Application of Big Data in Social Science

week 3

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Announcements

~~9.1~~	~~1~~	~~Introduction~~
~~9.8~~	~~2~~	**Web Scraping**
9.15	3	
9.22	4	Natural Language Processing
9.29	5	
10.6	6	Text Analysis (recorded lecture on week 7)
10.13	7	
10.20	8	Mid term exam (as school schedule)
10.27	9	Social Network Analysis
11.3	10	
11.10	11	Machine Learning: Supervised Learning
11.17	12	
11.24	13	Machine Learning: Unsupervised Learning
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12.8	15	Data Visualization
12.15	16	Final Exam

In today's class!

1. Scrap multiple pages
2. Try out selenium
3. Scrap google news!

Recap from last week: web scraping

1. Retrieve HTML data from a domain name
   - `requests.get("webpage")`
2. Parse that data for target information using BeautifulSoup
   - make a soup first, with html parser
3. Store the target information
   - `find_all() or find()`
   - `get_text()`
4. make it into dataframe using Pandas
   - `pd.DataFrame(data= variable_name, columns = ['name of the column']`
   - combine dataframes horizontally using `pd.concat([data1,data2], axis = 1)`
5. export df to excel
   - `df_name.to_excel("document_name.xlsx")`

Some Python refreshers

- import
- for loops
- f-strings
- Concatenation of pandas library

importing libraries

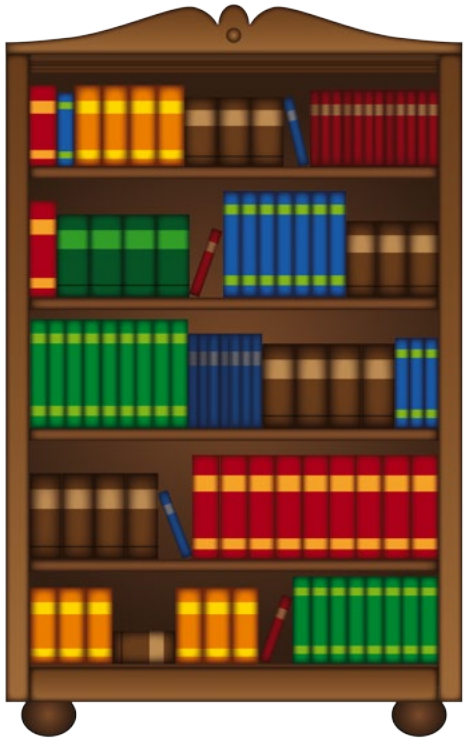
- In Python, if you want to use a certain module, you need to ‘import’ that specific library. eg) pandas, BeautifulSoup, numpy, requests etc.
- It is the first thing that we do, when we start coding. This means you have to ‘import’ necessary libraries every time we launch jupyter notebook.

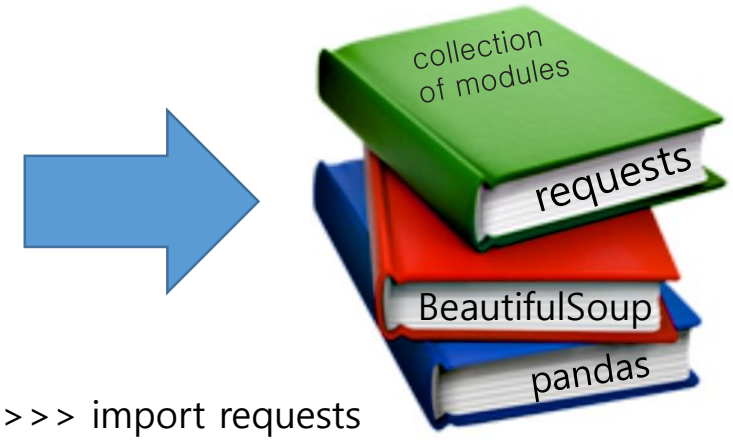
>>> from …. import … as …

>>> import …

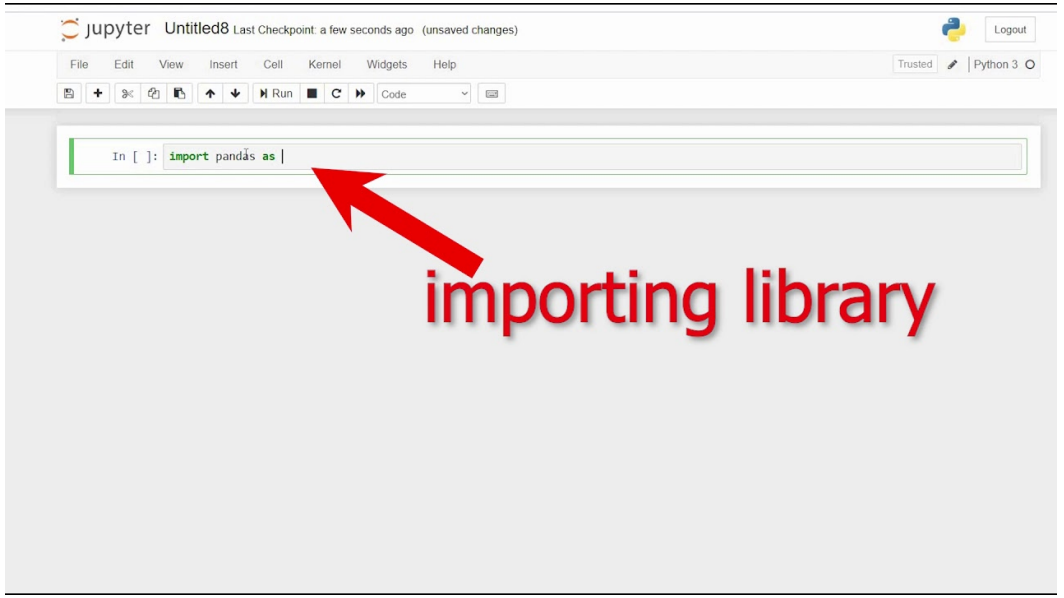
Python library

Python Standard Library





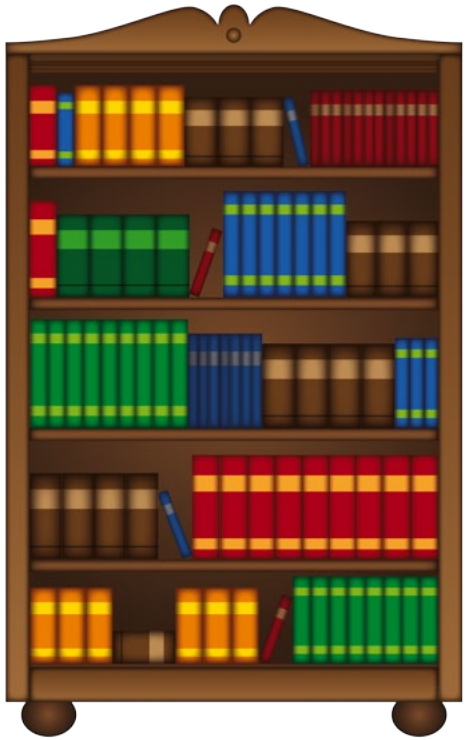

```
>>> import requests
>>> import pandas
>>> import BeautifulSoup
```

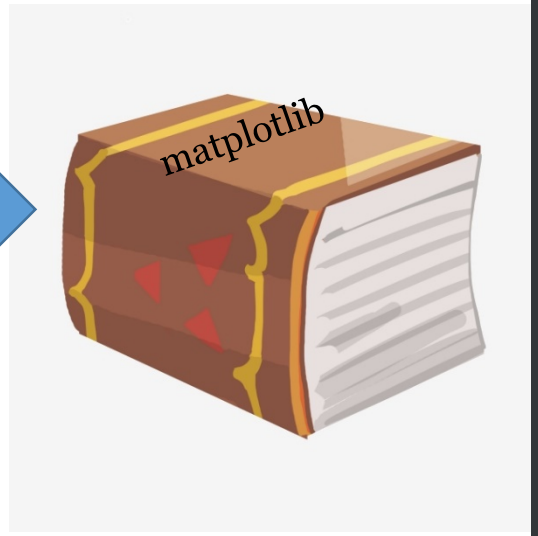


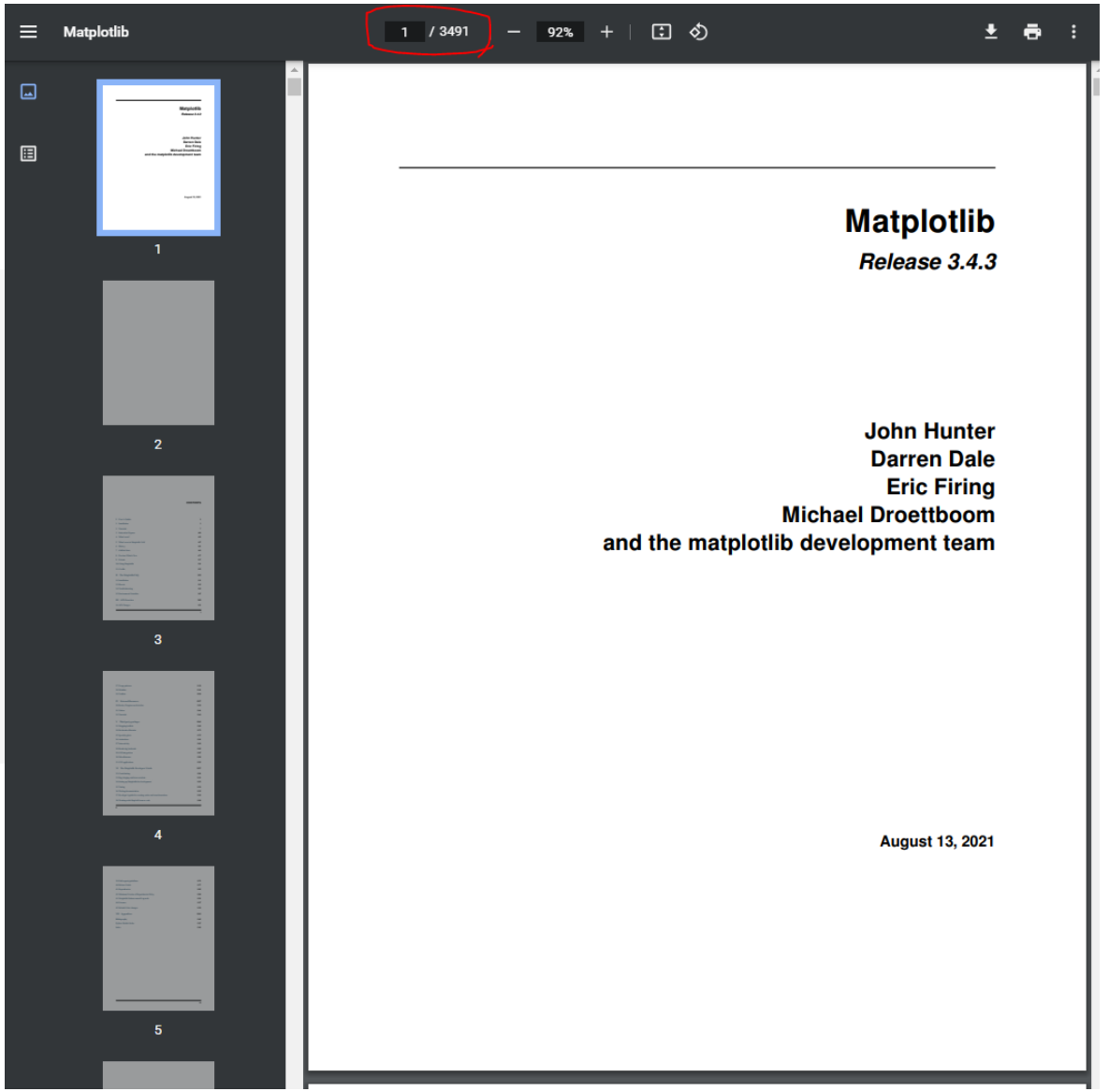
```
>>> import requests
>>> import pandas as pd
>>> import BeautifulSoup as bs
```

Python library

Python Standard Library







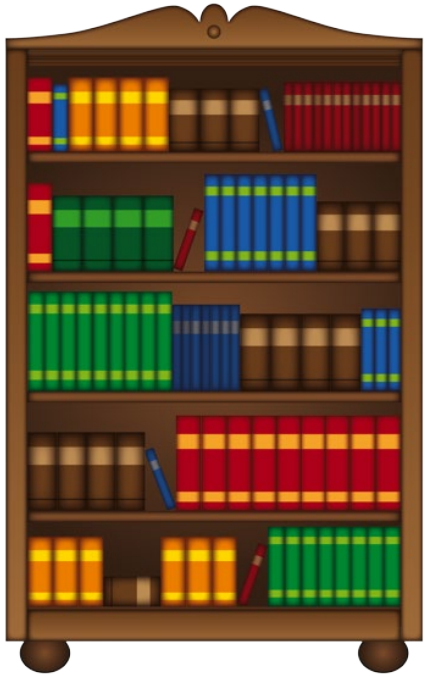

```
>>> from matplotlib import pyplot as plt
>>> from bs4 import BeautifulSoup as bs
```

module not found error?!

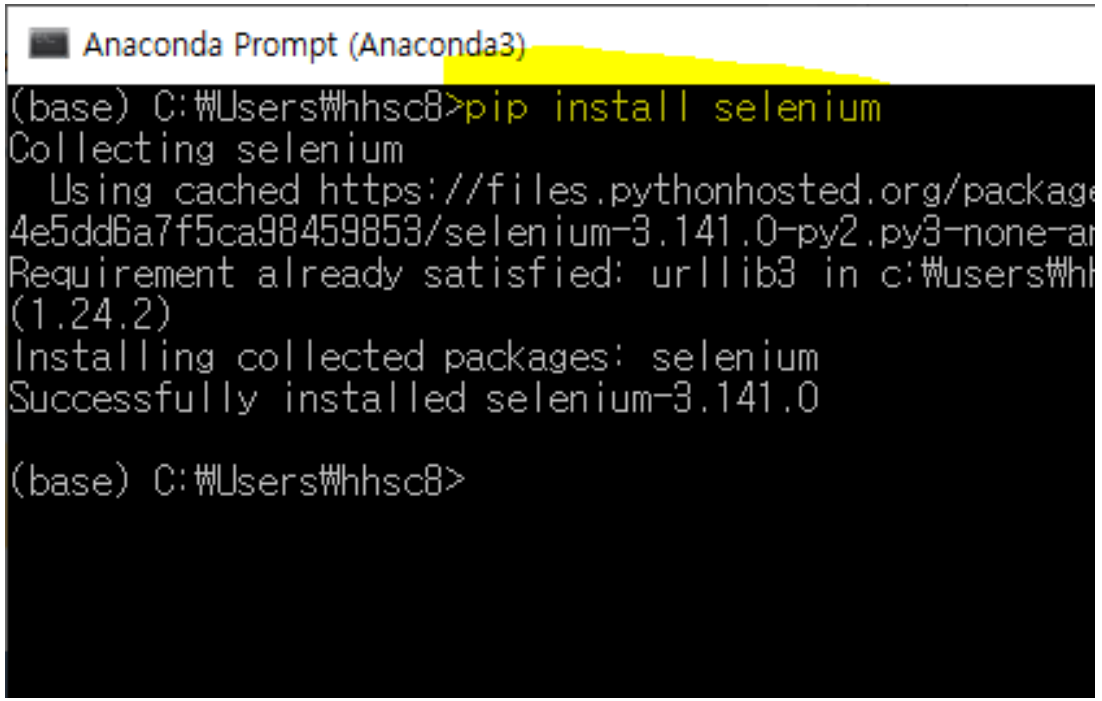
```
import selenium
```

```
---------------------------------------------------------------------------
ModuleNotFoundError                       Traceback (most recent call last)
<ipython-input-2-abb2a9e03f2a> in <module>
----> 1 import selenium

ModuleNotFoundError: No module named 'selenium'
```



Need to stock your library with a new book.



for loop.

- Invitation letter to my friends.

```
>>> friends = [‘lisa’, ‘jenny’, ‘alex’, ‘john’]
```

step 1. defining a list.

```
>>>for friend in friends:

                print(friend)
```

step 2. defining a **for** loop:
tells Python to ..
1) get elements from the list of friends
2) and assign it to friend.

step 3. tell Python to print the name which has been assigned to friend.

step 4.
Python repeats until the last element of the list.

a for loop inside a for loop.

```
>>> adj = ["red", "big", "tasty"]
>>> fruits = ["apple", "banana", "cherry"]
```

```
>>> for x in adj:
>>>     print(x)
>>> for y in fruits:
>>>     print(y)
```

red
big
tasty
apple
banana
cherry

```
>>> for x in adj:
>>>   for y in fruits:
>>>       print(x,y)
```

red apple
red banana
red cherry
big apple
big banana
big cherry
tasty apple
tasty banana
tasty cherry

f-strings vs % formatting

- f-strings in Python 3.6: new way to format strings.

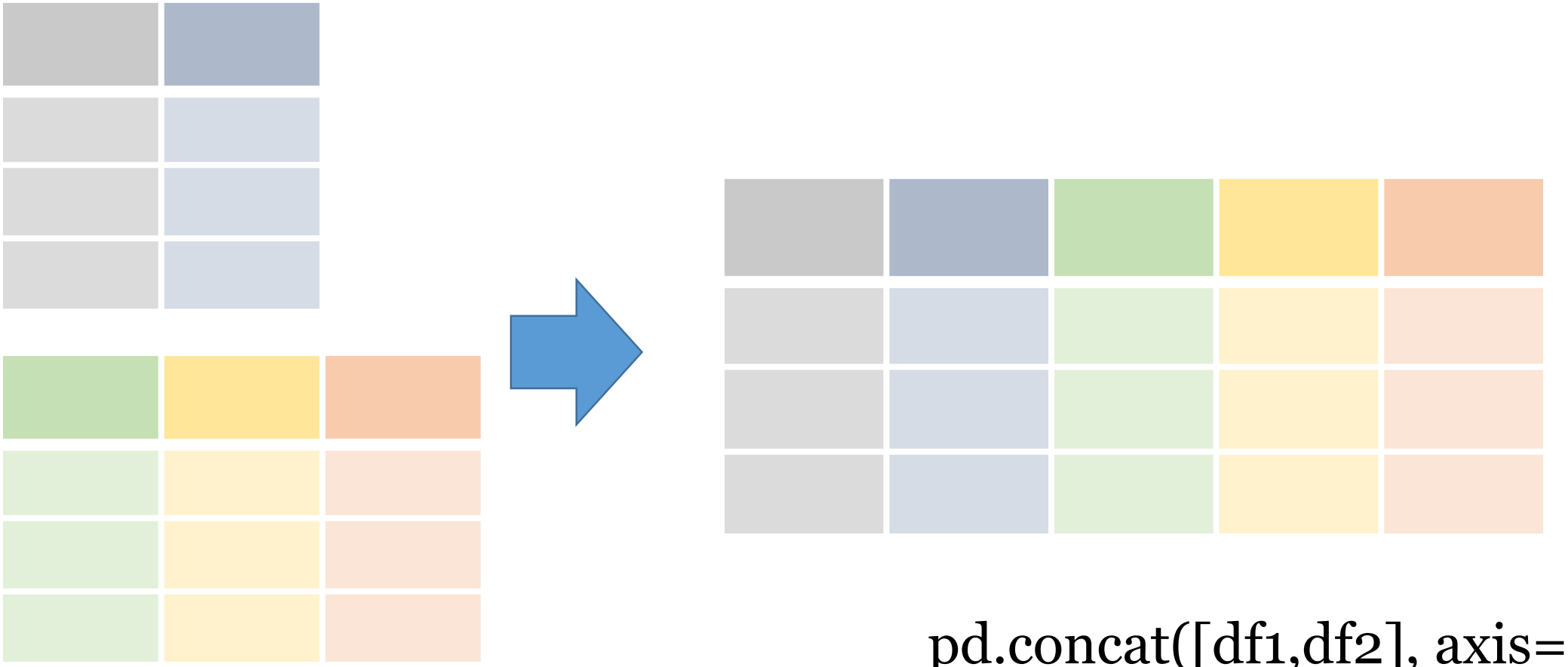
- more readable, concise.

```
>>> name = “Heidi”
>>> coffee = “Americano”
>>> f“Hello, {name}, would you like to drink your {coffee}?”
‘Hello Heidi, would you like to drink your Americano?’
```

```
>>> name = “Heidi”
>>> “Hello, %s.” % name
Hello, Heidi
```

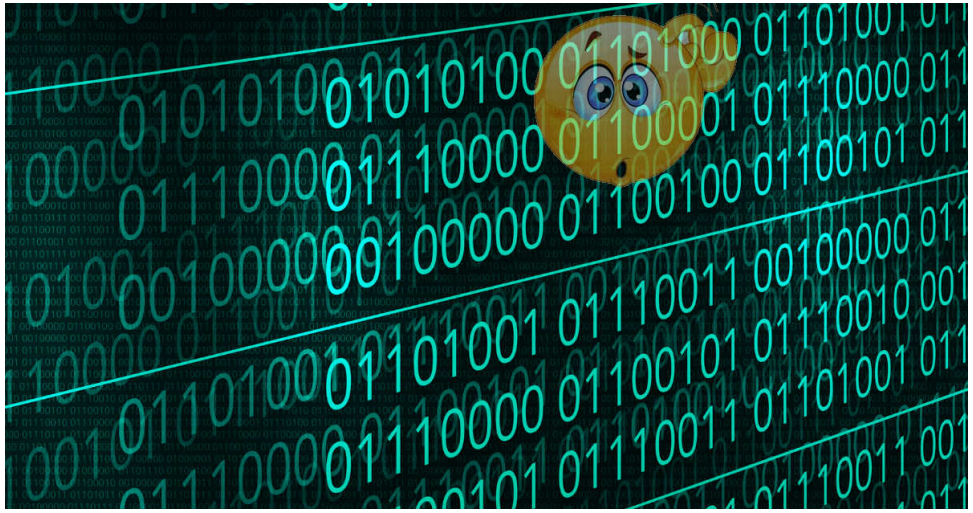
Concatenation function of pandas library

append columns of DataFrames



pd.concat([df1,df2], axis=1)

Encoding?!



- Basics: how computers store information
  - Computers use a binary system.
  - All data is represented in sequences of 1s and 0s.
  - Basic unit of binary is a bit. (single 1 or 0)
  - The largest unit of binary, a byte, consists of 8 bits.
  - Every digital stuff you see, from software to mobile apps, websites, Instagram etc is built on this system of bytes.
  - When we refer to file size, we are referencing the number of bytes.
  - ‘TEXT’ is represented in computers by a string of bits.

The American Standard Code for Information Interchange (ASCII)

- ASCII library include every upper and lower case letter in the Latin alphabet, every digit from 0-9 and some common symbols (/,.!?)
- There are 256 ways to group eight 1s and 0s together. (2^8)
- Was introduced in 1960. It was ok back then.
- But there are languages besides English.
- New systems were made to map other languages to the same set of 256 unique bytes.
- Having multiple encoding system is inefficient and confusing.
- So they developed 'Unicode' to store every symbol, and it is the universal standard for encoding all human languages and emojis.

ASCII characters with associated codes and bytes

Character	ASCII Code	BYTE
A	065	01000001
a	097	01100001
B	066	01000010
b	098	01100010
Z	090	01011010
z	122	01111010
0	048	00110000
9	057	00111001
!	033	00100001
?	063	00111111

Eg) The quick brown fox jumps over the lazy dog.

01010100 01101000 01100101 00100000 01110001 01110101
01101001 01100011 01101011 00100000 01100010 01110010
01101111 01110111 01101110 00100000 01100110 01101111
01111000 00100000 01101010 01110101 01101101 01110000
01110011 00100000 01101111 01110110 01100101 01110010
00100000 01110100 01101000 01100101 00100000 01101100
01100001 01111010 01111001 00100000 01100100 01101111
01100111 00101110

UTF-8 to the rescue

- UTF-8 is an encoding system for Unicode.
  - Unicode is an International Encoding Standard while UTF-8 is an encoding system.
- “UTF”, or “Unicode Transformation Format.”
- It can translate any Unicode character to a matching unique binary string, and can also translate the binary string back to a Unicode character.
- There are other encoding systems for Unicode besides UTF-8, but UTF-8 is unique because it represents characters in one-byte units.
- It is UTF “-8” because one byte consists of eight bits.
- UTF-8 is the most common character encoding method used on the internet today, and is the default character set for HTML5.
- Over 95% of all websites store characters this way.

Selenium

Limitations of BeautifulSoup

- Beautiful Soup has been a good web scraper starter for us.
- But! online retailers such as Amazon put anti-bot software so that you cannot crawl pages using Beautiful Soup. It will shut down requests coming from BeautifulSoup.
- Many websites will supply data that is dynamically loaded via javascript.
- So does that mean we have to do it manually?
- We can use…available Web Scraping tools.
- or.. we can try to automate our browsing behavior using selenium and chrome driver!

Selenium

- It was created primarily for automated web testing, but due to its compatibility with JavaScript, it is also used for web scraping.
- It is free to use and can be used across many platforms.
- Through Selenium…
  - your Google Chrome Browser mimics legitimate user browsing behaviors.
  - It will do the clicking and typing for you.
  - Scrape information from the websites
- But! It is slow.
- Selenium: complex projects
- Beautifulsoup: smaller projects

So let’s go ahead and install….

- ✓ChromeDriver
- ✓selenium

ChromeDriver

- Steps:

1. Check your chrome version
2. Download your ChromeDriver accordingly.
3. Unzip your ChromeDriver and place it in the same folder as your jupyter notebook file.

selenium

- access through anaconda prompt

```
>>> pip list
```

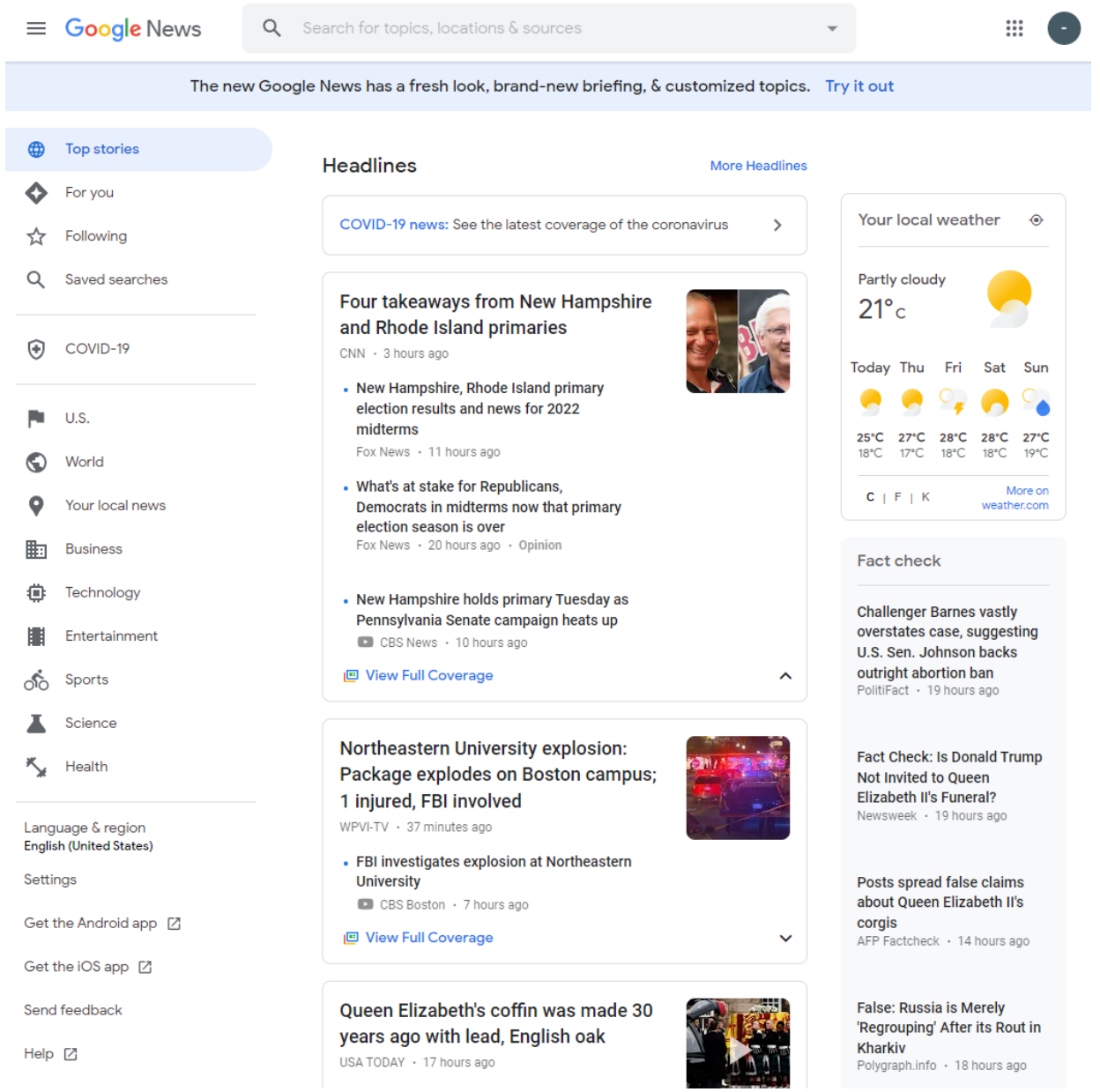
- see whether you have selenium. If not,

```
>>> pip install selenium
```

- same goes for all the other libraries

Pygooglenews

- Google News RSS feed.
- We can get top stories, topic related news feeds, geolocation news feeds, and an extensive full text search feed.



HTML vs XML

HTML	XML
HTML stands for Hyper Text Markup Language.	XML stands for extensible Markup Language.
Focusses on the appearance of data. Enhances the display of text.	The main purpose is to focus on the transport of data and saving the data.
HTML is static in nature.	XML is dynamic in nature.
HTML is a markup language.	XML provides framework to define markup languages.
HTML is not Case sensitive.	XML is Case sensitive.
HTML tags are predefined tags. (<title>,<head>,<body>)	XML tags are user defined tags.
There are limited number of tags in HTML.	XML tags are extensible.
HTML does not preserve white spaces.	White space can be preserved in XML.
HTML tags are used for displaying the data.	XML tags are used for describing the data not for displaying.
HTML is used to display the data. HTML is presentation driven. How the text appears is of utmost importance.	XML is used to store data. XML is content-driven and not many formatting features are available.
HTML does not carry data it just display it.	XML carries the data to and from database.
HTML document size is relatively small.	XML document size is relatively large as the approach of formatting and the codes both are lengthy.

XPath

- XPath stands for XML Path Language, and the most important function of XPath is that it tells us the path, or address, of the various pieces of data in the XML file.
- XPath is a syntax for defining parts of an XML document.
- XPath uses path expressions to navigate in XML documents.
- XPath contains a library of standard functions.
- All of the information that is transferred between the web server and the computers we use can be saved as **XML** files, and we can then use the **XPath** query language to search the XML data files, and even compute values based on selected criteria.

Let’s launch our jupyter notebook and try it for ourselves

```
>>> pip install selenium
>>> pip install pygooglenews
```

Other site that you can play around with

- http://books.toscrape.com/