2. Importing & Cleaning Data

July 4, 2022

1 IMPORTANTO DATOS CON PYTHON, BÁSICO

1.1 INTRODUCCIÓN Y DATOS PLANOS

[1]:
```
# Para checar cualquier archivo de texto sin formato, se puede usar la función␣
 ↪open para abrir una conexión con el archivo:

filename = "C:/Users/marco/Data Camp Python/Datasets/seaslug.txt"
file = open(filename, mode = "r") # "r" es por "read"
text = file.read()
file.close()

print(text)

# Este caso ejemplifica cómo importar un archivo de texto, que pudiera ser un␣
 ↪texto literal
# El mode = "w" se usa para escribir sobre un archivo de texto

# Alternativamente:

with open("C:/Users/marco/Data Camp Python/Datasets/seaslug.txt") as file:
    print(file.read())
```

```
Time    Percent
99      0.067
99      0.133
99      0.067
99      0
99      0
0       0.5
0       0.467
0       0.857
0       0.5
0       0.357
0       0.533
5       0.467
5       0.467
5       0.125
```

```
5       0.4
5       0.214
5       0.4
10      0.067
10      0.067
10      0.333
10      0.333
10      0.133
10      0.133
15      0.267
15      0.286
15      0.333
15      0.214
15      0
15      0
20      0.267
20      0.2
20      0.267
20      0.437
20      0.077
20      0.067
25      0.133
25      0.267
25      0.412
25      0
25      0.067
25      0.133
30      0
30      0.071
30      0
30      0.067
30      0.067
30      0.133
Time    Percent
99      0.067
99      0.133
99      0.067
99      0
99      0
0       0.5
0       0.467
0       0.857
0       0.5
0       0.357
0       0.533
5       0.467
5       0.467
5       0.125
```

```
5       0.4
5       0.214
5       0.4
10      0.067
10      0.067
10      0.333
10      0.333
10      0.133
10      0.133
15      0.267
15      0.286
15      0.333
15      0.214
15      0
15      0
20      0.267
20      0.2
20      0.267
20      0.437
20      0.077
20      0.067
25      0.133
25      0.267
25      0.412
25      0
25      0.067
25      0.133
30      0
30      0.071
30      0
30      0.067
30      0.067
30      0.133
```

1.1.1 Datos planos

Se trata de archivos de texto que contienen registros, como tablas de datos. Tienen renglones de campos o atributos y columnas de característica o atributo.

Los datos planos pueden ser del tipo CSV o TXT.

Si se quiere importar un archivo solo de números, es preferible utilizar una matriz de NumPy; si los datos contienen cadenas, es mejor usar un dataframe de Pandas.

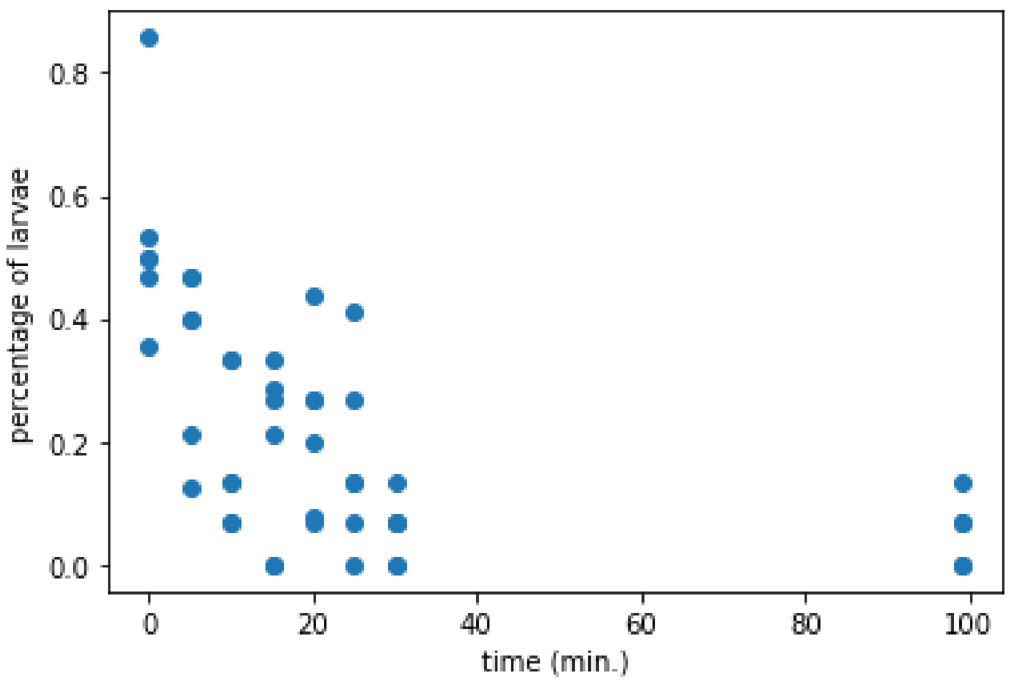
NOTA: Las matrices de NumPy son esenciales para el uso de otros paquetes, como scikit-learn, de machine learning.

[2]:
```
import numpy as np
```

```
# Las funciones básicas de NumPy para importar datos son np.loadtxt(filename,␣
↪delimiter = "", skiprows = 1, usecols = [],
# dtype = str)

# loadtxt() es bueno para datasets con un solo tipo de datos.

# y genfromtxt()
```

[3]:
```
import numpy as np
import matplotlib.pyplot as plt

file = "C:/Users/marco/Data Camp Python/Datasets/seaslug.txt"

data = np.loadtxt(file, delimiter = "\t", dtype = str)

print(data[0])

data_float = np.loadtxt(file, delimiter="\t", dtype=float, skiprows=1)

plt.scatter(data_float[:, 0], data_float[:, 1])
plt.xlabel('time (min.)')
plt.ylabel('percentage of larvae')
plt.show()
```

```
['Time' 'Percent']
```



[4]:
```
file = 'C:/Users/marco/Data Camp Python/Datasets/titanic_sub.csv'

d = np.recfromcsv(file, delimiter = ",", names = True, dtype = None)

print(d[:3])
```

```
[(1, 0, 3, b'male', 22., 1, 0, b'A/5 21171',  7.25  , b'', b'S')
 (2, 1, 1, b'female', 38., 1, 0, b'PC 17599', 71.2833, b'C85', b'C')
 (3, 1, 3, b'female', 26., 0, 0, b'STON/O2. 3101282',  7.925 , b'', b'S')]
```

```
C:\Users\marco\anaconda3\lib\site-packages\numpy\lib\npyio.py:2405:
VisibleDeprecationWarning: Reading unicode strings without specifying the
encoding argument is deprecated. Set the encoding, use None for the system
default.
  output = genfromtxt(fname, **kwargs)
```

1.1.2 Importación de datos planos con Pandas

[5]:
```
import pandas as pd

df = pd.read_csv('C:/Users/marco/Data Camp Python/Datasets/titanic_sub.csv')

print(df.head())

data_array = df.values # Para transformar el dataset en una matriz

print(type(data_array))
```

```
   PassengerId  Survived  Pclass     Sex   Age  SibSp  Parch  \
0            1         0       3    male  22.0      1      0
1            2         1       1  female  38.0      1      0
2            3         1       3  female  26.0      0      0
3            4         1       1  female  35.0      1      0
4            5         0       3    male  35.0      0      0

             Ticket     Fare Cabin Embarked
0         A/5 21171   7.2500   NaN        S
1          PC 17599  71.2833   C85        C
2  STON/O2. 3101282   7.9250   NaN        S
3            113803  53.1000  C123        S
4            373450   8.0500   NaN        S
<class 'numpy.ndarray'>
```

1.2 IMPORTANDO DATOS DE OTRO TIPO

1.2.1 Excel

[6]:
```
# Para importar Excel, y solo determinadas hojas de cálculo:

import pandas as pd

file = "C:/Users/marco/Data Camp Python/Datasets/battledeath.xlsx"

xls = pd.ExcelFile(file)

print(xls.sheet_names)

df1 = xls.parse("2004") # se puede indicar el nombre de la hoja

print(df1.head())

df2 = xls.parse(0) # o bien, el índice

print(df2.head())
```

```
['2002', '2004']
  War(country)      2004
0  Afghanistan  9.451028
1      Albania  0.130354
2      Algeria  3.407277
3      Andorra  0.000000
4       Angola  2.597931
  War, age-adjusted mortality due to       2002
0                        Afghanistan  36.083990
1                            Albania   0.128908
2                            Algeria  18.314120
3                            Andorra   0.000000
4                             Angola  18.964560
```

[7]:
```
df1 = xls.parse(0, skiprows=0, names=["Country", "AAM due to War (2002)"]) #␣
 ↪para renombrar las columnas:

print(df1.head())

###

df2 = xls.parse(1, usecols=[0], skiprows=[0], names=['Country'])

print(df2.head())
```

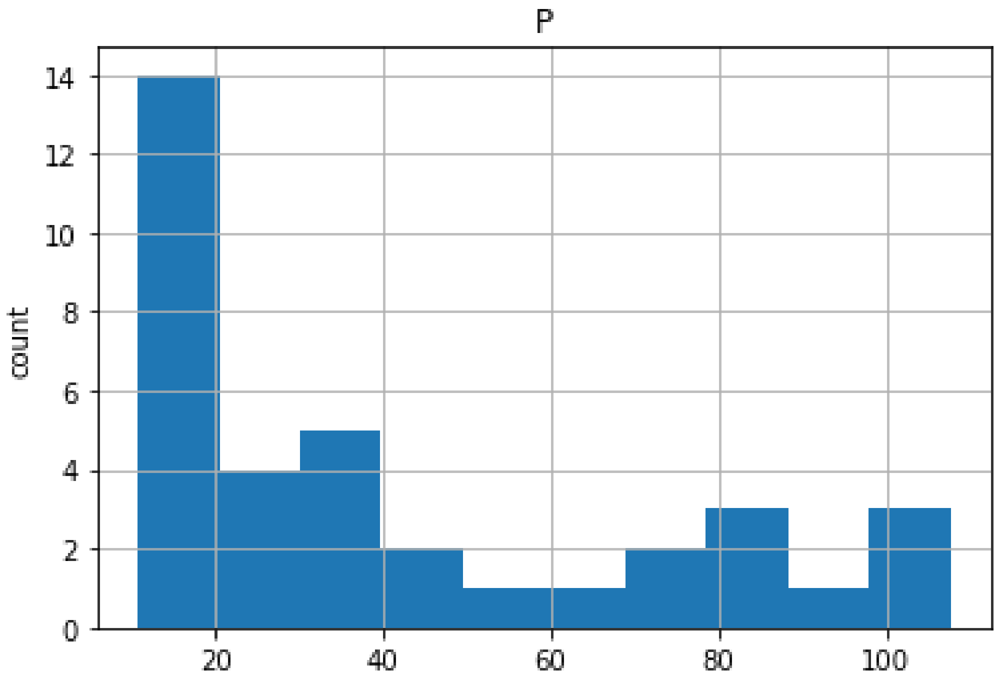
```
       Country  AAM due to War (2002)
0  Afghanistan              36.083990
```

```
1      Albania               0.128908
2      Algeria              18.314120
3      Andorra               0.000000
4       Angola              18.964560
                Country
0               Albania
1               Algeria
2               Andorra
3                Angola
4   Antigua and Barbuda
```

1.2.2 SAS/STATA

[8]:
```
from sas7bdat import SAS7BDAT

with SAS7BDAT('C:/Users/marco/Data Camp Python/Datasets/sales.sas7bdat') as␣
 ↪file:
    df_sas = file.to_data_frame()

# Print head of DataFrame
print(df_sas.head())

# Plot histogram of DataFrame features (pandas and pyplot already imported)
pd.DataFrame.hist(df_sas[['P']])
plt.ylabel('count')
plt.show()
```

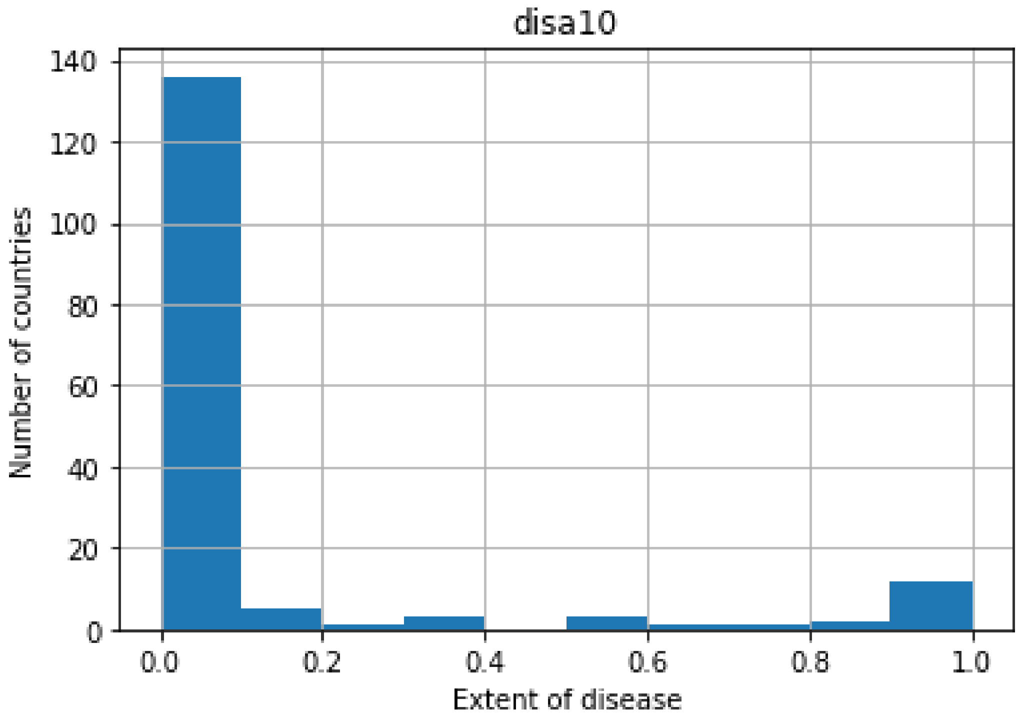
```
     YEAR     P           S
0  1950.0  12.9  181.899994
1  1951.0  11.9  245.000000
2  1952.0  10.7  250.199997
3  1953.0  11.3  265.899994
4  1954.0  11.2  248.500000
```



```
[9]: import pandas as pd

df = pd.read_stata("C:/Users/marco/Data Camp Python/Datasets/disarea.dta")

print(df.head())

pd.DataFrame.hist(df[['disa10']])
plt.xlabel('Extent of disease')
plt.ylabel('Number of countries')
plt.show()
```

```
  wbcode               country  disa1  disa2  disa3  disa4  disa5  disa6  \
0    AFG           Afghanistan   0.00   0.00   0.76   0.73    0.0   0.00
1    AGO                Angola   0.32   0.02   0.56   0.00    0.0   0.00
2    ALB               Albania   0.00   0.00   0.02   0.00    0.0   0.00
3    ARE  United Arab Emirates   0.00   0.00   0.00   0.00    0.0   0.00
4    ARG             Argentina   0.00   0.24   0.24   0.00    0.0   0.23

   disa7  disa8  …  disa16  disa17  disa18  disa19  disa20  disa21  disa22  \
0   0.00    0.0  …     0.0     0.0     0.0    0.00    0.00     0.0    0.00
1   0.56    0.0  …     0.0     0.4     0.0    0.61    0.00     0.0    0.99
2   0.00    0.0  …     0.0     0.0     0.0    0.00    0.00     0.0    0.00
3   0.00    0.0  …     0.0     0.0     0.0    0.00    0.00     0.0    0.00
4   0.00    0.0  …     0.0     0.0     0.0    0.00    0.05     0.0    0.00
```

```
   disa23  disa24  disa25
0    0.02    0.00    0.00
1    0.98    0.61    0.00
2    0.00    0.00    0.16
3    0.00    0.00    0.00
4    0.01    0.00    0.11

[5 rows x 27 columns]
```

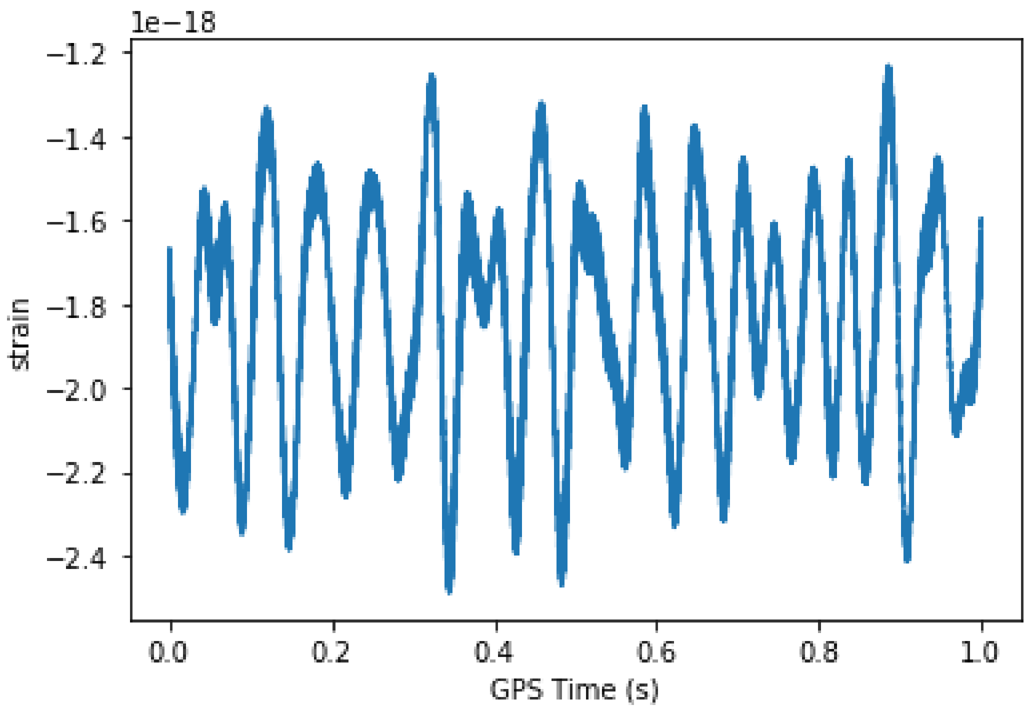


1.2.3 HDF5

Este tipo de formato permite almacenar gigas, teras e incluso exabytes de datos.

[10]:
```
import numpy as np
import h5py

file = "C:/Users/marco/Data Camp Python/Datasets/L-L1_LOSC_4_V1-1126259446-32.
 ↪hdf5"

data = h5py.File(file, "r")

print(type(data))

for key in data.keys():
    print(key)

###

# Get the HDF5 group: group
group = data['strain']

# Check out keys of group
for key in group.keys():
    print(key)

# Set variable equal to time series data: strain
strain = np.array(data['strain']['Strain'])

# Set number of time points to sample: num_samples
num_samples = 10000

# Set time vector
time = np.arange(0, 1, 1/num_samples)

# Plot data
plt.plot(time, strain[:num_samples])
plt.xlabel('GPS Time (s)')
plt.ylabel('strain')
plt.show()
```

```
<class 'h5py._hl.files.File'>
meta
quality
strain
Strain
```

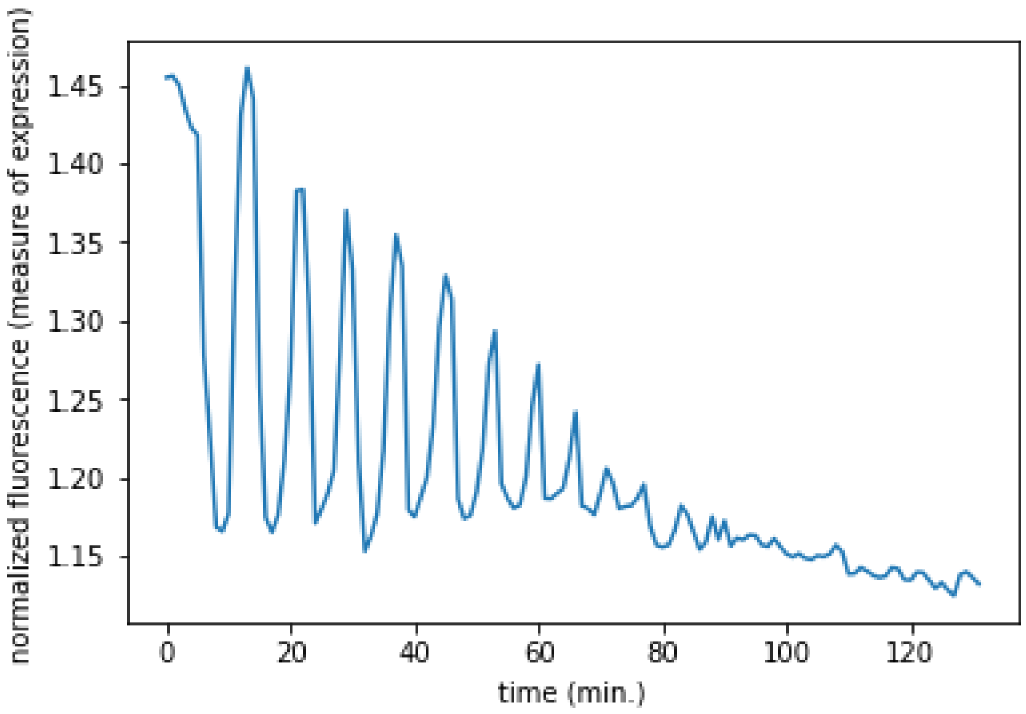


1.2.4 MATLAB

Para este tipo de archivos, se usa el paquete SciPy

[11]:
```
import scipy.io

mat = scipy.io.loadmat("C:/Users/marco/Data Camp Python/Datasets/ja_data2.mat")

print(type(mat))

print(mat.keys())

print(type(mat["CYratioCyt"]))

print(np.shape(mat['CYratioCyt']))

data = mat['CYratioCyt'][25, 5:]
fig = plt.figure()
plt.plot(data)
plt.xlabel('time (min.)')
plt.ylabel('normalized fluorescence (measure of expression)')
plt.show()
```

```
<class 'dict'>
dict_keys(['__header__', '__version__', '__globals__', 'rfpCyt', 'rfpNuc',
'cfpNuc', 'cfpCyt', 'yfpNuc', 'yfpCyt', 'CYratioCyt'])
<class 'numpy.ndarray'>
(200, 137)
```



1.3 BASES RELACIONALES

Son bases de datos basadas en el modelo de datos relacional. Intuitivamente, se trata de varias tablas cuyas variables o valores se relacionan entre sí.

[12]:
```
from sqlalchemy import create_engine
import pandas as pd

# Create engine: engine
engine = create_engine('sqlite:///C:/Users/marco/Data Camp Python/Datasets/
 ↪Chinook.sqlite')

# Execute query and store records in DataFrame: df
df = pd.read_sql_query("select * from album", engine)

# Print head of DataFrame
print(df.head())

# Open engine in context manager and store query result in df1
with engine.connect() as con:
    rs = con.execute("SELECT * FROM Album")
    df1 = pd.DataFrame(rs.fetchall())
    df1.columns = rs.keys()

# Confirm that both methods yield the same result
print(df.equals(df1))
```

```
   AlbumId                                  Title  ArtistId
0        1  For Those About To Rock We Salute You         1
1        2                      Balls to the Wall         2
2        3                      Restless and Wild         2
3        4                      Let There Be Rock         1
4        5                               Big Ones         3
True
```

2 IMPORTANTO DATOS CON PYTHON, INTERMEDIO

2.1 DATOS DE INTERNET

[13]:
```
# Los paquetes urllib y requests son útiles para realizar web scrapping

# urllib provee de un interfaz de alto nivel para ibtener datos de internet

     # El comando urlopen() acepta URLs en lugar de nombres de archivos

from urllib.request import urlretrieve

url = "http://archive.ics.uci.edu/ml/machine-learning-databases/wine-quality/
 ↪winequality-white.csv"

urlretrieve(url, "winequality-white.csv")
```

[13]:
```
('winequality-white.csv', <http.client.HTTPMessage at 0x181191610a0>)
```

[14]:
```
url = 'https://assets.datacamp.com/production/course_1606/datasets/
 ↪winequality-red.csv'

urlretrieve(url, "winequality-red.csv")

df = pd.read_csv('winequality-red.csv', sep=';')
print(df.head())
```

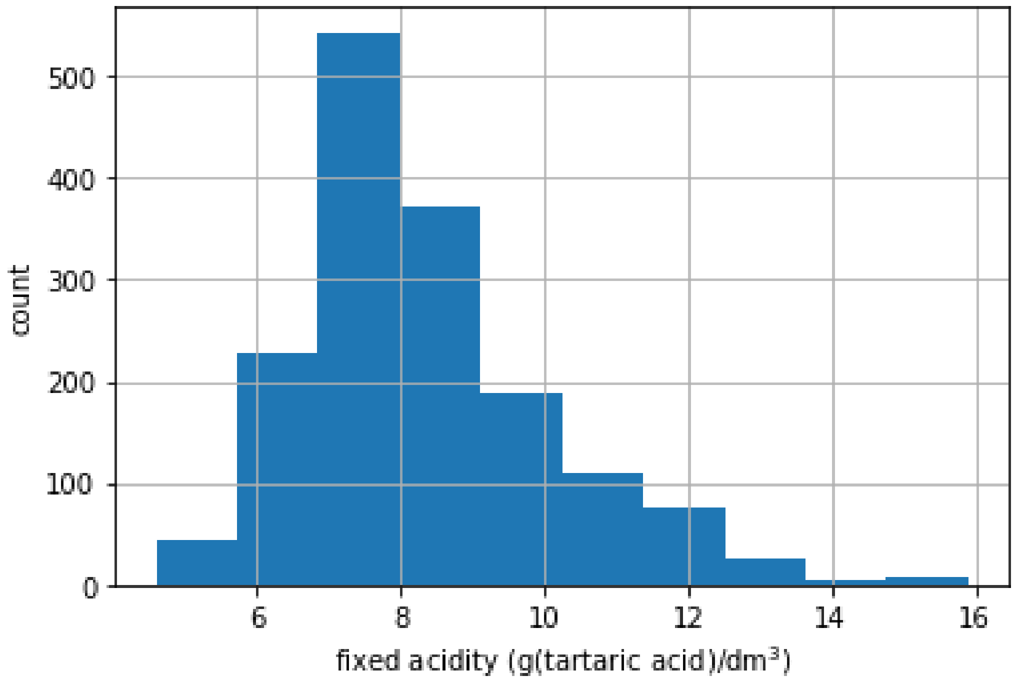
```
   fixed acidity  volatile acidity  citric acid  residual sugar  chlorides  \
0            7.4              0.70         0.00             1.9      0.076
1            7.8              0.88         0.00             2.6      0.098
2            7.8              0.76         0.04             2.3      0.092
3           11.2              0.28         0.56             1.9      0.075
4            7.4              0.70         0.00             1.9      0.076
```

```
   free sulfur dioxide  total sulfur dioxide  density    pH  sulphates  \
0                 11.0                  34.0   0.9978  3.51       0.56
1                 25.0                  67.0   0.9968  3.20       0.68
2                 15.0                  54.0   0.9970  3.26       0.65
3                 17.0                  60.0   0.9980  3.16       0.58
4                 11.0                  34.0   0.9978  3.51       0.56

   alcohol  quality
0      9.4        5
1      9.8        5
2      9.8        5
3      9.8        6
4      9.4        5
```

[15]:
```
# Para guardarlo como dataset:

url = 'https://assets.datacamp.com/production/course_1606/datasets/
 ↪winequality-red.csv'

df = pd.read_csv(url, sep = ";")

print(df.head())

df.iloc[:, 0].hist()
plt.xlabel('fixed acidity (g(tartaric acid)/dm$^3$)')
plt.ylabel('count')
plt.show()
```

```
   fixed acidity  volatile acidity  citric acid  residual sugar  chlorides  \
0            7.4              0.70         0.00             1.9      0.076
1            7.8              0.88         0.00             2.6      0.098
2            7.8              0.76         0.04             2.3      0.092
3           11.2              0.28         0.56             1.9      0.075
4            7.4              0.70         0.00             1.9      0.076

   free sulfur dioxide  total sulfur dioxide  density    pH  sulphates  \
0                 11.0                  34.0   0.9978  3.51       0.56
1                 25.0                  67.0   0.9968  3.20       0.68
2                 15.0                  54.0   0.9970  3.26       0.65
3                 17.0                  60.0   0.9980  3.16       0.58
4                 11.0                  34.0   0.9978  3.51       0.56

   alcohol  quality
0      9.4        5
1      9.8        5
2      9.8        5
3      9.8        6
```

```
4       9.4         5
```



[16]:
```python
url = 'https://assets.datacamp.com/course/importing_data_into_r/latitude.xls'

xls = pd.read_excel(url, sheet_name = None)

print(xls.keys())

print(xls["1700"].head())
```

```
dict_keys(['1700', '1900'])
                 country       1700
0            Afghanistan  34.565000
1  Akrotiri and Dhekelia  34.616667
2                Albania  41.312000
3                Algeria  36.720000
4         American Samoa -14.307000
```

2.1.1 HTTP requests

[17]:
```python
# Por ejemplo, para extraer el HTML de la página de inicio de Wikipedia:

from urllib.request import urlopen, Request

url = "http://www.wikipedia.org/"
```

```
request = Request(url)
response = urlopen(request)
html = response.read()
response.close()
```

[18]:
```
import requests

url = "http://wikipedia.org/"

r = requests.get(url)

text = r.text
```

[19]:
```
# Ejemplo

url = "https://campus.datacamp.com/courses/1606/4135?ex=2"

request = Request(url)

response = urlopen(request)

html = response.read()

print(type(response))

response.close()
```

```
<class 'http.client.HTTPResponse'>
```

[20]:
```
# Alternativamente:

import requests

url = "http://www.datacamp.com/teach/documentation"

r = requests.get(url)

text = r.text

print(text)
```

```
<!DOCTYPE HTML>
<html lang="en-US">
<head>
  <meta http-equiv="X-UA-Compatible" content="IE=Edge" />
  <meta name="robots" content="noindex, nofollow" />
  <meta name="viewport" content="width=device-width,initial-scale=1" />
  <title>Just a moment…</title>
  <style>
    html, body {width: 100%; height: 100%; margin: 0; padding: 0;}
    body {background-color: #ffffff; color: #000000; font-family:-apple-system,
system-ui, BlinkMacSystemFont, "Segoe UI", Roboto, Oxygen, Ubuntu, "Helvetica
Neue",Arial, sans-serif; font-size: 16px; line-height: 1.7em;-webkit-font-
smoothing: antialiased;}
    h1 { text-align: center; font-weight:700; margin: 16px 0; font-size: 32px;
color:#000000; line-height: 1.25;}
    p {font-size: 20px; font-weight: 400; margin: 8px 0;}
    p, .attribution, {text-align: center;}
    #spinner {margin: 0 auto 30px auto; display: block;}
    .attribution {margin-top: 32px;}
    @keyframes fader     { 0% {opacity: 0.2;} 50% {opacity: 1.0;} 100% {opacity:
0.2;} }
    @-webkit-keyframes fader { 0% {opacity: 0.2;} 50% {opacity: 1.0;} 100%
{opacity: 0.2;} }
    #cf-bubbles > .bubbles { animation: fader 1.6s infinite;}
    #cf-bubbles > .bubbles:nth-child(2) { animation-delay: .2s;}
    #cf-bubbles > .bubbles:nth-child(3) { animation-delay: .4s;}
    .bubbles { background-color: #f58220; width:20px; height: 20px; margin:2px;
border-radius:100%; display:inline-block; }
    a { color: #2c7cb0; text-decoration: none; -moz-transition: color 0.15s
ease; -o-transition: color 0.15s ease; -webkit-transition: color 0.15s ease;
transition: color 0.15s ease; }
    a:hover{color: #f4a15d}
    .attribution{font-size: 16px; line-height: 1.5;}
    .ray_id{display: block; margin-top: 8px;}
    #cf-wrapper #challenge-form { padding-top:25px; padding-bottom:25px; }
    #cf-hcaptcha-container { text-align:center;}
    #cf-hcaptcha-container iframe { display: inline-block;}
  </style>

      <meta http-equiv="refresh" content="35">
  <script>
    //<![CDATA[
    (function(){
      window._cf_chl_opt={
        cvId: "2",
        cType: "non-interactive",
        cNounce: "80761",
        cRay: "7258cb0c29df5266",
        cHash: "208b7c484fb5f26",
        cUPMDTk: "\/teach\/documentation?__cf_chl_tk=u_igNAQTBenTXqsl82ch1T8j6JQ
KKgpZsK3.pEWdrR4-1656947483-0-gaNycGzNCBE",
        cFPWv: "b",
        cTTimeMs: "1000",
        cRq: {
          ru: "aHR0cHM6Ly93d3cuZGF0YWNhbXAuY29tL3RlYWNoL2RvY3VtZW50YXRpb24=",
          ra: "cHl0aG9uLXJlcXVlc3RzLzIuMjguMQ==",
          rm: "R0VU",
          d: "99AvL8esOXtIa5swqdkLuwF4RIrSYrit4DPcqdNq5J6RF0WVKuePhrk+CRT/T+A1Vt
ZHvBGhFQi1PcqmxICi4P53GKbMcg6Em/lY4glP1AjE8yOdusEKiXU313xH+FAkZPau9Y+BtDRxdRFap7
wezFQHmHI3OTBTvwGb3S22WdUizohoYyQobm8OepF9CRdbwDCFt9LJT70Jv8mgt7p3pz55CndtR7w7+Q
EqGO51KOJibYEO+BZ3VAAYQlbm7V3gi5cmQQFZer7vSPj+TXby4UCh6Jy646Xk48L8PpR66zeyS2FfR9
qhObTUbBUJxqMJSF8pFWZwPChBrKEOlj7hvxyEN/UkH85AQqr99AvsuKnXPA+EdUakEq2Iau5uCwY5Cc
D6zxTXlpLOeUzRWiY/zdwyUyQ5sNkJkBdU/1iIrAR8BBzPyK78qPkUp6yjphzuW2zbr1Q9tQzzV3JIbs
ZFx0CB+afLTz2q585Z4dJoLeHZWJGV5ptFbiBH/GEktNfptpEZMilkqQzpY7iFmUOmePhO1VOtzNYnbI
6HnZ84vLg000eqKscqi2I9XOjG7/MJVG6cE9ohWWDFp++auOujzg==",
          t: "MTY1Njk0NzQ4My41NDcwMDA=",
          m: "xk2dGgRJNnIhHrLkkfIdA5vc0FdNK5W6fJHPklpqFqM=",
          i1: "kdOWWHgVrD4HZ4FQ23dhkw==",
          i2: "Ruq1MOBMPihQm6XFnEfM4A==",
          zh: "hzfiqo9hugT9sHeHQ1zy81NCL/SO295HO+GuRnkSV9o=",
          uh: "SLdVolODg++SO356HusO5I/hbfOpiiOxQXj62i/MUkA=",
          hh: "rAZnIHiyrNuZ6Oh9aAZNML8izDilqmOSNuCtac1WqPs=",
        }
      }
      window._cf_chl_enter = function(){window._cf_chl_opt.p=1};
    })();
    //]]>
  </script>


</head>
<body>
  <table width="100%" height="100%" cellpadding="20">
    <tr>
      <td align="center" valign="middle">
          <div class="cf-browser-verification cf-im-under-attack">
  <noscript>
    <h1 data-translate="turn_on_js" style="color:#bd2426;">Please turn
JavaScript on and reload the page.</h1>
  </noscript>
  <div id="cf-content" style="display:none">

    <div id="cf-bubbles">
      <div class="bubbles"></div>
      <div class="bubbles"></div>
      <div class="bubbles"></div>
    </div>
    <h1><span data-translate="checking_browser">Checking your browser before
accessing</span> www.datacamp.com.</h1>

    <div id="no-cookie-warning" class="cookie-warning" data-
translate="turn_on_cookies" style="display:none">
```

```
      <p data-translate="turn_on_cookies" style="color:#bd2426;">Please enable
Cookies and reload the page.</p>
    </div>
    <p data-translate="process_is_automatic">This process is automatic. Your
browser will redirect to your requested content shortly.</p>
    <p data-translate="allow_5_secs" id="cf-spinner-allow-5-secs" >Please allow
up to 5 seconds&hellip;</p>
    <p data-translate="redirecting" id="cf-spinner-redirecting"
style="display:none">Redirecting&hellip;</p>
  </div>

  <form class="challenge-form" id="challenge-form" action="/teach/documentation?
__cf_chl_f_tk=u_igNAQTBenTXqsl82ch1T8j6JQKKgpZsK3.pEWdrR4-1656947483-0-gaNycGzNC
BE" method="POST" enctype="application/x-www-form-urlencoded">
    <input type="hidden" name="md" value="PAQu.NJF1s_4yRUnymOjviyPRqg2pYtOB.fvpg
F3qjU-1656947483-0-AffNGz_DPI4FzOhJWDnANiUTckivGoDFJn48R-x5tf0tXzpRenOtBCvRw-duy
d3-zaD_SsfMGEv0szYg3vJYfV21G5GDrYQZ8ZimcM9uKqvDBBPg4V9nwgFUg_KnlgJiSvz2lNCKBZhMO
IFObrFFRdVRFLw1wNlnAMObDuM3aBxPBlflacW_FyL_c7euwguHPowoqz6xHRxli_jhGhygsgTQ4Nk18
Uca3xMt_QI_imE-myHcqeogCM8iyzQD4uIDnslrMFYOfpB3mCvRM5yrS5LZSX0FhycYQ1Ot7kU5FO8qI
chcuPQY0kb8OYfeESSd18XmygBkjBiKEvIDd-nM04pB60v2O0gO4q1OtjdLxEKRrqwKmLiJ93lM3nrf2
He2U5q1HXzbQdYiXmo07fcrzLgxEJh5k0XBBTPcYiR7E3AEox5qUwpsWLq0EcSTZ07LCKfs1Pz2Es4v-
Mk8G7lOrcyrYJWpQlZrsfh06kEp7-6KDMqwtyH3oTdfLHCTyBUsDsYX6lqPKGOoBynsn0VkVhfIig-Er
nOF6OrM_qWuMnEAArU1Y9xTV-6guDztPkcidYBj2DACUR3fIfGPJF4_qi7oIgF_ZoAfjdmgU7Usro6X4
zeDJsWbIAWwBMrn-l6Axrkn6XTlgNFgVfkuvW_PT68" />
    <input type="hidden" name="r" value="pgV8hsSrnC2CZ8W0I843s4mWSMXczyCuvuLg4xC
FjKo-1656947483-0-AY1F3VevysON8+PLAlJ/Kx+ZZi0ou/EOy4pVNsTsJpY1oXHqJ+W7x82aHe4+Sm
zStzuYKvWmUujqqrWs8ewkNlPKy1FAxD6XobbpKJsNeoJ62rIond2BvaGScuPA9X+DE/xmPmVHS45KON
5LxPFdVG6pgEf1I6Dz6MkEzQL1TTJWChsjPWlCy9PMA64MlAnzUozTZMXBMXMsURrNw5LIyKwpZ6Dfki
2duJsxHZKE04+0Vpt2fnuDtguKzSInqsd/9ZWIcLuIkXZngO/vnh0nYYZEaOKNaiEtSYFKtPBGX4JnU9
eFxBOUWQaJbPkNihhty4nxDQ/LwGjmfXSid2qQ4ytn3ue2ypCcoJp+brO4gb/t3e/rmaXh/LsgzDUN3n
JkpsSsjCXOeNlHB5cuelHZqV+UUGtDe3YMO3Uf0U9o5inT9n34OCv61GX3GX8O6KKx684VskebX0qsbb
1YdbRpaYQbZ6POADMJoWfx2P+KVgebK+2SPQ3sSTGIi3fk48pe/b4JMZTOA/2D+ZKCtfuPyPhkeOopoc
qoUjmPP0EafhtRGZ/+ZvogI2n8b2VwAq6HY8EinudAHXb6ThIp/lJyUQu8lhF+NzqNP1iAIhh7SbQmcV
vClO/oOotObatnHyYZ9U11ji1mDi7SqCb+sANjCNCI80Q5Cn9pGNQwTbuvHBrWnv4Y+E337AoBGqwk06
g3FLfGCk0WpX4ePekKRdXZzeTah2TV+MW2GEs1I/4fIWAnmWWG8OVM/QMGKDa1UkgBAWRXkZspmunhQm
6QS3A2z1pA7dYgpXIr3TQU/EdkOwUvFa1s7cVamZwDgS1kkNNoHYSkw2SZd4rX4g9YkmxYIYamHJq+cX
KKSfn8FDjt7FObR2ZUEdQ+Nfo22A86o5FZ7Hh6Rn2GIEUwHUdJyhEAnSUka5TUaZQ2mLPKmsZ/o2j7GO
hehuHzaITM3ex7QjOvIcH9fbV/Q4+aUMguwZK/nu5YtCbKYf3JGuiXLW8sT5ztlP/dNrzc9tyBi5EYTW
HYbTS2zpZ4MNRw9nHEQM0oni6Cz8Ue2lu5cGlhZa+mcgUaYbTVGWm1lWZLWoIqu8gptL+H4VowCffuxs
KwSDN6Nu9uKllyk//xsMqIVKl/unmimwmVHN0iOFXBo1+xPkL5slnrUYXgU3S5f7y+u0+7kpEVf9psYW
Q2B2bnwuWJXiLJEA34pnsHXHWgGo61ihSpqW992mYfk+t87+Q6QyqyeKas6jtrj+Js6fcEEDJwZecNNo
BKYig8wf6uoaBXt6bzMUz7KcV4G63sri3DspcPV0WQX7UUyHrSt5UgM4y2uM01mrYus1tQSNmqGC2abO
sr2RgBga+9VhXSo4wmJvAwPLSOtoMq1RMpBJ/jRhkLbOTHWZ83OY2X5KZg9LGDT02fKSxt2mAWCLJf93
pT/lFh9Fqecn0GqbZNX4sKpqvNpqC6LE5av0sDfIJMouir3jkUItv8cl1uQT1nIynH6PEG6YRaPpxsJd
C/hgU+qiFlkUFJy5KKcl7EyhZPtWp2KF+6sMOeEAd1vEi0wK+ZU9MlwXWGyU8VhKlHZ8gFCt7m9+SfSw
bkslfLOTy/q/Hvzya/Cq32Kit4JsnNJKLJaqpUausd5BDA6oHwcW/Sy64wN9DYsVe1ZEyHUeGLqWN5al
daPTqIyHWkd8oQWrpKyQ+fjyYReWn41eVP3JvsqRVEnxYG+HYCejljdxEPNENrrfed4R5lkpTfd/wO7N
pnx8S8DsCQiYVV66j+L6mCCfGik2w35wkax17261sjofhlWqkLhZZwtk4tZGocT23u6O4ZqLdp6p91Mu
```

```
CyWL66M2hiriXaVzU5FriiQ/bS7nUkQamBrGcyzcEzAaH73kTTRHSIroJpKDfxQJ/1ilFMxZxIHk001O
rmU/UATvDXNgDwLWMjX307JQBd5/B/Exvk+8q3CIVMYmD6y3uE6yZExk2eUnx8ccl/JUCx4aObAhZMeO
SpZhoM7knfjvyc6euEUm/4e10="/>
    <input type="hidden" value="0c60a421d60bdc1438760052287e58cb" id="jschl-vc"
name="jschl_vc"/>
    <!-- <input type="hidden" value="" id="jschl-vc" name="jschl_vc"/> -->
    <input type="hidden" name="pass" value="1656947484.547-ms7r4ezRdK"/>
    <input type="hidden" id="jschl-answer" name="jschl_answer"/>
  </form>
       <script>
      //<![CDATA[
      (function(){
          var a = document.getElementById('cf-content');
          a.style.display = 'block';
          var isIE =
/(MSIE|Trident\/|Edge\/)/i.test(window.navigator.userAgent);
          var trkjs = isIE ? new Image() : document.createElement('img');
          trkjs.setAttribute("src", "/cdn-
cgi/images/trace/jschal/js/transparent.gif?ray=7258cb0c29df5266");
          trkjs.id = "trk_jschal_js";
          trkjs.setAttribute("alt", "");
          document.body.appendChild(trkjs);
          var cpo=document.createElement('script');
          cpo.type='text/javascript';
          cpo.src="/cdn-cgi/challenge-
platform/h/b/orchestrate/jsch/v1?ray=7258cb0c29df5266";

          window._cf_chl_opt.cOgUHash = location.hash === '' &&
location.href.indexOf('#') !== -1 ? '#' : location.hash;
          window._cf_chl_opt.cOgUQuery = location.search === '' &&
location.href.slice(0, -window._cf_chl_opt.cOgUHash.length).indexOf('?') !== -1
? '?' : location.search;
          if (window._cf_chl_opt.cUPMDTk && window.history &&
window.history.replaceState) {
            var ogU = location.pathname + window._cf_chl_opt.cOgUQuery +
window._cf_chl_opt.cOgUHash;
            history.replaceState(null, null, "\/teach\/documentation?__cf_chl_rt
_tk=u_igNAQTBenTXqsl82ch1T8j6JQKKgpZsK3.pEWdrR4-1656947483-0-gaNycGzNCBE" +
window._cf_chl_opt.cOgUHash);
            cpo.onload = function() {
              history.replaceState(null, null, ogU);
            };
          }

          document.getElementsByTagName('head')[0].appendChild(cpo);
        }());
      //]]>
    </script>
  <div id="trk_jschal_nojs" style="background-image:url('/cdn-
cgi/images/trace/jschal/nojs/transparent.gif?ray=7258cb0c29df5266')"> </div>
</div>


          <div class="attribution">
            DDoS protection by <a rel="noopener noreferrer"
href="https://www.cloudflare.com/5xx-error-landing/"
target="_blank">Cloudflare</a>
            <br />
            <span class="ray_id">Ray ID: <code>7258cb0c29df5266</code></span>
          </div>
      </td>

    </tr>
  </table>
</body>
</html>
```

2.1.2 Web Scrapping con Python

[21]:
```python
from bs4 import BeautifulSoup

import requests

url = "https://www.crummy.com/software/BeautifulSoup/"

r = requests.get(url)

html_doc = r.text

soup = BeautifulSoup(html_doc) # Este paquete reorganiza el objeto html en la␣
 ↪forma correcta para su despliegue

print(soup.prettify())

# BeautifulSoup tiene métodos como soup.title() o soup.get_text() o spup.
 ↪find_all()
```

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 Transitional//EN"
"http://www.w3.org/TR/REC-html40/transitional.dtd">
<html>
 <head>
  <meta content="text/html; charset=utf-8" http-equiv="Content-Type"/>
  <title>
```

```
   Beautiful Soup: We called him Tortoise because he taught us.
  </title>
  <link href="mailto:leonardr@segfault.org" rev="made"/>
  <link href="/nb/themes/Default/nb.css" rel="stylesheet" type="text/css"/>
  <meta content="Beautiful Soup: a library designed for screen-scraping HTML and
XML." name="Description"/>
  <meta content="Markov Approximation 1.4 (module: leonardr)" name="generator"/>
  <meta content="Leonard Richardson" name="author"/>
 </head>
 <body alink="red" bgcolor="white" link="blue" text="black" vlink="660066">
  <style>
   #tidelift { }

#tidelift a {
 border: 1px solid #666666;
 margin-left: auto;
 padding: 10px;
 text-decoration: none;
}

#tidelift .cta {
 background: url("tidelift.svg") no-repeat;
 padding-left: 30px;
}
  </style>
  <img align="right" src="10.1.jpg" width="250"/>
  <br/>
  <p>
   [
   <a href="#Download">
    Download
   </a>
   |
   <a href="bs4/doc/">
    Documentation
   </a>
   |
   <a href="#HallOfFame">
    Hall of Fame
   </a>
   |
   <a href="enterprise.html">
    For enterprise
   </a>
   |
   <a href="https://code.launchpad.net/beautifulsoup">
    Source
   </a>
   |
   <a href="https://bazaar.launchpad.net/%7Eleonardr/beautifulsoup/bs4/view/head
:/CHANGELOG">
    Changelog
   </a>
   |
   <a href="https://groups.google.com/forum/?fromgroups#!forum/beautifulsoup">
    Discussion group
   </a>
   |
   <a href="zine/">
    Zine
   </a>
   ]
  </p>
  <div align="center">
   <a href="bs4/download/">
    <h1>
     Beautiful Soup
    </h1>
   </a>
  </div>
  <p>
   You didn't write that awful page. You're just trying to get some
data out of it. Beautiful Soup is here to help. Since 2004, it's been
saving programmers hours or days of work on quick-turnaround
screen scraping projects.
  </p>
  <p>
   Beautiful Soup is a Python library designed for quick turnaround
projects like screen-scraping. Three features make it powerful:
  </p>
  <ol>
   <li>
    Beautiful Soup provides a few simple methods and Pythonic idioms
for navigating, searching, and modifying a parse tree: a toolkit for
dissecting a document and extracting what you need. It doesn't take
much code to write an application
   </li>
   <li>
    Beautiful Soup automatically converts incoming documents to
Unicode and outgoing documents to UTF-8. You don't have to think
about encodings, unless the document doesn't specify an encoding and
Beautiful Soup can't detect one. Then you just have to specify the
original encoding.
   </li>
   <li>
    Beautiful Soup sits on top of popular Python parsers like
    <a href="http://lxml.de/">
     lxml
    </a>
    and
    <a href="http://code.google.com/p/html5lib/">
     html5lib
    </a>
    , allowing you
to try out different parsing strategies or trade speed for
flexibility.
   </li>
  </ol>
  <p>
   Beautiful Soup parses anything you give it, and does the tree
traversal stuff for you. You can tell it "Find all the links", or
"Find all the links of class
   <tt>
    externalLink
   </tt>
   ", or "Find all the
links whose urls match "foo.com", or "Find the table heading that's
got bold text, then give me that text."
  </p>
  <p>
   Valuable data that was once locked up in poorly-designed websites
is now within your reach. Projects that would have taken hours take
only minutes with Beautiful Soup.
  </p>
  <p>
   Interested?
   <a href="bs4/doc/">
    Read more.
   </a>
  </p>
  <h3>
   Getting and giving support
  </h3>
  <div align="center" id="tidelift">
   <a href="https://tidelift.com/subscription/pkg/pypi-
beautifulsoup4?utm_source=pypi-
beautifulsoup4&amp;utm_medium=referral&amp;utm_campaign=enterprise"
target="_blank">
    <span class="cta">
     Beautiful Soup for enterprise available via Tidelift
    </span>
   </a>
  </div>
  <p>
```

```
   If you have questions, send them to
   <a href="https://groups.google.com/forum/?fromgroups#!forum/beautifulsoup">
    the discussion
group
   </a>
   . If you find a bug,
   <a href="https://bugs.launchpad.net/beautifulsoup/">
    file it on Launchpad
   </a>
   . If it's a security vulnerability, report it confidentially through
   <a href="https://tidelift.com/security">
    Tidelift
   </a>
   .
  </p>
  <p>
   If you use Beautiful Soup as part of your work, please consider a
   <a href="https://tidelift.com/subscription/pkg/pypi-
beautifulsoup4?utm_source=pypi-
beautifulsoup4&amp;utm_medium=referral&amp;utm_campaign=website">
    Tidelift subscription
   </a>
   . This will support many of the free software projects your organization
depends on, not just Beautiful Soup.
  </p>
  <p>
   If Beautiful Soup is useful to you on a personal level, you might like to
read
   <a href="zine/">
    <i>
     Tool Safety
    </i>
   </a>
   , a short zine I wrote about what I learned about software development from
working on Beautiful Soup. Thanks!
  </p>
  <a name="Download">
   <h2>
    Download Beautiful Soup
   </h2>
  </a>
  <p>
   The current release is
   <a href="bs4/download/">
    Beautiful Soup
4.11.1
   </a>
   (April 8, 2022). You can install Beautiful Soup 4 with
   <code>
    pip install beautifulsoup4
   </code>
   .
  </p>
  <p>
   In Debian and Ubuntu, Beautiful Soup is available as the
   <code>
    python-bs4
   </code>
   package (for Python 2) or the
   <code>
    python3-bs4
   </code>
   package (for Python 3). In Fedora it's
available as the
   <code>
    python-beautifulsoup4
   </code>
   package.
  </p>
  <p>
   Beautiful Soup is licensed under the MIT license, so you can also
download the tarball, drop the
   <code>
    bs4/
   </code>
   directory into almost
any Python application (or into your library path) and start using it
immediately. (If you want to do this under Python 3, you will need to
manually convert the code using
   <code>
    2to3
   </code>
   .)
  </p>
  <p>
   Beautiful Soup 4 works on Python 3.6 and up. Support for Python 2 was
discontinued on January 1,
2021-one year after the Python 2 sunsetting date.
  </p>
  <h3>
   Beautiful Soup 3
  </h3>
  <p>
   Beautiful Soup 3 was the official release line of Beautiful Soup
from May 2006 to March 2012. It does not support Python 3 and was
discontinued or January 1, 2021-one year after the Python 2
```

```
sunsetting date. If you have any active projects using Beautiful Soup
3, you should migrate to Beautiful Soup 4 as part of your Python 3
conversion.
  </p>
  <p>
   <a
href="http://www.crummy.com/software/BeautifulSoup/bs3/documentation.html">
    Here's
the Beautiful Soup 3 documentation.
   </a>
  </p>
  <p>
   The current and hopefully final release of Beautiful Soup 3 is
   <a href="download/3.x/BeautifulSoup-3.2.2.tar.gz">
    3.2.2
   </a>
   (October 5,
2019). It's the
   <code>
    BeautifulSoup
   </code>
   package on pip. It's also
available as
   <code>
    python-beautifulsoup
   </code>
   in Debian and Ubuntu,
and as
   <code>
    python-BeautifulSoup
   </code>
   in Fedora.
  </p>
  <p>
   Once Beautiful Soup 3 is discontinued, these package names will be available
for use by a more recent version of Beautiful Soup.
  </p>
  <p>
   Beautiful Soup 3, like Beautiful Soup 4, is
   <a href="https://tidelift.com/subscription/pkg/pypi-
beautifulsoup?utm_source=pypi-
beautifulsoup&amp;utm_medium=referral&amp;utm_campaign=website">
    supported through Tidelift
   </a>
   .
  </p>
  <a name="HallOfFame">
   <h2>
```

```
    Hall of Fame
   </h2>
  </a>
  <p>
   Over the years, Beautiful Soup has been used in hundreds of
different projects. There's no way I can list them all, but I want to
highlight a few high-profile projects. Beautiful Soup isn't what makes
these projects interesting, but it did make their completion easier:
  </p>
  <ul>
   <li>
    <a href="http://www.nytimes.com/2007/10/25/arts/design/25vide.html">
     "Movable
 Type"
    </a>
    , a work of digital art on display in the lobby of the New
 York Times building, uses Beautiful Soup to scrape news feeds.
   </li>
   <li>
    Jiabao Lin's
    <a href="https://github.com/BlankerL/DXY-COVID-19-Crawler">
     DXY-COVID-19-Crawler
    </a>
    uses Beautiful Soup to scrape a Chinese medical site for information
about COVID-19, making it easier for researchers to track the spread
of the virus. (Source:
    <a href="https://blog.tidelift.com/how-open-source-software-is-fighting-
covid-19">
     "How open source software is fighting COVID-19"
    </a>
    )
   </li>
   <li>
    Reddit uses Beautiful Soup to
    <a href="https://github.com/reddit/reddit/blob/85f9cff3e2ab9bb8f19b96acd8da4
ebacc079f04/r2/r2/lib/media.py">
     parse
a page that's been linked to and find a representative image
    </a>
    .
   </li>
   <li>
    Alexander Harrowell uses Beautiful Soup to
    <a href="http://www.harrowell.org.uk/viktormap.html">
     track the business
 activities
    </a>
    of an arms merchant.
   </li>
   <li>
    The developers of Python itself used Beautiful Soup to
    <a href="http://svn.python.org/view/tracker/importer/">
     migrate the Python
bug tracker from Sourceforge to Roundup
    </a>
    .
   </li>
   <li>
    The
    <a href="http://www2.ljworld.com/">
     Lawrence Journal-World
    </a>
    uses Beautiful Soup to
    <a href="http://www.b-list.org/weblog/2010/nov/02/news-done-broke/">
     gather
statewide election results
    </a>
    .
   </li>
   <li>
    The
    <a href="http://esrl.noaa.gov/gsd/fab/">
     NOAA's Forecast
Applications Branch
    </a>
    uses Beautiful Soup in
    <a href="http://laps.noaa.gov/topograbber/">
     TopoGrabber
    </a>
    , a script for
downloading "high resolution USGS datasets."
   </li>
  </ul>
  <p>
   If you've used Beautiful Soup in a project you'd like me to know
about, please do send email to me or
   <a href="http://groups.google.com/group/beautifulsoup/">
    the discussion
group
   </a>
   .
  </p>
  <h2>
   Development
  </h2>
  <p>
```

```
   Development happens at
   <a href="https://launchpad.net/beautifulsoup">
    Launchpad
   </a>
   . You can
   <a href="https://code.launchpad.net/beautifulsoup/">
    get the source
code
   </a>
   or
   <a href="https://bugs.launchpad.net/beautifulsoup/">
    file
bugs
   </a>
   .
  </p>
  <hr/>
  <table>
   <tr>
    <td valign="top">
     <p>
      This document (
      <a href="/source/software/BeautifulSoup/index.bhtml">
       source
      </a>
      ) is part of Crummy, the webspace of
      <a href="/self/">
       Leonard Richardson
      </a>
      (
      <a href="/self/contact.html">
       contact information
      </a>
      ). It was last modified on Monday, June 27 2022, 15:36:35 Nowhere Standard
Time and last built on Monday, July 04 2022, 15:00:01 Nowhere Standard Time.
     </p>
     <p>
     </p>
     <table class="licenseText">
      <tr>
       <td>
        <a href="http://creativecommons.org/licenses/by-sa/2.0/">
         <img border="0" src="/nb//resources/img/somerights20.jpg"/>
        </a>
       </td>
       <td valign="top">
        Crummy is © 1996-2022 Leonard Richardson. Unless otherwise noted, all
text licensed under a
```

```
        <a href="http://creativecommons.org/licenses/by-sa/2.0/">
         Creative Commons License
        </a>
         .
       </td>
      </tr>
     </table>
     <!--<rdf:RDF xmlns="http://web.resource.org/cc/"
xmlns:dc="http://purl.org/dc/elements/1.1/"
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"><Work
rdf:about="http://www.crummy.com/"><dc:title>Crummy: The
Site</dc:title><dc:rights><Agent><dc:title>Crummy: the
Site</dc:title></Agent></dc:rights><dc:format>text/html</dc:format><license
rdf:resource=http://creativecommons.org/licenses/by-sa/2.0//></Work><License
rdf:about="http://creativecommons.org/licenses/by-
sa/2.0/"></License></rdf:RDF>-->
    </td>
    <td valign="top">
     <p>
      <b>
       Document tree:
      </b>
     </p>
     <dl>
      <dd>
       <a href="http://www.crummy.com/">
        http://www.crummy.com/
       </a>
       <dl>
        <dd>
         <a href="http://www.crummy.com/software/">
          software/
         </a>
         <dl>
          <dd>
           <a href="http://www.crummy.com/software/BeautifulSoup/">
            BeautifulSoup/
           </a>
          </dd>
         </dl>
        </dd>
       </dl>
      </dd>
     </dl>
     Site Search:
     <form action="/search/" method="get">
      <input maxlength="255" name="q" type="text" value=""/>
     </form>
    </td>
   </tr>
  </table>
 </body>
</html>
```

[22]:
```python
# Import packages
import requests
from bs4 import BeautifulSoup

# Specify url: url
url = 'https://www.python.org/~guido/'

# Package the request, send the request and catch the response: r
r = requests.get(url)

# Extracts the response as html: html_doc
html_doc = r.text

# Create a BeautifulSoup object from the HTML: soup
soup = BeautifulSoup(html_doc)

# Prettify the BeautifulSoup object: pretty_soup
pretty_soup = soup.prettify()

# Print the response
print(pretty_soup)
```

```
<html>
 <head>
  <title>
   Guido's Personal Home Page
  </title>
 </head>
 <body bgcolor="#FFFFFF" text="#000000">
  <!-- Built from main -->
  <h1>
   <a href="pics.html">
    <img border="0" src="images/IMG_2192.jpg"/>
   </a>
   Guido van Rossum - Personal Home Page
   <a href="pics.html">
    <img border="0" height="216" src="images/guido-headshot-2019.jpg"
width="270"/>
   </a>
  </h1>
  <p>
```

```
   <a href="http://www.washingtonpost.com/wp-
srv/business/longterm/microsoft/stories/1998/raymond120398.htm">
    <i>
     "Gawky and proud of it."
    </i>
   </a>
  </p>
  <h3>
   <a href="images/df20000406.jpg">
    Who I Am
   </a>
  </h3>
  <p>
   Read
my
   <a href="http://neopythonic.blogspot.com/2016/04/kings-day-speech.html">
    "King's
Day Speech"
   </a>
   for some inspiration.
  </p>
  <p>
   I am the author of the
   <a href="http://www.python.org">
    Python
   </a>
   programming language.  See also my
   <a href="Resume.html">
    resume
   </a>
   and my
   <a href="Publications.html">
    publications list
   </a>
   , a
   <a href="bio.html">
    brief bio
   </a>
   , assorted
   <a href="http://legacy.python.org/doc/essays/">
    writings
   </a>
   ,
   <a href="http://legacy.python.org/doc/essays/ppt/">
    presentations
   </a>
   and
   <a href="interviews.html">
```

```
    interviews
   </a>
   (all about Python), some
   <a href="pics.html">
    pictures of me
   </a>
   ,
   <a href="http://neopythonic.blogspot.com">
    my new blog
   </a>
   , and
my
   <a href="http://www.artima.com/weblogs/index.jsp?blogger=12088">
    old
blog
   </a>
   on Artima.com.  I am
   <a href="https://twitter.com/gvanrossum">
    @gvanrossum
   </a>
   on Twitter.
  </p>
  <p>
   I am currently a Distinguished Engineer at Microsoft.
I have worked for Dropbox, Google, Elemental Security, Zope
Corporation, BeOpen.com, CNRI, CWI, and SARA.  (See
my
   <a href="Resume.html">
    resume
   </a>
   .)  I created Python while at CWI.
  </p>
  <h3>
   How to Reach Me
  </h3>
  <p>
   You can send email for me to guido (at) python.org.
I read everything sent there, but I receive too much email to respond
to everything.
  </p>
  <h3>
   My Name
  </h3>
  <p>
   My name often poses difficulties for Americans.
  </p>
  <p>
   <b>
```

```
    Pronunciation:
   </b>
   in Dutch, the "G" in Guido is a hard G,
pronounced roughly like the "ch" in Scottish "loch".  (Listen to the
   <a href="guido.au">
    sound clip
   </a>
   .)  However, if you're
American, you may also pronounce it as the Italian "Guido".  I'm not
too worried about the associations with mob assassins that some people
have. :-)
  </p>
  <p>
   <b>
    Spelling:
   </b>
   my last name is two words, and I'd like to keep it
that way, the spelling on some of my credit cards notwithstanding.
Dutch spelling rules dictate that when used in combination with my
first name, "van" is not capitalized: "Guido van Rossum".  But when my
last name is used alone to refer to me, it is capitalized, for
example: "As usual, Van Rossum was right."
  </p>
  <p>
   <b>
    Alphabetization:
   </b>
   in America, I show up in the alphabet under
"V".  But in Europe, I show up under "R".  And some of my friends put
me under "G" in their address book…
  </p>
  <h3>
   More Hyperlinks
  </h3>
  <ul>
   <li>
    Here's a collection of
    <a href="http://legacy.python.org/doc/essays/">
     essays
    </a>
    relating to Python
that I've written, including the foreword I wrote for Mark Lutz' book
"Programming Python".
    <p>
    </p>
   </li>
   <li>
    I own the official
    <a href="images/license.jpg">
     <img align="center" border="0" height="75" src="images/license_thumb.jpg"
width="100"/>
     Python license.
    </a>
    <p>
    </p>
   </li>
  </ul>
  <h3>
   The Audio File Formats FAQ
  </h3>
  <p>
   I was the original creator and maintainer of the Audio File Formats
FAQ.  It is now maintained by Chris Bagwell
at
   <a href="http://www.cnpbagwell.com/audio-faq">
    http://www.cnpbagwell.com/audio-faq
   </a>
   .  And here is a link to
   <a href="http://sox.sourceforge.net/">
    SOX
   </a>
   , to which I contributed
some early code.
  </p>
  <hr/>
  <a href="images/internetdog.gif">
   "On the Internet, nobody knows you're
a dog."
  </a>
  <hr/>
 </body>
</html>
```

[23]:
```python
# Para extraer el título y texto:

guido_title = soup.title

print(guido_title)

guido_text = soup.get_text()

print(guido_text)
```

```
<title>Guido's Personal Home Page</title>
```

Guido's Personal Home Page

Guido van Rossum - Personal Home Page

"Gawky and proud of it."
Who I Am
Read
my "King's
Day Speech" for some inspiration.

I am the author of the Python
programming language. See also my resume
and my publications list, a brief bio, assorted writings, presentations and
interviews (all about Python), some
pictures of me,
my new blog, and
my old
blog on Artima.com. I am
@gvanrossum on Twitter.

I am currently a Distinguished Engineer at Microsoft.
I have worked for Dropbox, Google, Elemental Security, Zope
Corporation, BeOpen.com, CNRI, CWI, and SARA. (See
my resume.) I created Python while at CWI.

How to Reach Me
You can send email for me to guido (at) python.org.
I read everything sent there, but I receive too much email to respond
to everything.

My Name
My name often poses difficulties for Americans.

Pronunciation: in Dutch, the "G" in Guido is a hard G,
pronounced roughly like the "ch" in Scottish "loch". (Listen to the
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too worried about the associations with mob assassins that some people
have. :-)

Spelling: my last name is two words, and I'd like to keep it
that way, the spelling on some of my credit cards notwithstanding.
Dutch spelling rules dictate that when used in combination with my

```
first name, "van" is not capitalized: "Guido van Rossum".  But when my
last name is used alone to refer to me, it is capitalized, for
example: "As usual, Van Rossum was right."

Alphabetization: in America, I show up in the alphabet under
"V".  But in Europe, I show up under "R".  And some of my friends put
me under "G" in their address book…


More Hyperlinks

Here's a collection of essays relating to Python
that I've written, including the foreword I wrote for Mark Lutz' book
"Programming Python".
I own the official
Python license.

The Audio File Formats FAQ
I was the original creator and maintainer of the Audio File Formats
FAQ.  It is now maintained by Chris Bagwell
at http://www.cnpbagwell.com/audio-faq.  And here is a link to
SOX, to which I contributed
some early code.




"On the Internet, nobody knows you're
a dog."
```

[24]:
```python
# Y para encontrar todos los hipervínculos:

a_tags = soup.find_all("a") # "a" define a los hipervínculos

for link in a_tags:
    print(link.get("href"))
```

```
pics.html
pics.html
http://www.washingtonpost.com/wp-
srv/business/longterm/microsoft/stories/1998/raymond120398.htm
images/df20000406.jpg
http://neopythonic.blogspot.com/2016/04/kings-day-speech.html
http://www.python.org
Resume.html
```

```
Publications.html
bio.html
http://legacy.python.org/doc/essays/
http://legacy.python.org/doc/essays/ppt/
interviews.html
pics.html
http://neopythonic.blogspot.com
http://www.artima.com/weblogs/index.jsp?blogger=12088
https://twitter.com/gvanrossum
Resume.html
guido.au
http://legacy.python.org/doc/essays/
images/license.jpg
http://www.cnpbagwell.com/audio-faq
http://sox.sourceforge.net/
images/internetdog.gif
```

2.2 INTERACTUANDO CON APIs

Una API es un conjunto de protocolos y rutinas para crear e interactuar con aplicaciones de software.

El formulario estándar para la transferencia de datos a través de las APIs es el formato de archivo JSON.

El cargar JSONs en Python, se almacenan como diccionarios.

[25]:
```python
json_data = {"Ratings": [{"Source": "Internet Movie Database", "Value": "7.7/
 ↪10"}, {"Source": "Rotten Tomatoes", "Value": "95%"}, {"Source":␣
 ↪"Metacritic", "Value": "95/100"}], "Country": "USA", "imdbVotes": "550,434",␣
 ↪"Rated": "PG-13", "Plot": "Harvard student Mark Zuckerberg creates the␣
 ↪social networking site that would become known as Facebook, but is later␣
 ↪sued by two brothers who claimed he stole their idea, and the co-founder who␣
 ↪was later squeezed out of the business.", "Genre": "Biography, Drama",␣
 ↪"Response": "True", "Released": "01 Oct 2010", "Language": "English,␣
 ↪French", "DVD": "11 Jan 2011", "Poster": "https://m.media-amazon.com/images/
 ↪M/MV5BMTM2ODk0NDAwMF5BMl5BanBnXkFtZTcwNTM1MDc2Mw@@._V1_SX300.jpg",␣
 ↪"Production": "Columbia Pictures", "Director": "David Fincher", "Title":␣
 ↪"The Social Network", "imdbRating": "7.7", "Writer": "Aaron Sorkin␣
 ↪(screenplay), Ben Mezrich (book)", "Year": "2010", "Metascore": "95", "Type":
 ↪ "movie", "Runtime": "120 min", "Website": "http://www.
 ↪thesocialnetwork-movie.com/", "imdbID": "tt1285016", "Actors": "Jesse␣
 ↪Eisenberg, Rooney Mara, Bryan Barter, Dustin Fitzsimons", "Awards": "Won 3␣
 ↪Oscars. Another 165 wins & 168 nominations.", "BoxOffice": "$96,400,000"}

# with open("a_movie.json") as json_file:
#   json_data = json.load(json_file)

for k in json_data.keys():
    print(k + ': ', json_data[k])
```

```
Ratings:  [{'Source': 'Internet Movie Database', 'Value': '7.7/10'}, {'Source':
'Rotten Tomatoes', 'Value': '95%'}, {'Source': 'Metacritic', 'Value': '95/100'}]
Country:  USA
imdbVotes:  550,434
Rated:  PG-13
Plot:  Harvard student Mark Zuckerberg creates the social networking site that
would become known as Facebook, but is later sued by two brothers who claimed he
stole their idea, and the co-founder who was later squeezed out of the business.
Genre:  Biography, Drama
Response:  True
Released:  01 Oct 2010
Language:  English, French
DVD:  11 Jan 2011
Poster:  https://m.media-amazon.com/images/M/MV5BMTM2ODk0NDAwMF5BMl5BanBnXkFtZTc
wNTM1MDc2Mw@@._V1_SX300.jpg
Production:  Columbia Pictures
Director:  David Fincher
Title:  The Social Network
imdbRating:  7.7
Writer:  Aaron Sorkin (screenplay), Ben Mezrich (book)
Year:  2010
Metascore:  95
Type:  movie
Runtime:  120 min
Website:  http://www.thesocialnetwork-movie.com/
imdbID:  tt1285016
Actors:  Jesse Eisenberg, Rooney Mara, Bryan Barter, Dustin Fitzsimons
Awards:  Won 3 Oscars. Another 165 wins & 168 nominations.
BoxOffice:  $96,400,000
```

2.2.1 APIs e internet

[26]:
```python
import requests

url = "http://www.omdbapi.com/?apikey=72bc447a&t=the+social+network"

r = requests.get(url)

json_data = r.json()

for key, value in json_data.items():
    print(key + ":", value)
```

```
Title: The Social Network
Year: 2010
Rated: PG-13
Released: 01 Oct 2010
Runtime: 120 min
```

```
Genre: Biography, Drama
Director: David Fincher
Writer: Aaron Sorkin, Ben Mezrich
Actors: Jesse Eisenberg, Andrew Garfield, Justin Timberlake
Plot: As Harvard student Mark Zuckerberg creates the social networking site that
would become known as Facebook, he is sued by the twins who claimed he stole
their idea, and by the co-founder who was later squeezed out of the business.
Language: English, French
Country: United States
Awards: Won 3 Oscars. 172 wins & 186 nominations total
Poster: https://m.media-amazon.com/images/M/MV5BOGUyZDUxZjEtMmIzMC00MzlmLTg4MGIt
ZWJmMzBhZjE0Mjc1XkEyXkFqcGdeQXVyMTMxODk2OTU@._V1_SX300.jpg
Ratings: [{'Source': 'Internet Movie Database', 'Value': '7.8/10'}, {'Source':
'Rotten Tomatoes', 'Value': '96%'}, {'Source': 'Metacritic', 'Value': '95/100'}]
Metascore: 95
imdbRating: 7.8
imdbVotes: 687,228
imdbID: tt1285016
Type: movie
DVD: 11 Jan 2011
BoxOffice: $96,962,694
Production: N/A
Website: N/A
Response: True
```

[27]:
```python
# Assign URL to variable: url
url = "https://en.wikipedia.org/w/api.php?
 ↪action=query&prop=extracts&format=json&exintro=&titles=pizza"

# Package the request, send the request and catch the response: r
r = requests.get(url)

# Decode the JSON data into a dictionary: json_data
json_data = r.json()

# Print the Wikipedia page extract
pizza_extract = json_data['query']['pages']['24768']['extract']
print(pizza_extract)
```

```
<link rel="mw-deduplicated-inline-style" href="mw-
data:TemplateStyles:r1033289096">
<p class="mw-empty-elt">
</p>
<p><b>Pizza</b> (<small>Italian: </small><span title="Representation in the
International Phonetic Alphabet (IPA)" lang="it-Latn-fonipa">[ pittsa]</span>,
<small>Neapolitan: </small><span title="Representation in the International
Phonetic Alphabet (IPA)" lang="nap-Latn-fonipa">[ pittsə]</span>) is a dish of
Italian origin consisting of a usually round, flat base of leavened wheat-based
```

```
dough topped with tomatoes, cheese, and often various other ingredients (such as
various types of sausage, anchovies, mushrooms, onions, olives, vegetables,
meat, ham, etc.), which is then baked at a high temperature, traditionally in a
wood-fired oven. A small pizza is sometimes called a pizzetta. A person who
makes pizza is known as a <b>pizzaiolo</b>.
</p><p>In Italy, pizza served in a restaurant is presented unsliced, and is
eaten with the use of a knife and fork. In casual settings, however, it is cut
into wedges to be eaten while held in the hand.
</p><p>The term <i>pizza</i> was first recorded in the 10th century in a Latin
manuscript from the Southern Italian town of Gaeta in Lazio, on the border with
Campania. Modern pizza was invented in Naples, and the dish and its variants
have since become popular in many countries. It has become one of the most
popular foods in the world and a common fast food item in Europe, North America
and Australasia; available at pizzerias (restaurants specializing in pizza),
restaurants offering Mediterranean cuisine, via pizza delivery, and as street
food. Various food companies sell ready-baked pizzas, which may be frozen, in
grocery stores, to be reheated in a home oven.
</p><p>In 2017, the world pizza market was US$128 billion, and in the US it was
$44 billion spread over 76,000 pizzerias.  Overall, 13% of the U.S. population
aged 2 years and over consumed pizza on any given day.</p><p>The <i>Associazione
Verace Pizza Napoletana</i> (lit. True Neapolitan Pizza Association) is a non-
profit organization founded in 1984 with headquarters in Naples that aims to
promote traditional Neapolitan pizza. In 2009, upon Italy's request, Neapolitan
pizza was registered with the European Union as a Traditional Speciality
Guaranteed dish, and in 2017 the art of its making was included on UNESCO's list
of intangible cultural heritage.</p><p>Raffaele Esposito is often considered to
be the father of modern pizza.</p>
```

2.3 TWITTER API

El módulo tweepy es utilizado para realizar web scrapping en Twitter

Import package

import tweepy,json

Store OAuth authentication credentials in relevant variables

access_token = “1092294848-aHN7DcRP9B4VMTQIhwqOYiB14YkW92fFO8k8EPy” access_token_secret = “X4dHmhPfaksHcQ7SCbmZa2oYBBVSD2g8uIHXsp5CTaksx” consumer_key = “nZ6EA0FxZ293SxGNg8g8aP0HM” consumer_secret = “fJ-GEodwe3KiKUnsYJC3VRndj7jevVvXbK2D5EiJ2nehafRgA6i”

Pass OAuth details to tweepy’s OAuth handler

auth = tweepy.OAuthHandler(consumer_key, consumer_secret) auth.set_access_token(access_token,access_token_secret)

Initialize Stream listener

l = MyStreamListener()

Create you Stream object with authentication

stream = tweepy.Stream(auth, l)

Filter Twitter Streams to capture data by the keywords:

s = [‘clinton’, ‘trump’, ‘sanders’,‘cruz’] stream.filter(track = s)

Import package

import json

String of path to file: tweets_data_path

tweets_data_path = ‘tweets.txt’

Initialize empty list to store tweets: tweets_data

tweets_data = []

Open connection to file

tweets_file = open(tweets_data_path, “r”)

Read in tweets and store in list: tweets_data

for line in tweets_file: tweet = json.loads(line) tweets_data.append(tweet)

Close connection to file

tweets_file.close()

Print the keys of the first tweet dict

print(tweets_data[0].keys())

Import package

import pandas as pd

Build DataFrame of tweet texts and languages

df = pd.DataFrame(tweets_data, columns=[‘text’,‘lang’])

Print head of DataFrame

print(df.head())

Initialize list to store tweet counts

[clinton, trump, sanders, cruz] = [0, 0, 0, 0]

Iterate through df, counting the number of tweets in which each candidate is mentioned

for index, row in df.iterrows(): clinton += word_in_text(‘clinton’, row[‘text’]) trump += word_in_text(‘trump’, row[‘text’]) sanders += word_in_text(‘sanders’, row[‘text’]) cruz += word_in_text(‘cruz’, row[‘text’])

Import packages

import seaborn as sns import matplotlib.pyplot as plt

Set seaborn style

sns.set(color_codes=True)

Create a list of labels:cd

cd = [‘clinton’, ‘trump’, ‘sanders’, ‘cruz’]

Plot histogram

ax = sns.barplot(cd, [clinton, trump, sanders, cruz]) ax.set(ylabel="count") plt.show()

3 LIMPIEZA DE DATOS

3.1 PROBLEMAS EN DATOS COMUNES

Al trabajar con datos, es común encontrar texto, enteros, decimales, binarios, fechas o datos categóricos.

[28]:
```
sales = pd.read_csv("C:/Users/marco/Data Camp Python/Datasets/sales_subset.csv")

# Se pueden conocer los tipos de cada columna como sigue:

print(sales.dtypes)

# Y los NAs:

print(sales.info())

# Para eliminar un signo "$" se hace lo siguiente:

# df["column_name"] = sales["column_name"].str.strip("$")
# df["column_name"] = sales["column_name"].astype("int")

# Para asegurarse de que la columna ahora es efectivamente entero:

# assert sales["column_name"].dtype == "int"

# La cual no devuelve nada si se cumple la condición, y un error si no

assert 1 + 1 == 2
# assert 1 + 1 == 3
```

```
Unnamed: 0                int64
store                     int64
type                     object
department                int64
date                     object
weekly_sales            float64
```

```
is_holiday                  bool
temperature_c            float64
fuel_price_usd_per_l     float64
unemployment             float64
dtype: object
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10774 entries, 0 to 10773
Data columns (total 10 columns):
 #   Column                Non-Null Count  Dtype
---  ------                --------------  -----
 0   Unnamed: 0            10774 non-null  int64
 1   store                 10774 non-null  int64
 2   type                  10774 non-null  object
 3   department            10774 non-null  int64
 4   date                  10774 non-null  object
 5   weekly_sales          10774 non-null  float64
 6   is_holiday            10774 non-null  bool
 7   temperature_c         10774 non-null  float64
 8   fuel_price_usd_per_l  10774 non-null  float64
 9   unemployment          10774 non-null  float64
dtypes: bool(1), float64(4), int64(3), object(2)
memory usage: 768.2+ KB
None
```

[29]:
```python
# A veces los números pueden indicar categorías, por lo que es necesario␣
 ↪modificar su tipo:

# df["column_name"] = df["column_name"].astype("category")
```

[30]:
```python
# Ejemplo

ride_sharing = pd.read_csv("C:/Users/marco/Data Camp Python/Datasets/
 ↪ride_sharing_new.csv")

print(ride_sharing.info())

print(ride_sharing["user_type"].describe())

# Pero las estadísticas corresponden a una variable numérica, cuando en␣
 ↪realidad se quiere tratar como categórica:

ride_sharing['user_type_cat'] = ride_sharing['user_type'].astype("category")

assert ride_sharing['user_type_cat'].dtype == 'category'

print(ride_sharing['user_type_cat'].describe())
```

```
<class 'pandas.core.frame.DataFrame'>
```

```
RangeIndex: 25760 entries, 0 to 25759
Data columns (total 10 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   Unnamed: 0       25760 non-null  int64
 1   duration         25760 non-null  object
 2   station_A_id     25760 non-null  int64
 3   station_A_name   25760 non-null  object
 4   station_B_id     25760 non-null  int64
 5   station_B_name   25760 non-null  object
 6   bike_id          25760 non-null  int64
 7   user_type        25760 non-null  int64
 8   user_birth_year  25760 non-null  int64
 9   user_gender      25760 non-null  object
dtypes: int64(6), object(4)
memory usage: 2.0+ MB
None
count    25760.000000
mean         2.008385
std          0.704541
min          1.000000
25%          2.000000
50%          2.000000
75%          3.000000
max          3.000000
Name: user_type, dtype: float64
count     25760
unique        3
top           2
freq      12972
Name: user_type_cat, dtype: int64
```

[31]:
```python
# Si se quiere eliminar "minutes" de la columna duration:

ride_sharing["duration_trim"] = ride_sharing["duration"].str.strip("minutes")

ride_sharing["duration_time"] = ride_sharing["duration_trim"].astype("int")

assert ride_sharing["duration_time"].dtype == "int"

print(ride_sharing[['duration','duration_trim','duration_time']])
print((ride_sharing['duration_time']).mean())
```

```
         duration duration_trim  duration_time
0      12 minutes           12              12
1      24 minutes           24              24
2       8 minutes            8               8
3       4 minutes            4               4
```

```
4      11 minutes          11              11
…          …           …            …
25755  11 minutes          11              11
25756  10 minutes          10              10
25757  14 minutes          14              14
25758  14 minutes          14              14
25759  29 minutes          29              29

[25760 rows x 3 columns]
11.389052795031056
```

3.1.1 Problemas con rangos

A veces, los datos pueden estar fuera de rango (una fecha en el futuro o una magnitud fuera del rango establecido).

Aunque estos datos podrían eliminarse, esto implica un riesgo de pérdida de información relevante.

Otra opción es establecer mínimos y máximos para cada columna.

O bien, tratarlos como NAs e imputarlos.

[32]:
```
# Considérese el ejemplo de un dataset con calificaciones de películas, en␣
↪donde algunos registros son iguales a 6

# Puede filtrarse:
# movies = movies[movies["avg_rating"] <= 5]
# Alternativamente:
# movies.drop(movies[movies["avg_rating"] > 5].index, inplace = True)
# Y comprobamos:
# assert movies["avg_rating].max() <= 5

# Para cambiar los valores fuera del rango:
# movies.loc[movies["avg_rating"] > 5, "avg_rating"] = 5
# Y comprobamos:
# assert movies["avg_rating].max() <= 5

# FECHAS:
# user_signups["subscription_date"] = pd.
↪to_datetime(user_signups["subscription_date"]).dt.date
# today_date = dt.date.today()
# Entonces, para eliminar fechas futuras hay dos formas:
# user_signups = user_signups[user_signups["subscription_date"] < today_date]
# user_signups.drop(user_signups[user_signups["subscription_date"] >␣
↪today_date].index, inplace = True)
# O crear un límite superior:
# user_signups.loc[user_signups["subscription_date"] > today_date,␣
↪"subcription_date"] = today_date
# Y comprobarlo:
```

```
# asser user_signups.subscription_date.max().date() <= today_date
```

[33]:
```
# Ejemplo

ride_sharing['station_A_id'] = ride_sharing['station_A_id'].astype('int')

ride_sharing.loc[ride_sharing["station_A_id"] > 80, "tire_sizes"] = 80

ride_sharing['station_A_id'] = ride_sharing["station_A_id"].astype("category")

print(ride_sharing['station_A_id'].describe())
```

```
count     25760
unique        9
top          67
freq       3635
Name: station_A_id, dtype: int64
```

3.1.2 Restricciones de unicidad

[34]:
```
# Se pueden encontrar duplicados así:

duplicates = ride_sharing.duplicated()

print(duplicates)

# Y para ver exactamente las columnas duplicadas:

ride_sharing[duplicates]
```

```
0        False
1        False
2        False
3        False
4        False
         …
25755    False
25756    False
25757    False
25758    False
25759    False
Length: 25760, dtype: bool
```

[34]:
```
Empty DataFrame
Columns: [Unnamed: 0, duration, station_A_id, station_A_name, station_B_id,
station_B_name, bike_id, user_type, user_birth_year, user_gender, user_type_cat,
duration_trim, duration_time, tire_sizes]
Index: []
```

```
[35]: # Para calibrar correctamente el método .duplicate(), se usarán dos argumentos:␣
       ↪subset para lsitar las columnas para
      # checar por duplicidad; keep permite mantener o no la ocurrencia de un valor␣
       ↪duplicado (first, last, False)

      duplicates = ride_sharing.duplicated(subset = "user_gender", keep = "first")

      ride_sharing[duplicates]
```

```
[35]:        Unnamed: 0    duration station_A_id  \
      1               1  24 minutes            3
      2               2   8 minutes           67
      3               3   4 minutes           16
      4               4  11 minutes           22
      5               5  10 minutes           22
      …             …         …           …
      25755       25755  11 minutes           15
      25756       25756  10 minutes           15
      25757       25757  14 minutes           15
      25758       25758  14 minutes           15
      25759       25759  29 minutes           16

                                              station_A_name  station_B_id  \
      1            Powell St BART Station (Market St at 4th St)           118
      2      San Francisco Caltrain Station 2  (Townsend St…            23
      3                                 Steuart St at Market St            28
      4                                   Howard St at Beale St           350
      5                                   Howard St at Beale St             6
      …                                                  …           …
      25755  San Francisco Ferry Building (Harry Bridges Pl…            34
      25756  San Francisco Ferry Building (Harry Bridges Pl…            34
      25757  San Francisco Ferry Building (Harry Bridges Pl…            42
      25758  San Francisco Ferry Building (Harry Bridges Pl…            42
      25759                             Steuart St at Market St           115

                                          station_B_name  bike_id  user_type  \
      1                    Eureka Valley Recreation Center     5193          2
      2                      The Embarcadero at Steuart St     3652          3
      3                       The Embarcadero at Bryant St     1883          1
      4                            8th St at Brannan St     4626          2
      5                      The Embarcadero at Sansome St     3279          2
      …                                             …      …        …
      25755                   Father Alfred E Boeddeker Park     5063          1
      25756                   Father Alfred E Boeddeker Park     5411          2
      25757  San Francisco City Hall (Polk St at Grove St)     5157          2
      25758  San Francisco City Hall (Polk St at Grove St)     4438          2
      25759                              Jackson Playground     1705          3
```

```
       user_birth_year user_gender user_type_cat duration_trim  duration_time  \
1                 1965        Male             2            24             24
2                 1993        Male             3             8              8
3                 1979        Male             1             4              4
4                 1994        Male             2            11             11
5                 1979        Male             2            10             10
…                  …          …            …            …             …
25755             2000        Male             1            11             11
25756             1998        Male             2            10             10
25757             1995        Male             2            14             14
25758             1995        Male             2            14             14
25759             1990        Male             3            29             29

       tire_sizes
1             NaN
2             NaN
3             NaN
4             NaN
5             NaN
…          …
25755         NaN
25756         NaN
25757         NaN
25758         NaN
25759         NaN

[25757 rows x 14 columns]
```

[36]:
```
# El método .drop_duplicates() se usa para eliminar a los duplicados
```

[37]:
```
# Find duplicates
duplicates = ride_sharing.duplicated("bike_id", keep = False)

# Sort your duplicated rides
duplicated_rides = ride_sharing[duplicates].sort_values('bike_id')

# Print relevant columns of duplicated_rides
print(duplicated_rides[['bike_id','duration','user_birth_year']])
```

```
       bike_id    duration  user_birth_year
3638        11  12 minutes             1988
6088        11   5 minutes             1985
10857       11   4 minutes             1987
10045       27  13 minutes             1989
16104       27  10 minutes             1970
…          …          …              …
8812      6638  10 minutes             1986
```

```
6815      6638   5 minutes            1995
8456      6638   7 minutes            1983
8300      6638   6 minutes            1962
8380      6638   8 minutes            1984

[25717 rows x 3 columns]
```

[38]:
```
# Drop complete duplicates from ride_sharing
ride_dup = ride_sharing.drop_duplicates()

# Create statistics dictionary for aggregation function
statistics = {'user_birth_year': "min", 'duration': "mean"}

# Group by ride_id and compute new statistics
# ride_unique = ride_dup.groupby('bike_id').agg(statistics).reset_index()

# Find duplicated values again
# duplicates = ride_unique.duplicated(subset = 'bike_id', keep = False)
# duplicated_rides = ride_unique[duplicates == True]

# Assert duplicates are processed
# assert duplicated_rides.shape[0] == 0
```

3.2 PROBLEMAS DE TEXTO Y DE DATOS CATEGÓRICOS

[39]:
```
airlines = pd.read_csv("C:/Users/marco/Data Camp Python/Datasets/airlines_final.
 ↪csv")
data = [['Clean', "Neutral", "Very satisfied"], ['Average', "Very safe",␣
 ↪"Neutral"], ['Somewhat clean', "Somewhat safe", "Somewhat satisfied"],␣
 ↪["Somewhat dirty", "Very unsafe", "Somewhat unsatisfied"], ["Dirty",␣
 ↪"Somewhat unsafe", "Very Unsatisfied"]]
categories = pd.DataFrame(data, columns=['cleanliness', 'safety',␣
 ↪"satisfaction"])

# Print categories DataFrame
print(categories)

# Print unique values of survey columns in airlines
print('Cleanliness: ', airlines['cleanliness'].unique(), "\n")
print('Safety: ', airlines["safety"].unique(), "\n")
print('Satisfaction: ', airlines["satisfaction"].unique(), "\n")

# Find the cleanliness category in airlines not in categories
cat_clean = set(airlines["cleanliness"]).difference(categories["cleanliness"])

# Find rows with that category
cat_clean_rows = airlines['cleanliness'].isin(cat_clean)
```

```python
# Print rows with inconsistent category
print(airlines[cat_clean_rows])

# Print rows with consistent categories only
print(airlines[~cat_clean_rows])
```

```
      cleanliness           safety          satisfaction
0           Clean          Neutral        Very satisfied
1         Average        Very safe               Neutral
2  Somewhat clean    Somewhat safe    Somewhat satisfied
3  Somewhat dirty      Very unsafe  Somewhat unsatisfied
4           Dirty  Somewhat unsafe      Very Unsatisfied
Cleanliness:  ['Clean' 'Average' 'Somewhat clean' 'Somewhat dirty' 'Dirty']

Safety:  ['Neutral' 'Very safe' 'Somewhat safe' 'Very unsafe' 'Somewhat unsafe']

Satisfaction:  ['Very satisfied' 'Neutral' 'Somewhat satsified' 'Somewhat
unsatisfied'
 'Very unsatisfied']

Empty DataFrame
Columns: [Unnamed: 0, id, day, airline, destination, dest_region, dest_size,
boarding_area, dept_time, wait_min, cleanliness, safety, satisfaction]
Index: []
      Unnamed: 0    id        day        airline        destination  \
0              0  1351    Tuesday    UNITED INTL             KANSAI
1              1   373     Friday         ALASKA  SAN JOSE DEL CABO
2              2  2820   Thursday          DELTA        LOS ANGELES
3              3  1157    Tuesday      SOUTHWEST        LOS ANGELES
4              4  2992  Wednesday       AMERICAN              MIAMI
…            …   …         …            …                 …
2472        2804  1475    Tuesday         ALASKA       NEW YORK-JFK
2473        2805  2222   Thursday      SOUTHWEST            PHOENIX
2474        2806  2684     Friday         UNITED            ORLANDO
2475        2807  2549    Tuesday        JETBLUE         LONG BEACH
2476        2808  2162   Saturday  CHINA EASTERN            QINGDAO

        dest_region dest_size boarding_area   dept_time  wait_min  \
0              Asia       Hub  Gates 91-102  2018-12-31     115.0
1     Canada/Mexico     Small   Gates 50-59  2018-12-31     135.0
2           West US       Hub   Gates 40-48  2018-12-31      70.0
3           West US       Hub   Gates 20-39  2018-12-31     190.0
4           East US       Hub   Gates 50-59  2018-12-31     559.0
…               …        …            …           …        …
2472        East US       Hub   Gates 50-59  2018-12-31     280.0
2473        West US       Hub   Gates 20-39  2018-12-31     165.0
2474        East US       Hub   Gates 70-90  2018-12-31      92.0
```

```
2475        West US     Small    Gates 1-12  2018-12-31      95.0
2476           Asia     Large    Gates 1-12  2018-12-31     220.0

         cleanliness         safety        satisfaction
0              Clean        Neutral      Very satisfied
1              Clean      Very safe      Very satisfied
2            Average  Somewhat safe             Neutral
3              Clean      Very safe  Somewhat satsified
4     Somewhat clean      Very safe  Somewhat satsified
…                …            …                 …
2472  Somewhat clean        Neutral  Somewhat satsified
2473           Clean      Very safe      Very satisfied
2474           Clean      Very safe      Very satisfied
2475           Clean  Somewhat safe      Very satisfied
2476           Clean      Very safe  Somewhat satsified

[2477 rows x 13 columns]
```

3.2.1 Datos categóricos

Un problema común en los datos categóricos es la presencia de valores en mayúsculas. Pueden usarse los méteodos str.upper() para capitalizar, o str.lower() para poner en minúsculas.

Otro problema suelen ser los espacios antes o después de las cadenas o categorías. Para ello, se usa el método str.strip(), vacío, para eliminar espacios.

[40]:
```python
# Print unique values of both columns
print(airlines['dest_region'].unique())
print(airlines['dest_size'].unique())

# Lower dest_region column and then replace "eur" with "europe"
airlines['dest_region'] = airlines['dest_region'].str.lower()
airlines['dest_region'] = airlines['dest_region'].replace({'eur':'europe'})

# Remove white spaces from `dest_size`
airlines['dest_size'] = airlines['dest_size'].str.strip()

# Verify changes have been effected
print(airlines["dest_region"].unique())
print(airlines["dest_size"].unique())
```

```
['Asia' 'Canada/Mexico' 'West US' 'East US' 'Midwest US' 'EAST US'
 'Middle East' 'Europe' 'eur' 'Central/South America'
 'Australia/New Zealand' 'middle east']
['Hub' 'Small' '    Hub' 'Medium' 'Large' 'Hub     ' '    Small'
 'Medium     ' '    Medium' 'Small     ' '    Large' 'Large     ']
['asia' 'canada/mexico' 'west us' 'east us' 'midwest us' 'middle east'
 'europe' 'central/south america' 'australia/new zealand']
['Hub' 'Small' 'Medium' 'Large']
```

[41]:
```
# Create ranges for categories
label_ranges = [0, 60, 180, np.inf]
label_names = ['short', "medium", "long"]

# Create wait_type column
airlines['wait_type'] = pd.cut(airlines["wait_min"], bins = label_ranges,
                                labels = label_names)

# Create mappings and replace
mappings = {'Monday':'weekday', 'Tuesday':'weekday', 'Wednesday': 'weekday',
            'Thursday': 'weekday', 'Friday': 'weekday',
            'Saturday': 'weekend', 'Sunday': 'weekend'}

airlines['day_week'] = airlines['day'].replace(mappings)

print(airlines.head())
```

```
   Unnamed: 0    id        day      airline        destination    dest_region  \
0           0  1351    Tuesday  UNITED INTL             KANSAI           asia
1           1   373     Friday       ALASKA  SAN JOSE DEL CABO  canada/mexico
2           2  2820   Thursday        DELTA        LOS ANGELES        west us
3           3  1157    Tuesday    SOUTHWEST        LOS ANGELES        west us
4           4  2992  Wednesday     AMERICAN              MIAMI        east us

  dest_size boarding_area   dept_time  wait_min     cleanliness  \
0       Hub  Gates 91-102  2018-12-31     115.0           Clean
1     Small   Gates 50-59  2018-12-31     135.0           Clean
2       Hub   Gates 40-48  2018-12-31      70.0         Average
3       Hub   Gates 20-39  2018-12-31     190.0           Clean
4       Hub   Gates 50-59  2018-12-31     559.0  Somewhat clean

          safety        satisfaction wait_type day_week
0        Neutral      Very satisfied    medium  weekday
1      Very safe      Very satisfied    medium  weekday
2  Somewhat safe             Neutral    medium  weekday
3      Very safe  Somewhat satsified      long  weekday
4      Very safe  Somewhat satsified      long  weekday
```

3.2.2 Limpieza de datos de texto

Los problemas más comunes del texto incluyen inconsistencias, violaciones de longitud y *typos*.

[42]:
```
# Replace "Dr." with empty string ""
# airlines['full_name'] = airlines['full_name'].str.replace("Dr.","")

# Store length of each row in survey_response column
#resp_length = airlines['survey_response'].str.len()
```

```
# Find rows in airlines where resp_length > 40
#airlines_survey = airlines[resp_length > 40]

# Assert minimum survey_response length is > 40
#assert airlines_survey['survey_response'].str.len().min() > 40

# Print new survey_response column
#print(airlines_survey['survey_response'])
```

3.3 PROBLEMAS DE DATOS AVANZADOS

3.3.1 Uniformidad

A veces se trabaja con datos en diferentes temperaturas, unidades de peso, formatos de fecha o divisas. Para identificar valores atípicos que pudieran estar en otra escala, un scatterplot suele ser útil.

[43]:
```
banking = pd.read_csv("C:/Users/marco/Data Camp Python/Datasets/banking_dirty.
 ↪csv")

# Find values of acct_cur that are equal to 'euro'
# acct_eu = banking['acct_cur'] == 'euro'

# Convert acct_amount where it is in euro to dollars
# banking.loc[acct_eu, 'acct_amount'] = banking.loc[acct_eu, 'acct_amount'] * 1.
 ↪1

# Unify acct_cur column by changing 'euro' values to 'dollar'
# banking.loc[banking["acct_cur"] == "euro", 'acct_cur'] = "dollar"

# Assert that only dollar currency remains
# assert banking['acct_cur'].unique() == 'dollar'
```

[44]:
```
# Print the header of account_opened
print(banking.account_opened.head())

# Convert account_opened to datetime
banking['account_opened'] = pd.to_datetime(banking['account_opened'],
                                           # Infer datetime format
                                           infer_datetime_format = True,
                                           # Return missing value for error
                                           errors = 'coerce')

# Get year of account opened
banking['acct_year'] = banking['account_opened'].dt.strftime('%Y')

# Print acct_year
print(banking.head())
```

```
0    02-09-18
1    28-02-19
2    25-04-18
3    07-11-17
4    14-05-18
Name: account_opened, dtype: object
   Unnamed: 0   cust_id  birth_date  Age  acct_amount  inv_amount   fund_A  \
0           0  870A9281  1962-06-09   58     63523.31       51295  30105.0
1           1  166B05B0  1962-12-16   58     38175.46       15050   4995.0
2           2  BFC13E88  1990-09-12   34     59863.77       24567  10323.0
3           3  F2158F66  1985-11-03   35     84132.10       23712   3908.0
4           4  7A73F334  1990-05-17   30    120512.00       93230  12158.4

    fund_B   fund_C   fund_D account_opened last_transaction acct_year
0   4138.0   1420.0  15632.0     2018-02-09         22-02-19      2018
1    938.0   6696.0   2421.0     2019-02-28         31-10-18      2019
2   4590.0   8469.0   1185.0     2018-04-25         02-04-18      2018
3    492.0   6482.0  12830.0     2017-07-11         08-11-18      2017
4  51281.0  13434.0  18383.0     2018-05-14         19-07-18      2018
```

3.3.2 Validación de campos cruzados

Se refiere al uso de múltiples campos del conjunto de datos para verificar la integridad de estos.

Por ejemplo, comprobar que la suma de las columnas A, B y C efectivamente sean la suma de la D.

[45]:
```
# Store fund columns to sum against
fund_columns = ['fund_A', 'fund_B', 'fund_C', 'fund_D']

# Find rows where fund_columns row sum == inv_amount
inv_equ = banking[fund_columns].sum(axis = 1) == banking["inv_amount"]

# Store consistent and inconsistent data
consistent_inv = banking[inv_equ]
inconsistent_inv = banking[~inv_equ]

# Store consistent and inconsistent data
print("Number of inconsistent investments: ", inconsistent_inv.shape[0])
```

```
Number of inconsistent investments:  8
```

[46]:
```
# Store today's date and find ages
import datetime as dt
today = dt.date.today()
banking['birth_date'] = pd.to_datetime(banking['birth_date'], errors='coerce')
ages_manual = today.year - banking["birth_date"].dt.year - 2

# Find rows where age column == ages_manual
```

```
age_equ = ages_manual == banking["Age"]

# Store consistent and inconsistent data
consistent_ages = banking[age_equ]
inconsistent_ages = banking[~age_equ]

# Store consistent and inconsistent data
print("Number of inconsistent ages: ", inconsistent_ages.shape[0])
```

```
Number of inconsistent ages:  8
```

3.3.3 Completitud

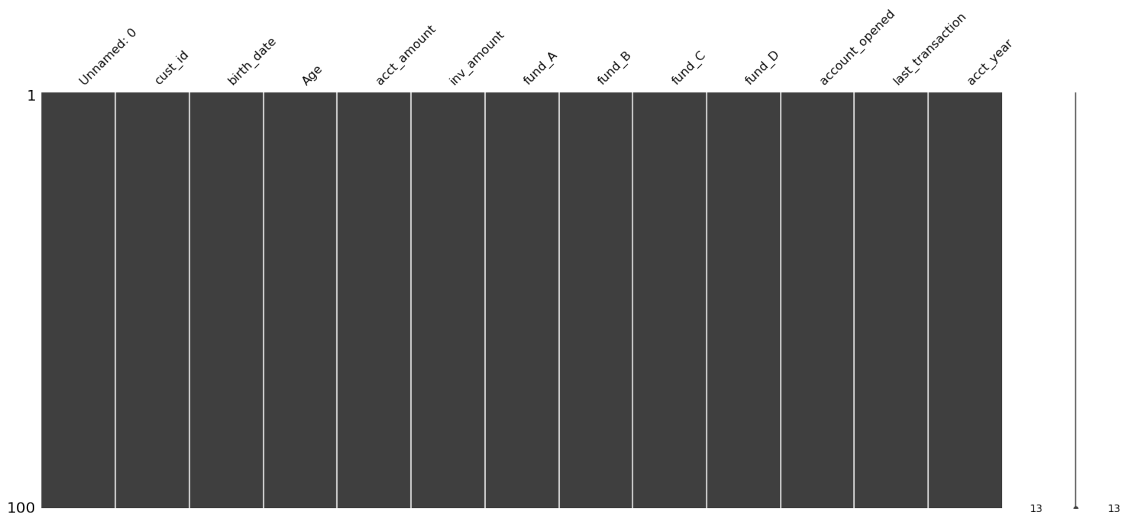
La falta de datos puede deberse a:

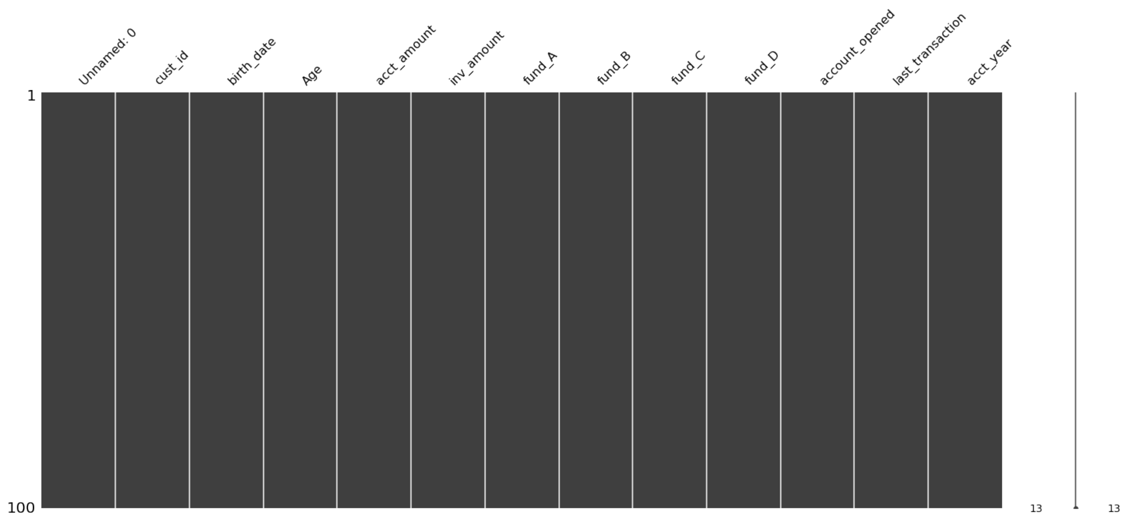
- Faltan completamente al azar: no existe una relación sistemática entre los valores faltantes de una columna y otros valores o valores propios. b
- Falta al azar: existe una relación sistemática entre los valores faltantes de una columna y otros valores observados.
- Falta no al azar: existe una relación sistemática entre los valores faltantes de una columna y los valores no observados.

[47]:
```
# Print number of missing values in banking
import missingno as msno

print(banking.isna().sum())

# Visualize missingness matrix
msno.matrix(banking)
plt.show()

# Isolate missing and non missing values of inv_amount
missing_investors = banking[banking["inv_amount"].isna()]
investors = banking[~banking["inv_amount"].isna()]

# Sort banking by age and visualize
banking_sorted = banking.sort_values(by = "Age")
msno.matrix(banking_sorted)
plt.show()
```

```
Unnamed: 0          0
cust_id             0
birth_date          0
Age                 0
acct_amount         0
inv_amount          0
fund_A              0
fund_B              0
```

```
fund_C               0
fund_D               0
account_opened       0
last_transaction     0
acct_year            0
dtype: int64
```





[48]:
```python
# Drop missing values of cust_id
banking_fullid = banking.dropna(subset = ['cust_id'])

# Compute estimated acct_amount
acct_imp = banking_fullid["inv_amount"]*5
```

```
# Impute missing acct_amount with corresponding acct_imp
banking_imputed = banking_fullid.fillna({'acct_amount':acct_imp})

# Print number of missing values
print(banking_imputed.isna().sum())
```

```
Unnamed: 0          0
cust_id             0
birth_date          0
Age                 0
acct_amount         0
inv_amount          0
fund_A              0
fund_B              0
fund_C              0
fund_D              0
account_opened      0
last_transaction    0
acct_year           0
dtype: int64
```

3.4 ENLACE DE REGISTRO

3.4.1 Distancia mínima de edición

La distancia mínima de edición es una forma sistemática para identificar qué tan cerca están 2 cadenas.

Considérense las palabras "intention" y "execution". Su distancia mínima de edición es el número de pasos mínimos necesarios para transicionar de una cadena a otra.

Las operaciones posibles son:

1. Inserción;
2. Eliminación;
3. Sustitución; y
4. Transposición.

Para esto se usa el paquete fuzzywuzzy

[49]:
```
from fuzzywuzzy import fuzz
from fuzzywuzzy import process

print(fuzz.WRatio("Houston Rockets", "Rockets")) # Que arroja un índice de␣
↪similitud entre ambas cadenas

string = "Houston Rockets vs Los Angeles Lakers"
choices = pd.Series(["Rockets vs Lakers", "Lakers vs Rockets", "Houson vs Los␣
↪Angeles", "Heat vs Bulls"])
```

```
print(process.extract(string, choices, limit = 4)) # Que arroja la cadena en␣
↪cuestión, el índice de similitud y su posición
```

```
90
[('Rockets vs Lakers', 86, 0), ('Lakers vs Rockets', 86, 1), ('Houson vs Los
Angeles', 86, 2), ('Heat vs Bulls', 86, 3)]
```

```
C:\Users\marco\anaconda3\lib\site-packages\fuzzywuzzy\fuzz.py:11: UserWarning:
Using slow pure-python SequenceMatcher. Install python-Levenshtein to remove
this warning
  warnings.warn('Using slow pure-python SequenceMatcher. Install python-
Levenshtein to remove this warning')
```

[50]:
```
# Ejemplo

restaurants = pd.read_csv("C:/Users/marco/Data Camp Python/Datasets/
↪restaurants_L2_dirty.csv")

# Store the unique values of cuisine_type in unique_types
unique_types = restaurants["type"].unique()

# Calculate similarity of 'asian' to all values of unique_types
print(process.extract('asian', unique_types, limit = len(unique_types)))

# Calculate similarity of 'american' to all values of unique_types
print(process.extract('american', unique_types, limit = len(unique_types)))

# Calculate similarity of 'italian' to all values of unique_types
print(process.extract("italian", unique_types, limit = len(unique_types)))
```

```
[('asian', 100), ('indonesian', 72), ('italian', 67), ('russian', 67),
('american', 62), ('californian', 54), ('japanese', 54), ('mexican/tex-mex',
54), ('american ( new )', 54), ('mexican', 50), ('cajun/creole', 36), ('middle
eastern', 36), ('vietnamese', 36), ('pacific new wave', 36), ('fast food', 36),
('chicken', 33), ('hamburgers', 27), ('hot dogs', 26), ('coffeebar', 26),
('continental', 26), ('steakhouses', 25), ('southern/soul', 22), ('delis', 20),
('eclectic', 20), ('pizza', 20), ('health food', 19), ('diners', 18), ('coffee
shops', 18), ('noodle shops', 18), ('french ( new )', 18), ('desserts', 18),
('seafood', 17), ('chinese', 17)]
[('american', 100), ('american ( new )', 90), ('mexican', 80), ('mexican/tex-
mex', 68), ('asian', 62), ('italian', 53), ('russian', 53), ('middle eastern',
51), ('pacific new wave', 45), ('hamburgers', 44), ('indonesian', 44),
('chicken', 40), ('southern/soul', 39), ('japanese', 38), ('eclectic', 38),
('delis', 36), ('pizza', 36), ('cajun/creole', 34), ('french ( new )', 34),
('vietnamese', 33), ('californian', 32), ('diners', 29), ('desserts', 25),
('coffeebar', 24), ('steakhouses', 21), ('seafood', 13), ('chinese', 13), ('fast
food', 12), ('coffee shops', 11), ('noodle shops', 11), ('health food', 11),
('continental', 11), ('hot dogs', 0)]
```

```
[('italian', 100), ('asian', 67), ('californian', 56), ('continental', 51),
('indonesian', 47), ('russian', 43), ('mexican', 43), ('american', 40),
('japanese', 40), ('mexican/tex-mex', 39), ('american ( new )', 39), ('pacific
new wave', 39), ('vietnamese', 35), ('delis', 33), ('pizza', 33), ('diners',
31), ('middle eastern', 30), ('chicken', 29), ('chinese', 29), ('health food',
27), ('southern/soul', 27), ('cajun/creole', 26), ('steakhouses', 26),
('seafood', 14), ('hot dogs', 13), ('noodle shops', 13), ('eclectic', 13),
('french ( new )', 13), ('desserts', 13), ('hamburgers', 12), ('fast food', 12),
('coffeebar', 12), ('coffee shops', 0)]
```

[51]:
```
# Inspect the unique values of the cuisine_type column
print(restaurants["type"].unique())

# Create a list of matches, comparing 'italian' with the cuisine_type column
matches = process.extract("italian", restaurants["type"], limit =␣
↪len(restaurants.type))

# Inspect the first 5 matches
print(matches[0:5])

# Iterate through the list of matches to italian
for match in matches:
  # Check whether the similarity score is greater than or equal to 80
  if match[1] >= 80:
    # Select all rows where the cuisine_type is spelled this way, and set them␣
↪to the correct cuisine
    restaurants.loc[restaurants["type"] == match[0]] == "italian"
```

```
['american' 'californian' 'japanese' 'cajun/creole' 'hot dogs' 'diners'
 'delis' 'hamburgers' 'seafood' 'italian' 'coffee shops' 'russian'
 'steakhouses' 'mexican/tex-mex' 'noodle shops' 'mexican' 'middle eastern'
 'asian' 'vietnamese' 'health food' 'american ( new )' 'pacific new wave'
 'indonesian' 'eclectic' 'chicken' 'fast food' 'southern/soul' 'coffeebar'
 'continental' 'french ( new )' 'desserts' 'chinese' 'pizza']
[('italian', 100, 14), ('italian', 100, 21), ('italian', 100, 47), ('italian',
100, 57), ('italian', 100, 73)]
```

[52]:
```

# Iterate through categories
categories = ['italian', 'asian', 'american']
for cuisine in categories:
  # Create a list of matches, comparing cuisine with the cuisine_type column
  matches = process.extract(cuisine, restaurants['type'], limit=len(restaurants.
↪type))

# Iterate through the list of matches
  for match in matches:
     # Check whether the similarity score is greater than or equal to 80
```

```
    if match[1] >= 80:
      # If it is, select all rows where the cuisine_type is spelled this way,␣
 ↪and set them to the correct cuisine
      restaurants.loc[restaurants['type'] == match[0]] = cuisine

# Inspect the final result
print(restaurants['type'].unique())
```

```
['american' 'californian' 'japanese' 'cajun/creole' 'hot dogs' 'diners'
 'delis' 'hamburgers' 'seafood' 'italian' 'coffee shops' 'russian'
 'steakhouses' 'mexican/tex-mex' 'noodle shops' 'middle eastern' 'asian'
 'vietnamese' 'health food' 'pacific new wave' 'indonesian' 'eclectic'
 'chicken' 'fast food' 'southern/soul' 'coffeebar' 'continental'
 'french ( new )' 'desserts' 'chinese' 'pizza']
```

3.4.2 Generando pares

[53]:
```
import recordlinkage

restaurants_new = pd.read_csv("C:/Users/marco/Data Camp Python/Datasets/
 ↪restaurants_L2.csv")

# Create an indexer and object and find possible pairs
indexer = recordlinkage.Index()

# Block pairing on cuisine_type
indexer.block("type")

# Generate pairs
pairs = indexer.index(restaurants, restaurants_new)

# Create a comparison object
comp_cl = recordlinkage.Compare()

# Create a comparison object
comp_cl = recordlinkage.Compare()

# Find exact matches on city, cuisine_types
comp_cl.exact('city', 'city', label='city')
comp_cl.exact('type', 'type', label = 'type')

# Find similar matches of rest_name
comp_cl.string('name', 'name', label='name', threshold = 0.8)

# Get potential matches and print
potential_matches = comp_cl.compute(pairs, restaurants, restaurants_new)
print(potential_matches)
```

```
        city  type  name
0  0       0     1   0.0
   1       0     1   0.0
   2       0     1   0.0
   3       0     1   0.0
   4       0     1   0.0
…       …    …    …
55 221     1     1   0.0
   230     1     1   0.0
   233     1     1   0.0
   238     1     1   0.0
   241     1     1   0.0

[4152 rows x 3 columns]
```

3.4.3 Vinculando dataframes

[54]:
```
# Isolate potential matches with row sum >=3
matches = potential_matches[potential_matches.sum(axis = 1) >= 3]

# Get values of second column index of matches
matching_indices = matches.index.get_level_values(1)

# Subset restaurants_new based on non-duplicate values
non_dup = restaurants_new[~restaurants_new.index.isin(matching_indices)]

# Append non_dup to restaurants
full_restaurants = restaurants.append(non_dup)
print(full_restaurants)
```

```
    Unnamed: 0                 name                addr           city  \
0     american             american            american       american
1     american             american            american       american
2            2              parkway    510 s. arroyo pkwy .       pasadena
3            3                r-23        923 e. third st.    los angeles
4            4               gumbo       6333 w. third st.             la
..         …                    …                   …              …
331        331     vivande porta via      2125 fillmore st.  san francisco
332        332   vivande ristorante   670 golden gate ave.  san francisco
333        333         world wrapps     2257 chestnut st.  san francisco
334        334              wu kong         101 spear st.  san francisco
335        335            yank sing       427 battery st.  san francisco

          phone         type
0      american     american
1      american     american
2    8187951001  californian
3    2136877178     japanese
```

```
4    2139330358  cajun/creole
..          …            …
331  4153464430       italian
332  4156739245       italian
333  4155639727      american
334  4159579300         asian
335  4155414949         asian

[417 rows x 6 columns]
```

4 TRANSORMACIÓN DE DATOS CON PANDAS

4.1 INTRODUCCIÓN A LA TRANSFORMACIÓN DE DATOS

[55]:
```
fifa_players = pd.read_csv("C:/Users/marco/Data Camp Python/Datasets/players_20.
 ↪csv")

# Este tipo de dataset es del formato wide, donde cada característica es una␣
 ↪columna, cada renglón contiene varias características

fifa_players.head()
```

[55]:
```
   sofifa_id                                         player_url  \
0     158023  https://sofifa.com/player/158023/lionel-messi/…
1      20801  https://sofifa.com/player/20801/c-ronaldo-dos-…
2     190871  https://sofifa.com/player/190871/neymar-da-sil…
3     200389  https://sofifa.com/player/200389/jan-oblak/20/…
4     183277  https://sofifa.com/player/183277/eden-hazard/2…

          short_name                            long_name  age         dob  \
0           L. Messi       Lionel Andrés Messi Cuccittini   32  1987-06-24
1  Cristiano Ronaldo  Cristiano Ronaldo dos Santos Aveiro   34  1985-02-05
2          Neymar Jr        Neymar da Silva Santos Junior   27  1992-02-05
3           J. Oblak                             Jan Oblak   26  1993-01-07
4          E. Hazard                           Eden Hazard   28  1991-01-07

   height_cm  weight_kg nationality                club  …   lwb   ldm  \
0        170         72   Argentina         FC Barcelona  …  68+2  66+2
1        187         83    Portugal            Juventus  …  65+3  61+3
2        175         68      Brazil  Paris Saint-Germain  …  66+3  61+3
3        188         87    Slovenia     Atlético Madrid  …   NaN   NaN
4        175         74     Belgium          Real Madrid  …  66+3  63+3

    cdm   rdm   rwb    lb   lcb    cb   rcb    rb
0  66+2  66+2  68+2  63+2  52+2  52+2  52+2  63+2
1  61+3  61+3  65+3  61+3  53+3  53+3  53+3  61+3
2  61+3  61+3  66+3  61+3  46+3  46+3  46+3  61+3
```

```
3    NaN    NaN    NaN    NaN    NaN    NaN    NaN    NaN
4  63+3   63+3   66+3   61+3   49+3   49+3   49+3   61+3

[5 rows x 104 columns]
```

[56]:
```
# Para transponer un dataset:

fifa_players.set_index("club")[["short_name", "nationality"]].transpose()
```

[56]:
```
club         FC Barcelona           Juventus Paris Saint-Germain  \
short_name       L. Messi   Cristiano Ronaldo           Neymar Jr
nationality     Argentina            Portugal              Brazil

club         Atlético Madrid Real Madrid Manchester City   FC Barcelona  \
short_name          J. Oblak    E. Hazard     K. De Bruyne  M. ter Stegen
nationality         Slovenia      Belgium          Belgium        Germany

club            Liverpool Real Madrid Liverpool  …            Finn Harps  \
short_name    V. van Dijk   L. Modrić  M. Salah  …           M. Gallagher
nationality   Netherlands     Croatia     Egypt  …  Republic of Ireland

club         Dalian YiFang FC Carlisle United           Derry City  \
short_name       Huang Jiahui         M. Sagaf             E. Tweed
nationality          China PR          England  Republic of Ireland

club                 Waterford FC Beijing Renhe FC Shanghai SIPG FC  \
short_name              P. Martin       Shao Shuai     Xiao Mingjie
nationality   Republic of Ireland         China PR         China PR

club         Hebei China Fortune FC Shanghai Greenland Shenhua FC  \
short_name                Zhang Wei                    Wang Haijian
nationality                China PR                        China PR

club         Hebei China Fortune FC
short_name               Pan Ximing
nationality                China PR

[2 rows x 18278 columns]
```

[57]:
```
# Change the DataFrame so rows become columns and vice versa
fifa_transpose = fifa_players.set_index('short_name')[['height_cm',␣
 ↪'weight_kg']].transpose()

# Print fifa_transpose
print(fifa_transpose)
```

```
short_name   L. Messi  Cristiano Ronaldo  Neymar Jr  J. Oblak  E. Hazard  \
height_cm         170                187        175       188        175
```

```
weight_kg         72                  83          68         87           74

short_name   K. De Bruyne  M. ter Stegen  V. van Dijk  L. Modrić  M. Salah  \
height_cm             181            187          193        172       175
weight_kg              70             85           92         66        71

short_name   …  M. Gallagher  Huang Jiahui  M. Sagaf  E. Tweed  P. Martin  \
height_cm    …           178           183       177       180        188
weight_kg    …            70            74        70        72         84

short_name   Shao Shuai  Xiao Mingjie  Zhang Wei  Wang Haijian  Pan Ximing
height_cm           186           177        186           185         182
weight_kg            79            66         75            74          78

[2 rows x 18278 columns]
```

4.1.1 Pivotes

Permite transformar los datos de un formato long a uno wide.

Su sintaxis tiene la forma: df.pivot(index = , columns = , values =)

[58]:
```python
# Pivot fifa_players to get overall scores indexed by name and identified by␣
↪movement
fifa_overall = fifa_players.pivot(index="long_name", columns="pace",␣
↪values="overall")

# Print fifa_overall
print(fifa_overall)
```

```
pace                          NaN   24.0  25.0  29.0  30.0  31.0  32.0  33.0  \
long_name
A. Benjamin Chiamuloira Paes   NaN   NaN   NaN   NaN   NaN   NaN   NaN   NaN
A. Pimenta Flora Pimenta       NaN   NaN   NaN   NaN   NaN   NaN   NaN   NaN
Aapo Halme                     NaN   NaN   NaN   NaN   NaN   NaN   NaN   NaN
Aaron  Lennon                  NaN   NaN   NaN   NaN   NaN   NaN   NaN   NaN
Aaron Amadi-Holloway           NaN   NaN   NaN   NaN   NaN   NaN   NaN   NaN
…                             …    …    …    …    …    …    …    …
                            NaN   NaN   NaN   NaN   NaN   NaN   NaN   NaN
   Ui Jo Hwang                 NaN   NaN   NaN   NaN   NaN   NaN   NaN   NaN
                            NaN   NaN   NaN   NaN   NaN   NaN   NaN   NaN
                            NaN   NaN   NaN   NaN   NaN   NaN   NaN   NaN
                            NaN   NaN   NaN   NaN   NaN   NaN   NaN   NaN

pace                          34.0  35.0  …  87.0  88.0  89.0  90.0  91.0  \
long_name                                 …
A. Benjamin Chiamuloira Paes   NaN   NaN  …   NaN   NaN   NaN   NaN   NaN
A. Pimenta Flora Pimenta       NaN   NaN  …   NaN   NaN   NaN   NaN   NaN
Aapo Halme                     NaN   NaN  …   NaN   NaN   NaN   NaN   NaN
```

```
Aaron  Lennon                   NaN   NaN  …   NaN   NaN   NaN   NaN   NaN
Aaron Amadi-Holloway            NaN   NaN  …   NaN   NaN   NaN   NaN   NaN
…                             …    …  …    …    …    …    …    …
                              NaN   NaN  …   NaN   NaN   NaN   NaN   NaN
   Ui Jo Hwang                  NaN   NaN  …   NaN   NaN   NaN   NaN   NaN
                              NaN   NaN  …   NaN   NaN   NaN   NaN   NaN
                              NaN   NaN  …   NaN   NaN   NaN   NaN   NaN
                              NaN   NaN  …   NaN   NaN   NaN   NaN  71.0

pace                           92.0  93.0  94.0  95.0  96.0
long_name
A. Benjamin Chiamuloira Paes    NaN   NaN   NaN   NaN   NaN
A. Pimenta Flora Pimenta        NaN   NaN   NaN   NaN   NaN
Aapo Halme                      NaN   NaN   NaN   NaN   NaN
Aaron  Lennon                   NaN   NaN   NaN   NaN   NaN
Aaron Amadi-Holloway            NaN   NaN   NaN   NaN   NaN
…                             …    …    …    …    …
                              NaN   NaN   NaN   NaN   NaN
   Ui Jo Hwang                  NaN   NaN   NaN   NaN   NaN
                             71.0   NaN   NaN   NaN   NaN
                              NaN   NaN   NaN   NaN   NaN
                              NaN   NaN   NaN   NaN   NaN

[18218 rows x 71 columns]
```

4.1.2 Tabla dinámica

Con este método también es posible resumir dataframes que no estén en formato largo.

Tiene la sintaxis: df.pivot_table(index = , columns = , values = , aggfunc =)

[59]:
```
fifa_players.pivot_table(index="long_name", columns="pace", aggfunc="mean")
```

[59]:
```
                              age                                           \
pace                         24.0 25.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0
long_name
A. Benjamin Chiamuloira Paes  NaN  NaN  NaN  NaN  NaN  NaN  NaN  NaN  NaN
A. Pimenta Flora Pimenta      NaN  NaN  NaN  NaN  NaN  NaN  NaN  NaN  NaN
Aapo Halme                    NaN  NaN  NaN  NaN  NaN  NaN  NaN  NaN  NaN
Aaron  Lennon                 NaN  NaN  NaN  NaN  NaN  NaN  NaN  NaN  NaN
Aaron Amadi-Holloway          NaN  NaN  NaN  NaN  NaN  NaN  NaN  NaN  NaN
…                            …  …  …  …  …  …  …  …  …
                             NaN  NaN  NaN  NaN  NaN  NaN  NaN  NaN  NaN
   Ui Jo Hwang                NaN  NaN  NaN  NaN  NaN  NaN  NaN  NaN  NaN
                             NaN  NaN  NaN  NaN  NaN  NaN  NaN  NaN  NaN
                             NaN  NaN  NaN  NaN  NaN  NaN  NaN  NaN  NaN
                             NaN  NaN  NaN  NaN  NaN  NaN  NaN  NaN  NaN
```

```
                                 … weight_kg                             \
pace                        36.0  …      87.0 88.0 89.0 90.0  91.0  92.0
long_name                         …
A. Benjamin Chiamuloira Paes  NaN  …       NaN  NaN  NaN  NaN   NaN   NaN
A. Pimenta Flora Pimenta      NaN  …       NaN  NaN  NaN  NaN   NaN   NaN
Aapo Halme                    NaN  …       NaN  NaN  NaN  NaN   NaN   NaN
Aaron  Lennon                 NaN  …       NaN  NaN  NaN  NaN   NaN   NaN
Aaron Amadi-Holloway          NaN  …       NaN  NaN  NaN  NaN   NaN   NaN
…                            …   …       …   …   …   …    …    …
                            NaN  …       NaN  NaN  NaN  NaN   NaN   NaN
   Ui Jo Hwang                NaN  …       NaN  NaN  NaN  NaN   NaN   NaN
                            NaN  …       NaN  NaN  NaN  NaN   NaN  72.0
                            NaN  …       NaN  NaN  NaN  NaN   NaN   NaN
                            NaN  …       NaN  NaN  NaN  NaN  77.0   NaN


pace                        93.0 94.0 95.0 96.0
long_name
A. Benjamin Chiamuloira Paes  NaN  NaN  NaN  NaN
A. Pimenta Flora Pimenta      NaN  NaN  NaN  NaN
Aapo Halme                    NaN  NaN  NaN  NaN
Aaron  Lennon                 NaN  NaN  NaN  NaN
Aaron Amadi-Holloway          NaN  NaN  NaN  NaN
…                            …   …   …   …
                            NaN  NaN  NaN  NaN
   Ui Jo Hwang                NaN  NaN  NaN  NaN
                            NaN  NaN  NaN  NaN
                            NaN  NaN  NaN  NaN
                            NaN  NaN  NaN  NaN

[16197 rows x 3773 columns]
```

4.2 CONVERSIÓN DE FORMATOS WIDE-LONG

Para transformar de wide a long se puede usar la función melt, cuya sintaxis es df.metl(id_vars =)

[60]:
```
books = pd.read_csv("C:/Users/marco/Data Camp Python/Datasets/books.csv",␣
↪error_bad_lines=False)

print(books.head())
```

```
   bookID                                              title  \
0       1  Harry Potter and the Half-Blood Prince (Harry …
1       2  Harry Potter and the Order of the Phoenix (Har…
2       4  Harry Potter and the Chamber of Secrets (Harry…
3       5  Harry Potter and the Prisoner of Azkaban (Harr…
4       8  Harry Potter Boxed Set  Books 1-5 (Harry Potte…
                     authors  average_rating        isbn         isbn13  \
0  J.K. Rowling/Mary GrandPré            4.57  0439785960  9780439785969
1  J.K. Rowling/Mary GrandPré            4.49  0439358078  9780439358071
2               J.K. Rowling            4.42  0439554896  9780439554893
3  J.K. Rowling/Mary GrandPré            4.56  043965548X  9780439655484
4  J.K. Rowling/Mary GrandPré            4.78  0439682584  9780439682589

  language_code   num_pages  ratings_count  text_reviews_count  \
0           eng         652        2095690               27591
1           eng         870        2153167               29221
2           eng         352           6333                 244
3           eng         435        2339585               36325
4           eng        2690          41428                 164

  publication_date        publisher
0        9/16/2006  Scholastic Inc.
1         9/1/2004  Scholastic Inc.
2        11/1/2003       Scholastic
3         5/1/2004  Scholastic Inc.
4        9/13/2004       Scholastic

b'Skipping line 3350: expected 12 fields, saw 13\nSkipping line 4704: expected
12 fields, saw 13\nSkipping line 5879: expected 12 fields, saw 13\nSkipping line
8981: expected 12 fields, saw 13\n'
```

[61]:
```python
books.melt(id_vars = "title")
```

[61]:
```
                                                     title   variable  \
0       Harry Potter and the Half-Blood Prince (Harry …     bookID
1       Harry Potter and the Order of the Phoenix (Har…     bookID
2       Harry Potter and the Chamber of Secrets (Harry…     bookID
3       Harry Potter and the Prisoner of Azkaban (Harr…     bookID
4       Harry Potter Boxed Set  Books 1-5 (Harry Potte…     bookID
…                                                    …        …
122348   Expelled from Eden: A William T. Vollmann Reader  publisher
122349                        You Bright and Risen Angels  publisher
122350                    The Ice-Shirt (Seven Dreams #1)  publisher
122351                                        Poor People  publisher
122352                        Las aventuras de Tom Sawyer  publisher

                value
0                   1
1                   2
2                   4
3                   5
4                   8
…                   …
```

```
122348  Da Capo Press
122349  Penguin Books
122350  Penguin Books
122351           Ecco
122352  Edimat Libros

[122353 rows x 3 columns]
```

```
[64]: # Si no se quieren derretir todas las columnas, se especifican:

      books.melt(id_vars = "title", value_vars = ["language_code", "ratings_count"],␣
       ↪var_name = "feature", value_name = "code")
```

```
[64]:                                                    title        feature code
      0      Harry Potter and the Half-Blood Prince (Harry …  language_code  eng
      1      Harry Potter and the Order of the Phoenix (Har…  language_code  eng
      2      Harry Potter and the Chamber of Secrets (Harry…  language_code  eng
      3      Harry Potter and the Prisoner of Azkaban (Harr…  language_code  eng
      4      Harry Potter Boxed Set  Books 1-5 (Harry Potte…  language_code  eng
      …                                                  …            …    …
      22241   Expelled from Eden: A William T. Vollmann Reader  ratings_count  156
      22242                        You Bright and Risen Angels  ratings_count  783
      22243                     The Ice-Shirt (Seven Dreams #1)  ratings_count  820
      22244                                         Poor People  ratings_count  769
      22245                          Las aventuras de Tom Sawyer  ratings_count  113

      [22246 rows x 3 columns]
```

```
[65]: books_new = books.melt(id_vars=["title", "authors", "publisher"])

      print(books_new)
```

```
                                                   title  \
0       Harry Potter and the Half-Blood Prince (Harry …
1       Harry Potter and the Order of the Phoenix (Har…
2       Harry Potter and the Chamber of Secrets (Harry…
3       Harry Potter and the Prisoner of Azkaban (Harr…
4       Harry Potter Boxed Set  Books 1-5 (Harry Potte…
…                                                  …
100102   Expelled from Eden: A William T. Vollmann Reader
100103                        You Bright and Risen Angels
100104                    The Ice-Shirt (Seven Dreams #1)
100105                                        Poor People
100106                        Las aventuras de Tom Sawyer

                                                 authors        publisher  \
0                                J.K. Rowling/Mary GrandPré  Scholastic Inc.
1                                J.K. Rowling/Mary GrandPré  Scholastic Inc.
```

```
2                                          J.K. Rowling       Scholastic
3                              J.K. Rowling/Mary GrandPré  Scholastic Inc.
4                              J.K. Rowling/Mary GrandPré       Scholastic
…                                                     …                …
100102  William T. Vollmann/Larry McCaffery/Michael He…    Da Capo Press
100103                                William T. Vollmann    Penguin Books
100104                                William T. Vollmann    Penguin Books
100105                                William T. Vollmann             Ecco
100106                                         Mark Twain    Edimat Libros

               variable       value
0                bookID           1
1                bookID           2
2                bookID           4
3                bookID           5
4                bookID           8
…                   …         …
100102  publication_date  12/21/2004
100103  publication_date   12/1/1988
100104  publication_date    8/1/1993
100105  publication_date   2/27/2007
100106  publication_date   5/28/2006

[100107 rows x 5 columns]
```

[71]:
```
# Melt rating and rating_count columns using the title as identifier
books.melt(id_vars=["title", "authors"], value_vars=["average_rating",␣
↪"ratings_count"])
```

[71]:
```
                                                   title  \
0      Harry Potter and the Half-Blood Prince (Harry …
1      Harry Potter and the Order of the Phoenix (Har…
2      Harry Potter and the Chamber of Secrets (Harry…
3      Harry Potter and the Prisoner of Azkaban (Harr…
4      Harry Potter Boxed Set  Books 1-5 (Harry Potte…
…                                                    …
22241   Expelled from Eden: A William T. Vollmann Reader
22242                         You Bright and Risen Angels
22243                    The Ice-Shirt (Seven Dreams #1)
22244                                         Poor People
22245                         Las aventuras de Tom Sawyer

                                     authors        variable  \
0                 J.K. Rowling/Mary GrandPré  average_rating
1                 J.K. Rowling/Mary GrandPré  average_rating
2                               J.K. Rowling  average_rating
3                 J.K. Rowling/Mary GrandPré  average_rating
```

```
4                             J.K. Rowling/Mary GrandPré  average_rating
…                                                    …               …
22241  William T. Vollmann/Larry McCaffery/Michael He…   ratings_count
22242                                William T. Vollmann   ratings_count
22243                                William T. Vollmann   ratings_count
22244                                William T. Vollmann   ratings_count
22245                                         Mark Twain   ratings_count

        value
0        4.57
1        4.49
2        4.42
3        4.56
4        4.78
…        …
22241  156.00
22242  783.00
22243  820.00
22244  769.00
22245  113.00

[22246 rows x 4 columns]
```

[84]:
```
# Otra alternativa es usar la función de Pandas wide_to_long

# pd.wide_to_long(df, stubnames = , i = , j = )

# Si el "año" viene después de un caracter especial, es necesario usar el␣
↪argumento sep = "_"
# De igual manera, si el año es una cadena, hay que usar el argumento suffix =␣
↪"\w+", que indica que el nombre de la columna
# termina en una palabra

books.rename(columns={'isbn' : "isbn10"}, inplace=True)

isbn_long = pd.wide_to_long(books, stubnames = "isbn", i = "bookID", j =␣
↪"version")

print(isbn_long)
```

```
               publication_date        publisher  text_reviews_count  \
bookID version
1      10             9/16/2006  Scholastic Inc.               27591
2      10              9/1/2004  Scholastic Inc.               29221
4      10             11/1/2003       Scholastic                 244
5      10              5/1/2004  Scholastic Inc.               36325
8      10             9/13/2004       Scholastic                 164
```

```
…                       …             …                 …
45631  13            12/21/2004    Da Capo Press                20
45633  13             12/1/1988    Penguin Books                56
45634  13              8/1/1993    Penguin Books                95
45639  13             2/27/2007             Ecco               139
45641  13             5/28/2006    Edimat Libros                12

                average_rating  \
bookID version
1       10                4.57
2       10                4.49
4       10                4.42
5       10                4.56
8       10                4.78
…                       …
45631  13                 4.06
45633  13                 4.08
45634  13                 3.96
45639  13                 3.72
45641  13                 3.91

                                                         authors  \
bookID version
1       10                              J.K. Rowling/Mary GrandPré
2       10                              J.K. Rowling/Mary GrandPré
4       10                                            J.K. Rowling
5       10                              J.K. Rowling/Mary GrandPré
8       10                              J.K. Rowling/Mary GrandPré
…                                                              …
45631  13       William T. Vollmann/Larry McCaffery/Michael He…
45633  13                                      William T. Vollmann
45634  13                                      William T. Vollmann
45639  13                                      William T. Vollmann
45641  13                                               Mark Twain

               language_code  \
bookID version
1       10               eng
2       10               eng
4       10               eng
5       10               eng
8       10               eng
…                      …
45631  13                eng
45633  13                eng
45634  13                eng
45639  13                eng
45641  13                spa
```

```
                                                             title  \
bookID version
1      10       Harry Potter and the Half-Blood Prince (Harry …
2      10       Harry Potter and the Order of the Phoenix (Har…
4      10       Harry Potter and the Chamber of Secrets (Harry…
5      10       Harry Potter and the Prisoner of Azkaban (Harr…
8      10       Harry Potter Boxed Set  Books 1-5 (Harry Potte…
…                                                           …
45631  13        Expelled from Eden: A William T. Vollmann Reader
45633  13                            You Bright and Risen Angels
45634  13                        The Ice-Shirt (Seven Dreams #1)
45639  13                                             Poor People
45641  13                            Las aventuras de Tom Sawyer

                  num_pages  ratings_count           isbn
bookID version
1      10               652        2095690     0439785960
2      10               870        2153167     0439358078
4      10               352           6333     0439554896
5      10               435        2339585     043965548X
8      10              2690          41428     0439682584
…                        …            …             …
45631  13               512            156  9781560254416
45633  13               635            783  9780140110876
45634  13               415            820  9780140131963
45639  13               434            769  9780060878825
45641  13               272            113  9788497646987

[22246 rows x 10 columns]
```

4.2.1 Columnas de cadenas

Es posible separar las cadenas.

```
[88]: print(books["title"].str.split(":"))

      print(books["title"].str.split(":").str.get(0))

      print(books["title"].str.split(":", expand = True))
```

```
0        [Harry Potter and the Half-Blood Prince (Harry…
1        [Harry Potter and the Order of the Phoenix (Ha…
2        [Harry Potter and the Chamber of Secrets (Harr…
3        [Harry Potter and the Prisoner of Azkaban (Har…
4        [Harry Potter Boxed Set  Books 1-5 (Harry Pott…
                                …
11118    [Expelled from Eden,  A William T. Vollmann Re…
```

```
11119                        [You Bright and Risen Angels]
11120                    [The Ice-Shirt (Seven Dreams #1)]
11121                                        [Poor People]
11122                        [Las aventuras de Tom Sawyer]
Name: title, Length: 11123, dtype: object
0         Harry Potter and the Half-Blood Prince (Harry …
1         Harry Potter and the Order of the Phoenix (Har…
2         Harry Potter and the Chamber of Secrets (Harry…
3         Harry Potter and the Prisoner of Azkaban (Harr…
4         Harry Potter Boxed Set  Books 1-5 (Harry Potte…
                               …
11118                                  Expelled from Eden
11119                          You Bright and Risen Angels
11120                      The Ice-Shirt (Seven Dreams #1)
11121                                         Poor People
11122                          Las aventuras de Tom Sawyer
Name: title, Length: 11123, dtype: object
                                                       0  \
0       Harry Potter and the Half-Blood Prince (Harry …
1       Harry Potter and the Order of the Phoenix (Har…
2       Harry Potter and the Chamber of Secrets (Harry…
3       Harry Potter and the Prisoner of Azkaban (Harr…
4       Harry Potter Boxed Set  Books 1-5 (Harry Potte…
…                                                    …
11118                                Expelled from Eden
11119                        You Bright and Risen Angels
11120                    The Ice-Shirt (Seven Dreams #1)
11121                                       Poor People
11122                       Las aventuras de Tom Sawyer

                                1     2     3
0                            None  None  None
1                            None  None  None
2                            None  None  None
3                            None  None  None
4                            None  None  None
…                               …     …     …
11118   A William T. Vollmann Reader  None  None
11119                        None  None  None
11120                        None  None  None
11121                        None  None  None
11122                        None  None  None

[11123 rows x 4 columns]
```

[94]:
```
# books[["main_title", "subtitle"]] = books["title"].str.split(":", expand =␣
 ↪True)
```

4.3 TRANSFORMACIÓN AVANZADA

[111]:
```
obesity = pd.read_csv("C:/Users/marco/Data Camp Python/Datasets/obesity_list.
 ↪csv")

# Explode the values of bounds to a separate row
obesity_bounds = obesity['bounds'].explode()

# Print obesity_bounds
print(obesity_bounds)

# Merge obesity_bounds with country and perc_obesity columns of obesity using␣
 ↪the indexes
obesity_final = obesity[['country', 'perc_obesity']].merge(obesity_bounds,
                                                           right_index=True,
                                                           left_index=True)

# Print obesity_final
print(obesity_final)
```

```
0    [15.4, 31.5]
1    [16.2, 32.4]
2      [1.1, 3.5]
3    [13.1, 33.0]
Name: bounds, dtype: object
     country  perc_obesity        bounds
0  Argentina          21.5  [15.4, 31.5]
1    Germany          22.3  [16.2, 32.4]
2      Japan           2.5    [1.1, 3.5]
3     Norway          23.0  [13.1, 33.0]
```

[113]:
```
# Transform the list-like column named bounds
obesity_explode = obesity.explode('bounds')

# Modify obesity_explode by resetting the index
obesity_explode.reset_index(drop=True, inplace=True)

# Print obesity_explode
print(obesity_explode)

# Transform the column bounds in the obesity DataFrame
obesity_split = obesity.assign(bounds=obesity['bounds'].str.split('-')).
 ↪explode('bounds')

# Print obesity_split
print(obesity_split)
```

```
     country  perc_obesity        bounds
0  Argentina          21.5  [15.4, 31.5]
```

```
1    Germany          22.3  [16.2, 32.4]
2      Japan           2.5    [1.1, 3.5]
3     Norway          23.0  [13.1, 33.0]
     country  perc_obesity        bounds
0  Argentina          21.5  [15.4, 31.5]
1    Germany          22.3  [16.2, 32.4]
2      Japan           2.5    [1.1, 3.5]
3     Norway          23.0  [13.1, 33.0]
```