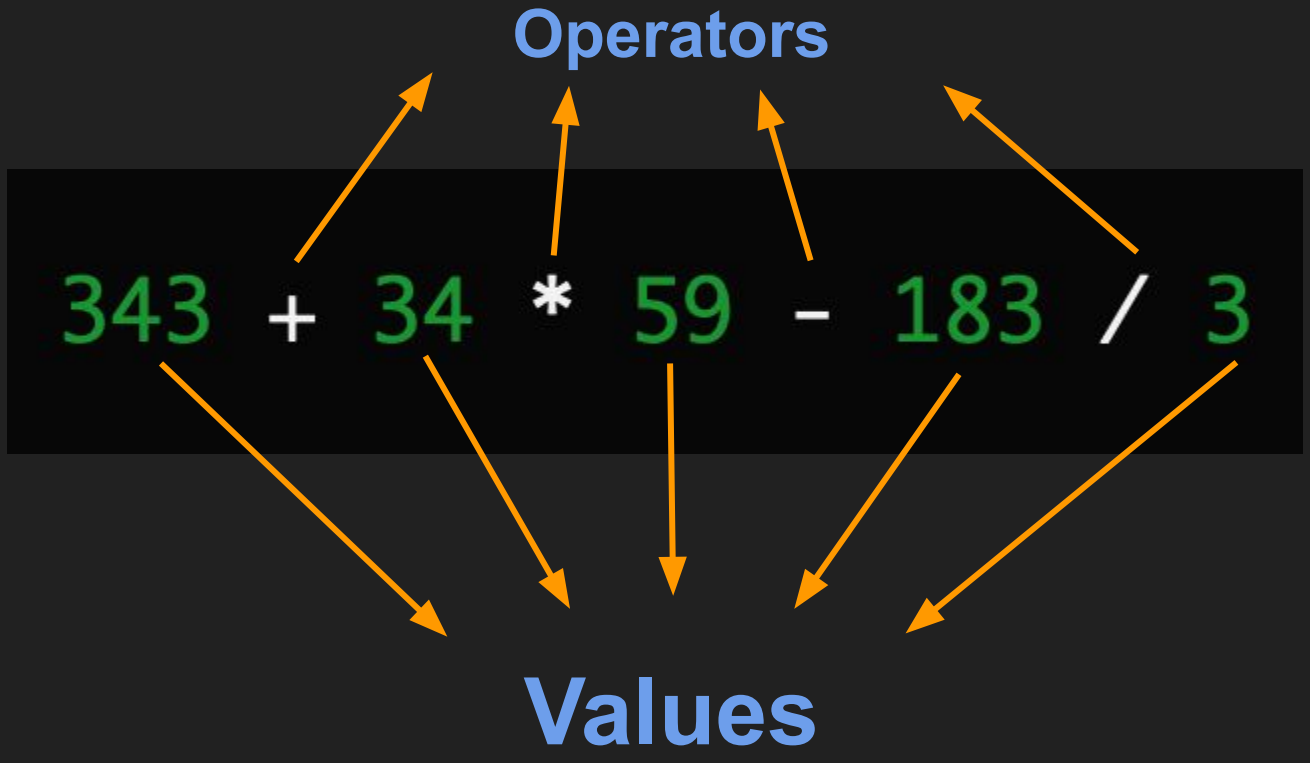
Rename a file: `mv/move ori_name new_name`

Remove a file: `rm/del file`

Better take a screenshot now!

We are going to do some demonstrations.

Expressions



Data Types-Numbers

- Integers (**`int`**) and Floats (**`float`**) - “NUMBERS”
  - Integers: **`-3  -2  -1  0  1  2  3`**
  - Floats: **`3.3  13451.133434  98.7`**

- How to check the type of an object?

```
type(your_object)
```

- Here is a question for you:
  - What is the output of **`type(183884913830484010372448 2.)`**?

+	Addition	4 + 7 ⟶ 11
-	Subtraction	12 - 5 ⟶ 7
*	Multiplication	6 * 6 ⟶ 36
/	Division	30 / 5 ⟶ 6
%	Modulus	10 % 4 ⟶ 2
//	Quotient	18 // 5 ⟶ 3
**	Exponent	3 ** 5 ⟶ 243

Data Types-Names

- VARIABLES - “Giving Names”
  - `x = 1, y = 2` ⟶ `x + y` ⟶ `3`

- We want to name the variables nicely :D
  - Cannot start the name with a number
  - Don’t start with “O”, “l”, or “I”
  - Make you variable name IMMEDIATELY clear and recognisable
  - https://visualgit.readthedocs.io/en/latest/pages/naming_convention.html

Data Types-Characters

- Strings (**`str`**) - “WORDS”
  - `‘Hello World’`
  - `“Go Bears!”`
  - Either type of quotation marks is fine so long as they are consistent
- You can add two strings

```
>>> “134” + “34”
“13434”
```

What is the output of `7 * “1”`?

- Indexing (Python index starts from 0, not 1!)

```
>>> “Hello World”[0]
“H”
```

```
>>> “Hello World”[5]
“ ”
```

Data Types-Lists

- List (**`list`**) **`[4, 9, 7.5, ‘astronomy’, [“Berkeley”, True]]`**
  - Calling certain elements (INDEXING)
    - `[1,2,3,4,5,6][0]` ⟶ `1` `[1,2,3,4,5,6][-1]` ⟶ `6`
    - `[1,2,3,4,5,6][2:5]` ⟶ `[3,4,5]` (from the 2nd element to the 5th, not included)
  - You can modify the elements in a list
    - `my_list = [1,2,3]` ⟶ `my_list[0] = 37`
      `my_list` ⟶ `[37,2,3]`
  - Operation
    - `3 * [1,2]` ⟶ `[1,2,1,2,1,2]`
    - `[1,2] + [1,2,3]` ⟶ `[1,2,1,2,3]`

Data Types - Tuples & Dictionaries

- Tuple (**tuple**) **(1,2,3,4)**
  - Indexing and operations are the same
  - You CANNOT change the elements
  - `my_tuple = (1, 2, [3, 4])` --→ `my_tuple[-1][0] = 100`
    Wnat is going to happen??????
- Dictionary (**dict**)

  d = {Stars: [‘Sirius’, ‘Sun’], Planets: [‘Venus’, ‘Saturn’]}
  - Accessing items:

```
>>> d[‘Stars’]
    [‘Sirius’, ‘Sun’]
```

Data Types-Booleans

- Booleans (**`bool`**) - “True or False”
  - **`True`**
    - **A value is true unless it is not**
  - **`False`**
    - **`0, [], (), {}, “”, None,`**

- Here is a question for you:
  - What is the output of **`bool(“ ”)`**?

- Operations :
  - **`3 > 2`** **`0 <= -100`** **`23 == 23`** **`73 != 9`**

Fill in the Attendance Form Please
https://forms.gle/XJJ4Bta8zyKV2LTo6

Also, please fill in the Office Hour W2M as well
https://www.when2meet.com/?10909208-jjGQr

WEDNESDAY

Recap

- Basic Command Line
- Data Types, Can you name them all?
- Functions

Before We Get Started

- Breakout room time!
- Challenge 1 : What does `cd`, `mkdir`, `pwd`, `ls` all mean? How are they used?
- Challenge 2 : If I `pwd` and the terminal reads `Users/yourname/Desktop`

  How would I get to a new directory `Users/yourname/Desktop/PyDeCal`

  If there is no pre existing folders on the desktop

Introduction to Functions

```
def func(x):
    y = x**100 + 23*x**2 + 56
    return y
```

- Just like a mathematical function f(x)
  - Takes a value(s) → outputs some other value
- Another Example: I have some values and I want to convert it to a string and attach ".jpg" at the end.

  (e.g. `[23, 7]` → "`[23, 7].jpg`")
- Built-in functions
  - `print` `abs` `max` `min`

Advanced Functions

- How do we make some more complicated functions?
- What can we do with more complicated functions?

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- What can we do with more complicated functions?

$$\frac{dP}{dr} = -\frac{GM(r)\rho(r)}{r^2}$$

$$\frac{dT}{dr} = -\frac{3L(r)\kappa\rho(r)}{16\pi acT^3r^2}$$

$$\frac{dM}{dr} = 4\pi r^2\rho(r)P = \frac{kT}{\bar{m}}\rho(r)$$

Advanced Functions

- How do we make some more complicated functions?
- What can we do with more complicated functions?

EW

$$\rho\left(\frac{\partial u}{\partial t}+u\frac{\partial u}{\partial x}+v\frac{\partial u}{\partial y}+w\frac{\partial u}{\partial z}\right)=-\frac{\partial p}{\partial x}+\mu\left(\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}+\frac{\partial^2 u}{\partial z^2}\right)+\rho g_x$$

$$\rho\left(\frac{\partial v}{\partial t}+u\frac{\partial v}{\partial x}+v\frac{\partial v}{\partial y}+w\frac{\partial v}{\partial z}\right)=-\frac{\partial p}{\partial y}+\mu\left(\frac{\partial^2 v}{\partial x^2}+\frac{\partial^2 v}{\partial y^2}+\frac{\partial^2 v}{\partial z^2}\right)+\rho g_y$$

$$\rho\left(\frac{\partial w}{\partial t}+u\frac{\partial w}{\partial x}+v\frac{\partial w}{\partial y}+w\frac{\partial w}{\partial z}\right)=-\frac{\partial p}{\partial z}+\mu\left(\frac{\partial^2 w}{\partial x^2}+\frac{\partial^2 w}{\partial y^2}+\frac{\partial^2 w}{\partial z^2}\right)+\rho g_z$$

Variable Scope

- Outside functions = Global variable
- Inside functions = Local variable

Global

```
G = 6.67e-11 #kg^-1 m^3 s^-2
pi = 3.14
def Luminosity(radius, temp):
    sigma_sb = 5.67e-8 #watt m^-2 K^-4
    L = 4*pi*radius**2 * sigma_sb * temp**4
    return L
```

Local

DEMO

Advanced/Extra Material

- Lambda functions!
- The quick and dirty way of making a function