

Introduction to Python programming

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Course material available on:

`https://github.com/leops95/intro_to_python`

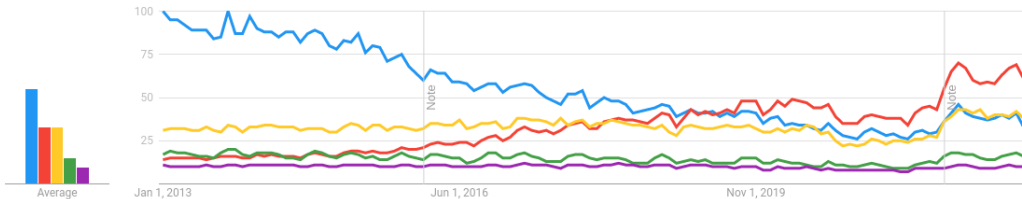
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What's Python?

- General-purpose programming language
- Free and open source
- Elegant and user-friendly syntax
- Many useful libraries (Pandas, NumPy, Matplotlib, OpenCV, NLTK, statsmodels, Scikit-learn, PyTorch...)

● **Java** Programming language ● **Python** Programming language ● **JavaScript** Programming language ● **C++** High-level programmin... ● **R** Programming language

Worldwide ▾ 1/1/13 - 1/2/23 ▾ All categories ▾ Web Search ▾

Interest over time 

Learning curve

- The learning curve is hard at first
- It gets easier with experience:
 - knowing the syntax and the tools
 - your past projects can still help you when you're stuck
- No one knows everything by heart
- My goal is to show you the basics and help you to **become independent**

Objectives

1. **Set-up:** Install and use Python
2. **Python essentials:** The syntax, data types and basic operators
3. **Scientific computing:** Load datasets and work with them, plot data
4. **Asking for help:** Becoming independent online

Before we start

- This course is for **you**, I'm adapting to your needs
- Tell us a bit about yourself !
 - Have you ever used Python ?
 - Why would you like to learn Python ?
 - Do you have any other programming experience ?

Sections

1 Set-up

Installation

Setting up your environment

2 Python essentials

Basics

Variables and data types

Operators and conditions

Loops

Functions

Exercises

Set-up

Installation

- To install the "core Python package" you can go to
`https://www.python.org/`
 - As we want to use Python for scientific programming, you only have to install "Anaconda": `https://www.anaconda.com/`
- Anaconda is a free distribution for Python which provides the core Python package and the most popular scientific libraries
- We write and compile code ("scripts") in files with the following extension:
`filename.py`

Setting up your environment

Definition

The **IDE (Integrated Development Environment)** is the software we're using to run python scripts

Different IDEs for different needs:

- Very light: problem sets, step-by-step tutorials (ex: Jupyter Notebook, Google Colab...)
- Intermediate: built-in data viewer (ex: Spyder)
- Heavy but efficient: for big projects and software engineering (ex: VS Code...)

Setting up your environment

- We will use the Spyder IDE which comes with Anaconda
- Load it either from the Anaconda navigator or using the terminal
- Spyder is split into different "panes" which are sections providing us with information or access to certain features. The most important are:
 - The editor
 - The console
 - The variable explorer and plots
- You can add, move or remove panes (see "View" → "Panes")

Basics

- Using hashtags (`#`), we take notes ("comments") directly into the code
- Enclosing lines within quotation marks (`"""`) makes multi-line comments
- To display something on the console, we use the `print()` function
- I use the symbol `>` at the start of a line to show the result on the console

```
# the command below is likely going to be the
# first thing you try in any programming language
print("Hello world!")

> "Hello world!"
```

Note: Most IDEs have a color scheme to distinguish different elements of code

Variables

- **Variables** store data in our programs
- Using the assignment operator "=", we give them names and values
- Variables can take different data types: numbers, text, they could be binary, complex, numbers, contain a tuple, a list, even a dictionary !
- the variable explorer shows you the type of all variables you have created

```
# assign values to variables
number_1 = 15
my_name = "Leo"
num_list = [2, 5]
```

Multiple assignment

You can assign multiple values to different variables in one line

```
# assign values to variables
```

```
number_1 = 15
```

```
my_name = "Leo"
```

```
num_list = [2, 5]
```

```
# delete them
```

```
del number_1, my_name, num_list
```

```
# assign them again all at once
```

```
number_1, my_name, num_list = 15, "Leo", [2,5]
```

Numbers

- There are two different types of data representing numbers
 - **Integers** (**int**): whole numbers (0, 1, 2, 5001, -9999)
 - **Floats** (**float**): numbers with decimals (1.1, 2.64, 6.666666...)
- Python may dynamically change variable types if values are affected

```
number_1, number_2 = 1.99, 15
```

```
type(number_2)
```

```
> <class 'int'>
```

```
number_2 = number_1 + number_2
```

```
type(number_2)
```

```
> <class 'float'>
```

Strings

- A **string** (**str**) is a series of characters
- In Python anything inside single or double quotes are strings:
"My name is..." or 'Python is fun!'
- We can also use quotes and apostrophes within our strings:
'He said, "I love my dog."'
- Using **F-strings**, we can enter any variable value within a string:

```
name, birth = "Léo", 1995  
sent = f"Hi ! My name is {name} and I'm {2023-birth} years old."
```

```
print(sent)
```

```
> "Hi ! My name is Léo and I'm 28 years old."
```

Booleans

- A **boolean** (**bool**) is a data type that has two possible values (**True** or **False**)
- They are often used to keep track of conditions
- But usually we get them from doing logical comparisons (ex: $2 == 3 \rightarrow \text{False}$)

```
boolname = False  
print(boolname)
```

```
> False
```

```
boolname = (5**2 == 25)  
print(boolname)
```

```
> True
```

Lists

- A **list** (**list**) is a sequence of **elements** (or items) in a particular order
- You can modify an element of a list by accessing it

```
listname = [1,4,5,8]
```

```
print(listname[2])
```

```
> 5
```

```
listname[2] = 7
```

```
print(listname)
```

```
> [1,4,7,8]
```

Lists

- Lists are mutable, which means we can change the order (**index**) of elements
- The following table shows the most important list methods

Method	Description
<code>listname.append(i)</code>	Add an item <code>i</code> at the end of the list
<code>listname.insert(x,i)</code>	Insert an item <code>i</code> at the position <code>x</code>
<code>listname.pop(x)</code>	Remove item at position <code>x</code> and return it
<code>listname.copy(x)</code>	Return a copy of the list
<code>listname.sort()</code>	Sort all the items in the list (increasing by default)

Important

The index position in Python starts at 0, not 1

(sorry Matlab users!)

Lists

Example	Outcome
<code>a = [1,2]; a.append(3)</code>	<code>> a = [1,2,3]</code>
<code>a = [1,2]; a.insert(1,3)</code>	<code>> a = [1,3,2]</code>
<code>a = [1,2,3]; popped = a.pop(1)</code>	<code>> a = [1,3]; popped = 2</code>
<code>a = [1,2]; b = a.copy()</code>	<code>> a = [1,2]; b = [1,2]</code>
<code>a = [4,1,5,3]; b = a.copy(); a.sort(); b.sort(reverse = True)</code>	<code>> a = [1, 3, 4, 5]; b = [5, 4, 3, 1]</code>

Slicing lists

To select some elements in a list, we **slice** it using: `listname[a:b]` (**b is excluded**)

```
colors = ["red", "green", "blue", "yellow"]
```

```
print(colors[1:3]) # elements 1 and 2
```

```
> ['green', 'blue']
```

```
print(colors[1:]) # last three elements
```

```
> ['green', 'blue', 'yellow']
```

```
print(colors[-1:]) # last element
```

```
> ['yellow']
```

Dictionaries

- **Dictionaries** (`dict`) are used to store data in pairs (key + value)
- They do not allow duplicates, elements can be retrieved by their key
- Assigning values to a new key creates a new element

```
dictname = {"BS": "Basel Stadt", "GE": "Geneva", "TI": "Ticino"}  
print(dictname["BS"])
```

```
> "Basel Stadt"
```

```
dictname["ZH"] = "Zurich"  
print(dictname)
```

```
> {'BS': 'Basel Stadt', 'GE': 'Geneva', 'TI': 'Ticino', 'ZH': 'Zurich'}
```

Dictionaries

- Dictionaries (and lists), can be **nested**

→ they can contain another dictionary, or data type

```
dictname = {"owners": ("Antonia", "Elda"),  
            "pets": {"dogs": ("Charlie", "Razmotte", "Nemo"),  
                     "cats": ("Zazie", "Peps", "Zélie")}}
```

```
print(dictname["pets"]["dogs"])
```

```
> ('Charlie', 'Razmotte', 'Nemo')
```

Arithmetic Operators

	Operator	Example
Addition	+	$10 + 5 = 15$
Subtraction	-	$30 - 20 = 10$
Multiplication	*	$2 * 5 = 10$
Division	/	$6 / 2 = 3.0$
Modulus	%	$10 \% 4 = 2$
Exponent	**	$2 ** 3 = 8$
Floor Division	//	$9 // 4 = 2$

Note: ^ is the bitwise operator "xor" (exclusive or)!

Comparison Operators

Operator	Description	Example
<code>==</code>	equal	<code>4 == 3</code> → False
<code>!=</code>	not equal	<code>4 != 3</code> → True
<code>></code>	greater than	<code>6 > 10</code> → False
<code><</code>	less than	<code>2 < 5</code> → True
<code>>=</code>	greater or equal	<code>8 >= 3</code> → False
<code><=</code>	less than or equal	<code>5 <= 5</code> → True

Boolean Operations

Suppose $x = \text{True}$ and $y = \text{False}$

Operation	Result
$x \text{ or } y \rightarrow \text{True}$	if x is false, then y , else x
$x \text{ and } y \rightarrow \text{False}$	if x is false, then x , else y
$\text{not } x \rightarrow \text{False}$	if x is false, then True , else False

Conditions

If statements (**if**) can execute a piece of code only if a **condition** is satisfied (**True**)

```
x, y = 5, 10
```

```
if y < x:
    print("y smaller than x")
else:
    print("y greater than x")

> "y greater than x"
```

- the **else** block runs only if the condition is not satisfied (**False**)
- For more than two conditions, you can insert **elif** ("else if") before **else**
- Be careful of the indentation !

For loops

- Often, we want to perform the same task repeatedly or with each item in a list
- **For statements** (**for**) iterate over items, in the index order
- Iterating does not make a copy of the sequence

```
numbers = [4,34,2]
```

```
for number in numbers:  
    print(number + 1)
```

```
> 5  
> 35  
> 3
```

List comprehension

To iterate over all elements of a list, using brackets as **list comprehension** are more efficient

```
listname = [1, 2, 3, 4, 5, 6]
```

```
listname = [x*x for x in listname]  
print(listname)
```

```
> [1, 4, 9, 16, 25, 36]
```

```
# we can even add conditions
```

```
listname = [x for x in listname if x%2 == 0]  
print(listname)
```

```
> [4, 16, 36]
```

How many loops ?

- The `range()` function generates arithmetic progressions
- It is commonly used to loop a specific number of time in `for` loops
- You need to name the current item (below `i`), in case you want to use it inside the loop

```
for i in range(1, 4):  
    print("Loop number", i)
```

```
> Loop number 1  
> Loop number 2  
> Loop number 3
```

How many loops ?

The `len()` function gives you the length of a list

```
floats = [1.2, 2.343, 0.44]
```

```
for i in range(len(floats)):
    print(i, floats[i])
```

```
> 0 1.2
```

```
> 1 2.343
```

```
> 2 0.44
```

```
# another example with list comprehension
```

```
list_loop = [2*i for i in range(5)]
```

```
list_loop
```

```
> [0, 2, 4, 6, 8]
```

While loops

- **While statements** (**while**) execute a task repeatedly *while* a condition is true.
- You can also stop the loop using **break**

```
i = 1
while i < 10:
    print(i)
    if i == 4:
        break
    i += 1 # equivalent to i = i + 1
```

```
> 1
> 2
> 3
> 4
```

Functions

Definition

A function is a block of code that is written to do a specific task, upon calling its name

- It saves time as we don't have to repeat the same code
- By using the keyword **def** we tell python that we are **defining** a function
- It is followed by the function name and a list of parameters in parentheses
- After the function is defined, we **call** it with the required parameters

Functions

An example using the Fibonacci series:

```
def fib(n):  
    """  
    Print a Fibonacci series up to n  
    """  
    a, b = 0, 1  
    while a < n:  
        print(a, end = ' ')  
        a, b = b, a + b
```

```
fib(10)
```

```
> 0 1 1 2 3 5 8
```

Functions

Functions can **return** an output, which will be stored in a variable (if assigned)

```
def squared(array):  
    """ find the square of each element in a vector """  
    output = []  
    for elem in array:  
        elem_squared = elem**2  
        output.append(elem_squared)  
    return output
```

```
n = [2, 5, 10]  
n_squared = squared(n)
```

```
print(n_squared)
```

```
> [4, 25, 100]
```

Now it's your turn !

Some exercises to practice:

- 1) Create two variables, then swap their values
- 2) Create a list containing the numbers 0 to 9, then invert it (9 to 0)
- 3) Write a function that returns the square of all odds or even numbers between 0 and 20

The file `solutions.py` contains the answers

Scientific computing

Paths

Definition

Your computer stores files in directories, which can be accessed using **paths**. It comes in different formats depending on your operating system (Windows, MacOS, Linux distributions)

Let's take the Desktop:

- For Windows: `C:\Users\picard0001\Desktop`
- For MacOS: `/Users/picard0001/Desktop`
- For Linux Ubuntu: `/home/picard0001/Desktop`

Simply replace "picard0001" by your own session user name

Note: `~\Desktop` is also valid

Paths

- The Python console is always looking at one directory
- You can show which one using the command `pwd` ("print working directory")
- Paths can be absolute and relative.
 - Absolute paths refer to the whole path to your data (from the beginning)
 - Relative paths refer to the path *relative* to the current directory
- Changing the directory is easy: either enter a new (absolute) path or go up/down the path tree with the (relative) path

Packages

Definition

Packages are a collection of modules (Python files) that we **import** into our code. They contain functions that serve a purpose, and are ready to be used.

- First, search a package name on the internet, find the command to install it
 - `https://pypi.org/`
 - `https://anaconda.org/conda-forge/`
- Then, paste the command on the terminal with a package manager:
 - **Pip**: the default one (`pip install pandas`)
 - **Conda**: the Anaconda version (`conda install -c conda-forge pandas`)

Packages

Installing new packages can be tedious, because:

- you need to use the terminal (with Bash commands) to install them
- they come in different versions
- they need to be stored in a specific location (the "\$PATH") where Python will look for them
- they can enter in conflict with other packages

No need to worry about the \$PATH with Anaconda. Otherwise, here are nice tutorials on using **Bash commands** and managing the **\$PATH**

Packages

Finally, we import a package into our code using an **import** statement

```
import numpy
```

```
# draw two random values (normally distributed)
```

```
print(numpy.random.randn(2))
```

```
> array([-1.0856306 ,  0.99734545])
```

- Subpackages only contain some functions
- We call them by using a point after the packge name (e.g. "numpy.random")
- Calling **import** numpy.random instead of **import** numpy saves a lot of memory !

Packages

- The keyword **as** names the package differently
- The keyword **from** calls only specific subpackages or functions

```
import numpy as np
from numpy import cos, pi
```

```
print(np.sin(np.pi)) # "np" is way shorter than "numpy"
```

```
> 1.2246467991473532e-16
```

```
print(cos(pi)) # with "from" we can even omit "np." !
```

```
> -1.0
```

Some examples

- **NumPy**: Basic package for scientific computing. Very fast with mathematical and matrix operations. You can create "ndarrays" which are flexible, efficient and also faster than lists.
- **SciPy**: More advanced than Numpy (e.g. find the determinant or the inverse of a matrix, solve linear equations).
- **Matplotlib**: Plotting data, with complete control over the outline of graphs.
- **Pandas**: Loading datasets and data manipulation.
- **Scikit-learn**: Classification, clustering, basic machine learning

Some examples

- **Requests + BeautifulSoup**: Scraping data from websites
- **NLTK, Regex, Fuzzywuzzy**: Text and natural language processing (NLP)
- **OpenCV**: Images and computer vision (CV)
- **Statsmodels**: Statistical analysis and regressions
- **Tensorflow, Keras, PyTorch**: Advanced machine learning

Loading a dataset

- We will use the **Pandas package** to load datasets
 - You can load many software-specific types of files
 - Import pandas and find the appropriate command to your dataset:
 - `pd.import_csv()` for comma-separated values (.csv)
 - `pd.import_excel()` for Excel datasets (.xlsx)
 - `pd.import_stata()` for Stata datasets (.dta)
 - `pd.import_r()` for R files (.R)
- Simply enter the path to your file inside the parentheses

Loading a dataset

- Pandas comes with a special data type to handle datasets: **DataFrames**
- They are very popular for handling and managing tabular data
- Versatile, it can do most of the data cleaning:
 - rename variables, replace or filter values
 - append, merge, collapse rows and columns
- Fast and efficient, up to a few gigabytes (depending on your computer)

Loading a dataset

A short example, using my own research on metaphors:

```
import os # to navigate between paths
import pandas as pd
```

```
os.chdir("/home/picard0001/Desktop/python_example")
```

```
df = pd.read_csv("data_raw/Alabama_2022.csv")
```

- Here, we use `os.chdir()` to set the working directory
- We capture paths in string format, do not forget " or ' around them

Summary statistics

Before going any further:

- A DataFrame contains **rows** (observations) and **columns** (variables)
- The **dimensions** of the DataFrame can be seen in the data viewer
- Each column has its own data type, use `df.dtypes` in the console to see them all at once
- Columns are usually objects (**object**), which is a special data type

Mea Culpa

While I speak, I tend to use both Python and Stata notations (in parentheses)

Summary statistics

→ Let's have a look at the DataFrame we have opened...

- We access columns using brackets: `df["filename"]`
- We access rows using their index: `df.iloc[1]`
- Subsetting rows in a dataset works just like lists: `df[1:3]`

Summary statistics

Basic summary statistics functions:

Function	Description
<code>df.dtypes</code>	Show all data types
<code>df["metaphor_score"].mean()</code>	Display the mean of the variable
<code>df["metaphor_score"].std()</code>	Display the standard error
<code>df["metaphor_score"].max()</code>	Display the maximum value (and so on)
<code>df["metaphor_score"].describe()</code>	Display N, mean, std, p10, median...
<code>df["arg1"].value_counts()</code>	Tabulate all values and frequencies
<code>df["speaker"].unique()</code>	Look for duplicates

Note: Here are nice websites for translating Stata and R commands to Python:

- https://www.danielsullivan.com/pages/tutorial_stata_to_python.html
- <https://www.mit.edu/~amidi/teaching/data-science-tools/conversion-guide/r-python-data-manipulation/>

Data manipulation

We would like to select metaphors in our sample:

```
# Drop the filename column
```

```
df = df.drop(columns = ["filename"])
```

```
# Rename the state column
```

```
df = df.rename(columns = {"st_name": "state"})
```

```
# Filter out bad metaphor scores
```

```
df = df[df["metaphor_score"] >= 0.7]
```

```
# Create a new metaphor column
```

```
df["metaphor"] = df["arg0"] + " " + df["arg1"]
```

Apply

If you want to *apply* a rule-based manipulation on all rows, use the **apply** function

```
# Recode the gender variable from int to str
```

```
def recode_party(gender):  
    gender_str = ""  
    if gender == 1:  
        gender_str = "Woman"  
    else:  
        gender_str = "Man"  
    return gender_str
```

```
df["gender_str"] = df.apply(lambda x: recode_party(x["gender"]),  
                             axis = 1)
```

Append

A short example of appending datasets:

```
import os
import glob # to store many file names
import pandas as pd

os.chdir("/home/picard0001/Desktop/python_example")

files = glob.glob("data_raw/*.csv") # star = "any"

df = pd.DataFrame() # creates an empty dataframe

for file in files:
    data = pd.read_csv(file)
    df = df.append(data)
```

Merge

We want to merge information on the political party of each speaker

```
df_party = pd.read_csv("political_party.csv")

df_merged = df.merge(df_party, on = "st_name", indicator = True,
                      how = "outer") # or "left", "right", "inner"

# print the output of the merge
print(df_merged['_merge'].value_counts())

> both          13186
> right_only      1
> left_only       0
> Name: _merge, dtype: int64
```

Merge

- Here, we are in a situation where one speaker belongs to one party
- But we have multiple rows for each speaker !
- We can enforce the type of merge using the "validate" parameter:
 - `1:1` = one-to-one
 - `m:1` = many-to-one / `1:m` = one-to-many
 - `m:m` = many-to-many

```
df_merged = df.merge(df_party, on = "st_name", indicator = True,  
                     validate = "m:1") # or "many_to_one"
```

Note: Default value of "how" parameter is "inner", so we can omit it here

Collapse

Now, which political party employs the most metaphors ?

We can answer this question by summing metaphors by party

```
df_merged = df_merged[df_merged["metaphor_score"] >= 0.7]
```

```
df_merged["nb_metaphors"] = 1
```

```
df_collapsed = df_merged.groupby("party",  
                                  as_index = False)  
                                ["nb_metaphors"].sum()
```

```
print(df_collapsed)
```

```
>          party  nb_metaphors  
> 0    Democrat           220  
> 1  Republican           305
```

Reshape

Now, suppose we want one column by party, then we need to reshape our dataset from long to wide

```
df_collapsed["statistic"] = "metaphor frequency"

df_wide = df_collapsed.pivot(index = "statistic",
                              columns = "party",
                              values = "nb_metaphors")

print(df_wide)
```

```
> party                Democrat    Republican
> statistic
> metaphor frequency           220           305
```

Note: stack and unstack are elegant substitutes

Plotting data

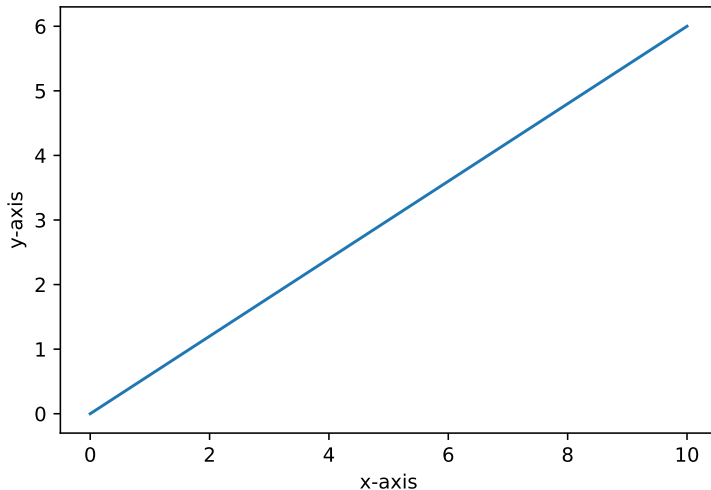
The easiest way to plot data is by using the `plot()` function from Matplotlib

```
import matplotlib.pyplot as plt
import numpy as np

x_vals = np.linspace(0,10,10)
y_vals = np.linspace(0,6,10)

plt.plot(x_vals, y_vals)
plt.ylabel("y-axis")
plt.xlabel("x-axis")
plt.savefig("plot_example.png") # save as png
plt.savefig("plot_example.pdf") # save as pdf
plt.show()
```

Plotting data



Plotting data

Useful Pyplot functions:

Function	Description
<code>plt.plot()</code>	Plot y versus x as lines and/or markers
<code>plt.ylabel()</code>	Set the label for the y-axis
<code>plt.xlabel()</code>	Set the label for the x-axis
<code>plt.axis()</code>	Method to get or set some axis properties
<code>plt.title()</code>	Set a title for the axes
<code>plt.scatter()</code>	A scatter plot of y vs x
<code>plt.bar()</code>	Make a bar plot
<code>plt.figure()</code>	Create a new figure
<code>plt.suptitle()</code>	Add a centered title to the figure
<code>plt.subplot()</code>	Add a subplot to the current figure
<code>plt.show()</code>	Display the figure

Plotting data

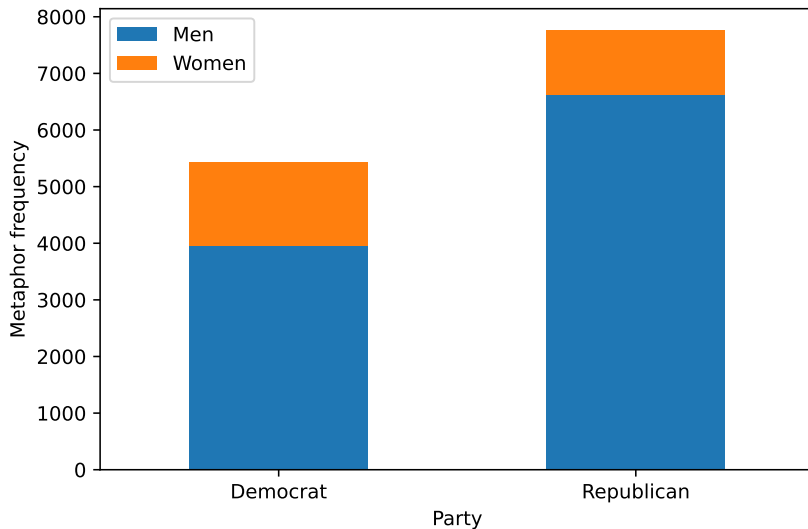
Histograms, pie charts, violin plots... everything is possible !

```
df_bar = df_merged.groupby(["party", "gender"],
                             as_index = False)
                             ["nb_metaphors"].sum()

df_bar = df_bar.pivot(index = "party",
                       columns = "gender",
                       values = "nb_metaphors")

ax = df_bar.plot.bar(stacked = True, rot = 0)
ax.set_ylabel("Metaphor frequency"); ax.set_xlabel("Party")
ax.legend(["Men", "Women"])
plt.tight_layout(); plt.savefig("plot_example2.pdf")
plt.show()
```

Plotting data

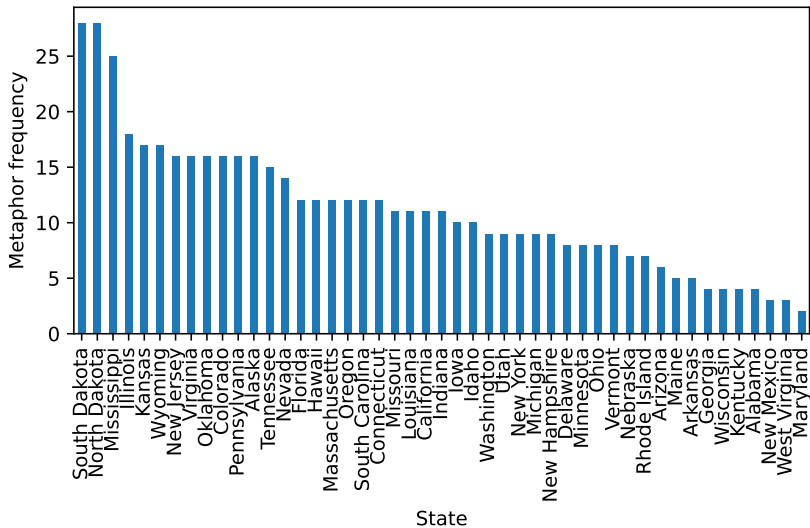


Now it's your turn !

Find out which U.S. state uses the most metaphors:

1. Append all datasets from the folder `data_raw`
2. Clean the columns of interest
3. Collapse the dataset to get the number of metaphors by state
4. Plot metaphor frequencies by state in a nice histogram

Example



Asking for help

Where you can find help

The documentation: Every package comes with a document for each function, containing information on:

- What the function does
- A list of arguments, and what they are
- Some examples on how to use them

Specialized websites: A great source of questions and answers (Stack Overflow mainly...)

Where you can find help

Search engines: Google, Yahoo, Yandex... Another way to find answers (tutorials, videos, short courses)

- Lot of content, but very few is applicable to your own *special* question
- Answers usually outdated, or simply not be the best anymore
- ChatGPT ? Yes but careful of copy-pasting, mistakes happen !

Friends and university staff: sharing your questions with someone also helps:

- Short questions can be answered very fast
- They may learn from your questions as well
- ...but their time is limited !

Where you can find help

Whenever possible, you should try to follow this rule of thumb:

- First, read the documentation
- Second, browse websites such as Stack Overflow
- Only then, use a search engine
- Lastly, ask friends, then university staff

What are you looking for ?

- *"I don't know how to code something"*
 - Structure your question with a few keywords
 - Look for answers online
 - If none apply to your question, ask your friends or on e.g. Stack Overflow
- *"I tried something but my code doesn't give me the expected result"*
 - Be careful of copy and pasting things online, review your code
 - If you are using a function/package, refer to the documentation of that package
 - If not, troubleshoot your code: follow what it does line by line and verify that is gives you what you want using a simple model (e.g. fake data)

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What are you looking for ?

- *"My code doesn't run"*

- The console is your ally, search for the line number at which the code breaks
- Read the error message and try to understand what it means
- If the message isn't clear, copy and paste it on a search engine
- Pay attention to the data types, sometimes they are incompatible
- If you are using a function/package, refer to the documentation of that package
- If the problem lies inside a loop, try to solve it outside of the loop

→ General rule: try to break down the problem; identify the source and make it run alone, then add it back to your code.

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Stack Overflow: How it works

- This website prioritizes quality over quantity of questions (or "posts")
- Do not ask a question before checking if it has already been answered before
- Only after, ask your question in the clearest and shortest way
 - Focus on what you don't know, skip all the details that you know how to do
 - Explain what you have tried before
 - Add a reproducible example (some code with fake data)
 - End your post by writing what the outcome should look like

→ Link to all the rules: <https://stackoverflow.com/help/how-to-ask>

Stack Overflow: Some examples

Badly written questions:

- <https://stackoverflow.com/questions/75507977/in-web-scarpping-from-python-i-am-getting-only-9-outputs-but->
- <https://stackoverflow.com/questions/75506603/pandas-combine-two-if-one-is-empty>

Nicely written questions:

- <https://stackoverflow.com/questions/75502195/validate-string-format-based-on-format>
- <https://stackoverflow.com/questions/75505923/how-to-skip-2-data-index-array-on-numpy>

Stack Overflow: Careful !

- Usually not the fastest way to answer your question: you could get a response in minutes, but most of the time it takes a few days (if anyone dares to help!)
- People won't try to be nice to you (no need to say "hi" and "thanks" as well)
- People might misunderstand your question, or tell you why you shouldn't do it this way
- People might give you a solution that works for the example you've laid out to them, but not on your real dataset (different data, issues of scale...)

Wrapping-up

Wrapping-up

With this course, you should now be able to:

- Install Python, set-up your first environment
- Understand most data types and work with them
- Load packages and datasets, perform basic data manipulation
- Efficiently look for help in the future...

Questions, remarks ?

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