python

Programming 1

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Lecture #10

- downloading webpages
- JSON serialization

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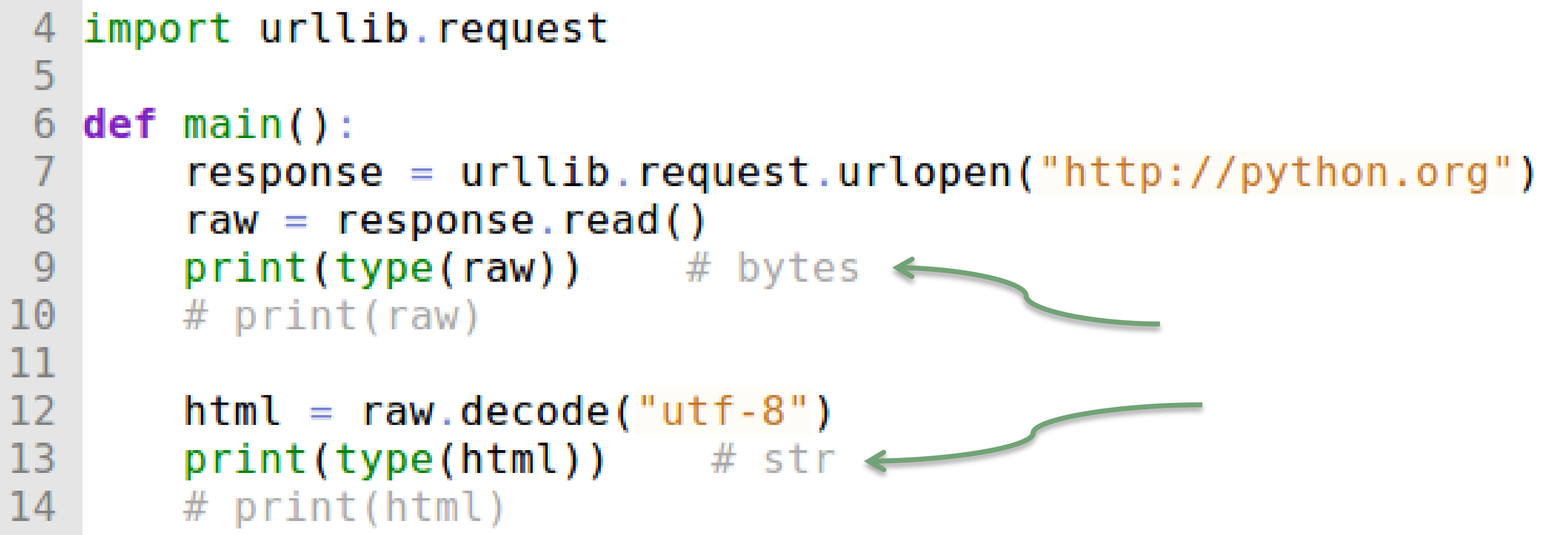
Downloading webpages

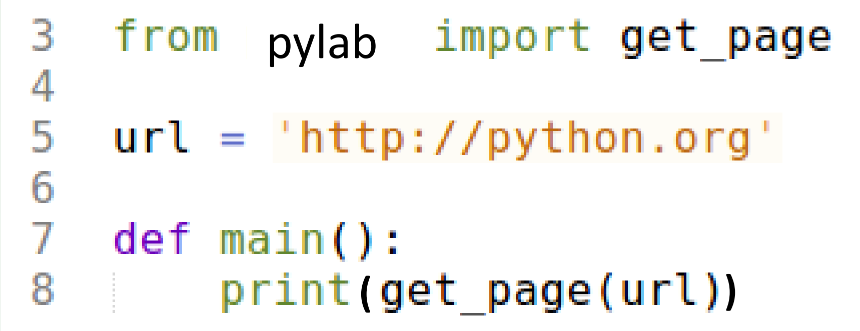


```python
import urllib.request

def main():
    response = urllib.request.urlopen("http://python.org")
    raw = response.read()
    print(type(raw))    # bytes
    # print(raw)

    html = raw.decode("utf-8")
    print(type(html))    # str
    # print(html)
```

Since it’s a common operation, let’s put it in our `pylab.py` module in a function called `get_page()` . We want to use it like this:

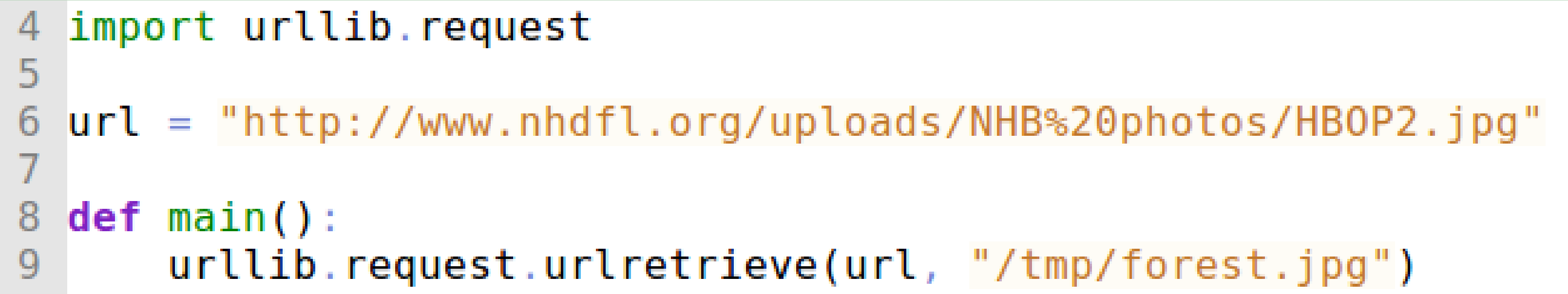


```python
from  pylab  import get_page

url = 'http://python.org'

def main():
    print(get_page(url))
```

Downloading a URL (it can be an HTML, an image, etc.).
The downloaded object will appear in the filesystem:

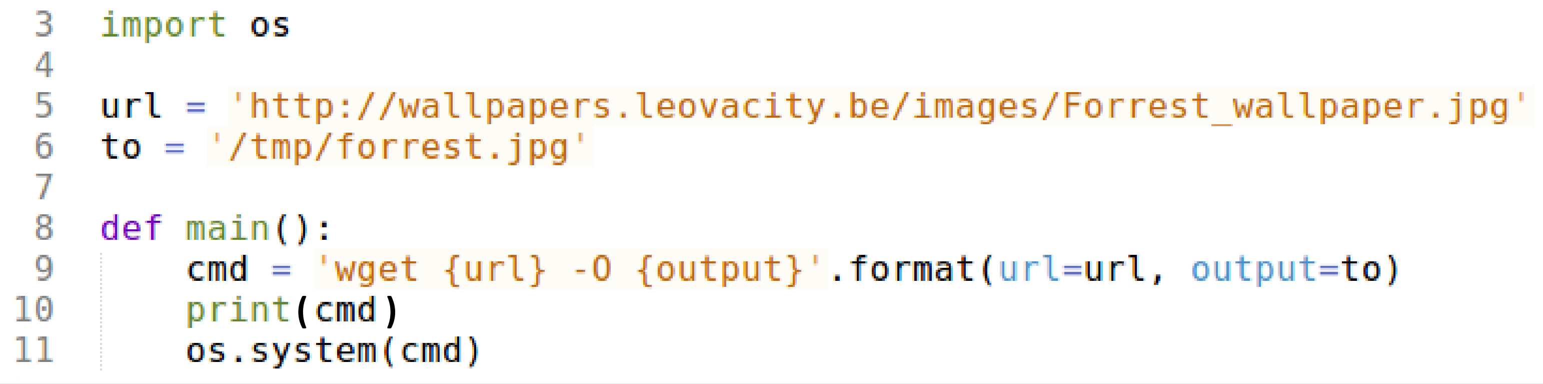


```python
import urllib.request

url = "http://www.nhdfl.org/uploads/NHB%20photos/HBOP2.jpg"

def main():
    urllib.request.urlretrieve(url, "/tmp/forest.jpg")
```

Or, you can also use an external program to download something, e.g. `wget` :



```python
import os

url = 'http://wallpapers.leovacity.be/images/Forrest_wallpaper.jpg'
to = '/tmp/forrest.jpg'

def main():
    cmd = 'wget {url} -O {output}'.format(url=url, output=to)
    print(cmd)
    os.system(cmd)
```

calling an external program in another process

The **requests** module

The Python standard library has the following modules for downloading URLs:

- urllib (https://docs.python.org/3/library/urllib.html)
- urllib.request (https://docs.python.org/3/library/urllib.request.html)
- ...

However, if you want to do something more complex, they are not that easy to use :(

There is a very useful module called **requests** (link). It ‘s not part of the standard library, you need to install it separately. But it’s much simpler to use than the two modules mentioned above…

Presentation from its author.

Installation:

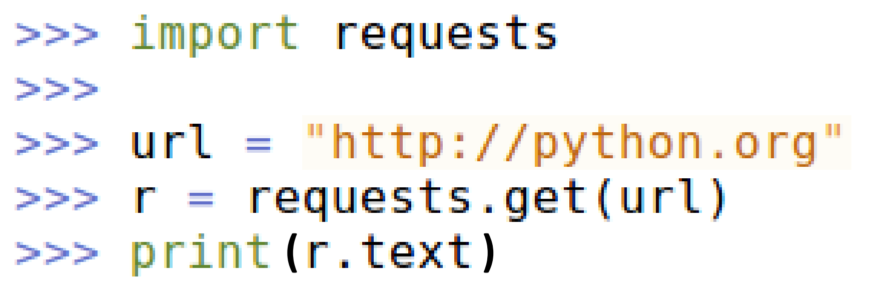
```
sudo apt-get install python3-pip
sudo pip3 install pip -U
sudo pip3 install requests -U
```

Run it once (if the package manager pip is not yet installed).

Update the pip package manager to the newset version.

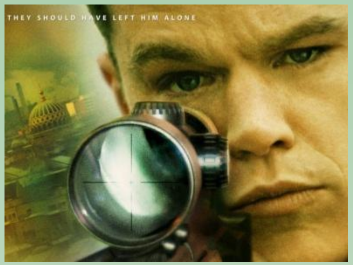
install/update requests

How to use the **requests** module



```
>>> import requests
>>> 
>>> url = "http://python.org"
>>> r = requests.get(url)
>>> print(r.text)
```

JSON serialization

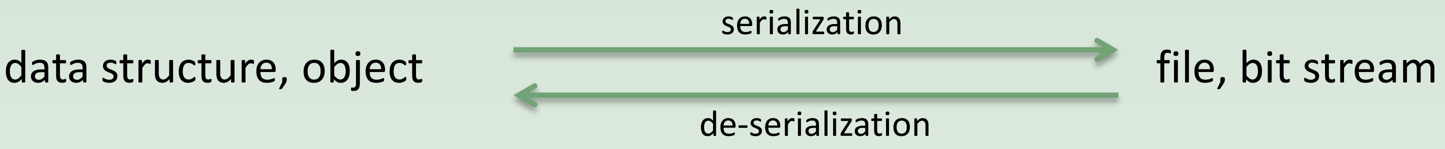


- http://json.org/
- http://en.wikipedia.org/wiki/Json

With the help of the **json** module you can serialize Python objects residing in the memory to JSON format.

Serialization

Converting a data structure or object to a format that can be stored in a file (or can be transmitted through network), and later either in the same, or in a different computing environment it can be „resurrected”.


data structure, object

serialization

de-serialization

file, bit stream

Formats: XML, JSON, YAML, stb.

JSON can be often used as an alternative of XML

- also text-based, easily readable for humans
- also hierarchical
- can also be used for communication between applications
- simpler than XML
- not as verbose, shorter
- can be written / read faster

XML:

```
<Person>
   <FirstName>Homer</FirstName>
   <LastName>Simpson</LastName>
   <Relatives>
      <Relative>Grandpa</Relative>
      <Relative>Marge</Relative>
      <Relative>The Boy</Relative>
      <Relative>Lisa</Relative>
   </Relatives>
</Person>
```

JSON:

```
{
   "firstName": "Homer",
   "lastName": "Simpson",
   "relatives": [ "Grandpa", "Marge", "The Boy", "Lisa" ]
}
```

XML:

```xml
<persons>
  <person>
    <name>Ford Prefect</name>
    <gender>male</gender>
  </person>
  <person>
    <name>Arthur Dent</name>
    <gender>male</gender>
  </person>
  <person>
    <name>Tricia McMillan</name>
    <gender>female</gender>
  </person>
</persons>
```

JSON:

```json
[
    {
      "name": "Ford Prefect",
      "gender": "male"
    },
    {
      "name": "Arthur Dent",
      "gender": "male"
    },
    {
      "name": "Tricia McMillan",
      "gender": "female"
    }
]
```

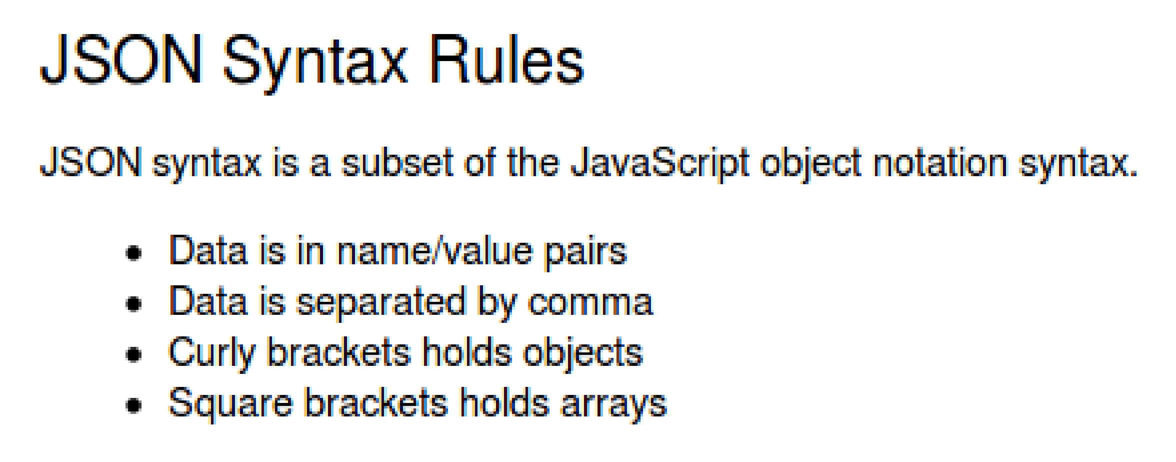
XML:

```
<settings>
    <path>/home/luke/Dropbox/Public</path>
    <user_id>123456</user_id>
    <auto_sync>True</auto_sync>
</settings>
```

(source: Dropbox Publicus)

JSON:

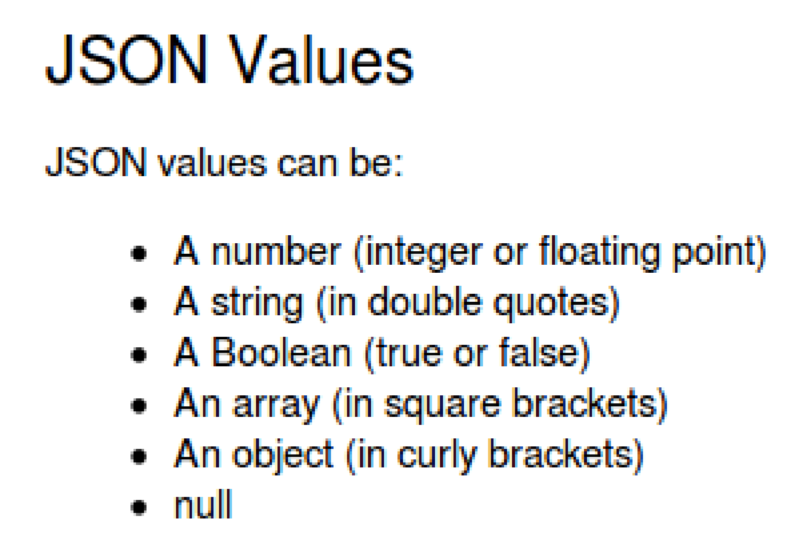
```
{
   "path": "/home/luke/Dropbox/Public",
   "user_id": 123456,
   "auto_sync": true
}
```



JSON Syntax Rules

JSON syntax is a subset of the JavaScript object notation syntax.

- Data is in name/value pairs
- Data is separated by comma
- Curly brackets holds objects
- Square brackets holds arrays



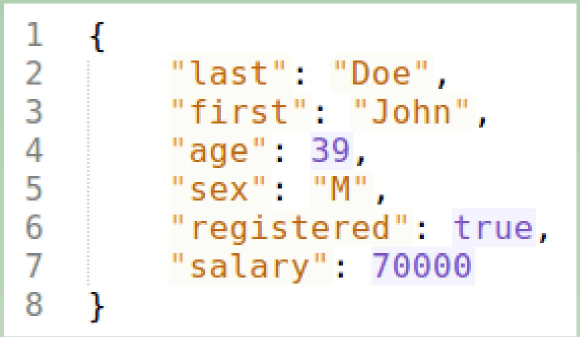
JSON Values

JSON values can be:

- A number (integer or floating point)
- A string (in double quotes)
- A Boolean (true or false)
- An array (in square brackets)
- An object (in curly brackets)
- null

loading a JSON **file**

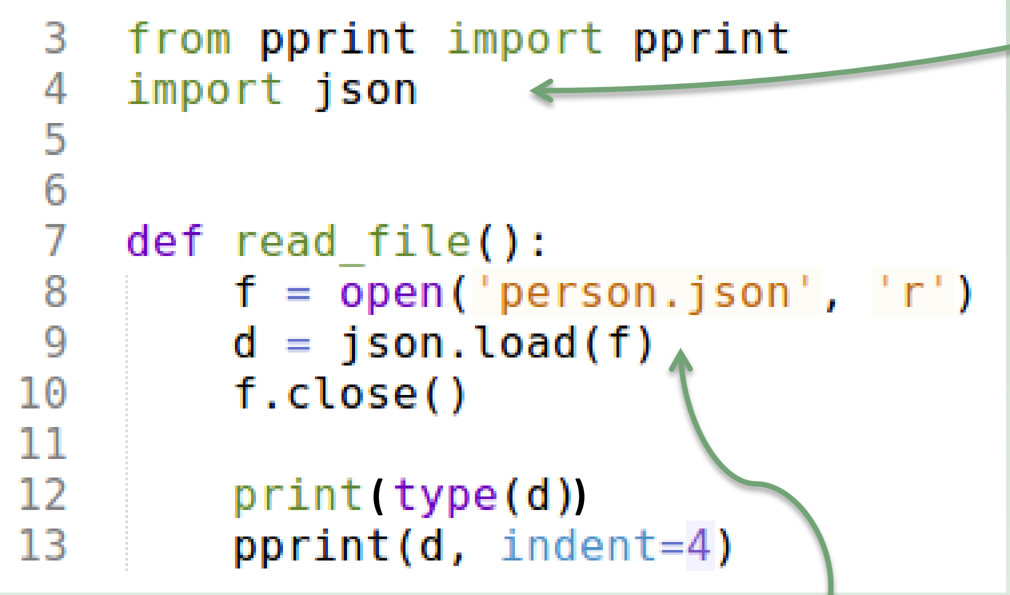
input file (person.json)



```json
{
    "last": "Doe",
    "first": "John",
    "age": 39,
    "sex": "M",
    "registered": true,
    "salary": 70000
}
```

pretty print
(data structures are printed in a nicer way)

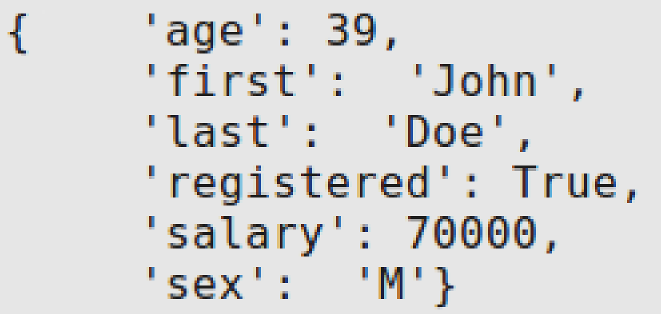
json module
(writing / reading json files)



```python
from pprint import pprint
import json


def read_file():
    f = open('person.json', 'r')
    d = json.load(f)
    f.close()

    print(type(d))
    pprint(d, indent=4)
```

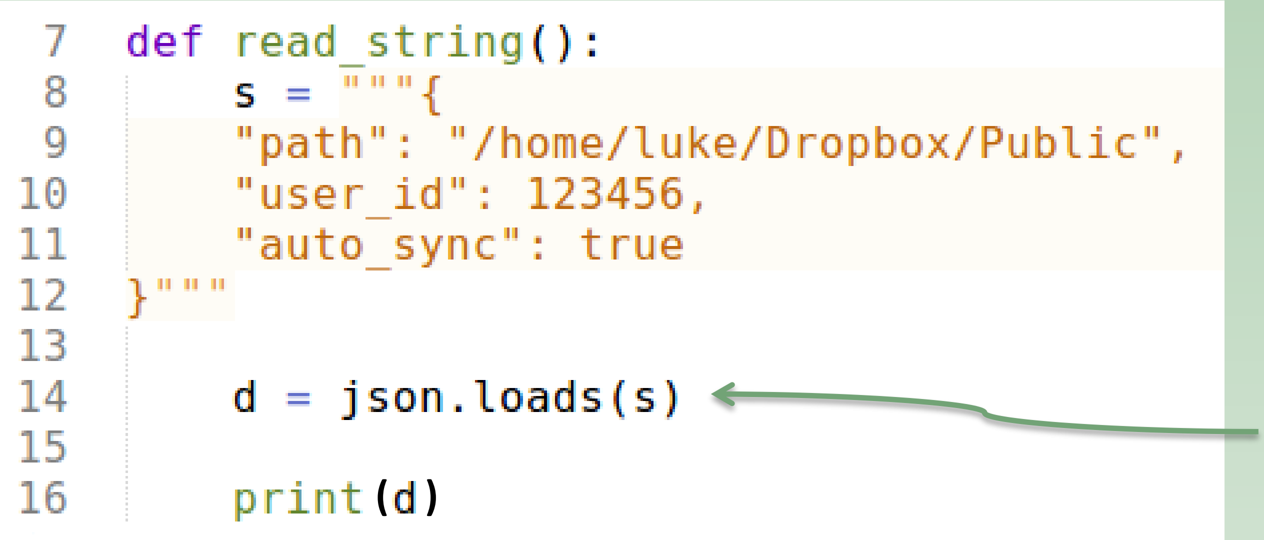


```
{   'age': 39,
    'first':  'John',
    'last':  'Doe',
    'registered': True,
    'salary': 70000,
    'sex':  'M'}
```

returned value: Python data structure
(here in the example: dictionary)

output (dictionary)

loading a JSON **string**



```python
def read_string():
    s = """{
    "path": "/home/luke/Dropbox/Public",
    "user_id": 123456,
    "auto_sync": true
}"""

    d = json.loads(s)

    print(d)
```

(see settings.py)

loads
(s stands for string)

Summary

The *json* module takes a string (either from a file or from a normal string) and **builds a Python object** (e.g. list, dictionary). That is, we don’t need to parse the string manually, the module performs this task for us!

Exercises

Asking my own IP address

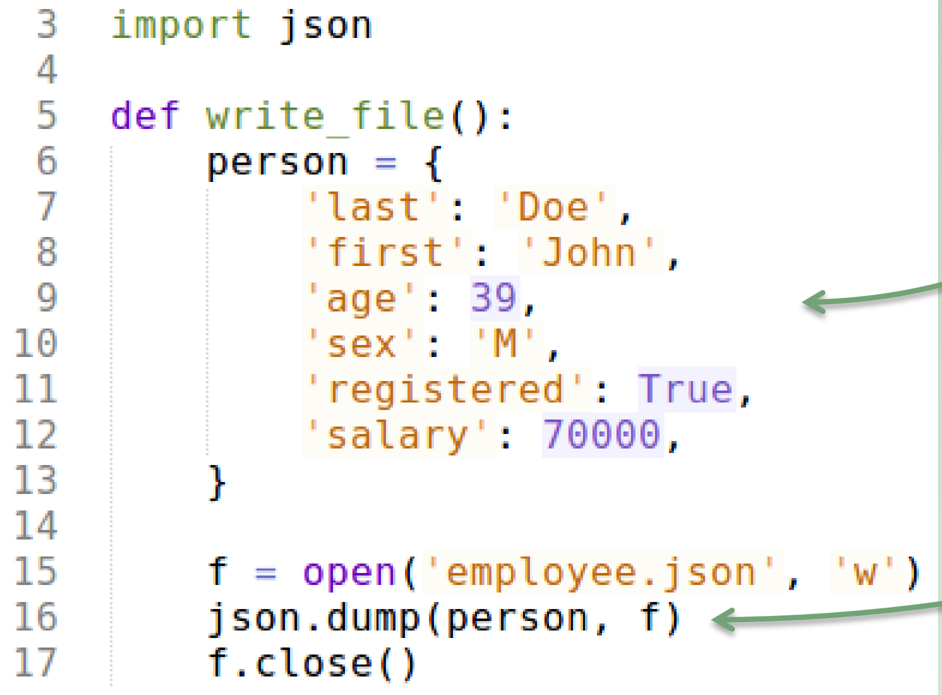
Link: https://arato.inf.unideb.hu/szathmary.laszlo/pmwiki/index.php?n=EnPy3.20120920g

Downloading an image from Reddit

Link: https://arato.inf.unideb.hu/szathmary.laszlo/pmwiki/index.php?n=EnPy3.20121126a

Writing data structures to **file** in JSON format

(see write_person.py)



```
import json

def write_file():
    person = {
        'last': 'Doe',
        'first': 'John',
        'age': 39,
        'sex': 'M',
        'registered': True,
        'salary': 70000,
    }

    f = open('employee.json', 'w')
    json.dump(person, f)
    f.close()
```

Python dictionary

json.dump(data_structure, file_handler)

```
print(json.dumps(person))
```

it creates a JSON string from the data structure and returns this JSON string

```
json.dump(person, f, indent=4)
```

pretty print

```
json.dump(person, f,
    indent=4, sort_keys=True)
```

pretty print,
ordered by keys

□ homework

Exercises

1. [20120815k] prison break