Python Beginners Bootcamp

Universität Potsdam

Winter 2025

```
print("Hello world!")
```

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Logistics

- This course is a one week intensive course designed to teach basic Python programming for scientists
- The course is aimed at complete beginners to Python or programming in general, those who know another language, or just those that want to brush up
- Each day will consist of two sessions: one from 10:15 - 12:30, and one from 13:15 - 15:30
- All sessions will take place here in room xxx

Logistics

- Each session will be lecture style for ~45 mins, followed by hands on coding for the remaining hour where I will be available to help
- Material is available on moodle, and you may use the computers here or your own personal laptop (may require extra setup)
- You are encouraged to work together with your neighbour, and to google things (stackoverflow is your friend)
- This is the first time this course is being delivered, so please ask questions where needed. We can slow things down as much as we need.

Course content

What this course will cover

- Basic shell usage, conda and virtual environments
- Python basics: Variables, input/output, operators, data types
- Control flow: conditional statements, boolean logic, error handling
- Loops, strings, functions and classes
- Data structures: Lists, tuples, dictionaries, sets
- Plotting with `matplotlib`
- Modules: `numpy`, `scipy`

What this course won't cover

- Shell scripting
- Binary and computer memory allocation
- Linux system administration or remote access tools
- Advanced Python (generators, lambda functions, decorators)
- Graphical user interfaces or animations
- Modules such as `pandas`, `seaborn`
- Using git

This is a course in Python *for scientists* **not** computer programmers, so we will focus on the practical aspects of Python.

What is Python?

- Python is a high level, interpreted programming language
- As an interpreted language it is easy to run and does not require a separate compiler such as with C/C++
- It is known for its ease of use and clear syntax
- Python is widely used in the scientific community, particularly for data analysis
- Python lets you use packages and code written by others easily, so you can build powerful programs without starting from scratch

Pros of Python

- Easy to read and write, very intuitive and easily debugged
- Huge community and libraries available
- Versatile, used in many industries

Cons of Python

- Slower than compiled languages such as C/C++
- Can be inefficient with memory
- Dynamically changing libraries can lead to outdated code

Session 1: Using the Terminal

```
williams@Natalie:~$ pwd
/home/williams

williams@Natalie:~$ ls
mycode.py  Documents

williams@Natalie:~$ mkdir Computing

williams@Natalie:~$ cd Computing

williams@Natalie:~/Computing$ touch mynotes.txt
```

The terminal

- Before we look at Python, we need to understand how to navigate our computer system using the **terminal**
- The terminal is a text based interface which allows us to interact with the computer
- This may seem unnecessary when we have a file explorer - however using the terminal provides much more flexibility, and as you become proficient at coding it will become easier and necessary to use the terminal

Opening the terminal

Linux & macOS:
Search in applications for "Terminal"

Windows:
Search in applications for "Powershell" or "Windows Terminal"
Download WSL (once) with

```
wsl --install
```

Open WSL from Powershell or Windows Terminal with

```
wsl
```

Where am I?

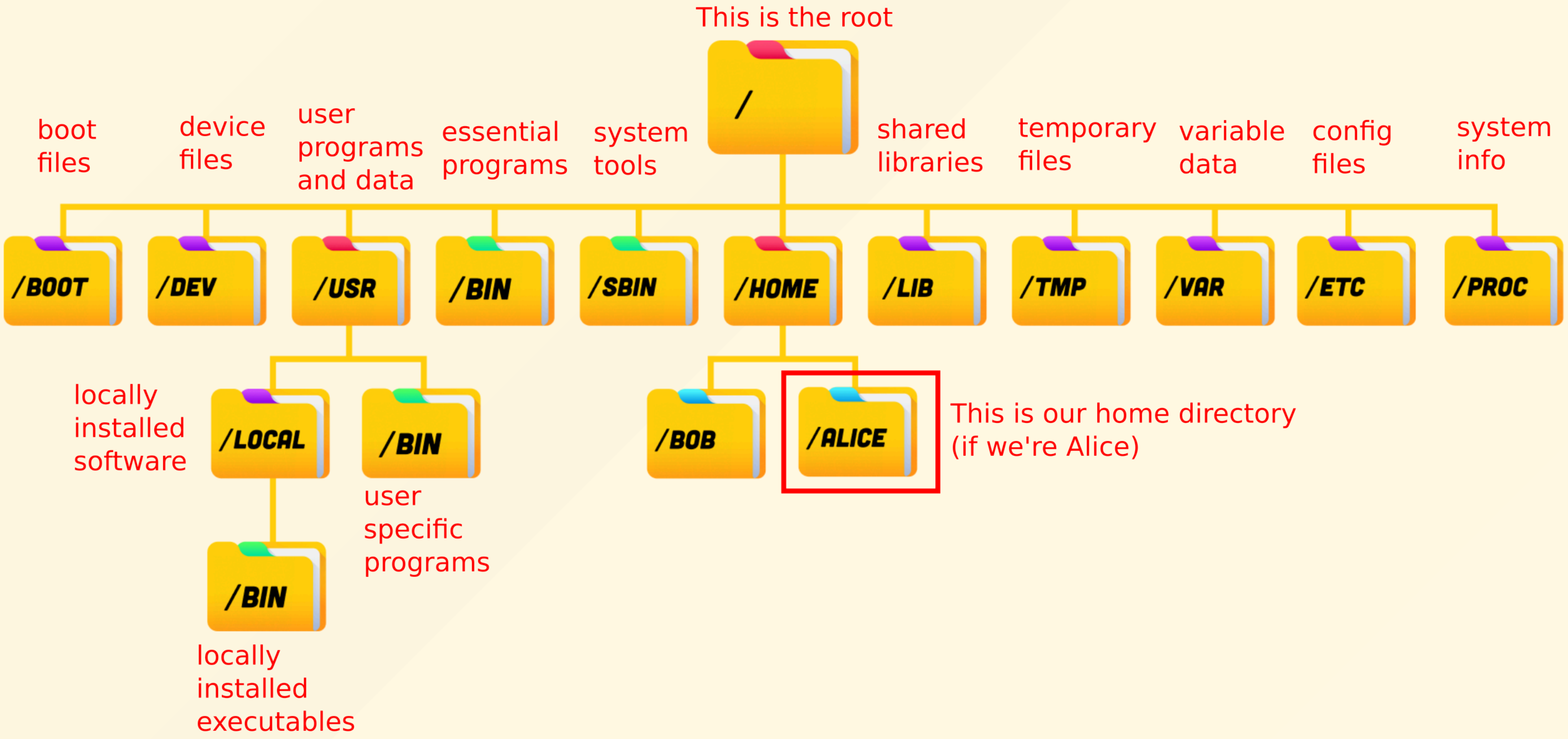
- When opening the terminal, we see the **command line**
- In the command line it shows `user_name@computer_name:location$`

```
Natalie@mylinux:~$
```

- We are in a location, our home **directory** (folder), denoted by `~`.
- To check where you currently are in the file system, you can use the command `pwd` to print our current location (or **path**)

```
Natalie@mylinux:~$ pwd
/home/Natalie
```

The file system



Commands

- We will explore some of the most useful **commands** that can be used on the command line and their functionality
- Each command may have many options, these can be listed for most commands by using `man *command*` or `*command* --help`

```
Natalie@mylinux:~$ pwd --help
```

```
Natalie@mylinux:~$ man pwd
```

- **Top tip**: Use the up and down arrowkeys to cycle through previous commands rather than typing them out again

Looking around

- The contents of the location we are in can be viewed with `ls`

```
Natalie@mylinux:~$ ls
Documents   mycode.py
```

- These file types are colour-coded as normal files, documents, and executable files.
- Hidden files (files/directories that start with `.` and are hidden from the user) can be shown with `ls -a`

```
Natalie@mylinux:~$ ls -a
.   ..   .bashrc mycode.py  Documents  .jupyter  .ssh
```

Looking around

- To view more details on the files we use `ls -l` with form

```
permissions | # of hard links | Owner | Group | File size (bytes)| Last modified | Name
```

```
Natalie@mylinux:~$ ls -l
drwxr-xr-x  6 Natalie Natalie    4096 Feb 20 14:32  Documents
-rw-rw-r--  1 Natalie Natalie       5 Mar 27 14:34  mycode.py
```

- Permissions are laid out as drwxrwxrwx where d - directory, r - read, w - write, x - execute for user, group and others users
- Permissions can be changed with `chmod` ie. `chmod u+x mycode.py`

Moving around

- To move to another directory from your current location use `cd`

```
Natalie@mylinux:~$ cd Documents
Natalie@mylinux:~/Documents$ ls
Computing    myfile1.txt    myfile2.txt
```

- **Top tip**: use tab to autocomplete file and directory names
- We denote one directory back with `..`, and the current with `.`

```
Natalie@mylinux:~/Documents$ cd ..
Natalie@mylinux:~$ cd .
Natalie@mylinux:~$
```

Moving around

- When only running `cd`, it takes you back to your home directory, this is the equivalent of `cd ~`
- We can pass **relative paths** from the current position

```
Natalie@mylinux:~$ cd Documents/Computing
Natalie@mylinux:~/Documents/Computing$ cd ../Computing
```

- We can also pass **absolute paths** to anywhere on system

```
Natalie@mylinux:~$ cd /home/Natalie/Documents/Computing
Natalie@mylinux:~/Documents/Computing$ cd ~/Documents
Natalie@mylinux:~/Documents$ cd /usr/bin
```

Creating and deleting directories

- We make new directories using `mkdir`

```
Natalie@mylinux:~$ mkdir Masters
Natalie@mylinux:~$ ls
Documents   Masters   mycode.py
Natalie@mylinux:~$ cd Masters
Natalie@mylinux/Masters:~$
```

- Directories can be deleted with `rm -r` (only need `rm` for files)

```
Natalie@mylinux:~$ rm -r Masters
Natalie@mylinux:~$ ls
Documents   mycode.py
```

Copying and moving files/directories

- We can copy a file/directory using `cp`

```
Natalie@mylinux:~$ cp mycode.py ./Documents
Natalie@mylinux:~$ ls ./Documents
Computing    mycode.py    myfile1.txt    myfile2.txt
Natalie@mylinux:~$ cp mycode.py mycode_copy.py
Natalie@mylinux:~$ ls
Documents   mycode.py   mycode_copy.py
```

- We can move/rename a file/directory with `mv`

```
Natalie@mylinux:~$ mv mycode.py ./Documents/Computing
Natalie@mylinux:~$ mv mycode_copy.py mycode_renamed.py
```

Creating files and text editing

- We can create a new file with `touch`

```
Natalie@mylinux:~$ touch newfile.txt
Natalie@mylinux:~$ ls
Documents   mycode.py   newfile.txt
```

- We can also create a file using a text editor (emacs, nano, vim)

```
Natalie@mylinux:~$ vim newfile.txt
Natalie@mylinux:~$ emacs newfile.txt &
```

Here vim opens in the terminal, emacs in the background (with `&`)

Using vim

- We use vim as an example - after opening the file press `i` to start editing

```
This is my text file


--INSERT--                                                  1,1           All
```

- After finishing press `esc` and enter `:wq` to write and quit, or `:q!` to quit without saving and go back to the terminal
- Vim can be used to write Python files with, ie. `vim myscript.py`

Session 2: Python basics

```python
# Calculate adjusted travel time to the ISS

name = input("Astronaut name: ")
speed = int(input("Speed in km/s: "))
distance = 400
time = distance / speed

time += 2  # docking delay
print(f"ETA for {name[:3]}: {time}")
```

Installing python

Everything for this course is set up on the lab computers, however you can do the exercises on your personal laptops if you wish.

You will need to make sure Python is installed - you can download Python here.

All exercises will be done through jupyter notebooks - for now this is easiest done by downloading and launching Anaconda navigator.

How does Python run code?

- Python execute your code **one line at a time**, from top to bottom
- This means

```
This line runs first
Then this one
And so on...
```

- If there's an error on a line, Python **stops running**, and shows an error, reading no more code
- This makes it easy for us to debug code

Ways to run Python

- On the terminal line by line

```
Natalie@mylinux:~$ python
>>> print('Hello world')
Hello world
```

- Through a prewritten python script (`.py` file) via the terminal

```
Natalie@mylinux:~$ python myscript.py
```

- Through an interactive development environment (Spyder, PyCharm, Visual Studio Code, Jupyter notebooks/lab)

Print

- The `print()` function displays output to the screen
- You can print text, numbers or variables
- Use quotes `""` or `''` for text (strings)

```
print('Hello world!')
```

Output:

```
Hello world!
```

Comments

- Comments allow us to add text to our code which is **not read** by the code
- This allows us to explain what the code is doing, which is very useful for long and complex code
- You are **highly encouraged** to comment your code - both for yourself looking back at code and anyone marking your code to understand what you did
- Comments are added by inserting a `#` followed by the comment

```
print('Hello world!') # This line outputs 'Hello world!'
```

Variables

- Variables are names chosen by the coder to store values
- We **assign** values to variables with `=`
- Variable names can include letters, numbers and underscores, but **cannot** start with a number or contain spaces
- Variables can be overwritten (be careful!)
- Multiple variables can be assigned at once

```
x = 5
y, z = x, 0.3
x = 2
print(x, y, z) # This will print: 2 5 0.3
```

Data Types

- There are several distinct data types we use in Python
- These include `int` (integers), `float` (decimals), `string` (text), `bool` (true or false)
- We can convert data types where allowed

```
x = 5 # int -> integer
factor = 2.4 # float -> decimal
greeting = 'hello' # string -> text
mybool = True

y = 2. # this is a float = 2.0
a = 1.5e-3 # this is a float = 0.0015
```

Casting

- We can specify the data type we would like, and where allowed, convert between them

```
x, y, z = int(3), int(2.8), int('5') # x is 3, y is 2, z is 5

x, y, z = float(3), float(2.8), float('5') # x is 3.0, y is 2.8, z is 5.0

x, y, z = str('hello'), str(3), str(2.8) # x is 'hello', y is '3', z is '3.8'

x = 4.7
y = int(x) # y is 4
z = 'hello'
int(z) # raises ValueError -> letters cannot be converted to numbers
```

Operations

- Python is built in with simple operations
- These include add `+`, minus `-`, times `*`, divide `/`, power `**`, modulus (remainder) `%` and floor division `//`

```
x = 5
y = (6 - x)**2 / x # y is 0.2
z = y + x # z = 5.2
```

Note that during operations data types may be implicitly converted ie. `x` is implicitly converted from `int` to `float` in this last line

Assignment operators

- In this previous slide the variables are never altered (`x` stays 5, `y` stays 0.2 etc)
- Variables can be altered, this is commonly done with assignment operators which take the form `*operator*=`

```
x = 5
x +=3 # equivalent to x = x + 3, x is now 8
x *=2 # equivalent to x = x * 2, x is now 16
x //= 3 # equivalent to x = x // 3, x is now 5
```

Conditional Operators

- Conditional operators are used to compare values
- They return a **boolean** (data type `bool`) value `True` or `False`, which if treated as integers are equal to 1 and 0 respectively
- Examples include equal `==`, not equal `!=`, greater than `>`, less than `<`, greater or equal to `>=`, less than or equal to `<=`

```
x, y = 5, 5.0
x == y # True -> implicitly converts x to a float to compare
x <= 10 # True
greeting, another_greeting  = 'hello', 'hello '
greeting == another_greeting # False - how are they not the same?
a = x != greeting # a = True, we are allowed to compare different data types
```

Logical Operators

- Logical operators combine conditional operators
- These are `and` (returns `True` if both statements are true), `or` (returns `True` if one statement is true) and `not` (reverses the result, returns `False` if `True` and vice versa)

```
x, y = 2, 7
x < 5 and y > 5 # True
x >= 10 or y != 3 # True
not(x >= 10 and y != 3) # False
```

Indexing strings

- We can also use the `+` operator to concatenate strings

```
name, message = 'Natalie', 'Hello, '
greeting = message + name + '!'
print(greeting) # 'Hello, Natalie!'
```

- We use `stringname[i]` to **index** the i-th component of a string
- **Important**: In Python indexing starts a 0, **not** 1

```
print(name[0]) # first component -> 'N'
print(name[2]) # third component -> 't'
print(name[-1]) # last component -> 'e'
print(name[-3]) # third last component -> 'l'
```

Slicing strings

- Slicing can be used to index multiple components of a string with notation `stringname[start:stop:step]` with defaults of `start = 0`, `stop = -1` and `step = 1`

```
name = 'Natalie'
print(name[2:5]) # 3rd to 5th -> 'tal'
print(name[:5]) # 1st to 5th -> 'Natal'
print(name[5:]) # 5th to end -> 'ie'
print(name[1:6:2]) # every 2nd letter 2nd to 7th -> 'aai'
print(name[::3]) # every 3rd letter -> 'Nae'
```

- We can also use `len` to get the length of a string ie. `len(name)`

Modifying strings

- Here is a selection of useful **methods** used to modify strings

```
x = ' Hello, World! '

print(x.upper()) # returns string in upper case -> ' HELLO, WORLD! '

print(x.lower()) # returns string in lower case -> ' hello, world! '

print(x.strip()) # removes whitespace -> 'Hello, World!'

print(x.replace('H', 'J')) # replaces one string with another -> ' Jello, World! '

print(x.split(',')) # returns a list of strings split by ',' -> '[' Hello', 'World! ']'
```

Formatting strings

- We can combine strings and numbers easily by using **f-strings**
- This requires `f` to be placed before the string, and number variables placed as `{num}`

```
num = 42
txt = f'The answer to Life, the Universe and Everything is {num}'
print(txt) # 'The answer to Life, the Universe and Everything is 42'
```

- Specify the number `n` of decimals to display `x` with `x:.nf`

```
pi = 3.14159265359
print(f'Pi is {pi:.2f}') # 'Pi is 3.14'
```

User input

- We use the function `input` to take an input from the user

```
name = input('Enter your name')
print(f'Hello {name}')
```

- Input **always** takes the input as a string, so if you require a number this needs to be manually converted

```
x = input('Enter a number')
print(x + 5) # returns TypeError: can only concatenate str (not "int") to str
x = int(input('Enter a number'))
print(x + 5) # returns expected value
```

Session 3: Lists, Tuples, Sets & Dictionaries

```python
planets = ["Mercury", "Venus", "Earth"]
constellations = ("Orion", "Cassiopeia", "Lyra")
observatories = {"ALMA", "Keck", "VLT", "ALMA"}
galaxy = {"name": "Andromeda", "distance": 2.5}

planets.append("Mars")
print(constellations[1])
print(observatories)
print(galaxy["distance"])
```

Lists

- Lists are an **ordered**, **mutable** collection (can be changed after it has been created) denoted by square brackets

```
planets = ["Mercury", "Venus", "Earth"]
series = [2 , 8 , 3 , 4]
```

- Lists can be indexed and sliced to obtain values

```
print(planets[2]) # 'Earth'
print(series[1:3]) # [8 , 4]
```

Changing and adding to lists

- Lists can be changed using indexing

```
planets[1] = 'Mars'
print(planets) # ['Mercury' , 'Mars' , 'Earth']
```

- We add single values to the end with the `append` method, inserted in specific positions with `insert`, and concantenate lists together with `extend` or `+`

```
planets.append('Jupiter')
planets.insert( 1 ,'Venus')
planets.extend(['Saturn', 'Neptune'])
print(planets) # ['Mercury' , 'Venus' , 'Mars' , 'Earth', 'Jupiter' , 'Saturn' , 'Neptune']
```

Removing from lists

- Items are removed by value with `remove` (removes first item of this value) and index with `pop`

```
planets.remove('Earth')
planets.pop(3)
print(planets) # ['Mercury' , 'Venus',  'Mars' , 'Saturn' , 'Neptune']
```

- Lists are mutable, so methods change them directly; string methods return new strings instead of changing the original.

```
mystring = 'Hello'
mystring[0] = 'J' # TypeError: 'str' object does not support item assignment
```

Lists properties

- Different data types can be combined in one list, and values can be repeated

```
mylist = ["banana", 4 , 1.8e-7 , "banana"]
```

- Other useful **functions** (do not change the list) include

```
x = [2, 6, -3, 8]
print(len(x)) # length of list -> 4
print(sum(x)) # sum if numeric -> 16
print(min(x)) # minimum if numeric -> -3
print(max(x)) # maximum if numeric -> 8
```

Tuples

- A tuple is a collection which is ordered and **unchangeable**, written with round brackets

```
planets = ("Mercury" , "Venus" , "Earth")
```

- We cannot change, add or remove items from a tuple
- Multiple entires with the same value are allowed

```
planets = ("Mercury" , "Venus" , "Earth" , "Venus")
```

Creating tuples

- Tuples can be created with one item but **must** contain a `,`

```
planets = ("Earth") # NOT a tuple
planets = ("Earth",) # a tuple
```

- Tuples can contain any and multiple data types

```
mytuple = ("Earth" , 5 , True , 3.46e5)
```

- `len` can still be used to obatain a tuple length

```
print(len(mytuple)) # 4
```

Accessing tuples

- Values in tuples can still be indexed and sliced

```
planets = ("Mercury", "Venus", "Earth", "Mars")
print(planets[2]) # "Earth"
print(planets[1:-1]) # ("Venus", "Earth")
```

- You can add a tuple to a tuple with `+`

```
x = ("Jupiter",)
planets += x
print(planets) # ("Mercury", "Venus", "Earth", "Mars", "Jupiter")
```

Unpacking tuples

Tuples can be **unpacked** to extract the individual values back into variables

```
planets = ("Mercury" , "Venus" , "Earth")
(planet1 , planet2 , planet3) = planets
print(planet1) # "Mercury"
```

- Multiple variables can be unpacked with `*`

```
(planet1 , *other_planets) = planets
print(other_planets) # ("Venus" , "Earth")
```

Sets

- A set is an **unordered, unindexed** collection denoted with curly brackets `{}`

```
planets = {"Mercury" , "Venus" , "Earth"}
print(planets) # {'Mercury', 'Earth', 'Venus'}
```

- Sets can contain all data types, but other collections, sets **do not** allow multiple entries with the same value

```
myset = {"Mercury" , "Venus" , "Earth" , "Mercury", 7.3 , 1 , True, False}
print(myset) # {False, 1, 'Earth', 'Mercury', 7.3, 'Venus'}
```

Acessing sets

- As they are unordered, sets cannot be indexed and can only be accessed by a loop (next session)
- We can use `in` / `not in` to check if an entry is in/not in a set

```
planets = {"Mercury" , "Venus" , "Earth"}
print("Earth" in planets) # True
print("Venus" not in planets) # False
```

Adding and removing from sets

- Set elements cannot be changed but sets can be added to with the `add` method

```
planets = {"Mercury" , "Venus" , "Earth"}
planets.add("Mars")
print(planets) # {"Mars" , "Mercury" , "Earth" , "Venus"}
```

- Items can be removed with either the `remove` or `discard` method

```
planets.remove("Venus")
planets.discard("Mars")
print(planets) # {"Mercury" , "Venus"}
```

Joining sets

- There are various method to join sets

```
planets1 = {"Mercury" , "Venus" , "Earth"}
planets2 = {"Venus" , "Earth" , "Mars"}

print(planets1.union(planets2))
# joins items from both sets ->  {'Earth', 'Venus', 'Mercury', 'Mars'}
print(planets1.intersection(planets2))
# joins but keeps only duplicates -> {'Earth', 'Venus'}
print(planets1.difference(planets2))
# keeps itens in first set not in the second ->  {'Mercury'}
print(planets1.symmetric_difference(planets2))
# keeps all except duplicates -> {'Mercury', 'Mars'}
```

Dictionaries

- Dictionaries are **ordered, changeable** collections
- Denoted with curly brackets with key: value pairs `{key:value}`

```
Mars = {
  "Radius": 3389.5,
  "Colour": "Red",
  "Temperature": -65 }
print(Mars) # {'Radius': 3389.5, 'Colour': 'Red', 'Temperature': -65}
```

- Since they are unordered, dictionaries cannot be indexed

```
print(Mars[0]) # KeyError: 0
```

Dictionaries

- Duplicate entries will overwrite existing values

```
Mars = {
  "Radius": 3389.5,
  "Colour": "Red",
  "Temperature": -65,
  "Colour": "Blue" }
print(Mars) # {'Radius': 3389.5, 'Colour': 'Blue', 'Temperature': -65}
```

- Dictionary keys can also be numbers

```
mydict = {0: 1}
print(mydict)  # {0: 1}
```

Accessing dictionaries

- Items are accessed with `dict_name["key_name"]`

```
Mars = {
  "Radius": 3389.5,
  "Colour": "Red",
  "Temperature": -65 }
print(Mars["Colour"]) # 'Red'
```

- Key names can be listed with `keys`, and values with `values`

```
print(Mars.keys()) # dict_keys(['Radius', 'Colour', 'Temperature'])
print(Mars.values()) # dict_values([3389.5, 'Red', -65])
```

Editing dictionaries

- Dictionaries can be added and changed with an assigment

```
Mars["Period"] = 687
Mars["Colour"] = "Blue"
print(Mars) # {'Radius': 3389.5, 'Colour': 'Blue' , 'Temperature': -65, 'Period': 687}
```

- Entries can be deleted with the `pop` method

```
Mars.pop("Period")
print(Mars) # {'Radius': 3389.5, 'Colour': 'Blue' , 'Temperature': -65}
```

Editing dictionaries

- Dictionaries can be copied with the `copy` method

```
Mars_2 = Mars.copy()
```

- You **cannot** copy dictionaries through assignement ie `Mars_2 = Mars` as any changes to one will change the other

Nested dictionaries

- Dictionaries can be **nested**

```
planets = {
  "Mercury" : {
    "Radius" : 2439,
    "Mass" : 3.285e23 },
  "Venus" : {
    "Radius" : 6052,
    "Mass" : 4.867e24 },
  "Earth" : {
    "Radius" : 6378,
    "Mass" : 5.972e24
  }
}
```

Nested dictionaries

- To access the items in a nested dictionary, use the key names moving outside in

```
print(planets["Venus"]["Radius"]) # 6052
```

- Again we can use `len` to get the length of a dictionary

```
print(len(Mars)) # 3
```

Property	List	Tuple	Set	Dictionary
Syntax	[1, 2, 3]	(1, 2, 3)	{1, 2, 3}	{"a": 1, "b": 2}
Ordered	Yes	Yes	No	Yes (Python 3.7+)
Indexed	Yes	Yes	No	By key
Mutable	Yes	No	Yes	Yes
Allows Duplicates	Yes	Yes	No	Keys: No Values: Yes

Session 4: Control Flow & Error Handling

```python
numbers = [10, -5, 0, 23, -1]

for n in numbers:
    if n > 0:
        print(f"{n} is positive")
    elif n < 0:
        print(f"{n} is negative")
    else:
        print("Zero found")
```

`if`, `elif` and `else`

- We can combine the conditional statements we saw in session 2 (ie. `==`, `<`, `>`)with `if` and `elif` and `else` statements to selectively evaluate blocks of code such as

```
if *some condition fulfilled*:
  *do something*
elif *some other condition fulfilled*:
  *do a different thing*
else:
  *do yet another different thing*
```

`if`, `elif` and `else`

- If a statement is evaluated is `True`, the code block contained is ran, and skipped otherwise

```
number = int(input("Enter a number: "))

if number > 0:
    print("The number is positive.")
elif number < 0:
    print("The number is negative.")
else:
    print("The number is zero.")
```

`if`, `elif` and `else`

- In a series of `if`, `elif` and `else` statements, if one is `True`, the rest are skipped

```python
number = 8
if number > 5:
    print("Number is greater than 5")
elif number % 2 == 0:
    print("Number is even")
elif number > 10:
    print("Number is greater than 10")
else:
    print("Number is 5 or less and odd")
# prints only the first one -> Number is greater than 5
```

`if`, `elif` and `else`

- In a series of `if` statements, they are run seperately

```
number = 8
if number > 5:
    print("Number is greater than 5")
if number % 2 == 0:
    print("Number is even")
if number > 10:
    print("Number is greater than 10")
# prints each one it fulfills -> Number is greater than 5    Number is even
```

`if`, `elif` and `else`

- We can use logical operators as well as conditional operators in our statements

```
number = 5
if number % 2 == 0 and number > 10:
    print(f"{number} is even and greater than 10")
elif number % 2 != 0 or number == 10:
    print(f"{number} is either odd or exactly 10")
else:
    print(f"{number} does not match the above conditions")
```

`while` loops

Session 5: Functions

Session 6: Classes

Session 7: Arrays & `numpy`

Session 8: `scipy` and `pandas`

Session 9: Plotting with `matplotlib`

Session 10: File I/O and Virtual Environments