# LEARN CODING

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github.com/ale66/learn-coding

# FILES

# RECAP SEQUENCES

- lists and dictionaries are mutable data structures
- lenght is variable
- elements are directly accessed via the `[i]` or `['key']` notation
- we iterate on them with `for` or `while`

# RECAP L/D VS. D/L

```
my_data = {'name':['Andrea', 'Tom'],
          'age':[32,35],
          'location':['London', 'Brighton']
}
```

```
my_data = [
          {'name':'Andrea', 'Age':32, 'location':'London'}
          {'name':'Tom', 'Age':35, 'location':'Brighton'}
]
```

# FURTHER OBSERVATIONS

- Python run-time data structures are *impermanent*
- data is made permanent con computer devices via the file system
- specific *formats* support memorization and exchange

# FILES

A permanent entry into the file system: `pg100.txt` or `C:/Users/aless/git/learn-code/60-files/pg100.txt`

Type is unspecified: a sequence of characters. Even for AV files.

The Python `with file:` instruction

- copies the content to the (volatile) work memory and
- associates it with a variable

We iterate on the variable to access data, following our model of what the data truly represents

# TEXT FILES

A natural organization in *rows*: sequences terminated by a `enter` character: `\n`

Also `space`, , and `tab` characters are relevant: `\t`

By default, reading a file returns a list of strings.

```python
MYFILE = './data/incipt.txt'

with open(MYFILE) as f:
  mytext = f.read()
```

```python
with open(MYFILE) as f:
    mytext = f.read()

print(mytext)
```

File operation is confined to the block under `with`

`f` represents the file itself in our code, in a way similar to iterators like `range(n)`

`f.read()` **copies** the whole text from the computer permanent memory to our `mytext` variable

Changes to `mytext` do not reflect on the file (see below)

# CHARACTER-ORIENTED

We receive a string and we parse it at the level of characters:

```
with open(MYFILE) as f:
    mytext = f.read()

for c in mytext:
  print(C.upper())
```

# LINE-ORIENTED

The \n are used as separators to create a list of strings.

```python
with open(MYFILE) as f:
    mytext = f.readlines()

for line in mytext:
  print(line)
```

# ITERATIVE FILE ACCESS

Handling large files, like `pg100.txt`, is better done by treating `f` as an iterator

Example: read text file one line at a time (the default setup)

```python
with open(MYFILE) as f:
  for line in f:
    print(line)
```

Notice how `print` adds an extra `\n` each time

# WRITING ON FILES

To keep a permanent copy of our results we need to write them on a file

Writing is more complex than reading:

- create a new file, write into it
- append new text at the bottom of an existing file
- overwrite an existing file with new material (irreversible)

# By default, open( ) simply reads

```python
with open(MYFILE, 'r') as f:
  mytext = f.read()
```

| parameter | effect |
|---|---|
| r | read |
| w | overwrite |
| x | create then write |
| a | append to existing f. |

# WRITING FILES

```python
FILE = 'test-writing.txt'

with open(FILE, 'w') as f:

    for num in range(10):
        f.write(num)
```

0123456789

Printing is but writing into a special file which represents the output window

Use the same format rules

```python
with open(FILE, 'w') as f:

    for num in range(10):
        f.write(f'This is value {num}\n')
```

# CSV/TSV

A text file with extra assumptions on how data is organised

Each line is a data point, described by an *interpretation structure* that is normally on the first line

Let’s have another look at `biostats.csv`

```
1  Name, Sex, Age, Height(in), Weight(lbs)
2  Alex, M, 41, 74, 170
3  Bert, M, 42, 68, 166
4  ...
5  Ruth, F, 28, 65, 131
```

Line 1 supplies the *keys* for a dictionary while further lines supply the values

`,` or `\t` separate values while `\n` separates datapoints (or *records*)

Often `"`s are used for text, e.g., `"Jean Jacques"`

# Python supports CVS files via a extra *module* (details later)

```python
import csv
FILE2 = './data/biostats.csv'

with open(FILE2) as f:

    lines = csv.reader(f, delimiter=',')

    for l in lines:
        print(l)
```

```
['Name', 'Sex', 'Age', 'Height(in)', 'Weight(lbs)']
['Alex', 'M', '41', '74', '170']
['Bert', 'M', '42', '68', '166']
['Dave', 'M', '32', '70', '155']
['Dave', 'M', '39', '72', '167']
['Elly', 'F', '30', '66', '124']
['Fran', 'F', '33', '66', '115']
['Gwen', 'F', '26', '64', '121']
['Hank', 'M', '30', '71', '158']
['Luke', 'M', '53', '72', '175']
['Jake', 'M', '32', '69', '143']
['Kate', 'F', '47', '69', '139']
['Luke', 'M', '34', '72', '163']
['Myra', 'F', '23', '62', '98']
```

# The first line is special

```python
# get the first line out
header = next(lines)

for l in lines:
  print(f'Patient: {l}')
```

# FROM CSV TO DICTIONARY

Function `DictReader` uses the first line to guide the creation of dictionaries

```python
with open(FILE2) as f:

    lines = csv.DictReader(f,  delimiter=',')

    for l in lines:
      print(f'Patient: {l}')
```

```
Patient: {'Name': 'Alex', 'Sex': 'M', 'Age': '41', 'Height(in)': '74',
'Weight(lbs)': '170'}
Patient: {'Name': 'Bert', 'Sex': 'M', 'Age': '42', 'Height(in)': '68',
'Weight(lbs)': '166'}
Patient: {'Name': 'Dave', 'Sex': 'M', 'Age': '32', 'Height(in)': '70',
'Weight(lbs)': '155'}
Patient: {'Name': 'Dave', 'Sex': 'M', 'Age': '39', 'Height(in)': '72',
'Weight(lbs)': '167'}
Patient: {'Name': 'Elly', 'Sex': 'F', 'Age': '30', 'Height(in)': '66',
'Weight(lbs)': '124'}
Patient: {'Name': 'Fran', 'Sex': 'F', 'Age': '33', 'Height(in)': '66',
'Weight(lbs)': '115'}
Patient: {'Name': 'Gwen', 'Sex': 'F', 'Age': '26', 'Height(in)': '64',
'Weight(lbs)': '121'}
Patient: {'Name': 'Hank', 'Sex': 'M', 'Age': '30', 'Height(in)': '71',
```

# A list of key names can also be supplied, to facilitate data migration

```python
first_line = ['Name', 'Sex', 'Age', 'Height(in)', 'Weight(lbs)']

mapping_es = ['Nombre', 'Sexo', 'Edad', 'Estatura(in)', 'Peso(lbs)']
```

```python
with open(FILE2) as f:
  lines = csv.DictReader(f,  fieldnames = mapping_es, delimiter = ',')

  for l in lines:
    print(f'Paciente: {l['Nombre'], l['Edad']}')
```

```
Paciente: ('Name', 'Age')
Paciente: ('Alex', '41')
Paciente: ('Bert', '42')
Paciente: ('Dave', '32')
Paciente: ('Dave', '39')
Paciente: ('Elly', '30')
Paciente: ('Fran', '33')
Paciente: ('Gwen', '26')
Paciente: ('Hank', '30')
Paciente: ('Luke', '53')
Paciente: ('Jake', '32')
Paciente: ('Kate', '47')
```

# DISCUSSION

CSV/TSV make exchanging data fast and reliable

However, they assume that for each datapoint we a *fixed* description that will fill the exact number of colums

Lack of data implies filling a *placeholder* or `null` value

Bert is NOT 68 years old

```
Name, Sex, Age, Height(in), Weight(lbs)
Alex, M, 41, 74, 170
Bert, M, NULL, 68, 166
```

But what if we know Alex’s shoe size and Bert’s lung capacity (and not vice versa)

# JSON

# FROM CSV TO JSON BY EXAMPLE

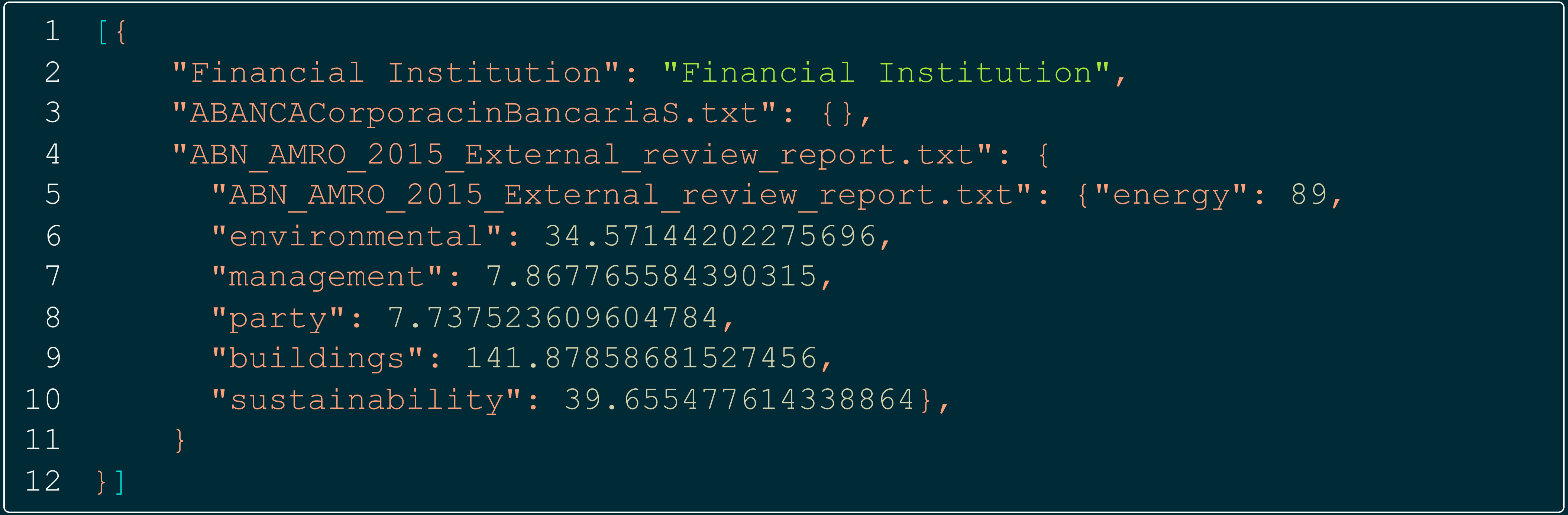
JSON is essentially *a list of nested Python dictionaries.*

Different levels of details are easily accomodated

so do data thas is naturally non-atomic, e.g., `passed_exams`

```
[{
    "Financial Institution": "Financial Institution",
    "ABANCACorporacinBancariaS.txt": {
        "energy": 51,
        "environmental": 32.5378277861242,
        "management": 15.73553116878063,
        "party": 35.37153650105044,
        "buildings": 1.1823215567939547,
        "sustainability": 29.487406431175053
    },
    // more and more...
}]
```

```json
[{
    "Financial Institution": "Financial Institution",
    "ABANCACorporacinBancariaS.txt": {},
    "ABN_AMRO_2015_External_review_report.txt": {},
}]
```



```
[{
    "Financial Institution": "Financial Institution",
    "ABANCACorporacinBancariaS.txt": {},
    "ABN_AMRO_2015_External_review_report.txt": {
      "ABN_AMRO_2015_External_review_report.txt": {"energy": 89,
      "environmental": 34.57144202275696,
      "management": 7.867765584390315,
      "party": 7.737523609604784,
      "buildings": 141.87858681527456,
      "sustainability": 39.655477614338864},
    }
}]
```

# JSON FORMAT RECAP

From the point of view of Python, a JSON object is

- a dictionary `{“first_name”: “John”, “last_name”: “Smith”, …}
- a list of dictionaries [{“first_name”: “John”, …}, {…}, {…}]

where each value is either a Boolean, a number, a string or list or a dictionary.

# These examples are from Wikipedia

```
{"first_name": "John",
 "last_name": "Smith",
 "address": {
    "street_address": "21 2nd Street",
    "city": "New York",
    "state": "NY",
    "postal_code": "10021-3100"
  }, ...}
```

```
{"first_name": "John",
 "last_name": "Smith",
 "phone_numbers": [
    {
      "type": "home",
      "number": "212 555-1234"
    },
    {
      "type": "office",
      "number": "646 555-4567"
    }
  ], ...}
```

# NON-TEXT FILES

By default, open( ) simply reads **text files**

```
with open(MYFILE, 'tr') as f:
  mytext = f.read()
```

| parameter | effect |
|---|---|
| t | text |
| w | binary |
| + | double read/write use |

Images, sound and video are treated as binary

# *DATA CLEANING* AND *DATA WRANGLING*

An informal introduction through a real project on *Green finance*: look at cells up to [5].

# CHALLENGE

Can you get fresh data from data.spectator.co.uk/category/energy and diplay it?