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# Intro to Python for Data Science

Python is a general-purpose programming language that is becoming more and more popular for doing data science. Companies worldwide are using Python to harvest insights from their data and get a competitive edge. Unlike any other Python tutorial, this course focuses on Python specifically for data science. In our Intro to Python class, you will learn about powerful ways to store and manipulate data as well as cool data science tools to start your own analyses. Enter DataCamp’s online Python curriculum.

**1Python Basics**

100%

An introduction to the basic concepts of Python. Learn how to use Python both interactively and through a script. Create your first variables and acquaint yourself with Python's basic data types.

* [**Hello Python!50 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-1-python-basics?ex=1)
* [**The Python Interface100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-1-python-basics?ex=2)
* [**When to use Python?50 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-1-python-basics?ex=3)
* [**Any comments?100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-1-python-basics?ex=4)
* [**Python as a calculator100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-1-python-basics?ex=5)
* [**Variables & Types50 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-1-python-basics?ex=6)
* [**Variable Assignment100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-1-python-basics?ex=7)
* [**Calculations with variables100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-1-python-basics?ex=8)
* [**Other variable types100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-1-python-basics?ex=9)
* [**Guess the type50 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-1-python-basics?ex=10)
* [**Operations with other types100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-1-python-basics?ex=11)
* [**Type conversion100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-1-python-basics?ex=12)
* [**Can Python handle everything?50 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-1-python-basics?ex=13)

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**2Python Lists**

100%

Learn to store, access and manipulate data in lists: the first step towards efficiently working with huge amounts of data.

* [**Lists, what are they?50 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-2-python-lists?ex=1)
* [**Create a list100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-2-python-lists?ex=2)
* [**Create list with different types100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-2-python-lists?ex=3)
* [**Select the valid list50 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-2-python-lists?ex=4)
* [**List of lists100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-2-python-lists?ex=5)
* [**Subsetting lists50 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-2-python-lists?ex=6)
* [**Subset and conquer100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-2-python-lists?ex=7)
* [**Subset and calculate100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-2-python-lists?ex=8)
* [**Slicing and dicing100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-2-python-lists?ex=9)
* [**Slicing and dicing (2)100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-2-python-lists?ex=10)
* [**Subsetting lists of lists50 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-2-python-lists?ex=11)
* [**List Manipulation50 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-2-python-lists?ex=12)
* [**Replace list elements100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-2-python-lists?ex=13)
* [**Extend a list100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-2-python-lists?ex=14)
* [**Delete list elements50 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-2-python-lists?ex=15)
* [**Inner workings of lists100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-2-python-lists?ex=16)

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**3Functions and Packages**

100%

To leverage the code that brilliant Python developers have written, you'll learn about using functions, methods and packages. This will help you to reduce the amount of code you need to solve challenging problems!

* [**Functions50 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-3-functions-and-packages?ex=1)
* [**Familiar functions100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-3-functions-and-packages?ex=2)
* [**Help!50 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-3-functions-and-packages?ex=3)
* [**Multiple arguments100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-3-functions-and-packages?ex=4)
* [**Methods50 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-3-functions-and-packages?ex=5)
* [**String Methods100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-3-functions-and-packages?ex=6)
* [**List Methods100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-3-functions-and-packages?ex=7)
* [**List Methods (2)100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-3-functions-and-packages?ex=8)
* [**Packages50 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-3-functions-and-packages?ex=9)
* [**Import package100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-3-functions-and-packages?ex=10)
* [**Selective import100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-3-functions-and-packages?ex=11)
* [**Different ways of importing50 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-3-functions-and-packages?ex=12)

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**4Numpy**

100%

Numpy is a Python package to efficiently do data science. Learn to work with the Numpy array, a faster and more powerful alternative to the list, and take your first steps in data exploration.

* [**Numpy50 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-4-numpy?ex=1)
* [**Your First Numpy Array100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-4-numpy?ex=2)
* [**Baseball players' height100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-4-numpy?ex=3)
* [**Baseball player's BMI100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-4-numpy?ex=4)
* [**Lightweight baseball players100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-4-numpy?ex=5)
* [**Numpy Side Effects50 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-4-numpy?ex=6)
* [**Subsetting Numpy Arrays100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-4-numpy?ex=7)
* [**2D Numpy Arrays50 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-4-numpy?ex=8)
* [**Your First 2D Numpy Array100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-4-numpy?ex=9)
* [**Baseball data in 2D form100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-4-numpy?ex=10)
* [**Subsetting 2D Numpy Arrays100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-4-numpy?ex=11)
* [**2D Arithmetic100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-4-numpy?ex=12)
* [**Numpy: Basic Statistics50 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-4-numpy?ex=13)
* [**Average versus median100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-4-numpy?ex=14)
* [**Explore the baseball data100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-4-numpy?ex=15)
* [**Blend it all together100 xp**](https://campus.datacamp.com/courses/intro-to-python-for-data-science/chapter-4-numpy?ex=16)

# Intermediate Python for Data Science

The intermediate python course is crucial to your data science curriculum. Learn to visualize real data with matplotlib's functions and get to know new data structures such as the dictionary and the Pandas DataFrame. After covering key concepts such as boolean logic, control flow and loops in Python, you're ready to blend together everything you've learned to solve a case study using hacker statistics.

**1Matplotlib**FREE

100%

Data Visualization is a key skill for aspiring data scientists. Matplotlib makes it easy to create meaningful and insightful plots. In this chapter, you will learn to build various types of plots and to customize them to make them more visually appealing and interpretable.

* [**Basic plots with matplotlib50 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/matplotlib?ex=1)
* [**Line plot (1)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/matplotlib?ex=2)
* [**Line Plot (2): Interpretation50 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/matplotlib?ex=3)
* [**Line plot (3)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/matplotlib?ex=4)
* [**Scatter Plot (1)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/matplotlib?ex=5)
* [**Scatter plot (2)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/matplotlib?ex=6)
* [**Histograms50 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/matplotlib?ex=7)
* [**Build a histogram (1)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/matplotlib?ex=8)
* [**Build a histogram (2): bins100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/matplotlib?ex=9)
* [**Build a histogram (3): compare100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/matplotlib?ex=10)
* [**Choose the right plot (1)50 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/matplotlib?ex=11)
* [**Choose the right plot (2)50 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/matplotlib?ex=12)
* [**Customization50 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/matplotlib?ex=13)
* [**Labels100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/matplotlib?ex=14)
* [**Ticks100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/matplotlib?ex=15)
* [**Sizes100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/matplotlib?ex=16)
* [**Colors100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/matplotlib?ex=17)
* [**Additional Customizations100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/matplotlib?ex=18)
* [**Interpretation50 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/matplotlib?ex=19)

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**2Dictionaries & Pandas**

100%

Learn about the dictionary, an alternative to the Python list, and the Pandas DataFrame, the de facto standard to work with tabular data in Python. You will get hands-on practice with creating, manipulating and accessing the information you need from these data structures.

* [**Dictionaries, Part 150 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/dictionaries-pandas?ex=1)
* [**Motivation for dictionaries100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/dictionaries-pandas?ex=2)
* [**Create dictionary100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/dictionaries-pandas?ex=3)
* [**Access dictionary100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/dictionaries-pandas?ex=4)
* [**Dictionaries, Part 250 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/dictionaries-pandas?ex=5)
* [**Dictionary Manipulation (1)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/dictionaries-pandas?ex=6)
* [**Dictionary Manipulation (2)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/dictionaries-pandas?ex=7)
* [**Dictionariception100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/dictionaries-pandas?ex=8)
* [**Pandas, Part 150 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/dictionaries-pandas?ex=9)
* [**Dictionary to DataFrame (1)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/dictionaries-pandas?ex=10)
* [**Dictionary to DataFrame (2)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/dictionaries-pandas?ex=11)
* [**CSV to DataFrame (1)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/dictionaries-pandas?ex=12)
* [**CSV to DataFrame (2)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/dictionaries-pandas?ex=13)
* [**Pandas, Part 250 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/dictionaries-pandas?ex=14)
* [**Square Brackets (1)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/dictionaries-pandas?ex=15)
* [**Square Brackets (2)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/dictionaries-pandas?ex=16)
* [**loc and iloc (1)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/dictionaries-pandas?ex=17)
* [**loc and iloc (2)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/dictionaries-pandas?ex=18)
* [**loc and iloc (3)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/dictionaries-pandas?ex=19)

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**3Logic, Control Flow and Filtering**

100%

Boolean logic is the foundation of decision-making in your Python programs. Learn about different comparison operators, how you can combine them with boolean operators and how to use the boolean outcomes in control structures. You'll also learn to filter data from Pandas DataFrames using logic.

* [**Comparison Operators50 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/logic-control-flow-and-filtering?ex=1)
* [**Equality100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/logic-control-flow-and-filtering?ex=2)
* [**Greater and less than100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/logic-control-flow-and-filtering?ex=3)
* [**Compare arrays100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/logic-control-flow-and-filtering?ex=4)
* [**Boolean Operators50 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/logic-control-flow-and-filtering?ex=5)
* [**and, or, not (1)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/logic-control-flow-and-filtering?ex=6)
* [**and, or, not (2)50 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/logic-control-flow-and-filtering?ex=7)
* [**Boolean operators with Numpy100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/logic-control-flow-and-filtering?ex=8)
* [**if, elif, else50 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/logic-control-flow-and-filtering?ex=9)
* [**Warmup50 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/logic-control-flow-and-filtering?ex=10)
* [**if100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/logic-control-flow-and-filtering?ex=11)
* [**Add else100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/logic-control-flow-and-filtering?ex=12)
* [**Customize further: elif100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/logic-control-flow-and-filtering?ex=13)
* [**Filtering Pandas DataFrame50 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/logic-control-flow-and-filtering?ex=14)
* [**Driving right (1)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/logic-control-flow-and-filtering?ex=15)
* [**Driving right (2)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/logic-control-flow-and-filtering?ex=16)
* [**Cars per capita (1)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/logic-control-flow-and-filtering?ex=17)
* [**Cars per capita (2)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/logic-control-flow-and-filtering?ex=18)

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**4Loops**

100%

There are several techniques to repeatedly execute Python code. While loops are like repeated if statements; the for loop is there to iterate over all kinds of data structures. Learn all about them in this chapter.

* [**while loop50 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/loops?ex=1)
* [**while: warming up50 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/loops?ex=2)
* [**Basic while loop100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/loops?ex=3)
* [**Add conditionals100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/loops?ex=4)
* [**for loop50 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/loops?ex=5)
* [**Loop over a list100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/loops?ex=6)
* [**Indexes and values (1)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/loops?ex=7)
* [**Indexes and values (2)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/loops?ex=8)
* [**Loop over list of lists100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/loops?ex=9)
* [**Looping Data Structures, Part 150 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/loops?ex=10)
* [**Loop over dictionary100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/loops?ex=11)
* [**Loop over Numpy array100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/loops?ex=12)
* [**Looping Data Structures, Part 250 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/loops?ex=13)
* [**Loop over DataFrame (1)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/loops?ex=14)
* [**Loop over DataFrame (2)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/loops?ex=15)
* [**Add column (1)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/loops?ex=16)
* [**Add column (2)100 xp**](https://campus.datacamp.com/courses/intermediate-python-for-data-science/loops?ex=17)

# Python Data Science Toolbox (Part 1)

It's now time to push forward and develop your Python chops even further. There are lots and lots of fantastic functions in Python and its library ecosystem. However, as a Data Scientist, you'll constantly need to write your own functions to solve problems that are dictated by your data. The art of function writing is what you'll learn in this first Python Data Science toolbox course. You'll come out of this course being able to write your very own custom functions, complete with multiple parameters and multiple return values, along with default arguments and variable-length arguments. You'll gain insight into scoping in Python and be able to write lambda functions and handle errors in your very own function writing practice. On top of this, you'll wrap up each Chapter by diving into using your acquired skills to write functions that analyze twitter DataFrames and are generalizable to broader Data Science contexts.

#### 1Writing your own functions FREE

100%

Here you will learn how to write your very own functions. In this Chapter, you'll learn how to write simple functions, as well as functions that accept multiple arguments and return multiple values. You'll also have the opportunity to apply these newfound skills to questions that commonly arise in Data Science contexts.

* [**User-defined functions50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/writing-your-own-functions?ex=1)
* [**Strings in Python50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/writing-your-own-functions?ex=2)
* [**Recapping built-in functions50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/writing-your-own-functions?ex=3)
* [**Write a simple function100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/writing-your-own-functions?ex=4)
* [**Single-parameter functions100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/writing-your-own-functions?ex=5)
* [**Functions that return single values100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/writing-your-own-functions?ex=6)
* [**Multiple parameters and return values50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/writing-your-own-functions?ex=7)
* [**Functions with multiple parameters100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/writing-your-own-functions?ex=8)
* [**A brief introduction to tuples100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/writing-your-own-functions?ex=9)
* [**Function that return multiple values100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/writing-your-own-functions?ex=10)
* [**Bringing it all together50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/writing-your-own-functions?ex=11)
* [**Bringing it all together (1)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/writing-your-own-functions?ex=12)
* [**Bringing it all together (2)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/writing-your-own-functions?ex=13)
* [**Congratulations!50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/writing-your-own-functions?ex=14)

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#### 2Default arguments, variable-length arguments and scope

100%

In this Chapter, you'll learn to write functions with default arguments, so that the user doesn't always need to specify them, and variable-length arguments, so that they can pass to your functions an arbitrary number of arguments. These are both incredibly useful tools! You'll also learn about the essential concept of scope. Enjoy!

* [**Scope and user-defined functions50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/default-arguments-variable-length-arguments-and-scope?ex=1)
* [**Pop quiz on understanding scope50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/default-arguments-variable-length-arguments-and-scope?ex=2)
* [**The keyword global100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/default-arguments-variable-length-arguments-and-scope?ex=3)
* [**Python's built-in scope50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/default-arguments-variable-length-arguments-and-scope?ex=4)
* [**Nested functions50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/default-arguments-variable-length-arguments-and-scope?ex=5)
* [**Nested Functions I100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/default-arguments-variable-length-arguments-and-scope?ex=6)
* [**Nested Functions II100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/default-arguments-variable-length-arguments-and-scope?ex=7)
* [**The keyword nonlocal and nested functions100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/default-arguments-variable-length-arguments-and-scope?ex=8)
* [**Default and flexible arguments50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/default-arguments-variable-length-arguments-and-scope?ex=9)
* [**Functions with one default argument100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/default-arguments-variable-length-arguments-and-scope?ex=10)
* [**Functions with multiple default arguments100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/default-arguments-variable-length-arguments-and-scope?ex=11)
* [**Function with variable-length arguments (\*args)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/default-arguments-variable-length-arguments-and-scope?ex=12)
* [**Function with variable-length keyword arguments (\*\*kwargs)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/default-arguments-variable-length-arguments-and-scope?ex=13)
* [**Bringing it all together50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/default-arguments-variable-length-arguments-and-scope?ex=14)
* [**Bringing it all together (1)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/default-arguments-variable-length-arguments-and-scope?ex=15)
* [**Bringing it all together (2)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/default-arguments-variable-length-arguments-and-scope?ex=16)

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#### 3Lambda functions and error-handling

100%

Herein, you'll learn about lambda functions, which allow you to write functions quickly and on-the-fly. You'll also get practice at handling errors that your functions, at some point, will inevitably throw. You'll wrap up once again applying these skills to Data Science questions.

* [**Lambda functions50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/lambda-functions-and-error-handling?ex=1)
* [**Pop quiz on lambda functions50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/lambda-functions-and-error-handling?ex=2)
* [**Writing a lambda function you already know100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/lambda-functions-and-error-handling?ex=3)
* [**Map() and lambda functions100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/lambda-functions-and-error-handling?ex=4)
* [**Filter() and lambda functions100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/lambda-functions-and-error-handling?ex=5)
* [**Reduce() and lambda functions100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/lambda-functions-and-error-handling?ex=6)
* [**Introduction to error handling50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/lambda-functions-and-error-handling?ex=7)
* [**Pop quiz about errors50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/lambda-functions-and-error-handling?ex=8)
* [**Error handling with try-except100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/lambda-functions-and-error-handling?ex=9)
* [**Error handling by raising an error100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/lambda-functions-and-error-handling?ex=10)
* [**Bringing it all together50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/lambda-functions-and-error-handling?ex=11)
* [**Bringing it all together (1)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/lambda-functions-and-error-handling?ex=12)
* [**Bringing it all together (2)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/lambda-functions-and-error-handling?ex=13)
* [**Bringing it all together (3)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/lambda-functions-and-error-handling?ex=14)
* [**Bringing it all together: testing your error handling skills50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/lambda-functions-and-error-handling?ex=15)
* [**Congratulations!50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-1/lambda-functions-and-error-handling?ex=16)

# Python Data Science Toolbox (Part 2)

#### 1Using iterators in PythonLand FREE

100%

Here, you'll learn all about iterators and iterables, which you have already worked with before when writing for loops! You'll learn about some very useful functions that will allow you to effectively work with iterators and finish the chapter with a use case that is pertinent to the world of Data Science - dealing with large amounts of data - in this case, data from Twitter that you will load in chunks using iterators!

* [**Introduction to iterators50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/using-iterators-in-pythonland?ex=1)
* [**Iterators vs Iterables50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/using-iterators-in-pythonland?ex=2)
* [**Iterating over iterables (1)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/using-iterators-in-pythonland?ex=3)
* [**Iterating over iterables (2)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/using-iterators-in-pythonland?ex=4)
* [**Iterators as function arguments100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/using-iterators-in-pythonland?ex=5)
* [**Playing with iterators50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/using-iterators-in-pythonland?ex=6)
* [**Using enumerate100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/using-iterators-in-pythonland?ex=7)
* [**Using zip100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/using-iterators-in-pythonland?ex=8)
* [**Using \* and zip to 'unzip'100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/using-iterators-in-pythonland?ex=9)
* [**Using iterators to load large files into memory50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/using-iterators-in-pythonland?ex=10)
* [**Processing large amounts of Twitter data100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/using-iterators-in-pythonland?ex=11)
* [**Extracting information for large amounts of Twitter data100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/using-iterators-in-pythonland?ex=12)
* [**Congratulations!!50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/using-iterators-in-pythonland?ex=13)

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#### 2List comprehensions and generators

100%

In this chapter, you'll build on your knowledge of iterators and be introduced to list comprehensions, which allow you to create complicated lists and lists of lists in one line of code! List comprehensions can dramatically simplify your code and make it more efficient, and will become a vital part of your Python Data Science toolbox. You'll then learn about generators, which are extremely helpful when working with large sequences of data that you may not want to store in memory but instead generate on the fly.

* [**List comprehensions50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/list-comprehensions-and-generators?ex=1)
* [**Write a basic list comprehension50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/list-comprehensions-and-generators?ex=2)
* [**List comprehension over iterables50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/list-comprehensions-and-generators?ex=3)
* [**Writing list comprehensions0 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/list-comprehensions-and-generators?ex=4)
* [**Nested list comprehensions100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/list-comprehensions-and-generators?ex=5)
* [**Advanced comprehensions50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/list-comprehensions-and-generators?ex=6)
* [**Using conditionals in comprehensions (1)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/list-comprehensions-and-generators?ex=7)
* [**Using conditionals in comprehensions (2)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/list-comprehensions-and-generators?ex=8)
* [**Dict comprehensions100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/list-comprehensions-and-generators?ex=9)
* [**Introduction to generator expressions50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/list-comprehensions-and-generators?ex=10)
* [**List comprehensions vs generators50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/list-comprehensions-and-generators?ex=11)
* [**Write your own generator expressions100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/list-comprehensions-and-generators?ex=12)
* [**Changing the output in generator expressions100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/list-comprehensions-and-generators?ex=13)
* [**Build a generator100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/list-comprehensions-and-generators?ex=14)
* [**Wrapping up comprehensions and generators.50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/list-comprehensions-and-generators?ex=15)
* [**List comprehensions for time-stamped data100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/list-comprehensions-and-generators?ex=16)
* [**Conditional list comprehesions for time-stamped data100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/list-comprehensions-and-generators?ex=17)

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#### 3Bringing it all together!

100%

This chapter will allow you to apply your newly acquired skills towards wrangling and extracting meaningful information from a real-world dataset - the World Bank's World Development Indicators dataset! You'll have the chance to write your own functions and list comprehensions as you work with iterators and generators and solidify your Python Data Science chops. Enjoy!

* [**Welcome to the case study!50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/bringing-it-all-together-3?ex=1)
* [**Dictionaries for data science100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/bringing-it-all-together-3?ex=2)
* [**Writing a function to help you100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/bringing-it-all-together-3?ex=3)
* [**Using a list comprehension0 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/bringing-it-all-together-3?ex=4)
* [**Turning this all into a DataFrame100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/bringing-it-all-together-3?ex=5)
* [**Using Python generators for streaming data50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/bringing-it-all-together-3?ex=6)
* [**Processing data in chunks (1)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/bringing-it-all-together-3?ex=7)
* [**Writing a generator to load data in chunks (2)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/bringing-it-all-together-3?ex=8)
* [**Writing a generator to load data in chunks (3)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/bringing-it-all-together-3?ex=9)
* [**Using pandas` read\_csv iterator for streaming data50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/bringing-it-all-together-3?ex=10)
* [**Writing an iterator to load data in chunks (1)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/bringing-it-all-together-3?ex=11)
* [**Writing an iterator to load data in chunks (2)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/bringing-it-all-together-3?ex=12)
* [**Writing an iterator to load data in chunks (3)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/bringing-it-all-together-3?ex=13)
* [**Writing an iterator to load data in chunks (4)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/bringing-it-all-together-3?ex=14)
* [**Writing an iterator to load data in chunks (5)100 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/bringing-it-all-together-3?ex=15)
* [**Final thoughts50 xp**](https://campus.datacamp.com/courses/python-data-science-toolbox-part-2/bringing-it-all-together-3?ex=16)

# Importing Data in Python (Part 1)

As a Data Scientist, on a daily basis you will need to clean data, wrangle and munge it, visualize it, build predictive models and interpret these models. Before doing any of these, however, you will need to know how to get data into Python. In this course, you'll learn the many ways to import data into Python: (i) from flat files such as .txts and .csvs; (ii) from files native to other software such as Excel spreadsheets, Stata, SAS and MATLAB files; (iii) from relational databases such as SQLite & PostgreSQL.

#### 1Introduction and flat files FREE

100%

In this chapter, you'll learn how to import data into Python from all types of flat files, a simple and prevalent form of data storage. You've previously learned how to use NumPy and pandas - you will learn how to use these packages to import flat files, as well as how to customize your imports.

* [**Welcome to the course!50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/introduction-and-flat-files-1?ex=1)
* [**Exploring your working directory50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/introduction-and-flat-files-1?ex=2)
* [**Importing entire text files100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/introduction-and-flat-files-1?ex=3)
* [**Importing text files line by line100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/introduction-and-flat-files-1?ex=4)
* [**The importance of flat files in data science50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/introduction-and-flat-files-1?ex=5)
* [**Pop quiz: examples of flat files50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/introduction-and-flat-files-1?ex=6)
* [**Pop quiz: what exactly are flat files?50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/introduction-and-flat-files-1?ex=7)
* [**Why we like flat files and the Zen of Python50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/introduction-and-flat-files-1?ex=8)
* [**Importing flat files using NumPy50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/introduction-and-flat-files-1?ex=9)
* [**Using NumPy to import flat files100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/introduction-and-flat-files-1?ex=10)
* [**Customizing your NumPy import100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/introduction-and-flat-files-1?ex=11)
* [**Importing different datatypes100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/introduction-and-flat-files-1?ex=12)
* [**Working with mixed datatypes (1)50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/introduction-and-flat-files-1?ex=13)
* [**Working with mixed datatypes (2)100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/introduction-and-flat-files-1?ex=14)
* [**Importing flat files using pandas50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/introduction-and-flat-files-1?ex=15)
* [**Using pandas to import flat files as DataFrames (1)100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/introduction-and-flat-files-1?ex=16)
* [**Using pandas to import flat files as DataFrames (2)100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/introduction-and-flat-files-1?ex=17)
* [**Customizing your pandas import100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/introduction-and-flat-files-1?ex=18)
* [**Final thoughts on data import50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/introduction-and-flat-files-1?ex=19)

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#### 2Importing data from other file types

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You've learned how to import flat files, but there are many other file types you will potentially have to work with as a data scientist. In this chapter, you'll learn how to import data into Python from a wide array of important file types. You will be importing file types such as pickled files, Excel spreadsheets, SAS and Stata files, HDF5 files, a file type for storing large quantities of numerical data, and MATLAB files.

* [**Introduction to other file types50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/importing-data-from-other-file-types-2?ex=1)
* [**Not so flat any more50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/importing-data-from-other-file-types-2?ex=2)
* [**Loading a pickled file100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/importing-data-from-other-file-types-2?ex=3)
* [**Listing sheets of Excel spreadsheets100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/importing-data-from-other-file-types-2?ex=4)
* [**Importing sheets of Excel spreadsheets100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/importing-data-from-other-file-types-2?ex=5)
* [**Customizing your spreadsheet import100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/importing-data-from-other-file-types-2?ex=6)
* [**Importing SAS/Stata files using pandas50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/importing-data-from-other-file-types-2?ex=7)
* [**How to import SAS7BDAT50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/importing-data-from-other-file-types-2?ex=8)
* [**Importing SAS files100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/importing-data-from-other-file-types-2?ex=9)
* [**Using read\_stata to import Stata files50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/importing-data-from-other-file-types-2?ex=10)
* [**Importing Stata files100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/importing-data-from-other-file-types-2?ex=11)
* [**Importing HDF5 files50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/importing-data-from-other-file-types-2?ex=12)
* [**Using File to import HDF5 files50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/importing-data-from-other-file-types-2?ex=13)
* [**Using h5py to import HDF5 files100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/importing-data-from-other-file-types-2?ex=14)
* [**Extracting data from your HDF5 file100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/importing-data-from-other-file-types-2?ex=15)
* [**Importing MATLAB files50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/importing-data-from-other-file-types-2?ex=16)
* [**Loading .mat files100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/importing-data-from-other-file-types-2?ex=17)
* [**The structure of .mat in Python100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/importing-data-from-other-file-types-2?ex=18)

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#### 3Working with relational databases in Python

100%

In this chapter, you'll learn how to extract meaningful data from relational databases, an essential element of any data scientist's toolkit. You will be learning about the relational model, creating SQL queries, filtering and ordering your SQL records, and advanced querying by JOINing database tables.

* [**Introduction to relational databases50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/working-with-relational-databases-in-python-3?ex=1)
* [**Pop quiz: The relational model50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/working-with-relational-databases-in-python-3?ex=2)
* [**Creating a database engine in Python50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/working-with-relational-databases-in-python-3?ex=3)
* [**Creating a database engine100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/working-with-relational-databases-in-python-3?ex=4)
* [**What are the tables in the database?100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/working-with-relational-databases-in-python-3?ex=5)
* [**Querying relational databases in Python50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/working-with-relational-databases-in-python-3?ex=6)
* [**The Hello World of SQL Queries!100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/working-with-relational-databases-in-python-3?ex=7)
* [**Customizing the Hello World of SQL Queries100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/working-with-relational-databases-in-python-3?ex=8)
* [**Filtering your database records using SQL's WHERE100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/working-with-relational-databases-in-python-3?ex=9)
* [**Ordering your SQL records with ORDER BY100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/working-with-relational-databases-in-python-3?ex=10)
* [**Querying relational databases directly with pandas50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/working-with-relational-databases-in-python-3?ex=11)
* [**Pandas and The Hello World of SQL Queries!100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/working-with-relational-databases-in-python-3?ex=12)
* [**Pandas for more complex querying100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/working-with-relational-databases-in-python-3?ex=13)
* [**Advanced Querying: exploiting table relationships50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/working-with-relational-databases-in-python-3?ex=14)
* [**The power of SQL lies in relationships between tables: INNER JOIN0 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/working-with-relational-databases-in-python-3?ex=15)
* [**Filtering your INNER JOIN100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/working-with-relational-databases-in-python-3?ex=16)
* [**Final Thoughts50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-1/working-with-relational-databases-in-python-3?ex=17)

# Importing Data in Python (Part 2)

As a Data Scientist, on a daily basis you will need to clean data, wrangle and munge it, visualize it, build predictive models and interpret these models. Before doing any of these, however, you will need to know how to get data into Python. In the prequel to this course, you have already learnt many ways to import data into Python: (i) from flat files such as .txts and .csvs; (ii) from files native to other software such as Excel spreadsheets, Stata, SAS and MATLAB files; (iii) from relational databases such as SQLite & PostgreSQL. In this course, you'll extend this knowledge base by learning to import data (i) from the web and (ii) a special and essential case of this: pulling data from Application Programming Interfaces, also known as APIs, such as the Twitter streaming API, which allows us to stream real-time tweets.

#### 1Importing data from the Internet FREE

100%

The web is a rich source of data from which you can extract various types of insights and findings. In this chapter, you will learn how to get data from the web, whether it be stored in files or in HTML. You'll also learn the basics of scraping and parsing web data.

* [**Importing flat files from the web50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/importing-data-from-the-internet-1?ex=1)
* [**Importing flat files from the web: your turn!100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/importing-data-from-the-internet-1?ex=2)
* [**Opening and reading flat files from the web100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/importing-data-from-the-internet-1?ex=3)
* [**Importing non-flat files from the web0 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/importing-data-from-the-internet-1?ex=4)
* [**HTTP requests to import files from the web50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/importing-data-from-the-internet-1?ex=5)
* [**Performing HTTP requests in Python using urllib100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/importing-data-from-the-internet-1?ex=6)
* [**Printing HTTP request results in Python using urllib100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/importing-data-from-the-internet-1?ex=7)
* [**Performing HTTP requests in Python using requests100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/importing-data-from-the-internet-1?ex=8)
* [**Scraping the web in Python50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/importing-data-from-the-internet-1?ex=9)
* [**Parsing HTML with BeautifulSoup100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/importing-data-from-the-internet-1?ex=10)
* [**Turning a webpage into data using BeautifulSoup: getting the text100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/importing-data-from-the-internet-1?ex=11)
* [**Turning a webpage into data using BeautifulSoup: getting the hyperlinks100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/importing-data-from-the-internet-1?ex=12)

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#### 2Interacting with APIs to import data from the web

100%

In this chapter, you will push further on your knowledge of importing data from the web. You will learn the basics of extracting data from APIs, gain insight on the importance of APIs and practice getting data from them with dives into the OMDB and Library of Congress APIs.

* [**Introduction to APIs and JSONs50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/interacting-with-apis-to-import-data-from-the-web-2?ex=1)
* [**Pop quiz: What exactly is a JSON?50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/interacting-with-apis-to-import-data-from-the-web-2?ex=2)
* [**Loading and exploring a JSON100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/interacting-with-apis-to-import-data-from-the-web-2?ex=3)
* [**Pop quiz: Exploring your JSON50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/interacting-with-apis-to-import-data-from-the-web-2?ex=4)
* [**APIs and interacting with the world wide web50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/interacting-with-apis-to-import-data-from-the-web-2?ex=5)
* [**Pop quiz: What's an API?50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/interacting-with-apis-to-import-data-from-the-web-2?ex=6)
* [**API requests100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/interacting-with-apis-to-import-data-from-the-web-2?ex=7)
* [**JSON- from the web to Python100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/interacting-with-apis-to-import-data-from-the-web-2?ex=8)
* [**Checking out the Wikipedia API100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/interacting-with-apis-to-import-data-from-the-web-2?ex=9)

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#### 3Diving deep into the Twitter API

100%

In this chapter, you will consolidate your knowledge of interacting with APIs in a deep dive into the Twitter streaming API. You'll learn how to stream real-time Twitter data and to analyze and visualize it!

* [**The Twitter API and Authentication50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/diving-deep-into-the-twitter-api?ex=1)
* [**API Authentication100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/diving-deep-into-the-twitter-api?ex=2)
* [**Streaming tweets100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/diving-deep-into-the-twitter-api?ex=3)
* [**Load and explore your Twitter data100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/diving-deep-into-the-twitter-api?ex=4)
* [**Twitter data to DataFrame100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/diving-deep-into-the-twitter-api?ex=5)
* [**A little bit of Twitter text analysis100 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/diving-deep-into-the-twitter-api?ex=6)
* [**Plotting your Twitter data70 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/diving-deep-into-the-twitter-api?ex=7)
* [**Final Thoughts50 xp**](https://campus.datacamp.com/courses/importing-data-in-python-part-2/diving-deep-into-the-twitter-api?ex=8)

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# Cleaning Data in Python

A vital component of data science involves acquiring raw data and getting it into a form ready for analysis. In fact, it is commonly said that data scientists spend 80% of their time cleaning and manipulating data, and only 20% of their time actually analyzing it. This course will equip you with all the skills you need to clean your data in Python, from learning how to diagnose your data for problems to dealing with missing values and outliers. At the end of the course, you'll apply all of the techniques you've learned to a case study in which you'll clean a real-world Gapminder dataset!

#### 1Exploring your data FREE

100%

So you've just got a brand new dataset and are itching to start exploring it. But where do you begin, and how can you be sure your dataset is clean? This chapter will introduce you to the world of data cleaning in Python! You'll learn how to explore your data with an eye for diagnosing issues such as outliers, missing values, and duplicate rows.

* [**Diagnose data for cleaning50 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/exploring-your-data?ex=1)
* [**Loading and viewing your data50 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/exploring-your-data?ex=2)
* [**Further diagnosis50 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/exploring-your-data?ex=3)
* [**Exploratory data analysis50 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/exploring-your-data?ex=4)
* [**Calculating summary statistics50 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/exploring-your-data?ex=5)
* [**Frequency counts for categorical data100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/exploring-your-data?ex=6)
* [**Visual exploratory data analysis50 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/exploring-your-data?ex=7)
* [**Visualizing single variables with histograms100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/exploring-your-data?ex=8)
* [**Visualizing multiple variables with boxplots100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/exploring-your-data?ex=9)
* [**Visualizing multiple variables with scatter plots100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/exploring-your-data?ex=10)

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#### 2Tidying data for analysis

100%

Here, you'll learn about the principles of tidy data and more importantly, why you should care about them and how they make subsequent data analysis more efficient. You'll gain first hand experience with reshaping and tidying your data using techniques such as pivoting and melting.

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#### 3Combining data for analysis

100%

The ability to transform and combine your data is a crucial skill in data science, because your data may not always come in one monolithic file or table for you to load. A large dataset may be broken into separate datasets to facilitate easier storage and sharing. Or if you are dealing with time series data, for example, you may have a new dataset for each day. No matter the reason, it is important to be able to combine datasets so you can either clean a single dataset, or clean each dataset separately and then combine them later so you can run your analysis on a single dataset. In this chapter, you'll learn all about combining data.

* [**Concatenating data50 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/combining-data-for-analysis?ex=1)
* [**Combining rows of data100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/combining-data-for-analysis?ex=2)
* [**Combining columns of data100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/combining-data-for-analysis?ex=3)
* [**Finding and concatenating data50 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/combining-data-for-analysis?ex=4)
* [**Finding files that match a pattern100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/combining-data-for-analysis?ex=5)
* [**Iterating and concatenating all matches100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/combining-data-for-analysis?ex=6)
* [**Merge data50 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/combining-data-for-analysis?ex=7)
* [**1-to-1 data merge100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/combining-data-for-analysis?ex=8)
* [**Many-to-1 data merge100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/combining-data-for-analysis?ex=9)
* [**Many-to-many data merge100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/combining-data-for-analysis?ex=10)

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#### 4Cleaning data for analysis

100%

Here, you'll dive into some of the grittier aspects of data cleaning. You'll learn about string manipulation and pattern matching to deal with unstructured data, and then explore techniques to deal with missing or duplicate data. You'll also learn the valuable skill of programmatically checking your data for consistency, which will give you confidence that your code is running correctly and that the results of your analysis are reliable!

* [**Data types50 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/cleaning-data-for-analysis?ex=1)
* [**Converting data types100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/cleaning-data-for-analysis?ex=2)
* [**Working with numeric data100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/cleaning-data-for-analysis?ex=3)
* [**Using regular expressions to clean strings50 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/cleaning-data-for-analysis?ex=4)
* [**String parsing with regular expressions100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/cleaning-data-for-analysis?ex=5)
* [**Extracting numerical values from strings100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/cleaning-data-for-analysis?ex=6)
* [**Pattern matching100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/cleaning-data-for-analysis?ex=7)
* [**Using functions to clean data50 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/cleaning-data-for-analysis?ex=8)
* [**Custom functions to clean data100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/cleaning-data-for-analysis?ex=9)
* [**Lambda functions100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/cleaning-data-for-analysis?ex=10)
* [**Duplicate and missing data50 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/cleaning-data-for-analysis?ex=11)
* [**Dropping duplicate data100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/cleaning-data-for-analysis?ex=12)
* [**Filling missing data100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/cleaning-data-for-analysis?ex=13)
* [**Testing with asserts50 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/cleaning-data-for-analysis?ex=14)
* [**Testing your data with asserts100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/cleaning-data-for-analysis?ex=15)

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#### 5Case study

100%

In this final chapter, you'll apply all of the data cleaning techniques you've learned in this course towards tidying a real-world, messy dataset obtained from the Gapminder Foundation. Once you're done, not only will you have a clean and tidy dataset, you'll also be ready to start working on your own data science projects using the power of Python!

* [**Putting it all together50 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/case-study-5?ex=1)
* [**Exploratory analysis50 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/case-study-5?ex=2)
* [**Visualizing your data100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/case-study-5?ex=3)
* [**Thinking about the question at hand100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/case-study-5?ex=4)
* [**Assembling your data100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/case-study-5?ex=5)
* [**Initial impressions of the data50 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/case-study-5?ex=6)
* [**Reshaping your data100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/case-study-5?ex=7)
* [**Checking the data types100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/case-study-5?ex=8)
* [**Looking at country spellings100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/case-study-5?ex=9)
* [**More data cleaning and processing100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/case-study-5?ex=10)
* [**Wrapping up100 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/case-study-5?ex=11)
* [**Final thoughts50 xp**](https://campus.datacamp.com/courses/cleaning-data-in-python/case-study-5?ex=12)

# pandas Foundations

Many real-world data sets contain strings, integers, time-stamps and unstructured data. How do you store data like this so that you can manipulate it and easily retrieve important information? The answer is in a pandas DataFrame! In this course, you'll learn how to use the industry-standard pandas library to import, build, and manipulate DataFrames. With pandas, you'll always be able to convert your data into a form that permits you to analyze it easily. You'll also learn more about NumPy, how it stores data, and its relation to the pandas DataFrame.

#### 1Data ingestion & inspection FREE

100%

In this chapter, you will become acquainted with the powertool of pandas - the DataFrame. You will learn how to use pandas to import and then inspect a variety of datasets, ranging from population data obtained from The World Bank to monthly stock data obtained via Yahoo! Finance. You will practice building DataFrames from scratch and become familiar with pandas' data visualization capabilities.

* [**Review of pandas DataFrames50 xp**](https://campus.datacamp.com/courses/pandas-foundations/data-ingestion-inspection?ex=1)
* [**Inspecting your data50 xp**](https://campus.datacamp.com/courses/pandas-foundations/data-ingestion-inspection?ex=2)
* [**DataFrame data types50 xp**](https://campus.datacamp.com/courses/pandas-foundations/data-ingestion-inspection?ex=3)
* [**NumPy and pandas working together100 xp**](https://campus.datacamp.com/courses/pandas-foundations/data-ingestion-inspection?ex=4)
* [**Building DataFrames from scratch50 xp**](https://campus.datacamp.com/courses/pandas-foundations/data-ingestion-inspection?ex=5)
* [**Zip lists to build a DataFrame100 xp**](https://campus.datacamp.com/courses/pandas-foundations/data-ingestion-inspection?ex=6)
* [**Labeling your data100 xp**](https://campus.datacamp.com/courses/pandas-foundations/data-ingestion-inspection?ex=7)
* [**Building DataFrames with broadcasting100 xp**](https://campus.datacamp.com/courses/pandas-foundations/data-ingestion-inspection?ex=8)
* [**Importing & exporting data50 xp**](https://campus.datacamp.com/courses/pandas-foundations/data-ingestion-inspection?ex=9)
* [**Reading a flat file100 xp**](https://campus.datacamp.com/courses/pandas-foundations/data-ingestion-inspection?ex=10)
* [**Delimiters, headers, and extensions100 xp**](https://campus.datacamp.com/courses/pandas-foundations/data-ingestion-inspection?ex=11)
* [**Plotting with pandas50 xp**](https://campus.datacamp.com/courses/pandas-foundations/data-ingestion-inspection?ex=12)
* [**Plotting series using pandas100 xp**](https://campus.datacamp.com/courses/pandas-foundations/data-ingestion-inspection?ex=13)
* [**Plotting DataFrames100 xp**](https://campus.datacamp.com/courses/pandas-foundations/data-ingestion-inspection?ex=14)

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#### 2Exploratory data analysis

100%

Having learned how to ingest and inspect your data, the next step is to explore it visually as well as quantitatively. This process, known as exploratory data analysis (EDA), is a crucial component of any data science project, and pandas has powerful methods that help with statistical and visual EDA. In this chapter, you will learn how and when to apply these techniques.

* [**Visual exploratory data analysis50 xp**](https://campus.datacamp.com/courses/pandas-foundations/exploratory-data-analysis?ex=1)
* [**pandas line plots100 xp**](https://campus.datacamp.com/courses/pandas-foundations/exploratory-data-analysis?ex=2)
* [**pandas scatter plots100 xp**](https://campus.datacamp.com/courses/pandas-foundations/exploratory-data-analysis?ex=3)
* [**pandas box plots100 xp**](https://campus.datacamp.com/courses/pandas-foundations/exploratory-data-analysis?ex=4)
* [**pandas hist, pdf and cdf100 xp**](https://campus.datacamp.com/courses/pandas-foundations/exploratory-data-analysis?ex=5)
* [**Statistical exploratory data analysis50 xp**](https://campus.datacamp.com/courses/pandas-foundations/exploratory-data-analysis?ex=6)
* [**Fuel efficiency50 xp**](https://campus.datacamp.com/courses/pandas-foundations/exploratory-data-analysis?ex=7)
* [**Bachelor's degrees awarded to women100 xp**](https://campus.datacamp.com/courses/pandas-foundations/exploratory-data-analysis?ex=8)
* [**Median vs mean100 xp**](https://campus.datacamp.com/courses/pandas-foundations/exploratory-data-analysis?ex=9)
* [**Quantiles100 xp**](https://campus.datacamp.com/courses/pandas-foundations/exploratory-data-analysis?ex=10)
* [**Standard deviation of temperature100 xp**](https://campus.datacamp.com/courses/pandas-foundations/exploratory-data-analysis?ex=11)
* [**Separating populations with Boolean indexing50 xp**](https://campus.datacamp.com/courses/pandas-foundations/exploratory-data-analysis?ex=12)
* [**Filtering and counting50 xp**](https://campus.datacamp.com/courses/pandas-foundations/exploratory-data-analysis?ex=13)
* [**Separate and summarize100 xp**](https://campus.datacamp.com/courses/pandas-foundations/exploratory-data-analysis?ex=14)
* [**Separate and plot100 xp**](https://campus.datacamp.com/courses/pandas-foundations/exploratory-data-analysis?ex=15)

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#### 3Time series in pandas

100%

In this chapter, you will learn how to manipulate and visualize time series data using pandas. You will become familiar with concepts such as upsampling, downsampling, and interpolation. You will practice using pandas' method chaining to efficiently filter your data and perform time series analyses. From stock prices to flight timings, time series data are found in a wide variety of domains and being able to effectively work with such data can be an invaluable skill.

* [**Indexing pandas time series50 xp**](https://campus.datacamp.com/courses/pandas-foundations/time-series-in-pandas?ex=1)
* [**Reading and slicing times50 xp**](https://campus.datacamp.com/courses/pandas-foundations/time-series-in-pandas?ex=2)
* [**Creating and using a DatetimeIndex50 xp**](https://campus.datacamp.com/courses/pandas-foundations/time-series-in-pandas?ex=3)
* [**Partial string indexing and slicing100 xp**](https://campus.datacamp.com/courses/pandas-foundations/time-series-in-pandas?ex=4)
* [**Reindexing the Index100 xp**](https://campus.datacamp.com/courses/pandas-foundations/time-series-in-pandas?ex=5)
* [**Resampling pandas time series50 xp**](https://campus.datacamp.com/courses/pandas-foundations/time-series-in-pandas?ex=6)
* [**Resampling and frequency100 xp**](https://campus.datacamp.com/courses/pandas-foundations/time-series-in-pandas?ex=7)
* [**Separating and resampling100 xp**](https://campus.datacamp.com/courses/pandas-foundations/time-series-in-pandas?ex=8)
* [**Rolling mean and frequency100 xp**](https://campus.datacamp.com/courses/pandas-foundations/time-series-in-pandas?ex=9)
* [**Resample and roll with it100 xp**](https://campus.datacamp.com/courses/pandas-foundations/time-series-in-pandas?ex=10)
* [**Manipulating pandas time series50 xp**](https://campus.datacamp.com/courses/pandas-foundations/time-series-in-pandas?ex=11)
* [**Method chaining and filtering100 xp**](https://campus.datacamp.com/courses/pandas-foundations/time-series-in-pandas?ex=12)
* [**Missing values and interpolation100 xp**](https://campus.datacamp.com/courses/pandas-foundations/time-series-in-pandas?ex=13)
* [**Time zones and conversion100 xp**](https://campus.datacamp.com/courses/pandas-foundations/time-series-in-pandas?ex=14)
* [**Visualizing pandas time series50 xp**](https://campus.datacamp.com/courses/pandas-foundations/time-series-in-pandas?ex=15)
* [**Plotting time series, datetime indexing100 xp**](https://campus.datacamp.com/courses/pandas-foundations/time-series-in-pandas?ex=16)
* [**Plotting date ranges, partial indexing100 xp**](https://campus.datacamp.com/courses/pandas-foundations/time-series-in-pandas?ex=17)

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#### 4Case Study - Sunlight in Austin

100%

Working with real-world weather and climate data, in this chapter you will bring together and apply all of the skills you have acquired in this course. You will use pandas to manipulate the data into a form usable for analysis, and then systematically explore it using the techniques you learned in the prior chapters. Enjoy!

* [**Reading and cleaning the data50 xp**](https://campus.datacamp.com/courses/pandas-foundations/case-study-sunlight-in-austin?ex=1)
* [**What method should we use to read the data?50 xp**](https://campus.datacamp.com/courses/pandas-foundations/case-study-sunlight-in-austin?ex=2)
* [**Reading in a data file100 xp**](https://campus.datacamp.com/courses/pandas-foundations/case-study-sunlight-in-austin?ex=3)
* [**Re-assigning column names100 xp**](https://campus.datacamp.com/courses/pandas-foundations/case-study-sunlight-in-austin?ex=4)
* [**Cleaning and tidying datetime data100 xp**](https://campus.datacamp.com/courses/pandas-foundations/case-study-sunlight-in-austin?ex=5)
* [**Cleaning the numeric columns100 xp**](https://campus.datacamp.com/courses/pandas-foundations/case-study-sunlight-in-austin?ex=6)
* [**Statistical exploratory data analysis50 xp**](https://campus.datacamp.com/courses/pandas-foundations/case-study-sunlight-in-austin?ex=7)
* [**Signal min, max, median100 xp**](https://campus.datacamp.com/courses/pandas-foundations/case-study-sunlight-in-austin?ex=8)
* [**Signal variance100 xp**](https://campus.datacamp.com/courses/pandas-foundations/case-study-sunlight-in-austin?ex=9)
* [**Sunny or cloudy100 xp**](https://campus.datacamp.com/courses/pandas-foundations/case-study-sunlight-in-austin?ex=10)
* [**Visual exploratory data analysis50 xp**](https://campus.datacamp.com/courses/pandas-foundations/case-study-sunlight-in-austin?ex=11)
* [**Weekly average temperature and visibility100 xp**](https://campus.datacamp.com/courses/pandas-foundations/case-study-sunlight-in-austin?ex=12)
* [**Daily hours of clear sky100 xp**](https://campus.datacamp.com/courses/pandas-foundations/case-study-sunlight-in-austin?ex=13)
* [**Heat or humidity100 xp**](https://campus.datacamp.com/courses/pandas-foundations/case-study-sunlight-in-austin?ex=14)
* [**Probability of high temperatures100 xp**](https://campus.datacamp.com/courses/pandas-foundations/case-study-sunlight-in-austin?ex=15)
* [**Congratulations!50 xp**](https://campus.datacamp.com/courses/pandas-foundations/case-study-sunlight-in-austin?ex=16)

# Manipulating DataFrames with pandas

In this course, you'll learn how to leverage pandas' extremely powerful data manipulation engine to get the most out of your data. It is important to be able to extract, filter, and transform data from DataFrames in order to drill into the data that really matters. The pandas library has many techniques that make this process efficient and intuitive. You will learn how to tidy, rearrange, and restructure your data by pivoting or melting and stacking or unstacking DataFrames. These are all fundamental next steps on the road to becoming a well-rounded Data Scientist, and you will have the chance to apply all the concepts you learn to real-world datasets.

#### 1Extracting and transforming data FREE

100%

In this chapter, you will learn all about how to index, slice, filter, and transform DataFrames, using a variety of datasets, ranging from 2012 US election data for the state of Pennsylvania to Pittsburgh weather data.

* [**Indexing DataFrames50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/extracting-and-transforming-data?ex=1)
* [**Index ordering50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/extracting-and-transforming-data?ex=2)
* [**Positional and labeled indexing100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/extracting-and-transforming-data?ex=3)
* [**Indexing and column rearrangement100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/extracting-and-transforming-data?ex=4)
* [**Slicing DataFrames50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/extracting-and-transforming-data?ex=5)
* [**Slicing rows100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/extracting-and-transforming-data?ex=6)
* [**Slicing columns100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/extracting-and-transforming-data?ex=7)
* [**Subselecting DataFrames with lists100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/extracting-and-transforming-data?ex=8)
* [**Filtering DataFrames50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/extracting-and-transforming-data?ex=9)
* [**Thresholding data100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/extracting-and-transforming-data?ex=10)
* [**Filtering columns using other columns100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/extracting-and-transforming-data?ex=11)
* [**Filtering using NaNs100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/extracting-and-transforming-data?ex=12)
* [**Transforming DataFrames50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/extracting-and-transforming-data?ex=13)
* [**Using apply() to transform a column100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/extracting-and-transforming-data?ex=14)
* [**Using .map() with a dictionary100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/extracting-and-transforming-data?ex=15)
* [**Using vectorized functions100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/extracting-and-transforming-data?ex=16)

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#### 2Advanced indexing

100%

Having learned the fundamentals of working with DataFrames, you will now move on to more advanced indexing techniques. You will learn about MultiIndexes, or hierarchical indexes, and learn how to interact with and extract data from them.

* [**Index objects and labeled data50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/advanced-indexing?ex=1)
* [**Index values and names50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/advanced-indexing?ex=2)
* [**Changing index of a DataFrame100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/advanced-indexing?ex=3)
* [**Changing index name labels100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/advanced-indexing?ex=4)
* [**Building an index, then a DataFrame100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/advanced-indexing?ex=5)
* [**Hierarchical indexing50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/advanced-indexing?ex=6)
* [**Extracting data with a MultiIndex100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/advanced-indexing?ex=7)
* [**Setting & sorting a MultiIndex100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/advanced-indexing?ex=8)
* [**Using .loc[] with nonunique indexes100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/advanced-indexing?ex=9)
* [**Indexing multiple levels of a MultiIndex100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/advanced-indexing?ex=10)

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#### 3Rearranging and reshaping data

100%

Here, you will learn how to reshape your DataFrames using techniques such as pivoting, melting, stacking, and unstacking. These are powerful techniques that allow you to tidy and rearrange your data into the format that allows you to most easily analyze it for insights.

* [**Pivoting DataFrames50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/rearranging-and-reshaping-data?ex=1)
* [**Pivoting and the index50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/rearranging-and-reshaping-data?ex=2)
* [**Pivoting a single variable100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/rearranging-and-reshaping-data?ex=3)
* [**Pivoting all variables100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/rearranging-and-reshaping-data?ex=4)
* [**Stacking & unstacking DataFrames50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/rearranging-and-reshaping-data?ex=5)
* [**Stacking & unstacking I100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/rearranging-and-reshaping-data?ex=6)
* [**Stacking & unstacking II100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/rearranging-and-reshaping-data?ex=7)
* [**Restoring the index order100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/rearranging-and-reshaping-data?ex=8)
* [**Melting DataFrames50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/rearranging-and-reshaping-data?ex=9)
* [**Adding names for readability100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/rearranging-and-reshaping-data?ex=10)
* [**Going from wide to long100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/rearranging-and-reshaping-data?ex=11)
* [**Obtaining key-value pairs with melt()100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/rearranging-and-reshaping-data?ex=12)
* [**Pivot tables50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/rearranging-and-reshaping-data?ex=13)
* [**Setting up a pivot table100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/rearranging-and-reshaping-data?ex=14)
* [**Using other aggregations in pivot tables100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/rearranging-and-reshaping-data?ex=15)
* [**Using margins in pivot tables100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/rearranging-and-reshaping-data?ex=16)

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#### 4Grouping data

100%

In this chapter, you'll learn how to identify and split DataFrames by groups or categories for further aggregation or analysis. You'll also learn how to transform and filter your data, including how to detect outliers and impute missing values. Knowing how to effectively group data in pandas can be a seriously powerful addition to your data science toolbox.

* [**Categoricals and groupby50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/grouping-data?ex=1)
* [**Advantages of categorical data types50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/grouping-data?ex=2)
* [**Grouping by multiple columns100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/grouping-data?ex=3)
* [**Grouping by another series100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/grouping-data?ex=4)
* [**Groupby and aggregation50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/grouping-data?ex=5)
* [**Computing multiple aggregates of multiple columns100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/grouping-data?ex=6)
* [**Aggregating on index levels/fields100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/grouping-data?ex=7)
* [**Grouping on a function of the index100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/grouping-data?ex=8)
* [**Groupby and transformation50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/grouping-data?ex=9)
* [**Detecting outliers with Z-Scores100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/grouping-data?ex=10)
* [**Filling missing data (imputation) by group100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/grouping-data?ex=11)
* [**Other transformations with .apply100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/grouping-data?ex=12)
* [**Groupby and filtering50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/grouping-data?ex=13)
* [**Grouping and filtering with .apply()100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/grouping-data?ex=14)
* [**Grouping and filtering with .filter()100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/grouping-data?ex=15)
* [**Filtering and grouping with .map()100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/grouping-data?ex=16)

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#### 5Bringing it all together

100%

Here, you will bring together everything you have learned in this course while working with data recorded from the Summer Olympic games that goes as far back as 1896! This is a rich dataset that will allow you to fully apply the data manipulation techniques you have learned. You will pivot, unstack, group, slice, and reshape your data as you explore this dataset and uncover some truly fascinating insights. Enjoy!

* [**Case Study - Summer Olympics50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/bringing-it-all-together?ex=1)
* [**Grouping and aggregating50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/bringing-it-all-together?ex=2)
* [**Using .value\_counts() for ranking100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/bringing-it-all-together?ex=3)
* [**Using .pivot\_table() to count medals by type100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/bringing-it-all-together?ex=4)
* [**Understanding the column labels50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/bringing-it-all-together?ex=5)
* [**Applying .drop\_duplicates()100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/bringing-it-all-together?ex=6)
* [**Finding possible errors with .groupby()100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/bringing-it-all-together?ex=7)
* [**Locating suspicious data100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/bringing-it-all-together?ex=8)
* [**Constructing alternative country rankings50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/bringing-it-all-together?ex=9)
* [**Using .nunique() to rank by distinct sports100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/bringing-it-all-together?ex=10)
* [**Counting USA vs. USSR Cold War Olympic Sports100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/bringing-it-all-together?ex=11)
* [**Counting USA vs. USSR Cold War Olympic Medals100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/bringing-it-all-together?ex=12)
* [**Reshaping DataFrames for visualization50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/bringing-it-all-together?ex=13)
* [**Visualizing USA Medal Counts by Edition: Line Plot100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/bringing-it-all-together?ex=14)
* [**Visualizing USA Medal Counts by Edition: Area Plot100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/bringing-it-all-together?ex=15)
* [**Visualizing USA Medal Counts by Edition: Area Plot with Ordered Medals100 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/bringing-it-all-together?ex=16)
* [**Congratulations!50 xp**](https://campus.datacamp.com/courses/manipulating-dataframes-with-pandas/bringing-it-all-together?ex=17)

# Merging DataFrames with pandas

As a Data Scientist, you'll often find that the data you need is not in a single file. It may be spread across a number of text files, spreadsheets, or databases. You want to be able to import the data of interest as a collection of DataFrames and figure out how to combine them to answer your central questions. This course is all about the act of combining, or merging, DataFrames, an essential part of any working Data Scientist's toolbox. You'll hone your pandas skills by learning how to organize, reshape, and aggregate multiple data sets to answer your specific questions.

##### Prerequisites:

1. [pandas Foundations](https://www.datacamp.com/courses/pandas-foundations)
2. [Manipulating DataFrames with pandas](https://www.datacamp.com/courses/manipulating-dataframes-with-pandas)

#### 1Preparing data FREE

100%

In this chapter, you'll learn about different techniques you can use to import multiple files into DataFrames. Having imported your data into individual DataFrames, you'll then learn how to share information between DataFrames using their Indexes. Understanding how Indexes work is essential information that you'll need for merging DataFrames later in the course.

* [**Reading multiple data files50 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/preparing-data?ex=1)
* [**Reading DataFrames from multiple files100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/preparing-data?ex=2)
* [**Reading DataFrames from multiple files in a loop100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/preparing-data?ex=3)
* [**Combining DataFrames from multiple data files100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/preparing-data?ex=4)
* [**Reindexing DataFrames50 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/preparing-data?ex=5)
* [**Sorting DataFrame with the Index & columns100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/preparing-data?ex=6)
* [**Reindexing DataFrame from a list100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/preparing-data?ex=7)
* [**Reindexing using another DataFrame Index100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/preparing-data?ex=8)
* [**Arithmetic with Series & DataFrames50 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/preparing-data?ex=9)
* [**Adding unaligned DataFrames50 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/preparing-data?ex=10)
* [**Broadcasting in arithmetic formulas100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/preparing-data?ex=11)
* [**Computing percentage growth of GDP100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/preparing-data?ex=12)
* [**Converting currency of stocks100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/preparing-data?ex=13)

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#### 2Concatenating data

100%

Having learned how to import multiple DataFrames and share information using Indexes, in this chapter you'll learn how to perform database-style operations to combine DataFrames. In particular, you'll learn about appending and concatenating DataFrames while working with a variety of real-world datasets.

* [**Appending & concatenating Series50 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/concatenating-data?ex=1)
* [**Appending Series with nonunique Indices50 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/concatenating-data?ex=2)
* [**Appending pandas Series100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/concatenating-data?ex=3)
* [**Concatenating pandas Series along row axis100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/concatenating-data?ex=4)
* [**Appending & concatenating DataFrames50 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/concatenating-data?ex=5)
* [**Appending DataFrames with ignore\_index100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/concatenating-data?ex=6)
* [**Concatenating pandas DataFrames along column axis100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/concatenating-data?ex=7)
* [**Reading multiple files to build a DataFrame100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/concatenating-data?ex=8)
* [**Concatenation, keys, & MultiIndexes50 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/concatenating-data?ex=9)
* [**Concatenating vertically to get MultiIndexed rows100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/concatenating-data?ex=10)
* [**Slicing MultiIndexed DataFrames100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/concatenating-data?ex=11)
* [**Concatenating horizontally to get MultiIndexed columns100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/concatenating-data?ex=12)
* [**Concatenating DataFrames from a dict100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/concatenating-data?ex=13)
* [**Outer & inner joins50 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/concatenating-data?ex=14)
* [**Concatenating DataFrames with inner join100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/concatenating-data?ex=15)
* [**Resampling & concatenating DataFrames with inner join100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/concatenating-data?ex=16)

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#### 3Merging data

100%

Here, you'll learn all about merging pandas DataFrames. You'll explore different techniques for merging, and learn about left joins, right joins, inner joins, and outer joins, as well as when to use which. You'll also learn about ordered merging, which is useful when you want to merge DataFrames whose columns have natural orderings, like date-time columns.

* [**Merging DataFrames50 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/merging-data?ex=1)
* [**Merging company DataFrames50 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/merging-data?ex=2)
* [**Merging on a specific column100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/merging-data?ex=3)
* [**Merging on columns with non-matching labels100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/merging-data?ex=4)
* [**Merging on multiple columns100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/merging-data?ex=5)
* [**Joining DataFrames50 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/merging-data?ex=6)
* [**Joining by Index50 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/merging-data?ex=7)
* [**Choosing a joining strategy50 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/merging-data?ex=8)
* [**Left & right merging on multiple columns100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/merging-data?ex=9)
* [**Merging DataFrames with outer join100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/merging-data?ex=10)
* [**Ordered merges50 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/merging-data?ex=11)
* [**Using merge\_ordered()100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/merging-data?ex=12)
* [**Using merge\_asof()100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/merging-data?ex=13)

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#### 4Case Study - Summer Olympics

100%

To cement your new skills, you'll apply them by working on an in-depth study involving Olympic medal data. The analysis involves integrating your multi-DataFrame skills from this course and also skills you've gained in previous pandas courses. This is a rich dataset that will allow you to fully leverage your pandas data manipulation skills. Enjoy!

* [**Medals in the Summer Olympics50 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/case-study-summer-olympics?ex=1)
* [**Loading Olympic edition DataFrame100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/case-study-summer-olympics?ex=2)
* [**Loading IOC codes DataFrame100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/case-study-summer-olympics?ex=3)
* [**Building medals DataFrame100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/case-study-summer-olympics?ex=4)
* [**Quantifying Performance50 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/case-study-summer-olympics?ex=5)
* [**Counting medals by country/edition in a pivot table100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/case-study-summer-olympics?ex=6)
* [**Computing fraction of medals per Olympic edition100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/case-study-summer-olympics?ex=7)
* [**Computing percentage change in fraction of medals won100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/case-study-summer-olympics?ex=8)
* [**Reshaping and plotting50 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/case-study-summer-olympics?ex=9)
* [**Building hosts DataFrame100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/case-study-summer-olympics?ex=10)
* [**Reshaping for analysis100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/case-study-summer-olympics?ex=11)
* [**Merging to compute influence100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/case-study-summer-olympics?ex=12)
* [**Plotting influence of host country100 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/case-study-summer-olympics?ex=13)
* [**Final thoughts50 xp**](https://campus.datacamp.com/courses/merging-dataframes-with-pandas/case-study-summer-olympics?ex=14)

# 11. Introduction to Databases in Python

In this Python SQL course, you'll learn the basics of using Structured Query Language (SQL) with Python. This will be useful since whether you like it or not, databases are ubiquitous and, as a data scientist, you'll need to interact with them constantly. The Python SQL toolkit SQLAlchemy provides an accessible and intuitive way to query, build & write to SQLite, MySQL and Postgresql databases (among many others), all of which you will encounter in the daily life of a data scientist.

#### 1Basics of Relational Databases FREE

100%

In this chapter, you will become acquainted with the fundamentals of Relational Databases and the Relational Model. You will learn how to connect to a database and then interact with it by writing basic SQL queries, both in raw SQL as well as with SQLAlchemy, which provides a Pythonic way of interacting with databases.

* [**Introduction to Databases50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/basics-of-relational-databases?ex=1)
* [**Relational Model50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/basics-of-relational-databases?ex=2)
* [**Connecting to your Database50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/basics-of-relational-databases?ex=3)
* [**Engines and Connection Strings100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/basics-of-relational-databases?ex=4)
* [**Autoloading Tables from a Database100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/basics-of-relational-databases?ex=5)
* [**Viewing Table Details100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/basics-of-relational-databases?ex=6)
* [**Introduction to SQL50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/basics-of-relational-databases?ex=7)
* [**Selecting data from a Table: raw SQL100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/basics-of-relational-databases?ex=8)
* [**Selecting data from a Table with SQLAlchemy100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/basics-of-relational-databases?ex=9)
* [**Handling a ResultSet100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/basics-of-relational-databases?ex=10)
* [**Congratulations!0 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/basics-of-relational-databases?ex=11)

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#### 2Applying Filtering, Ordering and Grouping to Queries

6%

In this chapter, you will build on the database knowledge you began acquiring in the previous chapter by writing more nuanced queries that allow you to filter, order, and count your data, all within the Pythonic framework provided by SQLAlchemy!

* [**Filtering and Targeting Data50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/applying-filtering-ordering-and-grouping-to-queries?ex=1)
* [**Connecting to a PostgreSQL Database50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/applying-filtering-ordering-and-grouping-to-queries?ex=2)
* [**Filter data selected from a Table - Simple100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/applying-filtering-ordering-and-grouping-to-queries?ex=3)
* [**Filter data selected from a Table - Expressions100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/applying-filtering-ordering-and-grouping-to-queries?ex=4)
* [**Filter data selected from a Table - Advanced100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/applying-filtering-ordering-and-grouping-to-queries?ex=5)
* [**Overview of Ordering50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/applying-filtering-ordering-and-grouping-to-queries?ex=6)
* [**Ordering by a Single Column100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/applying-filtering-ordering-and-grouping-to-queries?ex=7)
* [**Ordering in Descending Order by a Single Column100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/applying-filtering-ordering-and-grouping-to-queries?ex=8)
* [**Ordering by Multiple Columns100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/applying-filtering-ordering-and-grouping-to-queries?ex=9)
* [**Counting, Summing and Grouping Data50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/applying-filtering-ordering-and-grouping-to-queries?ex=10)
* [**Counting Distinct Data100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/applying-filtering-ordering-and-grouping-to-queries?ex=11)
* [**Count of Records by State100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/applying-filtering-ordering-and-grouping-to-queries?ex=12)
* [**Determining the Population Sum by State100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/applying-filtering-ordering-and-grouping-to-queries?ex=13)
* [**Let's use Pandas and Matplotlib to visualize our Data50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/applying-filtering-ordering-and-grouping-to-queries?ex=14)
* [**SQLAlchemy ResultsProxy and Pandas Dataframes100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/applying-filtering-ordering-and-grouping-to-queries?ex=15)
* [**From SQLAlchemy results to a Graph100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/applying-filtering-ordering-and-grouping-to-queries?ex=16)

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#### 3Advanced SQLAlchemy Queries

0%

Herein, you will learn to perform advanced - and incredibly useful - queries that will enable you to interact with your data in powerful ways.

* [**Calculating Values in a Query50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/advanced-sqlalchemy-queries?ex=1)
* [**Connecting to a MySQL Database100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/advanced-sqlalchemy-queries?ex=2)
* [**Calculating a Difference between Two Columns100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/advanced-sqlalchemy-queries?ex=3)
* [**Determining the Overall Percentage of Females100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/advanced-sqlalchemy-queries?ex=4)
* [**SQL Relationships50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/advanced-sqlalchemy-queries?ex=5)
* [**Automatic Joins with an Established Relationship100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/advanced-sqlalchemy-queries?ex=6)
* [**Joins100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/advanced-sqlalchemy-queries?ex=7)
* [**More Practice with Joins100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/advanced-sqlalchemy-queries?ex=8)
* [**Working with Hierarchical Tables50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/advanced-sqlalchemy-queries?ex=9)
* [**Using alias to handle same table joined queries100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/advanced-sqlalchemy-queries?ex=10)
* [**Leveraging Functions and Group\_bys with Hierarchical Data100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/advanced-sqlalchemy-queries?ex=11)
* [**Dealing with Large ResultSets50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/advanced-sqlalchemy-queries?ex=12)
* [**Working on Blocks of Records100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/advanced-sqlalchemy-queries?ex=13)

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#### 4Creating and Manipulating your own Databases

0%

In the previous chapters, you interacted with existing databases and queried them in various different ways. Now, you will learn how to build your own databases and keep them updated!

* [**Creating Databases and Tables50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/creating-and-manipulating-your-own-databases?ex=1)
* [**Creating Tables with SQLAlchemy100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/creating-and-manipulating-your-own-databases?ex=2)
* [**Constraints and Data Defaults100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/creating-and-manipulating-your-own-databases?ex=3)
* [**Inserting Data into a Table50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/creating-and-manipulating-your-own-databases?ex=4)
* [**Inserting a single row with an insert() statement100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/creating-and-manipulating-your-own-databases?ex=5)
* [**Inserting Multiple Records at Once100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/creating-and-manipulating-your-own-databases?ex=6)
* [**Loading a CSV into a Table100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/creating-and-manipulating-your-own-databases?ex=7)
* [**Updating Data in a Database50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/creating-and-manipulating-your-own-databases?ex=8)
* [**Updating individual records100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/creating-and-manipulating-your-own-databases?ex=9)
* [**Updating Multiple Records100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/creating-and-manipulating-your-own-databases?ex=10)
* [**Correlated Updates100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/creating-and-manipulating-your-own-databases?ex=11)
* [**Removing Data From a Database50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/creating-and-manipulating-your-own-databases?ex=12)
* [**Deleting all the records from a table100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/creating-and-manipulating-your-own-databases?ex=13)
* [**Deleting specific records100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/creating-and-manipulating-your-own-databases?ex=14)
* [**Deleting a Table Completely100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/creating-and-manipulating-your-own-databases?ex=15)

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#### 5Putting it all together

0%

Here, you will bring together all of the skills you acquired in the previous chapters to work on a real life project! From connecting to a database, to populating it, to reading and querying it, you will have a chance to apply all the key concepts you learned in this course. Enjoy!

* [**Census Case Study50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/putting-it-all-together?ex=1)
* [**Setup the Engine and MetaData100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/putting-it-all-together?ex=2)
* [**Create the Table to the Database100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/putting-it-all-together?ex=3)
* [**Populating the Database50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/putting-it-all-together?ex=4)
* [**Reading the Data from the CSV100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/putting-it-all-together?ex=5)
* [**Load Data from a list into the Table100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/putting-it-all-together?ex=6)
* [**Example Queries50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/putting-it-all-together?ex=7)
* [**Build a Query to Determine the Average Age by Population100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/putting-it-all-together?ex=8)
* [**Build a Query to Determine the Percentage of Population by Gender and State100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/putting-it-all-together?ex=9)
* [**Build a Query to Determine the Difference by State from the 2000 and 2008 Censuses100 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/putting-it-all-together?ex=10)
* [**Congratulations50 xp**](https://campus.datacamp.com/courses/introduction-to-relational-databases-in-python/putting-it-all-together?ex=11)

# 12. Introduction to Data Visualization with Python

This course extends Intermediate Python for Data Science to provide a stronger foundation in data visualization in Python. The course provides a broader coverage of the Matplotlib library and an overview of Seaborn (a package for statistical graphics). Topics covered include customizing graphics, plotting two-dimensional arrays (e.g., pseudocolor plots, contour plots, images, etc.), statistical graphics (e.g., visualizing distributions & regressions), and working with time series and image data.

##### Prerequisites:

* [Intro to Python for Data Science](https://www.datacamp.com/courses/intro-to-python-for-data-science)
* [Intermediate Python for Data Science](https://www.datacamp.com/courses/intermediate-python-for-data-science)

#### 1Customizing plots FREE

100%

Following a review of basic plotting with Matplotlib, this chapter delves into customizing plots using Matplotlib. This includes overlaying plots, making subplots, controlling axes, adding legends and annotations, and using different plot styles.

* [**Plotting multiple graphs50 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/customizing-plots?ex=1)
* [**Multiple plots on single axis100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/customizing-plots?ex=2)
* [**Using axes()100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/customizing-plots?ex=3)
* [**Using subplot() (1)100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/customizing-plots?ex=4)
* [**Using subplot() (2)100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/customizing-plots?ex=5)
* [**Customizing axes50 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/customizing-plots?ex=6)
* [**Using xlim(), ylim()100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/customizing-plots?ex=7)
* [**Using axis()100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/customizing-plots?ex=8)
* [**Legends, annotations, and styles50 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/customizing-plots?ex=9)
* [**Using legend()100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/customizing-plots?ex=10)
* [**Using annotate()100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/customizing-plots?ex=11)
* [**Modifying styles100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/customizing-plots?ex=12)

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#### 2Plotting 2D arrays

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This chapter showcases various techniques for visualizing two-dimensional arrays. This includes the use, presentation, and orientation of grids for representing two-variable functions followed by discussions of pseudocolor plots, contour plots, color maps, two-dimensional histograms, and images.

* [**Working with 2D arrays50 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/plotting-2d-arrays?ex=1)
* [**Generating meshes100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/plotting-2d-arrays?ex=2)
* [**Array orientation50 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/plotting-2d-arrays?ex=3)
* [**Visualizing bivariate functions50 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/plotting-2d-arrays?ex=4)
* [**Contour & filled contour plots100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/plotting-2d-arrays?ex=5)
* [**Modifying colormaps100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/plotting-2d-arrays?ex=6)
* [**Visualizing bivariate distributions50 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/plotting-2d-arrays?ex=7)
* [**Using hist2d()100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/plotting-2d-arrays?ex=8)
* [**Using hexbin()100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/plotting-2d-arrays?ex=9)
* [**Working with images50 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/plotting-2d-arrays?ex=10)
* [**Loading, examining images100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/plotting-2d-arrays?ex=11)
* [**Pseudocolor plot from image data100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/plotting-2d-arrays?ex=12)
* [**Extent and aspect100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/plotting-2d-arrays?ex=13)
* [**Rescaling pixel intensities100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/plotting-2d-arrays?ex=14)

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#### 3Statistical plots with Seaborn

100%

This is a high-level tour of the Seaborn plotting library for producing statistical graphics in Python. The tour covers Seaborn tools for computing and visualizing linear regressions as well as tools for visualizing univariate distributions (e.g., strip, swarm, and violin plots) and multivariate distributions (e.g., joint plots, pair plots, and heatmaps). This also includes a discussion of grouping categories in plots.

* [**Visualizing regressions50 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/statistical-plots-with-seaborn?ex=1)
* [**Simple linear regressions100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/statistical-plots-with-seaborn?ex=2)
* [**Plotting residuals of a regression100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/statistical-plots-with-seaborn?ex=3)
* [**Higher-order regressions100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/statistical-plots-with-seaborn?ex=4)
* [**Grouping linear regressions by hue100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/statistical-plots-with-seaborn?ex=5)
* [**Grouping linear regressions by row or column100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/statistical-plots-with-seaborn?ex=6)
* [**Visualizing univariate distributions50 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/statistical-plots-with-seaborn?ex=7)
* [**Constructing strip plots100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/statistical-plots-with-seaborn?ex=8)
* [**Constructing swarm plots100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/statistical-plots-with-seaborn?ex=9)
* [**Constructing violin plots100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/statistical-plots-with-seaborn?ex=10)
* [**Visualizing multivariate distributions50 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/statistical-plots-with-seaborn?ex=11)
* [**Plotting joint distributions (1)100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/statistical-plots-with-seaborn?ex=12)
* [**Plotting joint distributions (2)100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/statistical-plots-with-seaborn?ex=13)
* [**Plotting distributions pairwise (1)100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/statistical-plots-with-seaborn?ex=14)
* [**Plotting distributions pairwise (2)100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/statistical-plots-with-seaborn?ex=15)
* [**Visualizing correlations with a heatmap100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/statistical-plots-with-seaborn?ex=16)

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#### 4Analyzing time series and images

100%

This chapter ties together the skills gained so far through examining time series data and images. This involves customizing plots of stock data, generating histograms of image pixel intensities, and enhancing image contrast through histogram equalization.

* [**Visualizing time series50 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/analyzing-time-series-and-images?ex=1)
* [**Multiple time series on common axes100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/analyzing-time-series-and-images?ex=2)
* [**Multiple time series slices (1)100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/analyzing-time-series-and-images?ex=3)
* [**Multiple time series slices (2)100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/analyzing-time-series-and-images?ex=4)
* [**Plotting an inset view100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/analyzing-time-series-and-images?ex=5)
* [**Time series with moving windows50 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/analyzing-time-series-and-images?ex=6)
* [**Plotting moving averages100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/analyzing-time-series-and-images?ex=7)
* [**Plotting moving standard deviations100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/analyzing-time-series-and-images?ex=8)
* [**Interpreting moving statistics50 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/analyzing-time-series-and-images?ex=9)
* [**Histogram equalization in images50 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/analyzing-time-series-and-images?ex=10)
* [**Extracting a histogram from a grayscale image100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/analyzing-time-series-and-images?ex=11)
* [**Cumulative Distribution Function from an image histogram100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/analyzing-time-series-and-images?ex=12)
* [**Equalizing an image histogram100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/analyzing-time-series-and-images?ex=13)
* [**Extracting histograms from a color image100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/analyzing-time-series-and-images?ex=14)
* [**Extracting bivariate histograms from a color image100 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/analyzing-time-series-and-images?ex=15)
* [**Congratulations!!50 xp**](https://campus.datacamp.com/courses/introduction-to-data-visualization-with-python/analyzing-time-series-and-images?ex=16)