UFRN UNIVERSIDADE FEDERAL DO RIO GRANDE DO NORTE

IMD INSTITUTO METRÓPOLE DIGITAL

IMD0105 - Special Issues in Information Technology VI

Importing Data from the Internet

Natal-RN
May 2017

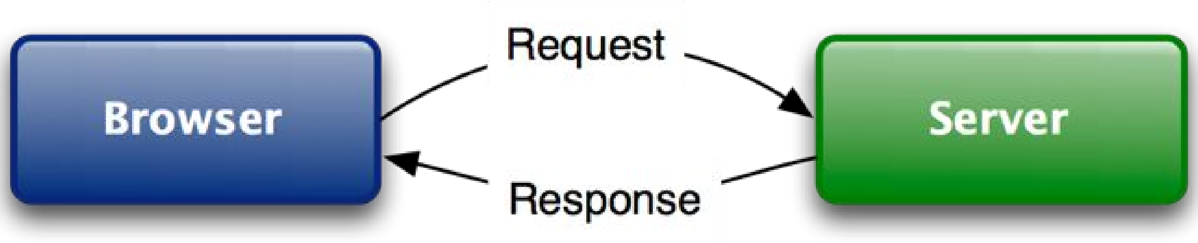
Agenda

- Use the urllib and requests packages
- Make HTTP requests (GET requests)
- Scrape web data such as HTML
- Parse HTML into useful data (BeautifulSoup)

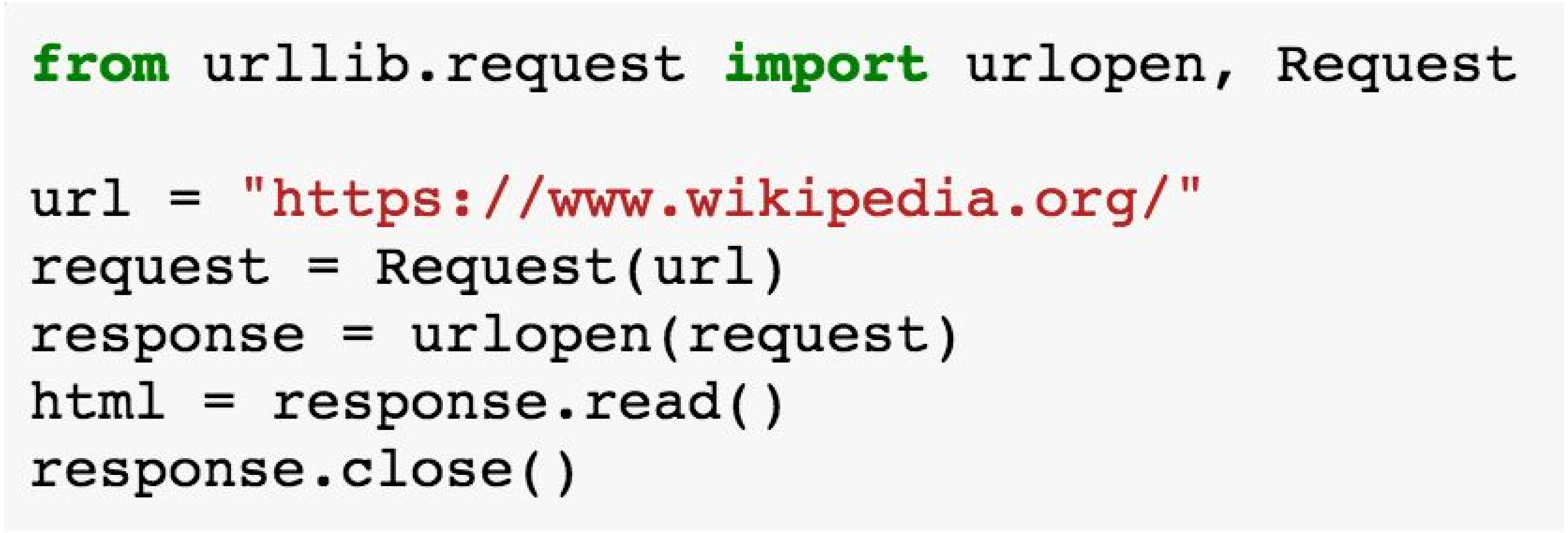
Previously on last class (...)

HyperText Transfer Protocol (HTTP)

- Foundation of data communication for the web
- HTTP is the protocol that is used by web servers and browsers to communicate.
- HTTP is based on a request and a response.



GET requests using *urllib*



```python
from urllib.request import urlopen, Request

url = "https://www.wikipedia.org/"
request = Request(url)
response = urlopen(request)
html = response.read()
response.close()
```

#print the type of response
#change the url to http://portal.imd.ufrn.br

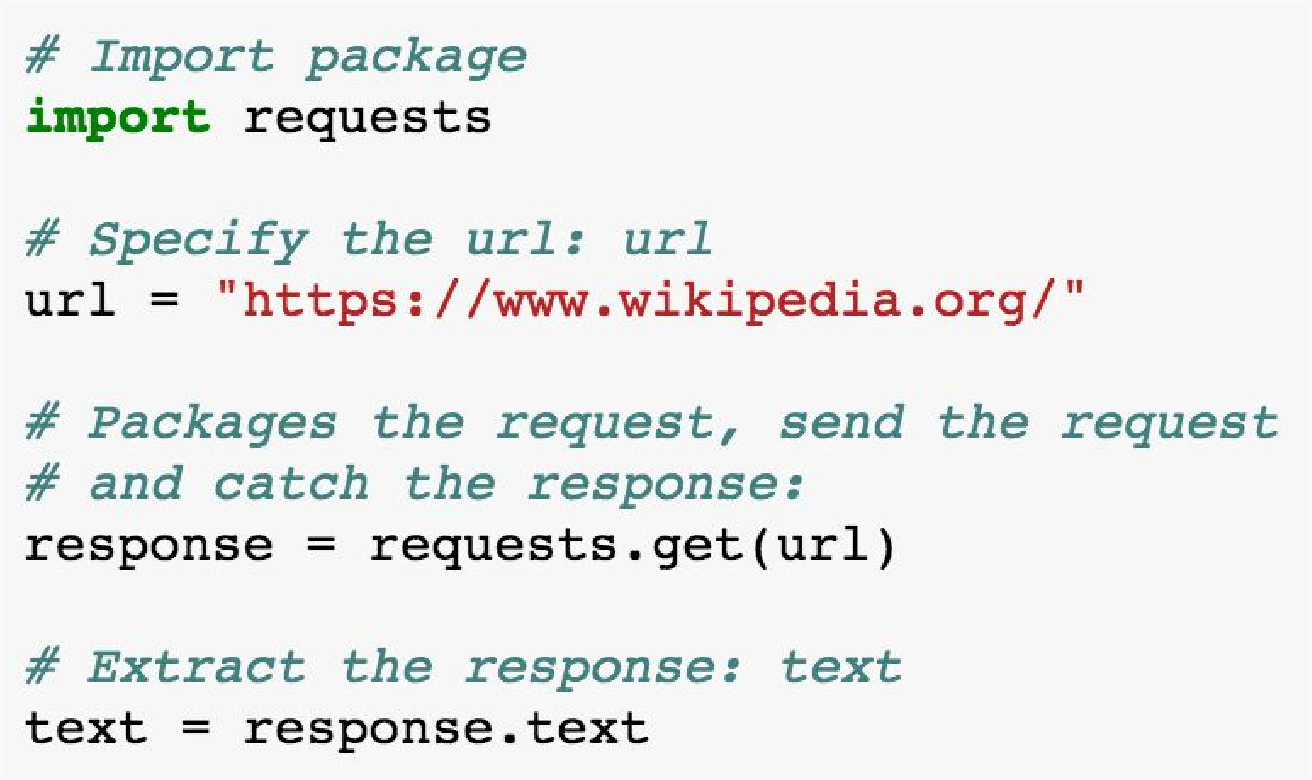
GET requests using a higher-level request lib.

http://docs.python-requests.org/

- One of the most downloaded Python packages

Used by: Twitter, Spotify, Microsoft, Amazon, Lyft, BuzzFeed, Reddit, The NSA, Her Majesty's Government, Google, Twilio, Runscope, Mozilla, Heroku, PayPal, NPR, Obama for America, Transifex, Native Instruments, The Washington Post, SoundCloud, Kippt, Sony, and Federal U.S. Institutions that prefer to be unnamed claim to use Requests internally.

Get requests using "requests"



```
# Import package
import requests

# Specify the url: url
url = "https://www.wikipedia.org/"

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

# Extract the response: text
text = response.text
```

Understanding status code

```
response.status_code
```

https://en.wikipedia.org/wiki/List_of_HTTP_status_codes

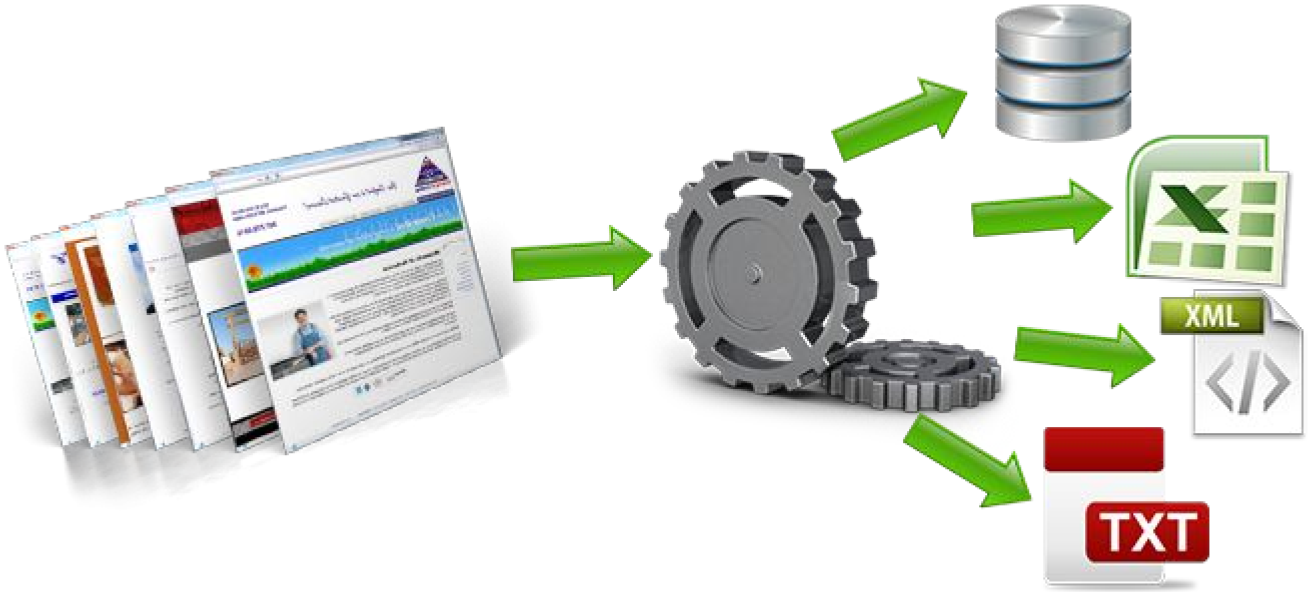
- 200 - Everything went okay, and the server returned a result (if any).
- 301 - The server is redirecting you to a different endpoint. This can happen when a company switches domain names, or an endpoint's name has changed.
- 401 - The server thinks you're not authenticated. This happens when you don't send the right credentials to access an API (we'll talk about this in a later mission).
- 400 - The server thinks you made a bad request. This can happen when you don't send the information the API requires to process your request, among other things.
- 403 - The resource you're trying to access is forbidden; you don't have the right permissions to see it.
- 404 - The server didn't find the resource you tried to access.

Headers

- The server sends more than a status code and the data when it generates a response.
- It also sends metadata containing information on how it generated the data and how to decode it.
- This information appears in the response headers.

```
response.headers
```

Web Scraping



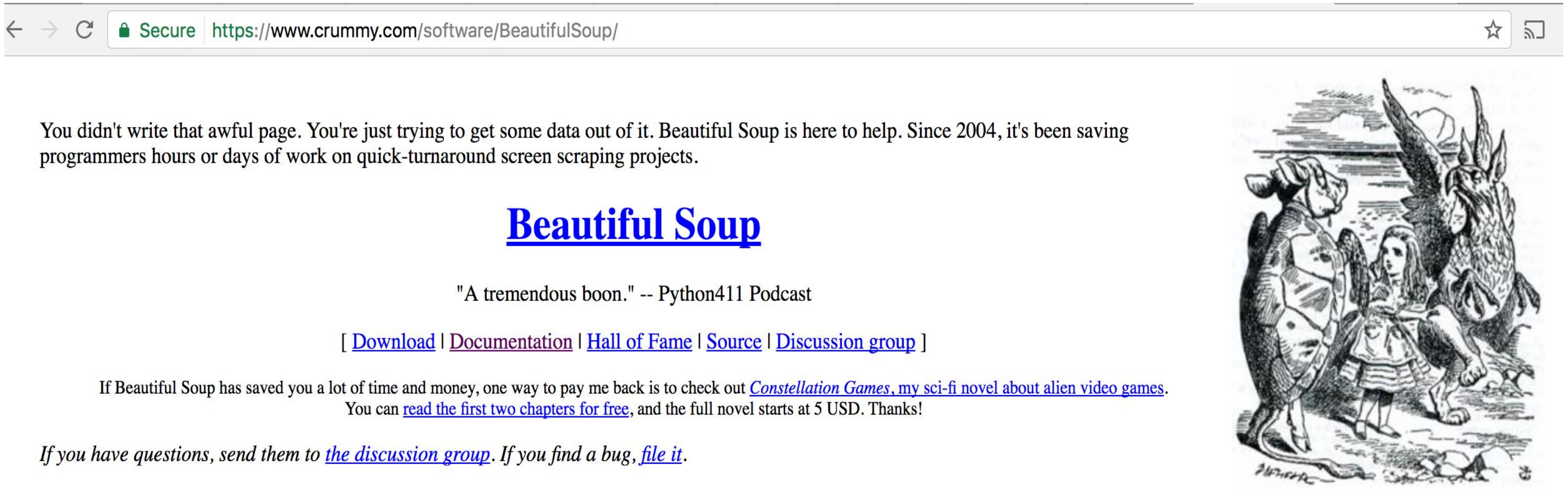
- A lot of data aren't accessible through datasets or APIs.
- One way to access the data without waiting for the provider to create an API is to use a technique called **Web scraping**

Scraping the Web: what might someone do with this kind of data?

- Find email addresses proximate to certain keywords for spamming purposes
- Imagine, for example, a single site that aggregates (illicitly, probably) raw content from a dozen other websites
- Harvest stats from government websites
- Scan listings from multiple job sites for search strings
- Perform sentiment analysis on blog sites from a variety of platforms
- Monitor price fluctuations among many different web retailers for a specific product
- There's really no end to it ...

Beautiful Soup

- Parse and extract structured data from HTML
- To the Internet, a webpage is just a SOUP of text, symbols, and whitespace



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.

Beautiful Soup

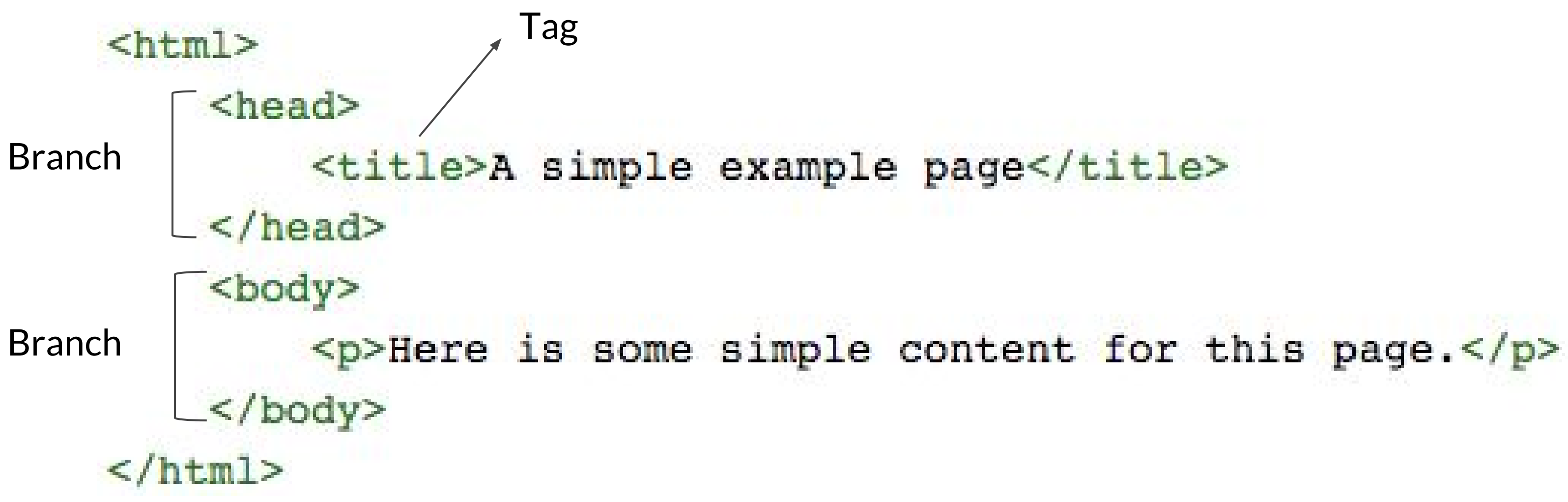
"A tremendous boon." -- Python411 Podcast

[Download | Documentation | Hall of Fame | Source | Discussion group]

If Beautiful Soup has saved you a lot of time and money, one way to pay me back is to check out *Constellation Games*, my sci-fi novel about alien video games. You can read the first two chapters for free, and the full novel starts at 5 USD. Thanks!

If you have questions, send them to the discussion group. If you find a bug, file it.

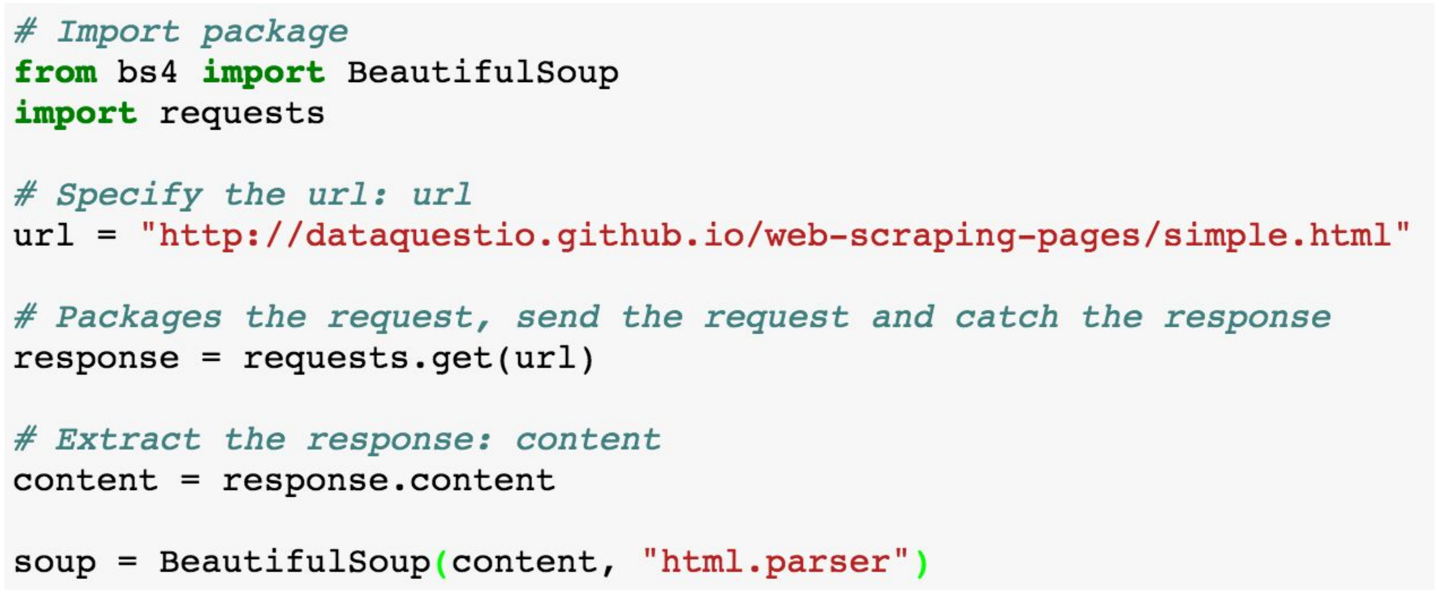
Web page structure



```
<html>
  <head>
      <title>A simple example page</title>
  </head>
  <body>
      <p>Here is some simple content for this page.</p>
  </body>
</html>
```

- We can think of HTML documents as "trees," and the nested tags as "branches" (similar to a family tree).
- BeautifulSoup works the same way.

Beautiful Soup #1 (simple.html)

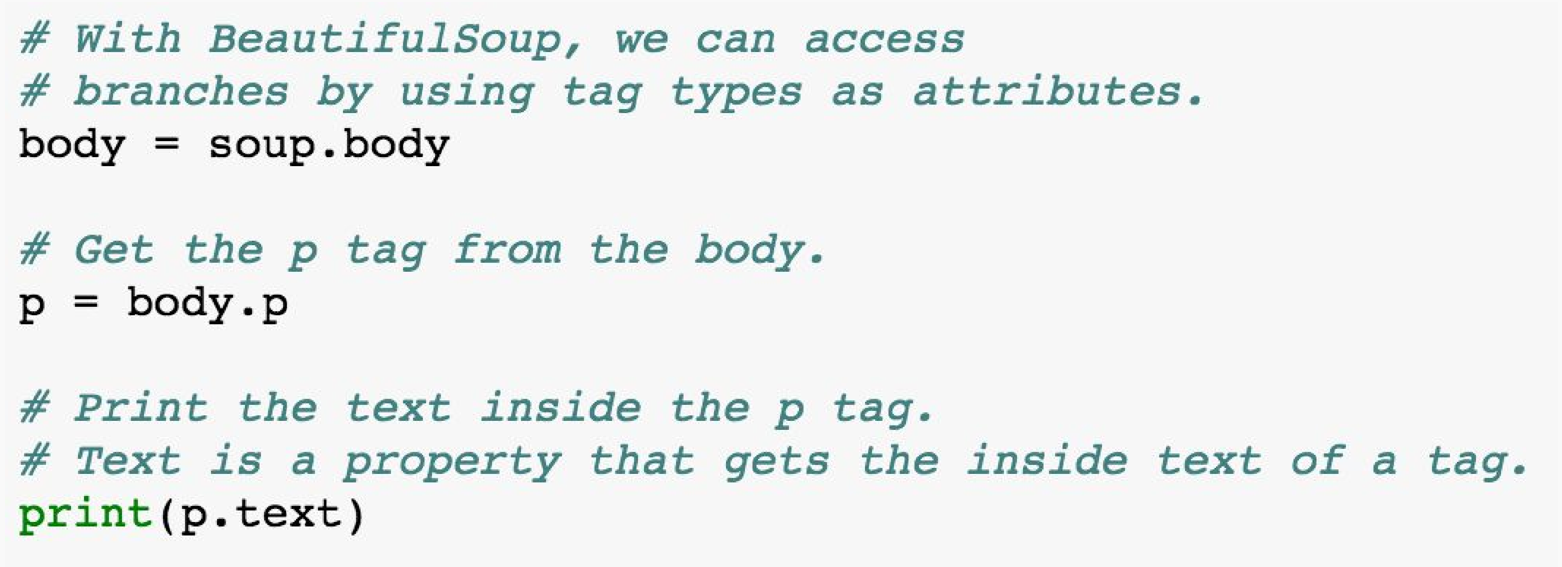


```
# Import package
from bs4 import BeautifulSoup
import requests

# Specify the url: url
url = "http://dataquestio.github.io/web-scraping-pages/simple.html"

# Packages the request, send the request and catch the response
response = requests.get(url)

# Extract the response: content
content = response.content

soup = BeautifulSoup(content, "html.parser")
```

```
!pip install beautifulsoup4
```

```
print(content)
print(soup)
```

Beautiful Soup #2 (Retrieving Elements From A Page)



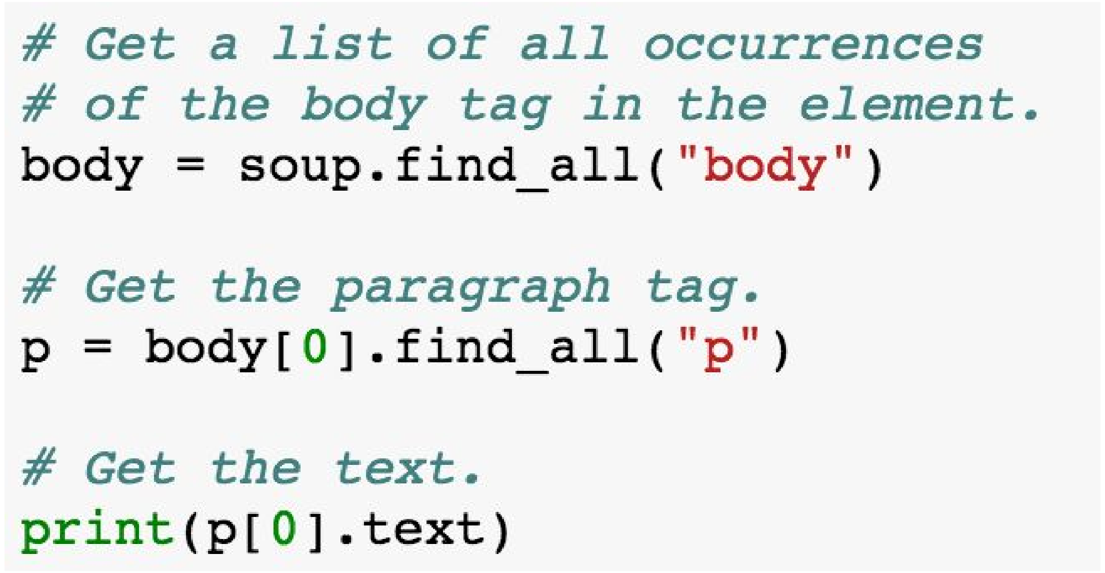
```python
# With BeautifulSoup, we can access
# branches by using tag types as attributes.
body = soup.body

# Get the p tag from the body.
p = body.p

# Print the text inside the p tag.
# Text is a property that gets the inside text of a tag.
print(p.text)
```

- Get the text inside the title tag, and assign the result to title_text.

Using **Find All**

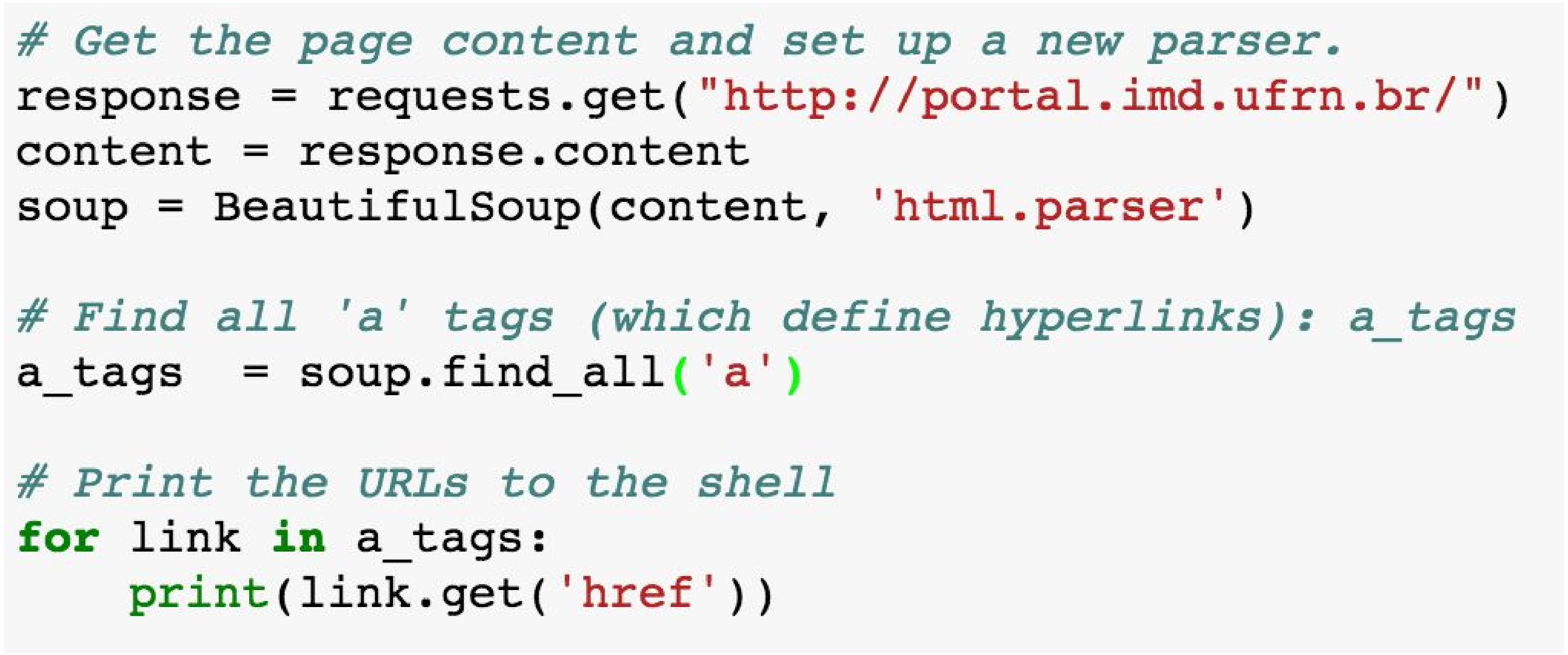
- While it's nice to use the tag type as a property, it's not always a very robust way to parse a document.
- It's usually better to be more explicit by using the find_all method.
- This method will find all occurrences of a tag in the current element, and return a list.
- E.g: print all hyperlinks from a page

Beautiful Soup #3 (find_all)



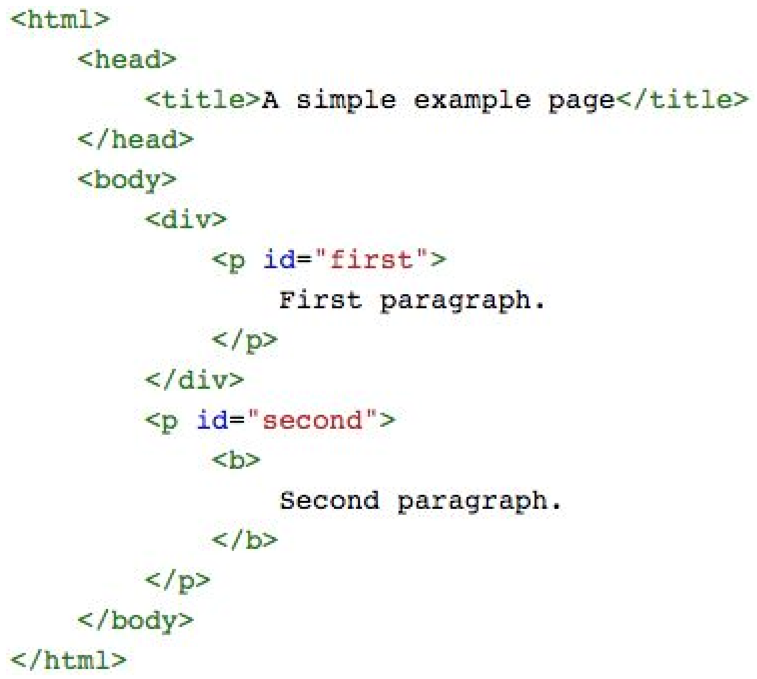
```python
# Get a list of all occurrences
# of the body tag in the element.
body = soup.find_all("body")

# Get the paragraph tag.
p = body[0].find_all("p")

# Get the text.
print(p[0].text)
```

Beautiful Soup #4 (find_all)



```python
# Get the page content and set up a new parser.
response = requests.get("http://portal.imd.ufrn.br/")
content = response.content
soup = BeautifulSoup(content, 'html.parser')

# Find all 'a' tags (which define hyperlinks): a_tags
a_tags  = soup.find_all('a')

# Print the URLs to the shell
for link in a_tags:
    print(link.get('href'))
```

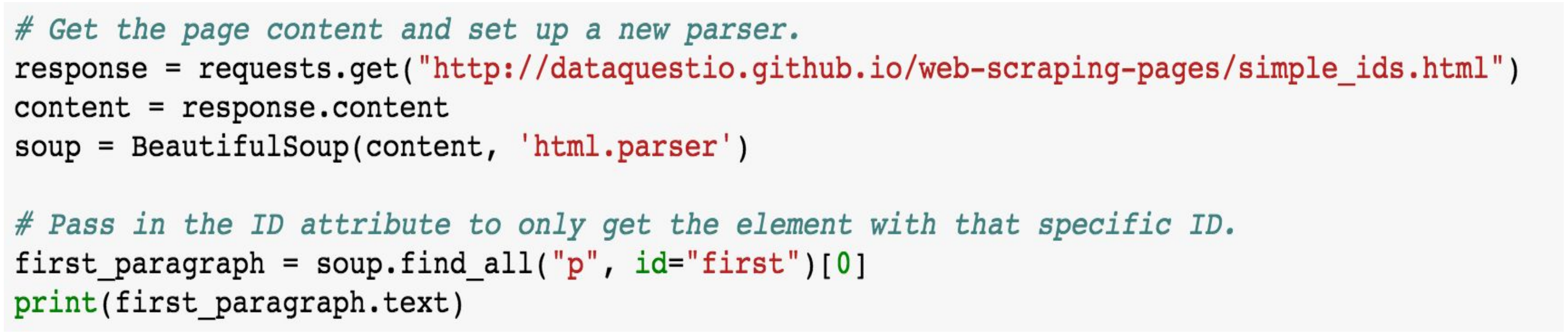
Element ID



```
<html>
    <head>
        <title>A simple example page</title>
    </head>
    <body>
        <div>
            <p id="first">
                First paragraph.
            </p>
        </div>
        <p id="second">
            <b>
                Second paragraph.
            </b>
        </p>
    </body>
</html>
```

- HTML allows elements to have IDs. Because **they are unique**, we can use an ID to refer to a specific element.
- HTML uses the div tag to create a divider that splits the page into logical units.
- For example, different dividers hold a Web page's footer, sidebar, and horizontal menu.

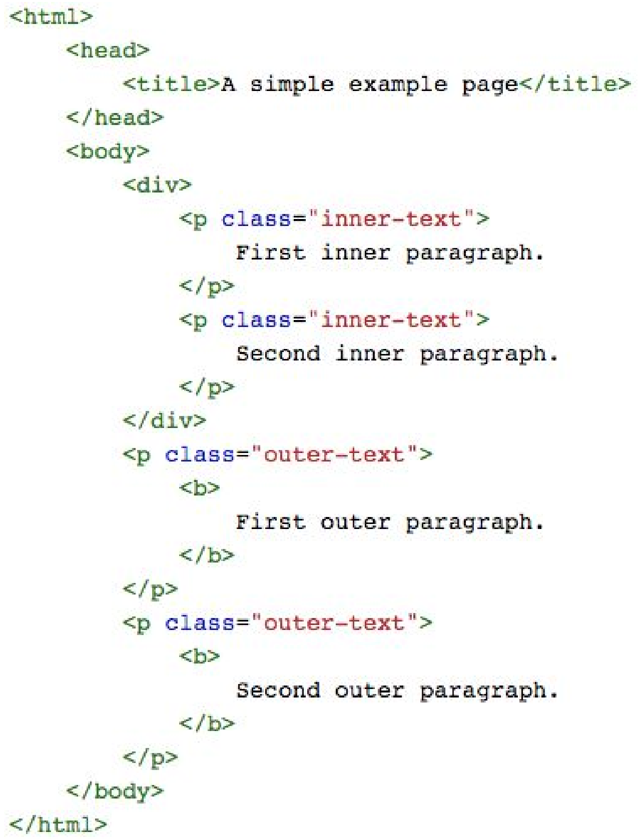
Beautiful Soup #5 (element ID)



```
# Get the page content and set up a new parser.
response = requests.get("http://dataquestio.github.io/web-scraping-pages/simple_ids.html")
content = response.content
soup = BeautifulSoup(content, 'html.parser')

# Pass in the ID attribute to only get the element with that specific ID.
first_paragraph = soup.find_all("p", id="first")[0]
print(first_paragraph.text)
```

Get the text of the second paragraph

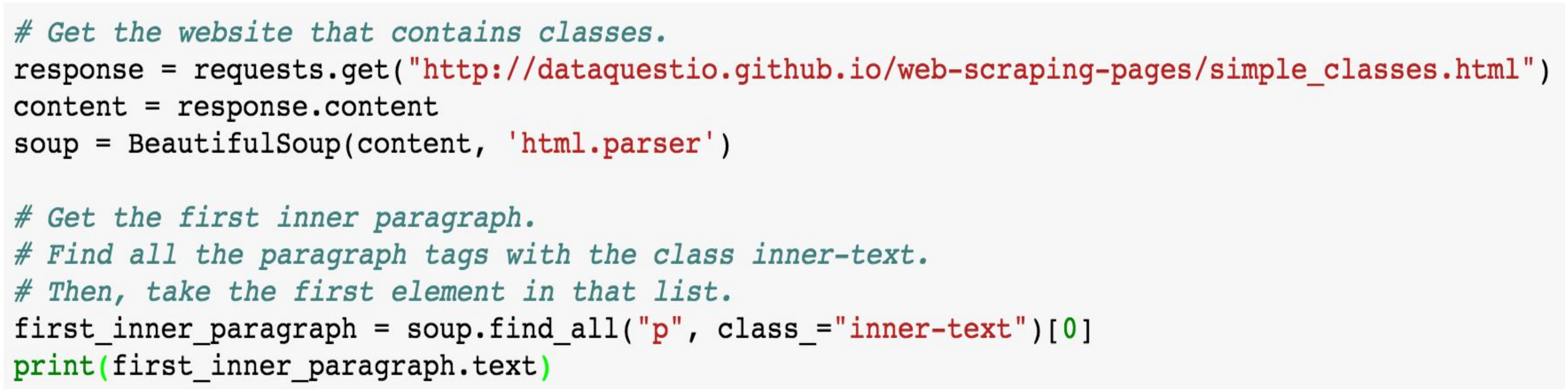
Element Classes



```
<html>
    <head>
        <title>A simple example page</title>
    </head>
    <body>
        <div>
            <p class="inner-text">
                First inner paragraph.
            </p>
            <p class="inner-text">
                Second inner paragraph.
            </p>
        </div>
        <p class="outer-text">
            <b>
                First outer paragraph.
            </b>
        </p>
        <p class="outer-text">
            <b>
                Second outer paragraph.
            </b>
        </p>
    </body>
</html>
```

- In HTML, elements can also have classes.
- Classes aren't globally unique.
- In other words, many different elements belong to the same class, usually because they share a common purpose or characteristic.

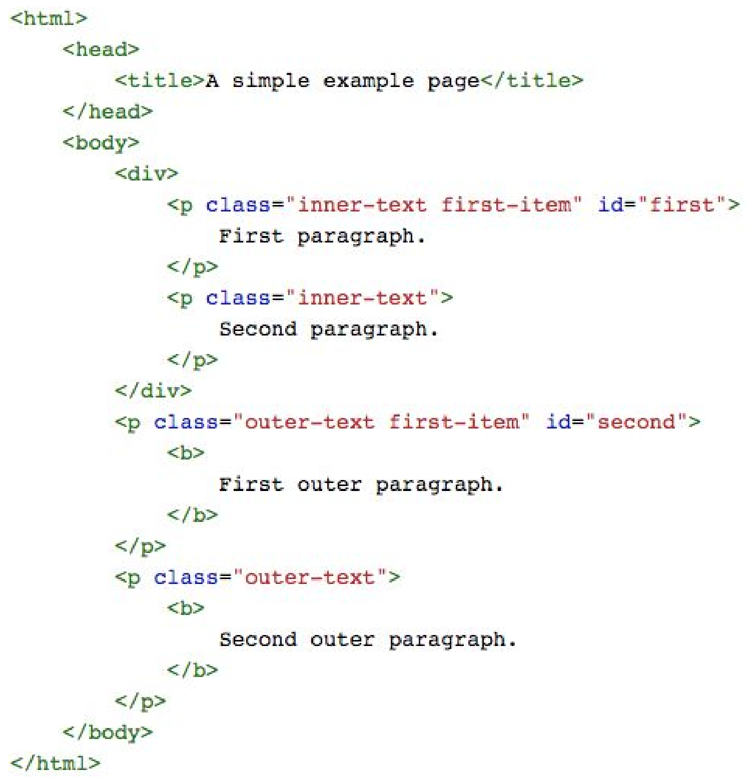
Beautiful Soup #6 (classes)



```
# Get the website that contains classes.
response = requests.get("http://dataquestio.github.io/web-scraping-pages/simple_classes.html")
content = response.content
soup = BeautifulSoup(content, 'html.parser')

# Get the first inner paragraph.
# Find all the paragraph tags with the class inner-text.
# Then, take the first element in that list.
first_inner_paragraph = soup.find_all("p", class_="inner-text")[0]
print(first_inner_paragraph.text)
```

Get the text in the second inner paragraph
Get the text of the first outer paragraph

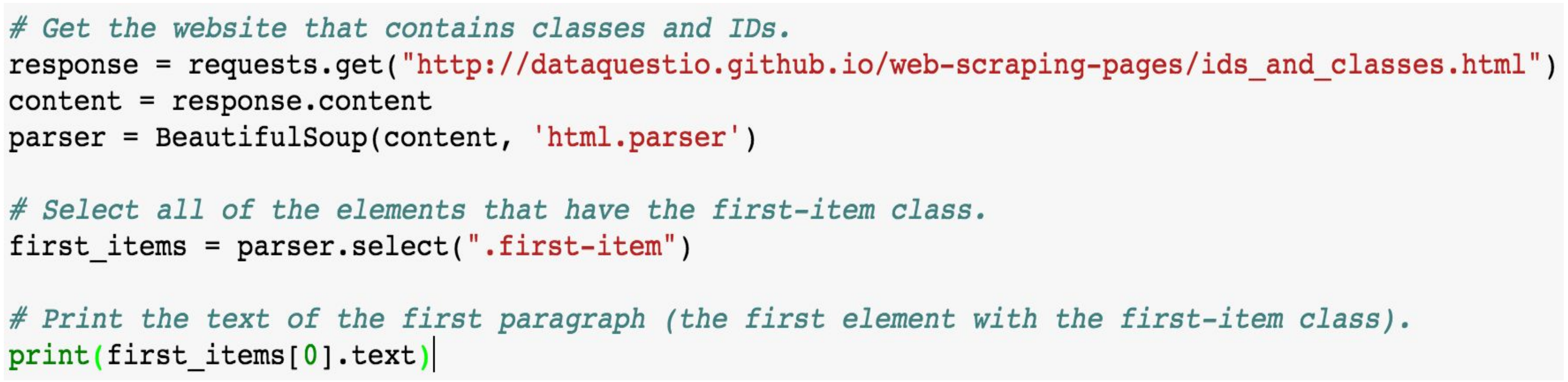
Using Selectors



```
<html>
    <head>
        <title>A simple example page</title>
    </head>
    <body>
        <div>
            <p class="inner-text first-item" id="first">
                First paragraph.
            </p>
            <p class="inner-text">
                Second paragraph.
            </p>
        </div>
        <p class="outer-text first-item" id="second">
            <b>
                First outer paragraph.
            </b>
        </p>
        <p class="outer-text">
            <b>
                Second outer paragraph.
            </b>
        </p>
    </body>
</html>
```

- We can use BeautifulSoup's .select method to work with CSS selectors.
- You may have noticed that the same element can have both an ID and a class

Beautiful Soup #7 (selectors)



```python
# Get the website that contains classes and IDs.
response = requests.get("http://dataquestio.github.io/web-scraping-pages/ids_and_classes.html")
content = response.content
parser = BeautifulSoup(content, 'html.parser')

# Select all of the elements that have the first-item class.
first_items = parser.select(".first-item")

# Print the text of the first paragraph (the first element with the first-item class).
print(first_items[0].text)
```

Print first_items[1]

Beautiful Soup #8 (selectors)

```python
# Get the website that contains classes and IDs.
response = requests.get("http://dataquestio.github.io/web-scraping-pages/ids_and_classes.html")
content = response.content
parser = BeautifulSoup(content, 'html.parser')

# Select all of the elements that have the outer-text class.
outer_texts = parser.select(".outer-text")

# Print the text of the first paragraph (the first element with the outer-text class).
print(outer_texts[0].text)
```

Print outer_texts[1]

Beautiful Soup #9 (selectors)

```
# Get the website that contains classes and IDs.
response = requests.get("http://dataquestio.github.io/web-scraping-pages/ids_and_classes.html")
content = response.content
parser = BeautifulSoup(content, 'html.parser')

# Select all of the elements that have ID second.
second_id = parser.select("#second")

# Print the text of the first paragraph (the first element with id second).
print(second_id[0].text)
```