
An Introduction to Python

Azalee Bostroem

1. Python as a Calculator

- Addition: +
- Subtraction: -
- Multiplication: *
- Division: /
- Modulo: %
- Powers: **

Exercises 1

1. Calculate the mean of the numbers 2, 3, and 10
2. Calculate the hypotenuse of a triangle with sides 6 and 8

2. Basic Types

- Integer: int
- Floating Point: float
- String: str
- Boolean: bool

Exercise 2:

1. Try multiplying each type by 2. What does multiplication mean for an int, float, str, and bool
2. Test addition, subtraction, and division on all of the types. What types support which operations? What does each operation mean for each type?

3. Variables

- Variable assignment
- print statement
- order of operations

Aside: 3 reasons to use ipython

- %whos
- tab complete
- repeating previous commands

Containers:

lists, tuples, dictionaries

4. Lists []

- Example
- indexing: start with 0
- size: len()
- slicing
- negative indexing
- changing values

Exercise 4:

1. Make a list with 5 items in it
2. Print the 4th item in the list
3. print the sublist containing the 3rd, 4th, and 5th items in the list
4. Experiment with multiplication and addition with lists. What do these operations do?

5. Tuples ()

- association items
- Can't be modified
- Can't be indexed
- unpacking

Aside: Sets

Unique elements of a list or Tuple

6. Dictionaries { }

- keys and values
- adding items
- size: len()
- dict.keys()
- dict.items()

Exercise 6:

Make a dictionary and experiment using different types as keys. Can containers be keys?

Code Blocks

if, while, for

7. If, elif, else

- less than: <
- greater than: >
- less than or equal to: <=
- greater than or equal to: >=
- equals: ==
- not equal: !=

Exercise 7:

Write an if statement that prints whether x is even or odd

8. Side Note: Basic Plotting

- plot
- symbol: '.', 'o', 's', '*', 'd', '^', more
- line: '-', '--', ':', ':-'
- color: 'b', 'g', 'r', 'c', 'm', 'y', 'k', 'w', more

Exercise 8

1. Create a plot with at least 5 points. Make your points circles with a dashed line connecting them.
2. Zoom in on a point on your plot. Notice what happens to the x and y tick labels as you zoom in close. Do the symbols change size?

9. Looping - while and for

- While loop
- for loop
- Object oriented!
- range()
- zip()
- putting it all together: for loop+dictionary+.items()+unpacking
- modifying a list
- empty list
- .append()

Exercise 9:

1. Using a loop, calculate the factorial of 42
(the product of all integers up to and including 42)
2. Using a loop, plot $y = x^2$ for x between 0 and 10

10. Functions

- def
- return
- multiple inputs
- Basic functions
 - type()
 - float(), str(), int()

Exercise 10:

Create a function that returns the factorial of a given number

11. Reading Files

- `open()`
- `dir()`
- `help()`
- `.readlines()`
- `.split()`
- `.seek(0)`

Exercise 11:

1. Read the file 'big_animals.txt' and print each line on which more than 10 moose were sighted.
2. Turn the code for #1 into a function and use it on the files 'merida_animals.txt' and 'fergus_animals.txt'.

Advanced Topics

more on functions and
plotting

12. Modules, functions, and importing

- .py
- multiple def/return statements
- area()
- import statement

Exercise: Add a function to your circle module which calculates the circumference of a circle given the radius.

- math module

Exercise 12:

1. import the math module into your function file and replace your estimate of 3.14 with `math.pi`

13. More Plotting

- `pylab.xlabel()`
- `pylab.ylabel()`
- `pylab.title()`
- `pylab.legend([])`
- keyword arguments
 - legend: loc
 - plot: color, marker, linestyle, linewidth