Introduction to Python

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Outline

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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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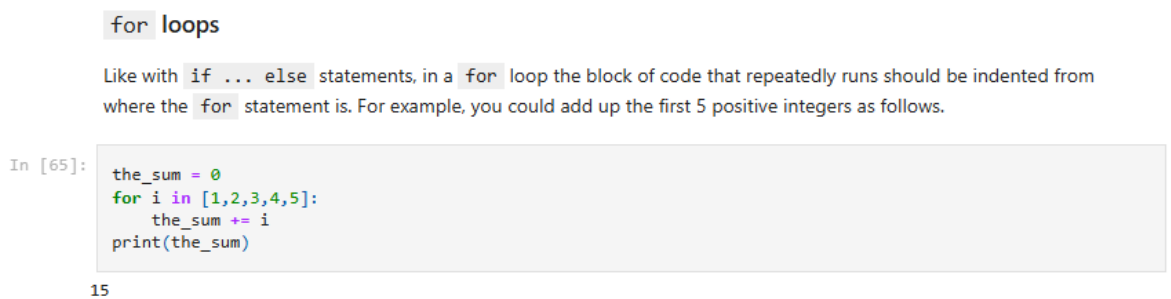

`for` loops

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]:

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

```
15
```

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

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Assigning variables

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

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2 y = 5
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# Make an ordered pair; output would be (10.11, 4)
(x + y, y - 1)
```

- Possible to assign more than one variable in one line.

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

Data type

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

```
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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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y += 1
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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 *null* type in Python is `None`. We'll talk about using it in later lectures.

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`list` is a *sequential* data type in Python – it holds a sequence of "items."

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2 empty_list = []
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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]`, since

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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

Two important types that contain items, but are not sequential are sets (**`set`** type) and dictionaries (**`dict`** type).

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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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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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Some examples:

- `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]`.
To get shorter list with consecutive items from `my_list`.

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1  my_list = ['a','b', 'c', 'd', 'e', 'f', 'g', 'h', 'i']
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
10 print(my_list[-1])
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There is an easy way to reverse the order of a list.[2]

```
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.