Introduction to Python programming

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Course material available on:
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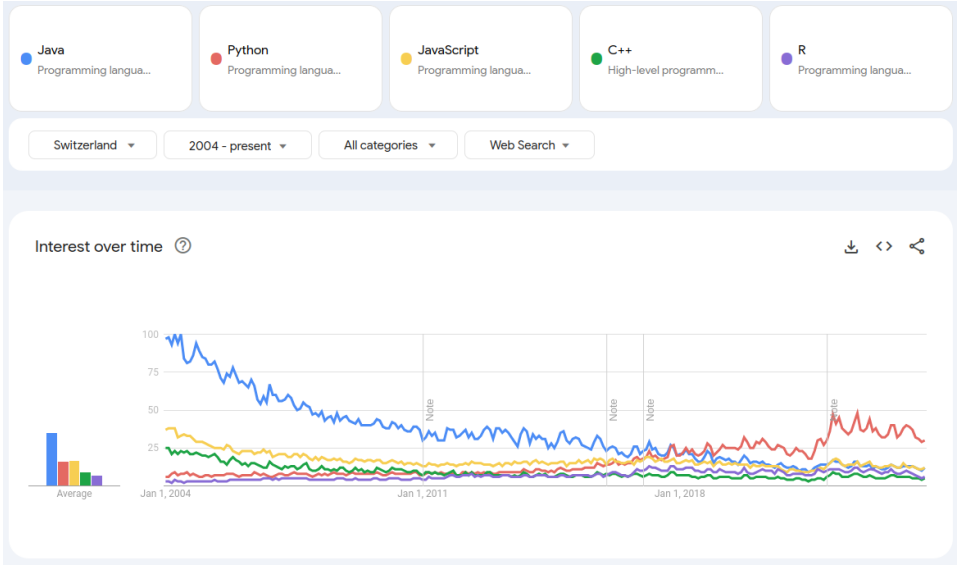
What's Python?

- 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...)

One of the most popular programming languages



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

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" $\rightarrow$ "Panes")

Python essentials

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 do 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
- Anything inside single or double quotes are strings
  For example: `"My name is..."` or `'Python is fun!'`
- We can also nest single and double quotes
  For example: `'He said, "I love my dog."'`
- Using **F-strings**, we can **forward** (enter) any variable value within a string

```
name, birth = "Léo", 1995
sent = f"Hi! My name is {name} and I'm {2025-birth} years old."

print(sent)

> "Hi! My name is Léo and I'm 30 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` → `False`)

```
boolname = False
print(boolname)

> False

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

> True
```

Lists

- A **list** (`list`) is a sequence of **elements** (items) in a particular order
- You can modify any element by accessing its **index** (position in the list)

Important

The index numbering in Python starts at 0, not 1 (sorry Matlab users!)

```
listname = [1,4,5,8]; print(listname[2])

> 5

listname[2] = 7; print(listname)

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

Lists

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

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

List operations

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

Slicing lists

We can select only some elements within a list with a **slice**
For example: `listname[a:b]`

Important

Element a is always included, but **b is always excluded**

```
colors = ["red", "green", "blue", "yellow"], print(colors[1:3])

> ['green', 'blue']

print(colors[1:], colors[-1:]) # last 3 elements, last element

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

Dictionaries

- **Dictionaries** (`dict`) are used to store data in pairs (key + value)
- Values can be retrieved by their key (unique)
- Assigning values to a new key creates a new element

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

> "Basel Stadt"

dictname["ZG"] = "Zug"
print(dictname)

> {'BS': 'Basel Stadt', 'GE': 'Geneva', 'TI': 'Ticino', 'ZG': 'Zug'}
```

Dictionaries

- Dictionaries (and lists) can be nested
- Nests can contain another 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	Description	Example	Result
`+`	Addition	`10 + 5`	`15`
`-`	Substraction	`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`

Comparison Operators

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

Logical Operations

Let's assume two Boolean variables, `x = True` and `y = False`

Operation	Description	Example	Result
`or`	Returns `True` if at least one Boolean is true	`x or y`	`True`
`and`	Returns `True` if both Booleans are true	`x and y`	`False`
`not`	Returns the opposite of the Boolean	`not x`	`False`

Conditions

If statements (`if`) 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 an `elif` ("else if") before `else`
- Be careful of indentation!

For loops

- Often, we want to perform the same task repeatedly
- **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 is 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(a, b)` function generates arithmetic progressions
- As with lists, the last element (`b`) is excluded
- It is commonly used to loop a specific number of time in `for` loops
- You need to name the current item (below, `i`), if you want to use its value 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)]
print(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** saves a specific task, to be executed upon calling its name

- It saves us time as we don't have to write the same code again
- We first need to **define** (`def`) a function, by giving it:
  - A name
  - A set of parameters in parentheses
  - A description (optional, but recommended)
  - A set of instructions
- 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 (**return**) an output, and store the result (if assigned to)

```
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]
```

Lambda expressions

Functions can be time-wise inefficient for simple operations

Instead, we can use **lambda expressions**: `(lambda x: operation)(value)`

```
def simple_operation(x):
    x_new = x**2-1
    return x_new

n_new = simple_operation(10); print(n_new)

> 99

# Same with lambda expression
(lambda x: x**2-1)(10)

> 99
```

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** (folders), which can be accessed using **paths**. The latter comes in different formats depending on your operating system.

Let's take the Desktop:

Windows	`C:\Users\`**`username`**`\Desktop`
MacOS	`/Users/`**`username`**`/Desktop`
Linux (Ubuntu)	`/home/`**`username`**`/Desktop`

Simply replace "username" by your own session user name

Note: `~\Desktop` is also valid

Paths

- The Python console is always looking at one directory
- Not sure which one is it? Just type `pwd` ("print working directory") in the console
- Paths can be **absolute** or **relative**
  - Absolute paths refer to the entire path to your destination
  - Relative paths refer to paths *relative* to the current directory
- Changing directory is easy: either enter a new (absolute) path or go up/down the path tree (relative to the working directory)

Note: ".." refers to the parent directory (i.e., for going down the tree)

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, which can conflict with each other
- They need to be stored in a folder listed in the "$PATH" variable where Python will look for them

→ Anaconda manages all of this for you.

Otherwise, here are nice tutorials on using Bash commands **[LINK]** and managing the $PATH variable **[LINK]**

Packages

Finally, we import a package into our code using the keyword **import**

```
import numpy

# draw two random values (normally distributed)
print(numpy.random.randn(2))

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

- Subpackages (e.g. "numpy.random") only contain some functions
- Calling **import** `numpy.random` instead of **import** `numpy` saves memory!

Packages

- The keyword `as` gives a nickname to the package
- 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
- Pandas can load most types of **structured data** (spreadsheets)
- First, find the appropriate command to your dataset, for example:
  - `pd.import_csv(path_data)` for comma-separated values (.csv)
  - `pd.import_excel(path_data)` for Excel datasets (.xlsx, .xls)
  - `pd.import_stata(path_data)` for Stata datasets (.dta)
  - `pd.import_r(path_data)` for R files (.R)
- Then, simply replace `path_data` to the path leading to your dataset

Loading a dataset

- Pandas comes with a special data type to handle datasets: **DataFrames**
- They are very popular for handling structured 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 of data (rule of thumb: 16Gb of RAM works well for datasets < 1 or 2 Gb)
- If memory becomes scarce: look for alternatives like Dask, Modin, or Vaex (many other packages exist)

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/username/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.iloc[1:3]`

Summary statistics

Basic summary statistics functions:

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

Here are nice websites to translate Stata **[LINK]** and R **[LINK]** commands into Python

Data manipulation

Let's apply some basic data manipulation techniques...

```
# 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

You can **apply** rule-based data manipulation with the function `apply()`

```
# Recode the gender variable from int to str
def recode_gender(x):
    gender_str = ""
    if x == 1:
        gender_str = "Woman"
    else:
        gender_str = "Man"
    return gender_str

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

Append

You can **append** (join) datasets based on columns with the function `pd.concat()`

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

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

files = glob.glob("data_raw/*_2022.csv") # star = "any"

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

for file in files:
    data = pd.read_csv(file)
    df = pd.concat([df, data])
```

Note: `df.append(data)` is **deprecated** (i.e, it is not updated anymore!)

Merge

You can also **merge** (join) other information based on rows (e.g., political party)

```
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: The default value for the parameter "how" is "inner"

Collapse

Now, which political party employs the most metaphors?

We can answer this question by **collapsing** (grouping) the data

```
df_merged = df_merged[df_merged["metaphor_score"] >= 0.7]
df_merged["nb_metaphors"] = 1 # each row is worth one metaphor

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

Finally, we can **reshape** (rearrange rows and columns of) the dataset

```
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

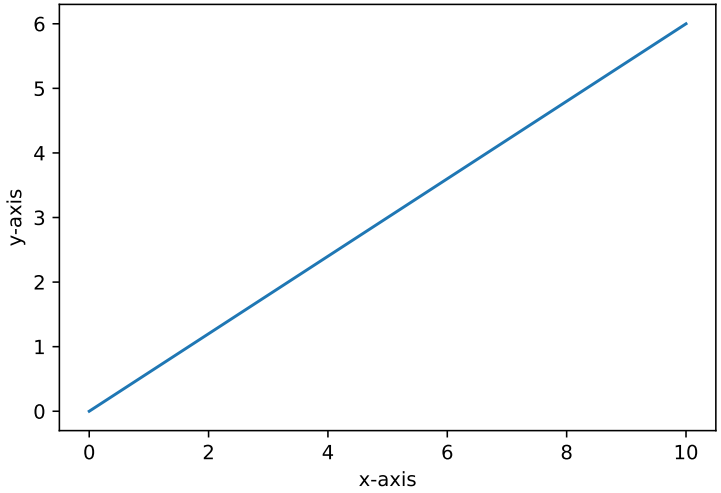
The easiest way to **plot** (visualize) data is using the **Matplotlib** package

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

x_vals = np.linspace(0,10,10) # Generate 10 values within [0, 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
`plt.plot()`	Plot y versus x as lines and/or markers
`plt.ylabel()`	Set the label for the y-axis
`plt.xlabel()`	Set the label for the x-axis
`plt.axis()`	Method to get or set some axis properties
`plt.title()`	Set a title for the axes
`plt.scatter()`	A scatter plot of y vs x
`plt.bar()`	Make a bar plot
`plt.figure()`	Create a new figure
`plt.subtitle()`	Add a centered title to the figure
`plt.subplot()`	Add a subplot to the current figure
`plt.show()`	Display the figure

Plotting data

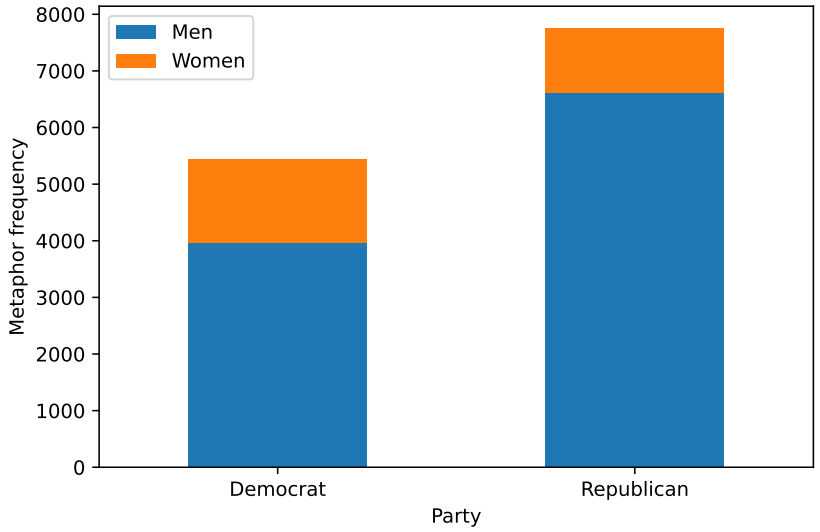
Histograms, pie charts, violin plots... everything is possible!

```
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

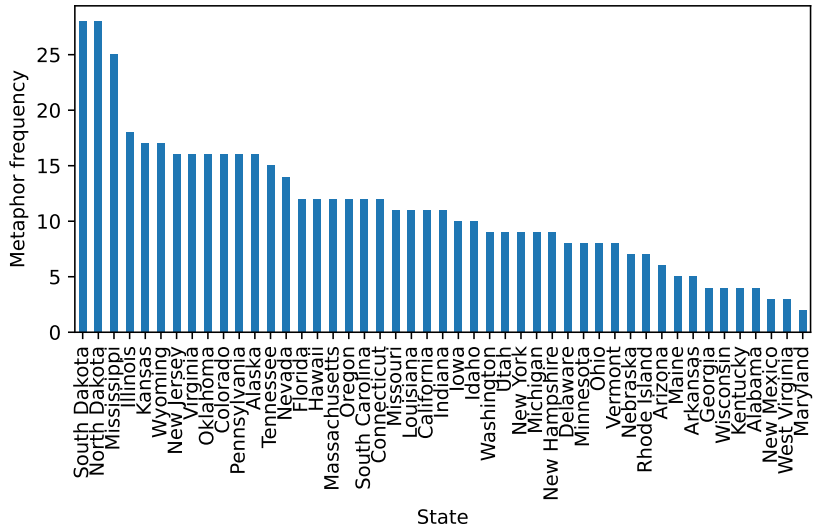


Now it's your turn!

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


Metaphor frequency
0
5
10
15
20
25
South Dakota
North Dakota
Mississippi
Illinois
Kansas
Wyoming
New Jersey
Virginia
Oklahoma
Colorado
Pennsylvania
Alaska
Tennessee
Nevada
Florida
Hawaii
Massachusetts
Oregon
South Carolina
Connecticut
Missouri
Louisiana
California
Indiana
Iowa
Idaho
Washington
Utah
New York
Michigan
New Hampshire
Delaware
Minnesota
Ohio
Vermont
Nebraska
Rhode Island
Arizona
Maine
Arkansas
Georgia
Wisconsin
Kentucky
Alabama
New Mexico
West Virginia
Maryland
State

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
- The full list of arguments, what they are, their default value
- Some examples for using them

Websites of collaborative knowledge: Stack Overflow (a few words on this later)

Where you can find help

Search engines: Another way to find answers (tutorials, videos, short courses)

- Lot of content, but very few is applicable to your own *special* question
- Answers can be outdated, or simply not most efficient
- Large language models? Great, but careful of copy-pasting!

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

- Your interlocutors may learn from your questions too
- ...but their time is limited!

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, you may ask on 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/78106125/how-bypass-kleinanzeigen-js-detected-input-in-email`
- `https://stackoverflow.com/questions/79488901/building-a-packed-and-building-the-structure`

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!

- Response times are unpredictable: you could get an answer within minutes, but it can also take hours, even days... Sadly may also wait for nothing :-(
- People won't always be nice to you (no need to say "hi" and "thanks" too)
- 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 entire dataset (incomplete representation of the 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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Other fun stuff on: leopicard.net