

Python for Bioinformatics

Intro & Foundations



UNIVERSITY OF
LIVERPOOL



The University
Of Sheffield.



Websites

NEOF: <https://neof.org.uk/>

NERC: <https://nerc.ukri.org/>

CGR:

<https://www.liverpool.ac.uk/genomic-research/>



Twitter

NEOF: @NERC_EOF

NERC: @NERCscience

CGR: @CGR_UoL

Upcoming workshops

<https://neof.org.uk/training/>

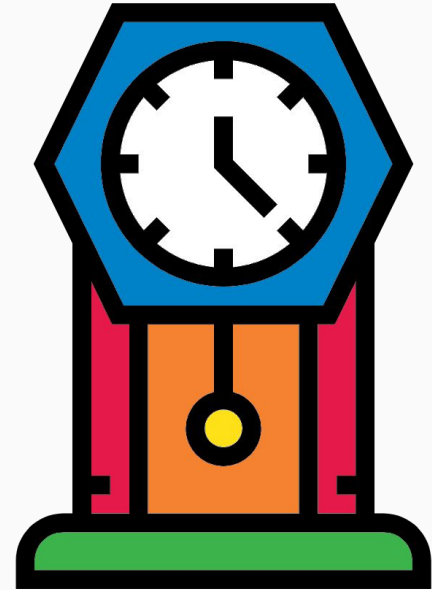
- Population genomics
 - 17th & 19th January 2023
- Bacterial 16S metabarcoding
 - 7th & 9th February 2023
- Metabarcoding for diet analysis and environmental DNA
 - 28th February & 2nd March 2023
- Microbial shotgun metagenomics
 - 21st & 23rd March 2023



Format & Schedule

This intro
Bookdown
Theory
Practice
Exercises
Optional materials

Work at your own
pace



Map

Plans and goals

What is Python?

The Python Shell

Python foundations





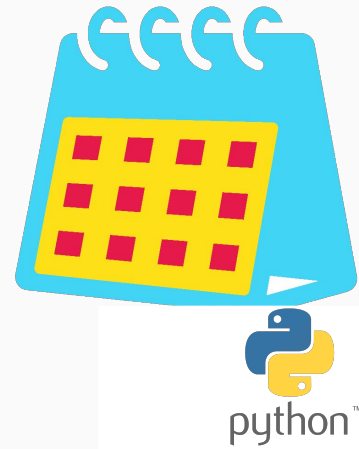
Calendar

Morning 1: **Foundations of Python**

Afternoon 1: Data Structures, Conditions, & Loops

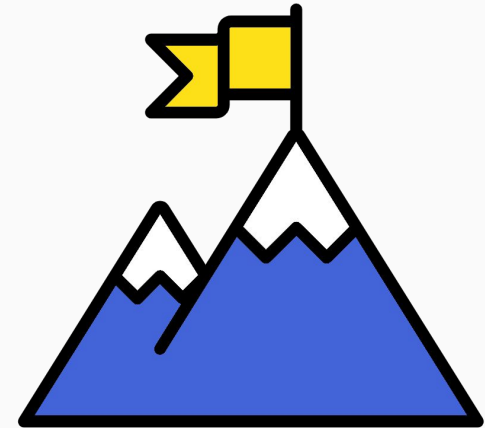
Morning 2: Reading & Manipulating DNA Data

Afternoon 2: Reading and Writing Files



Goals

- Understand Python Code
 - Know what the next steps are to improve further
- Write & run Python scripts
- Learn data flow and conditions
- Read in DNA data files
- Manipulate DNA sequence data
- Write out data files



Python (v 3.10.5 - released June 2022)

<https://www.python.org>

Language & Environment

Clear syntax

File and Data manipulation

Popular in bioinformatics

February 1991

Most used language on TIOBE

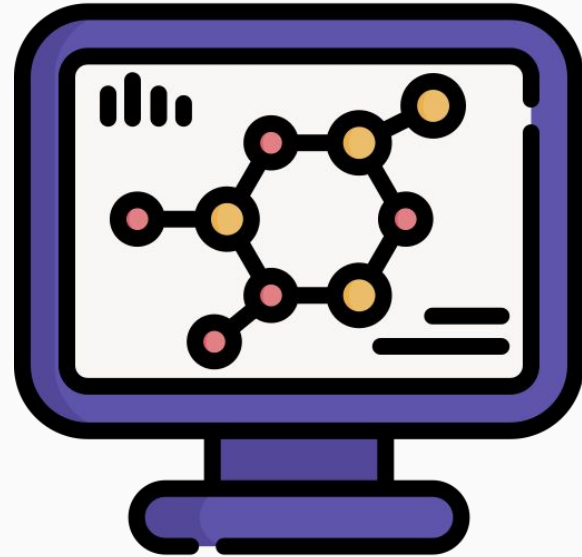
Well maintained and updated

Lots of resources, libraries



Why use Python?

- Powerful
- Flexible
- Clear syntax
- Widely used
- Many Packages

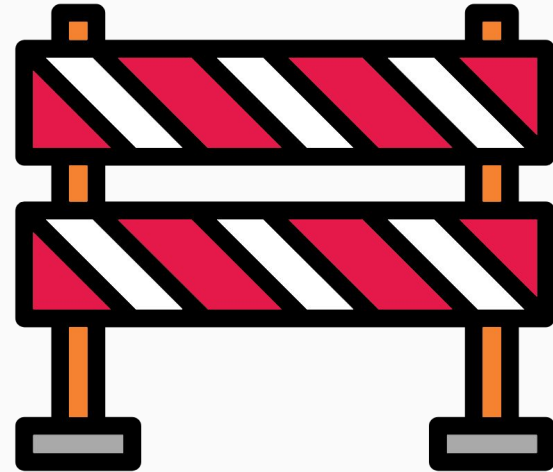


Barriers to entry

Difficult

Learning curve

Requires coding



Foundations of Python





The Python Shell

www.python.org

```
graeme@pop-os:~$ python3
Python 3.10.6 (main, Aug 10 2022, 11:40:04) [GCC 11.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> print("Hello, world!")
Hello, world!
>>>
```

Download & install the latest Python
interpreter (Free and open source)

Basic interaction - one command at a time





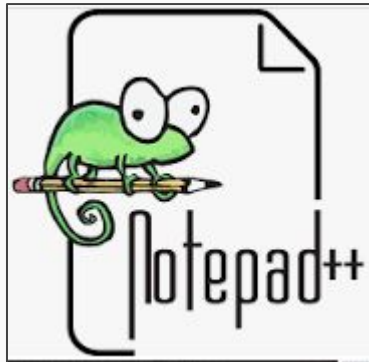
Running a Python script

Lots of commands

Complex programs

Any “plain-text” editor

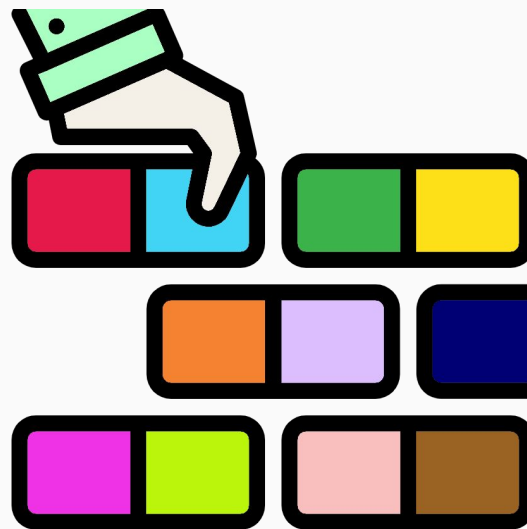
```
R_undulata_data = SeqIO.parse(wd + "data/Raja_undulata_WGS_trim_R1.fastq", "fastq")
counter = 0
for record in R_undulata_data:
    #print(record.id)
    #print(record.seq)
    counter = counter + 1
print("Raw sequence file has " + str(counter) + " sequence records.")
number_raw_reads = counter
```





Python Foundations

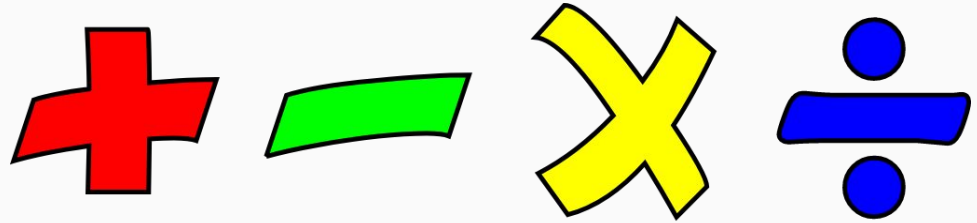
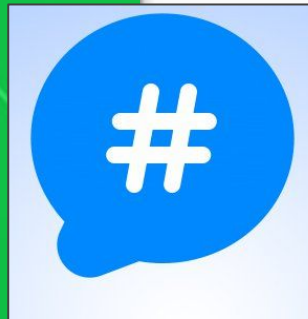
- Operators
- Comments
- Variables
- Classes
- Functions & Methods
- Indentation



Operators & Comments

Python supports all the usual mathematical operators and follows BODMAS.

Comments use the '#'



```
# This line is a comment
```

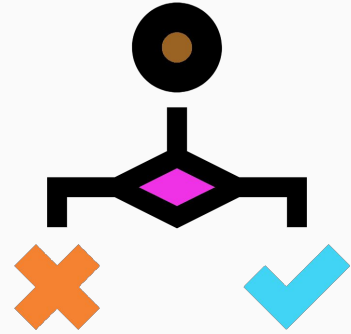
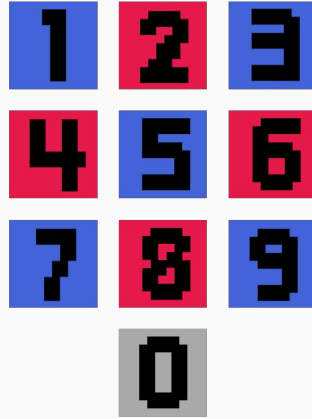
```
print("This section will print") # This section is ignored
```

Variables & Classes

Variables

Class is the 'type' of variable:

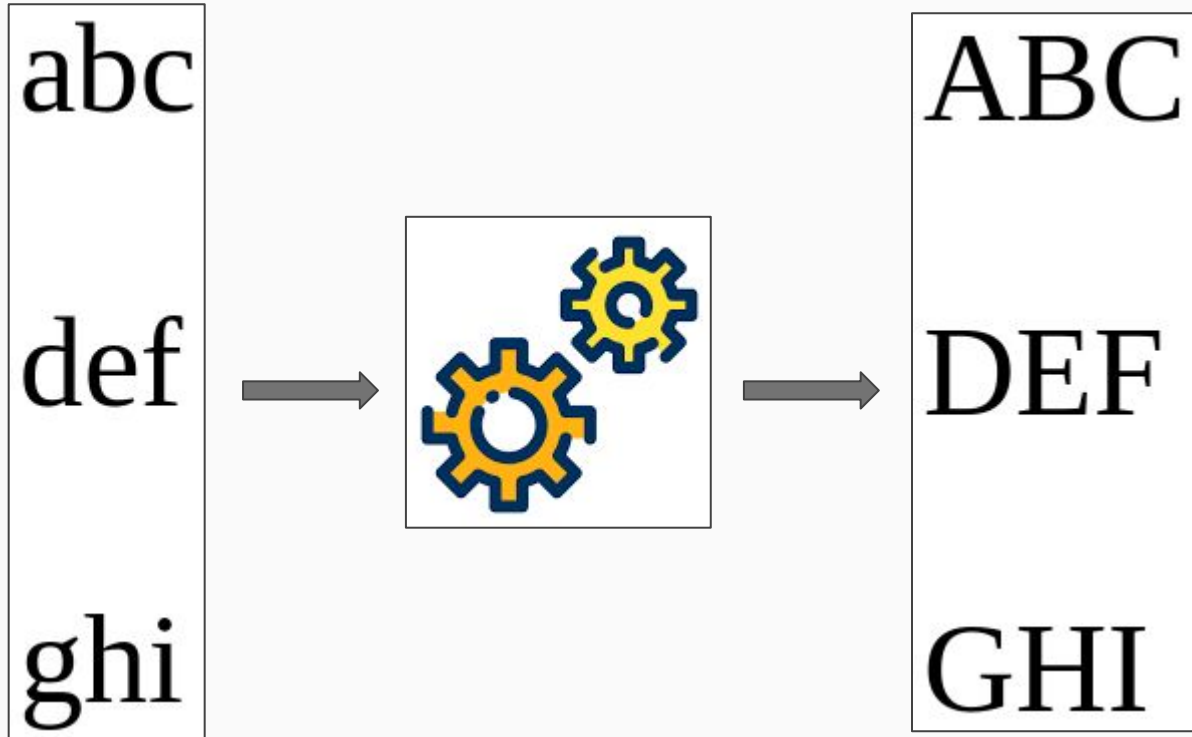
- Integer / Float
- String
- Logical



“a_string_variable”

Functions & Methods

A function/method is used to run the same task repeatedly



Indentation

Python is very particular about line indentations.

This will make more sense in the practical!

Zero indentation

Tab

One level of indentation

Tab

Tab

Two levels

Tab

Tab

Tab

Three

Zero indentation

Course info



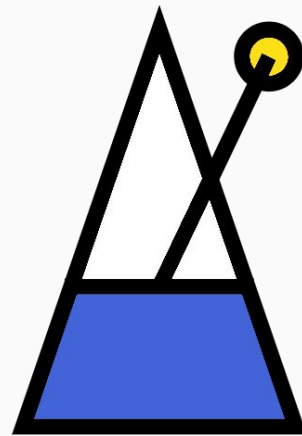
Pace

Work at your own pace through the book

If you get stuck:

1st check for typos

2nd ask for help

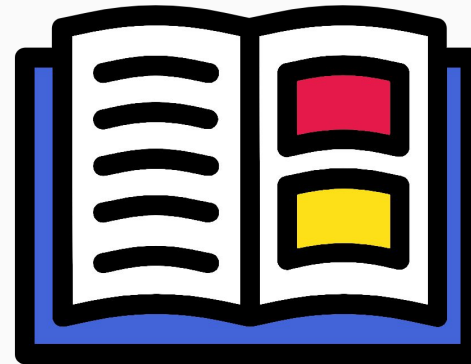


No such thing as a dumb question, just dumb answers by me

Book

HTML book

Theory, practice, exercise and solutions



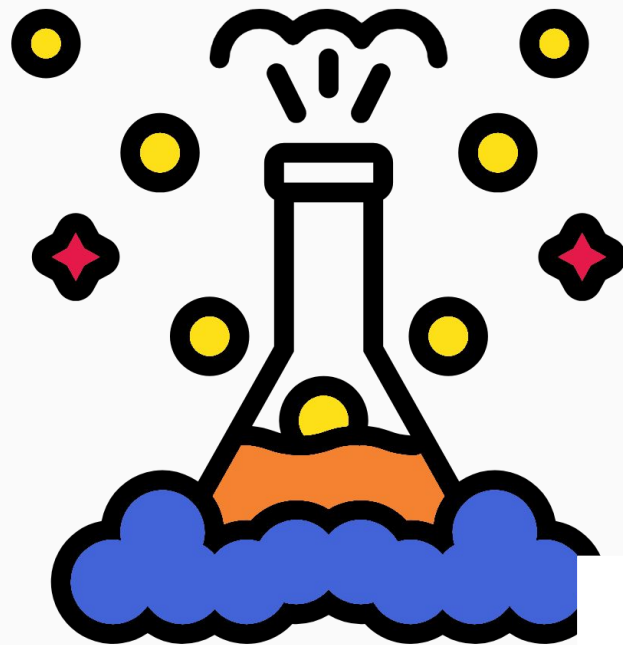
Experiment

Experiment

Different commands

Combining functions

You will not break anything





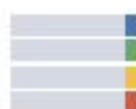
Ask questions!

Here to help!

Don't understand a concept?

Don't understand the objective of an exercise?





Reminders and Tips

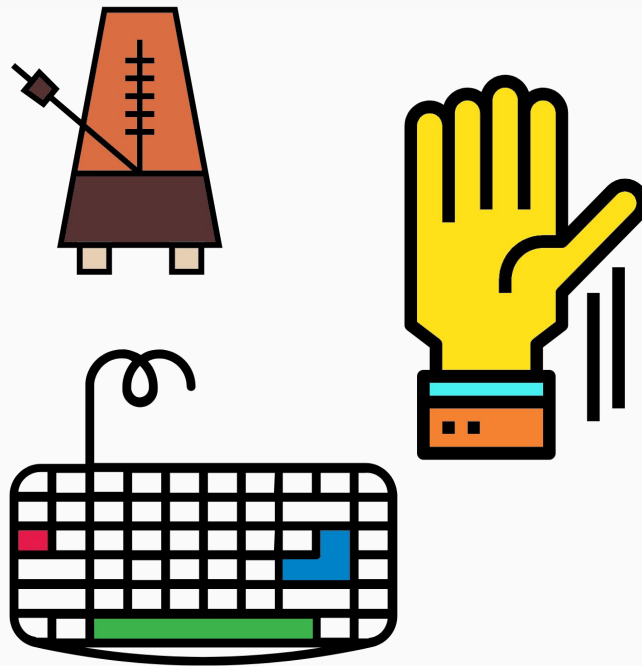
Work at your own pace

Typos

Ask questions

Breaks are important

Answers in bookdown





Workshop sessions

Zoom - Ask via microphone if no question currently being asked/answered

Slack - Ask questions via the channel or ask to go into a zoom breakout room with one of us
Breakout rooms upon request



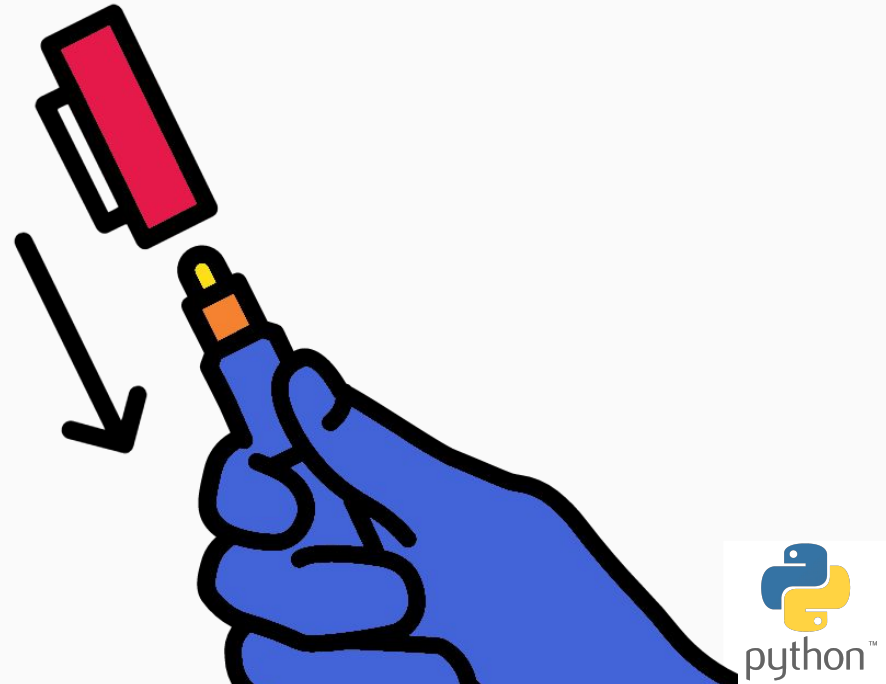
Recap

Plans and goals

What is Python

Python Foundations

Course Information





Thank you!

Questions?

