Introduction to Python

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Outline

Running Python and Jupyter

Variables and Types

Operations on different types

Lists

Intro to Python functions

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Working in Python throughout the semester.

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Two approaches to run and work with Jupyter notebooks.

1. Google's Colaboratory – *easiest startup*, done in the cloud, extra effort to interact with other files.

2. Install and run Python and Jupyter on your computer – *installation steps to get started*, can work offline, easy to interact with other files.

Instructions for the two approaches.

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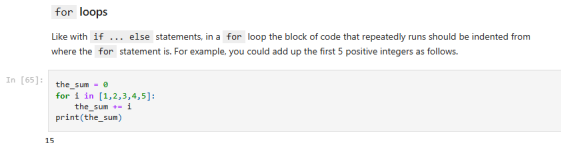
<div style="border:1px solid #ccc; padding:1em;">

for loops

Like with `if ... else` statements, in a `for` loop the block of code that repeatedly runs should be indented from where the `for` statement is. For example, you could add up the first 5 positive integers as follows.

In [65]:
```python
the_sum = 0
for i in [1,2,3,4,5]:
    the_sum += i
print(the_sum)
```

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</div>

Figure: A Markdown cell followed by a Code cell in a Jupyter notebook

Outline

Assigning variables

▶ A variable is assigned by placing, on one line,
   `<variable name> = <assigned value>`.

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2  y = 5
3  name_full = 'Chris Cornwell'
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1  # Make an ordered pair; output would be (10.11, 4)
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- Possible to assign more than one variable in one line.

```
1  x, y = 5.11, 5
2  # or, you could use
3  x = 5.11; y = 5
```

Data type

Each variable has a *data type* (or, simply *type*).

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1  x = 5.11
2  y = 5
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↑ the types of the assigned vars are **float**, **int**, and **str** respectively.

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Unlike in other programming languages, don't need to declare the types of the variables. Python *interprets* it. (The type might even *change* at a later point.)

- ► type **int**: like an integer.
- ► type **float**: like a real number in decimal form . . . *kind of*.
- ► type **str**: a "string," or sequence of *characters* (that can be typed from keyboard). Will return to this again.

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Numerical types

The four main operations[1] `+`, `-`, `*`, and `/` work as you would expect on numerical types **int** and **float**. Unlike when writing math, you cannot leave out `*` when multiplying.

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Assigning after an operation. Very often want to change a variable by some amount (e.g., increase it by 1); to keep new value, *reassign* after the operation.

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This is *not* a mathematical equation, but an assignment. The shorthand works for other operations.

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Logical types and None

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↑ the line above will return 0.

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↑ the line above will return 0.

The *null* type in Python is None. We'll talk about using it in later lectures.

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Basics of lists

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The + operation is defined on lists. It results in the *concatenation* of the lists – putting them together, end to end.

```
1  # the code below outputs [2, 3, 5, 'p', 11, 13]
2  my_list + [11, 13]
```

Other operations on lists

- ▶ Multiplication by an integer: adds that many copies of the list together. For example, [1,2]*3 will result in [1,2,1,2,1,2].

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▶ Length of a list: use the function len(), with your list as input, to get the number of items in your list.

▶ Checking if an item is in a list: use the *keyword* in to check this. For example, if my_list is [2, 3, 5, 'p'] then the first line below would result in True, the second would be False.

```
1  print ( 2 in my_list )
2  print ( 4 in my_list )
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- Above, the variable that was assigned 'Chris Cornwell', and the item 'p' in `my_list`, each is a string.
- *Thinking* of a string as a list of single characters, operations on strings work like they do on lists (e.g., + will concatenate and `len()` gives the number of characters, etc.

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Escape characters can be handled inside strings also: e.g., '\t' will produce a tab; '\n' produces a newline.

Two more container types

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▶ Two example dictionaries with same keys:

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Good idea to work with dictionaries for certain kinds of data. Later in the semester, will work with something very similar to a dictionary – a DataFrame.

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Basic functions

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In Python, run the following to see how `round()` works.

```
1  a = -3**2/8
2  print( a+8 )
3  print( (round(a+8), round(a+8, 2)) )
```

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- ► `str()` changes to a string; works on nearly anything.
- ► `int()` will convert a float to an int; always rounds toward 0.
- ► `set()` will convert a list or tuple into a set; "forgets" order, drops repeats.

Slicing lists

Recall: if `my_list` is a list, the item at index i is found with `my_list[i]`.
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2   # Return letters at index 1 to 4 (excluding 4)
3   print (my_list[1:4])
4
5   # Leave off number either left of colon, or right of it;
6   # will go from the start, or until the end
7   print (my_list[:5])
8
9   # Negative numbers to step back from end of the list
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There is an easy way to reverse the order of a list.[2]

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my_list[::-1]
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    - ▶ Changes `my_list` in place, making it shorter.
    - ▶ `my_list.pop(i)` does something similar with item at index i, but also returns (has as output) that item.

More information on working with lists, tuples, sets, and dictionaries: Tutorial from the Python documentation.