Intro to Python Course – Content specific objectives

* 3 sessions x 3h, over 3 weeks
* 1 virtual drop in to help with setup
* Plan to use JupyterLab and Conda
* Based on [Software Carpentry Fundamentals course](https://swcarpentry.github.io/python-novice-inflammation/)

Day 0: Virtual drop-in for setup help – 30 mins

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| Content | Content specific objectives |
| Help participants set up Python. Install Conda & JupyterLab | * Participants have managed to install Python and JupyterLab, and can access the course materials |

Day 1: Intro to Python 1 – 3h

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| Content | | Content specific objectives (O) & questions (Q) |
| Setup check & help | 15 mins | * O: Check participants have a working Python installation & interpreter, and have access to materials. |
| Initial motivation | 15 mins | * Q: Why should I learn to code? Why should I learn Python? What can I achieve with Python? * O: Participants (who might’ve been told they should attend a course without much reason behind this) become more aware of the benefits of coding, why Python in particular, and are shown some examples. |
| Python fundamentals | 30 mins | * Q: What basic data types can I work with in Python? How can I create a new variable in Python? How do I use a function? Can I change the value associated with a variable after I create it? * O: Assign values to variables |
| Lists | 25 mins | * Q: How can I store many values together? What is a data structure? What is a list? * O: Explain what a list is. Create and index lists of simple values. Change the values of individual elements. Append values to an existing list. Reorder and slice list elements. Create and manipulate nested lists. |
| Break – 5 mins | | |
| Dictionaries | 15 mins | * Q: What other data structures exist? What is a dictionary? How does this differ from a list? * O: Explain what a dictionary is, and how it differs from a list. Explain key, value relationship. Create dictionary of simple values. Change values in dictionaries. |
| Control flow | 30 mins | * Q: How can my programs do different things based on data values? * O: Write conditional statements including *if*, *elif*, and *else* branches. Correctly evaluate expressions containing *and* and *or*. |
| Loops | 45 mins | * Q: How can I do the same operations on many different values? * O: Explain what a *for* loop does. Correctly write *for* loops to repeat simple calculations. Trace changes to a loop variable as the loop runs. Trace changes to other variables as they are updated by a *for* loop. |

Day 2: Intro to Python 2 – 3h

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| Content | | Content specific objectives (O) & questions (Q) |
| Recap | 15 mins | * Q: What did we cover in the previous session? * O: Provide overview of last session. |
| Functions | 35 mins | * Q: How can I define new functions? What's the difference between defining and calling a function? What happens when I call a function? * O: Define a function that takes parameters. Return a value from a function. Test and debug a function. Set default values for function parameters. Explain why we should divide programs into small, single-purpose functions. |
| Debugging & errors | 15 mins | * Q: How does Python report errors? How can I handle errors in Python programs? How can I fix my code or ensure the correct functionality? * O: To be able to read a traceback and determine where the error took place and what type it is. To be able to describe the types of situations in which syntax errors, indentation errors, name errors, index errors, and missing file errors occur. Debug code containing an error systematically. Identify ways of making code less error-prone and more easily tested. |
| Reading and processing data files | 30 mins | * Q: How can I open my files in Python? What if they are text files, or tabular data? What is a library? * O: Explain what a library is and what libraries are used for. Import a Python library and use the functions it contains. Read tabular data from a file into a program. Select individual values and subsections from data. Perform operations on arrays of data. |
| Break – 5 mins | | |
| Visualising data | 30 mins | * Q: How can I visualise my tabular data using Python? How can I group plots together? How can I change the type of plot? * O: Plot simple graphs in Python, and group these together. |
| Simple analysis task (i.e. software carpentry example) | 40 mins | * Q: How can I perform a piece of analysis on some data? How can I solve academic/business questions using Python? How can I incorporate what I’ve learnt so far? * O: Perform a (simple) task where data is loaded, some processing applied, a visualisation created, and it is saved. |
| Wrap up/what next | 10 mins | * Q: What areas can I focus on next? What resources should I use/are recommended? * O: Provide a roadmap for future learning for different streams, and link to some resources that can be used. |

Draft Day 3: Intro to Python 3 – Projects

The format of day three is slightly different to the other days. Here participants will have the opportunity to pick one of the projects below to tackle during the session. These will be suitable for independent study, but an instructor will be on hand to provide support if necessary. If participants finish, they can move on to another project as time allows.

The aim is to add more projects to this list.

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| Content | | Content specific objectives (O) & questions (Q) |
| Physics simulation | 3h | * O: Explain what a library is and what libraries are used for. Import a Python library and use the functions it contains. Read tabular data from a file into a program. Represent and solve pendulum equations using Python. Select individual values and subsections from data. Perform operations on arrays of data. Create visualisations. |
| Data science | 3h | * O: Explain what Pandas is, and what it can be used for. Explain what a *DataFrame* is, similarities with Excel spreadsheets, how to manipulate them, load them, and make changes. Perform an analysis task using Pandas and the traffic accidents dataset provided. Perform exploratory data analysis, data wrangling and filtering, and create visualisations to answer research questions. |
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