[220 / 319] Web 3

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Learning Objectives Today

Use BeautifulSoup module

- prettify, find_all, find, get_text

Learn about scraping

- Document Object Model
- extracting links
- robots.txt

https://www.crummy.com/software/BeautifulSoup/#Download

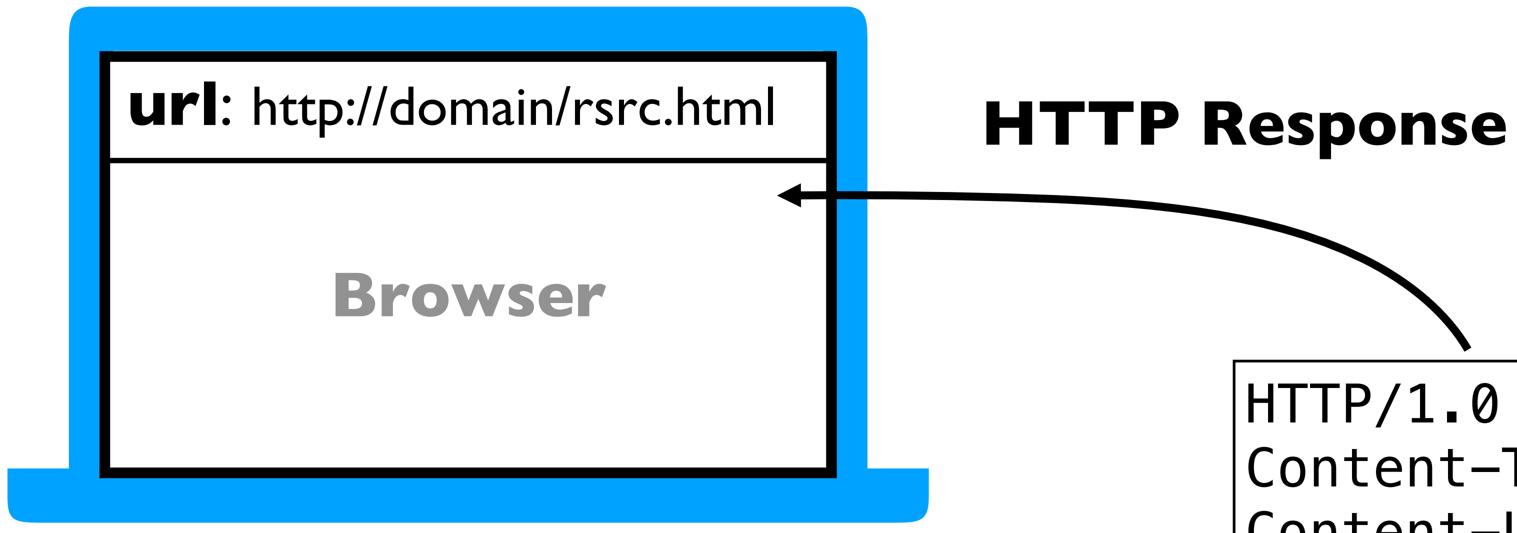
Outline

Document Object Model

BeautifulSoup module

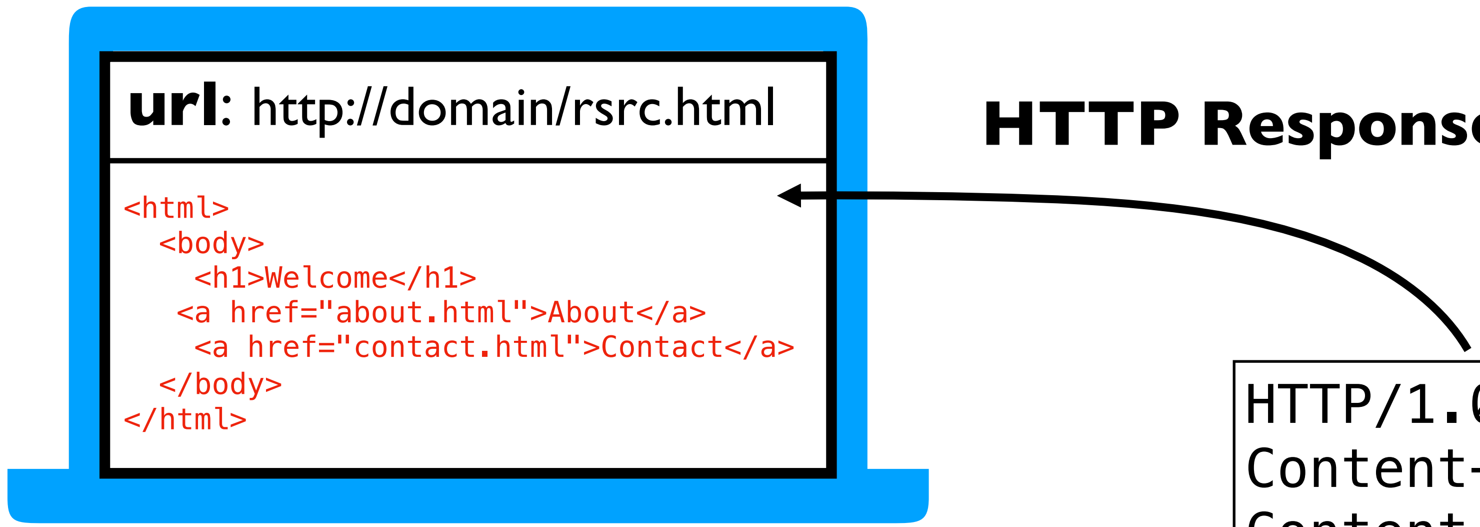
Scraping States from Wikipedia

What does a web browser do when it gets some HTML in an HTTP response?



```
HTTP/1.0 200 OK
Content-Type: text/html; charset=utf-8
Content-Length: 74

<html>
  <body>
    <h1>Welcome</h1>
    <a href="about.html">About</a>
    <a href="contact.html">Contact</a>
  </body>
</html>
```

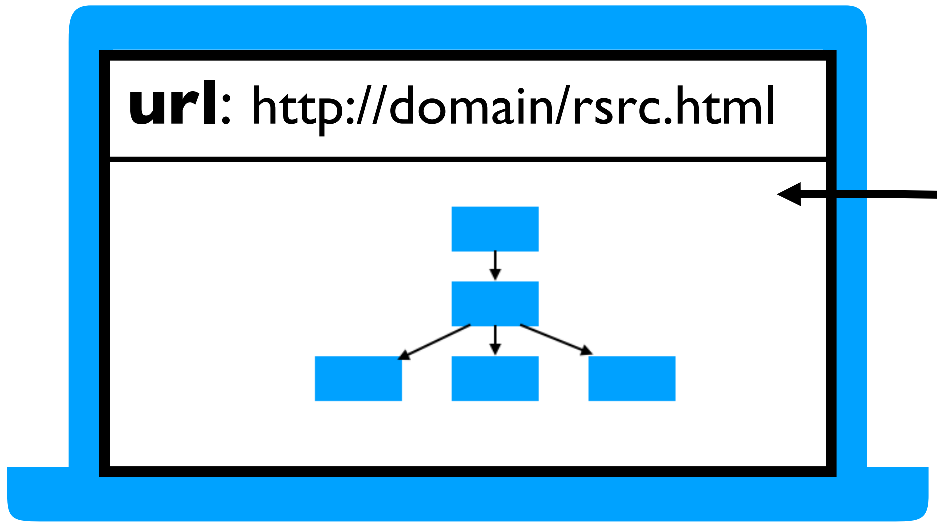
HTTP Response



url: http://domain/rsrc.html

```
<html>
  <body>
    <h1>Welcome</h1>
   <a href="about.html">About</a>
    <a href="contact.html">Contact</a>
  </body>
</html>
```

```
HTTP/1.0 200 OK
Content-Type: text/html; charset=utf-8
Content-Length: 74

<html>
  <body>
    <h1>Welcome</h1>
    <a href="about.html">About</a>
    <a href="contact.html">Contact</a>
  </body>
</html>
```



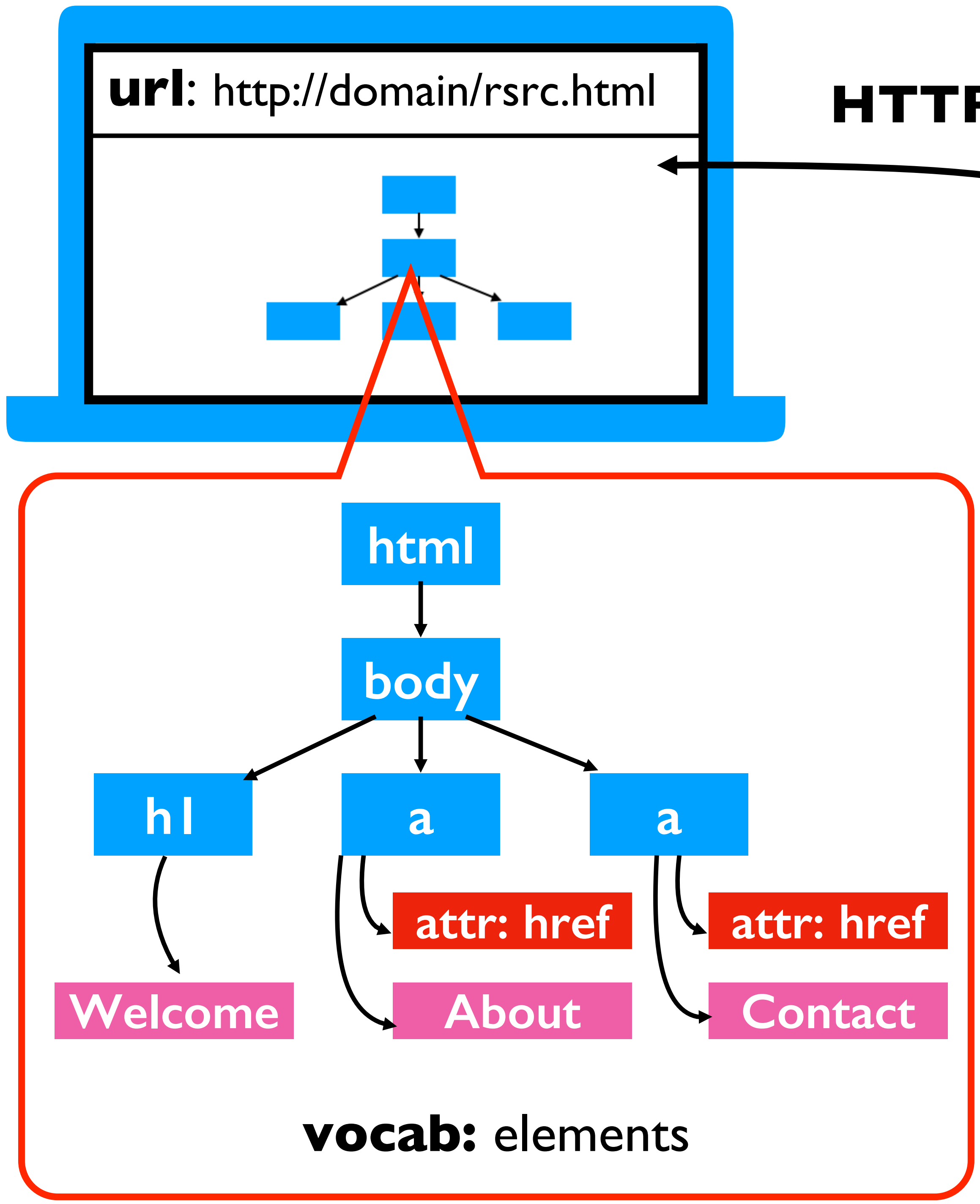
HTTP Response

```
HTTP/1.0 200 OK
Content-Type: text/html; charset=utf-8
Content-Length: 74

<html>
  <body>
    <h1>Welcome</h1>
    <a href="about.html">About</a>
    <a href="contact.html">Contact</a>
  </body>
</html>
```

before displaying a page, the browser uses HTML to generate a Document Object Model (DOM Tree)

Elements may contain

- attributes
- text

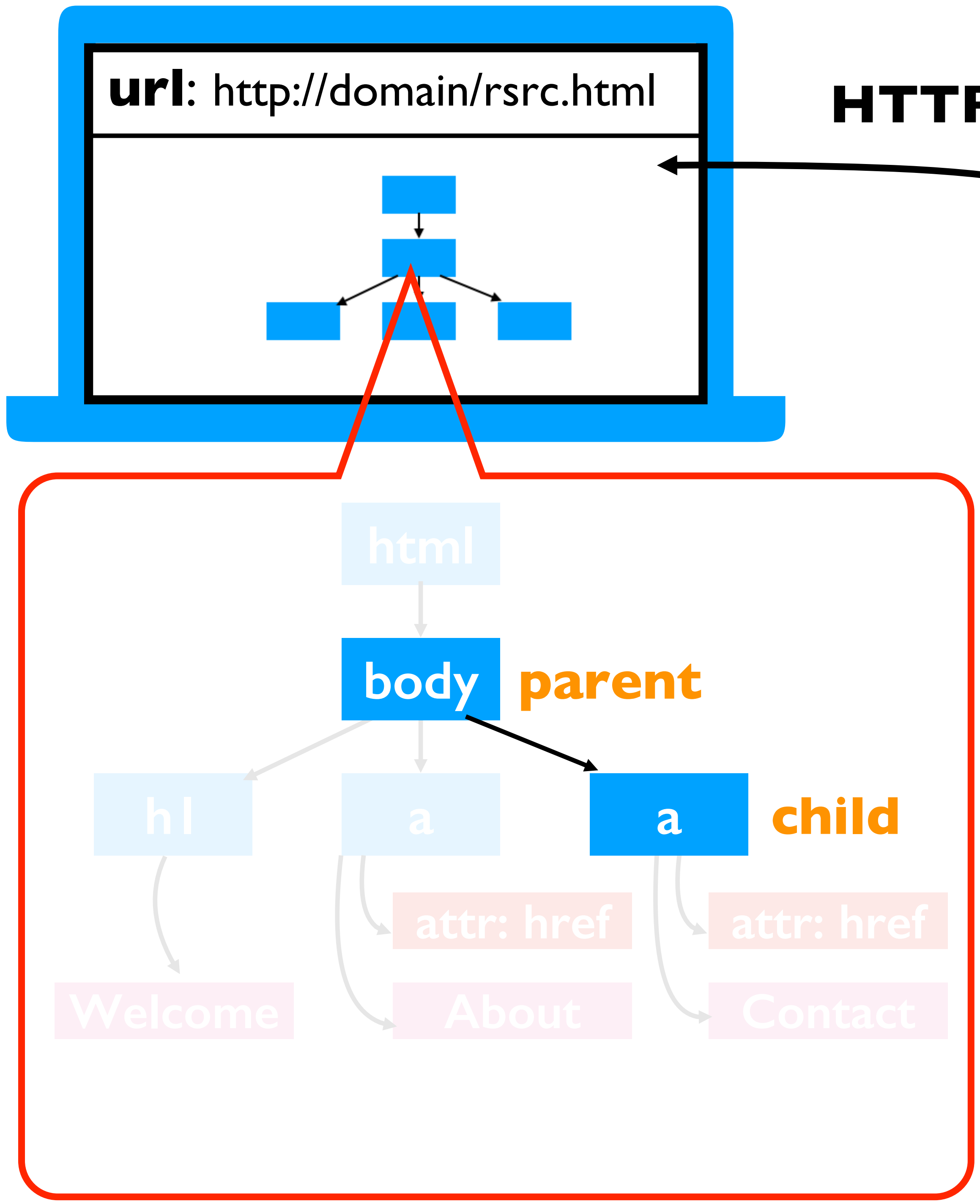


HTTP Response

```
HTTP/1.0 200 OK
Content-Type: text/html; charset=utf-8
Content-Length: 74

<html>
  <body>
    <h1>Welcome</h1>
    <a href="about.html">About</a>
    <a href="contact.html">Contact</a>
  </body>
</html>
```

Elements may contain

- attributes
- text
- other elements



HTTP Response

```
HTTP/1.0 200 OK
Content-Type: text/html; charset=utf-8
Content-Length: 74

<html>
  <body>
    <h1>Welcome</h1>
    <a href="about.html">About</a>
    <a href="contact.html">Contact</a>
  </body>
</html>
```

Elements may contain

- attributes
- text
- other elements

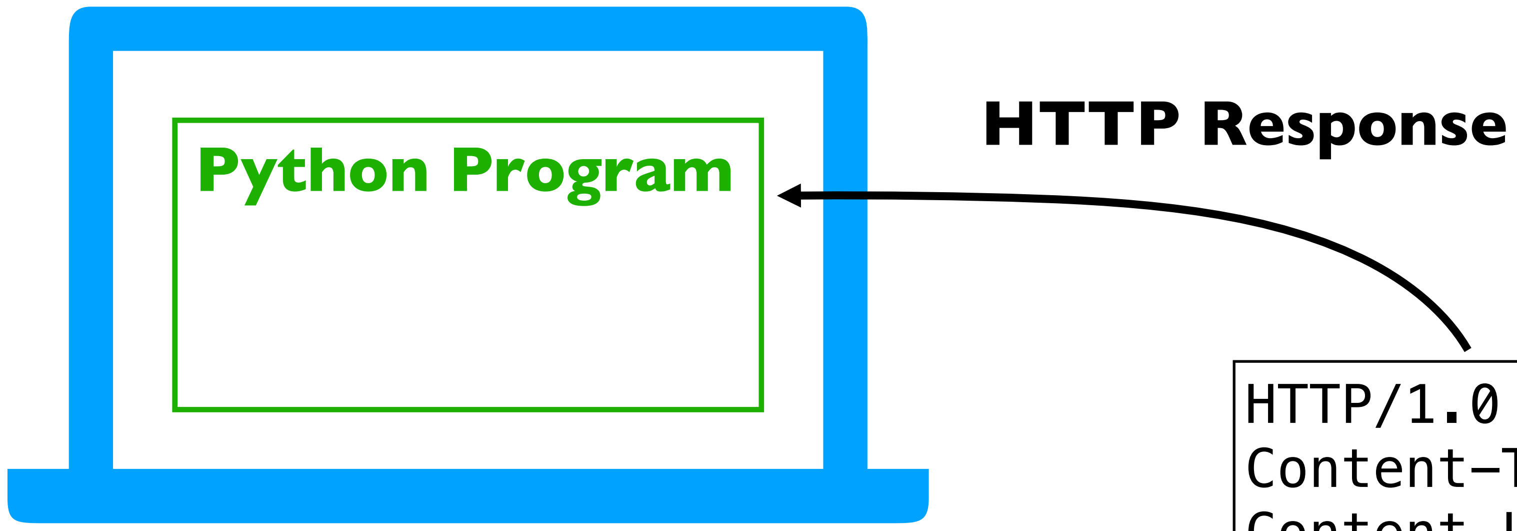
url: http://domain/rsrc.html
Welcome
About Contact

HTTP Response

```
HTTP/1.0 200 OK
Content-Type: text/html; charset=utf-8
Content-Length: 74

<html>
  <body>
    <h1>Welcome</h1>
    <a href="about.html">About</a>
    <a href="contact.html">Contact</a>
  </body>
</html>
```

browser renders (displays) the DOM tree

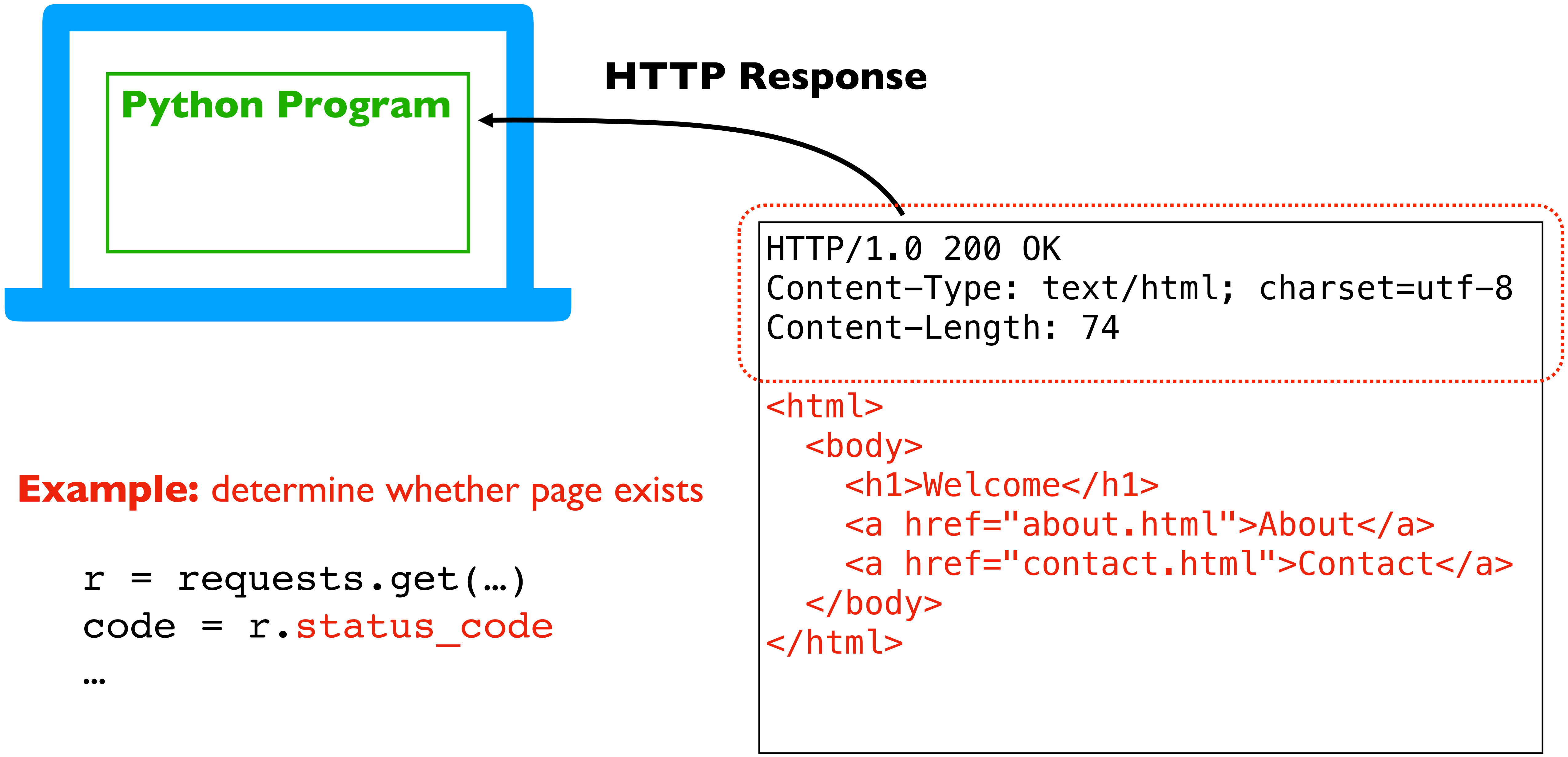
Python program gets back the same info as a web browser (HTTP and HTML)



```
HTTP/1.0 200 OK
Content-Type: text/html; charset=utf-8
Content-Length: 74

<html>
  <body>
    <h1>Welcome</h1>
    <a href="about.html">About</a>
    <a href="contact.html">Contact</a>
  </body>
</html>
```

Depending on application, we may want to use:

1. **HTTP information**



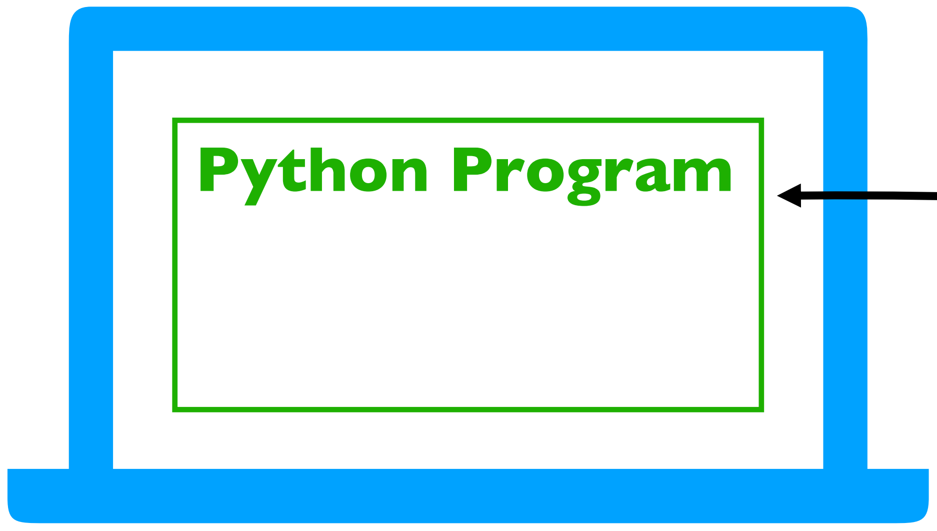
```
HTTP/1.0 200 OK
Content-Type: text/html; charset=utf-8
Content-Length: 74

<html>
  <body>
    <h1>Welcome</h1>
    <a href="about.html">About</a>
    <a href="contact.html">Contact</a>
  </body>
</html>
```

Example: determine whether page exists

```
r = requests.get(…)
code = r.status_code
…
```

Depending on application, we may want to use:

1. HTTP information
2. **raw HTML (or JSON, CSV, etc)**



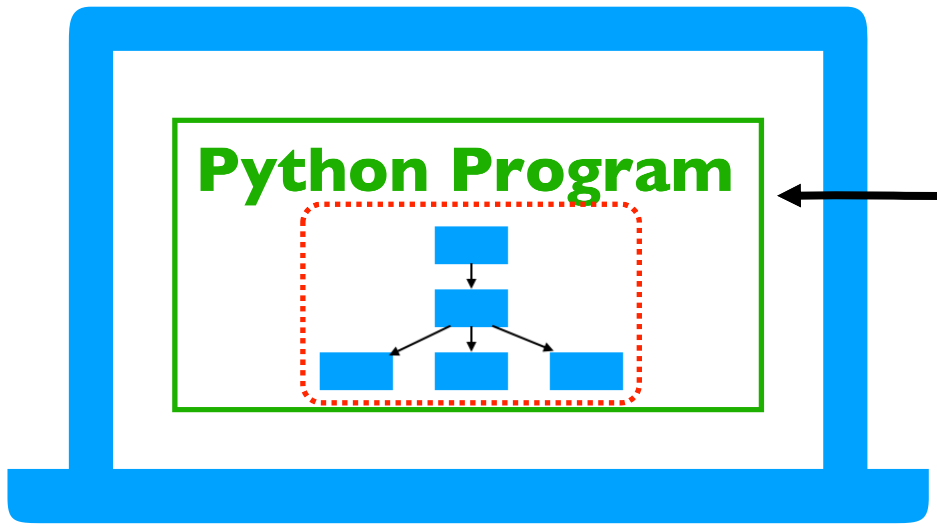
```
HTTP/1.0 200 OK
Content-Type: text/html; charset=utf-8
Content-Length: 74

<html>
  <body>
    <h1>Welcome</h1>
    <a href="about.html">About</a>
    <a href="contact.html">Contact</a>
  </body>
</html>
```

Example: downloader

```
r = requests.get(…)
f = open(…, "w")
f.write(r.text)
f.close()
```

Depending on application, we may want to use:

1. HTTP information
2. raw HTML (or JSON, CSV, etc)
3. **model of HTML document**



HTTP Response

```
HTTP/1.0 200 OK
Content-Type: text/html; charset=utf-8
Content-Length: 74

<html>
  <body>
    <h1>Welcome</h1>
    <a href="about.html">About</a>
    <a href="contact.html">Contact</a>
  </body>
</html>
```

Example: extract URLs from every hyperlink

```
from bs4 import BeautifulSoup
# parse HTML to a model.
# TODAY's topic…
```

Outline

Document Object Model

BeautifulSoup module

Scraping States from Wikipedia

BeautifulSoup module

Purpose

- convert HTML (downloaded from the web or otherwise) to a model of **elements**, **attributes**, and **text**
- simple functions for searching for elements for a particular type (e.g., find all "a" tags to extract all hyperlinks)

Installation

- `pip install beautifulsoup4`

Using it

- `from bs4 import BeautifulSoup`

Parsing HTML

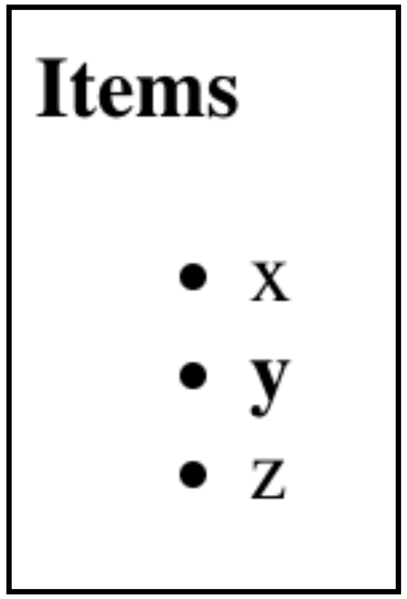
new type

```
from bs4 import BeautifulSoup

html = "<b>Items</b><ul><li>x</li><li><b>y</b></li><li>z</li></ul>"
doc = BeautifulSoup(html, "html.parser")
```

we'll always use this (other strings parse other formats)

this could have come from anywhere:

- hardcoded string
- something from requests GET
- loaded from local file



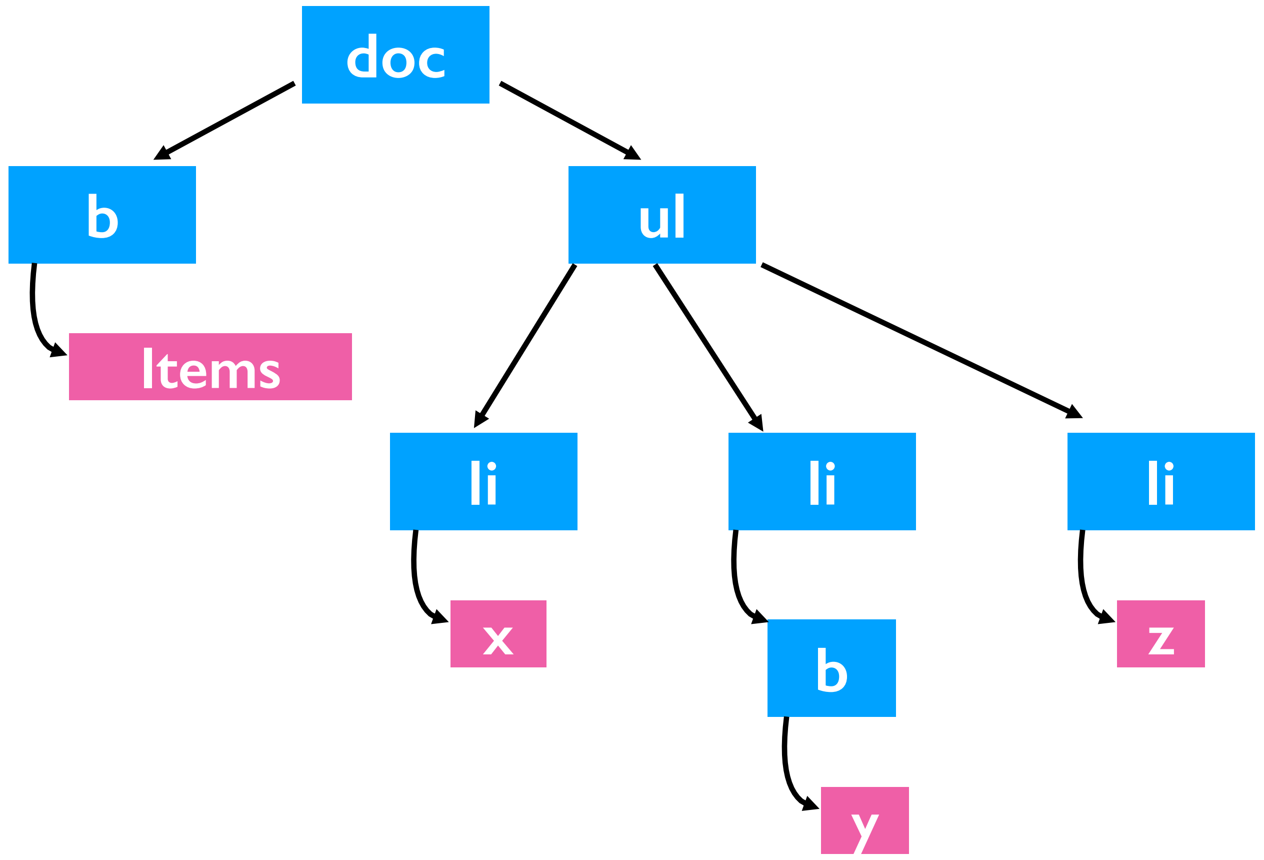
Items

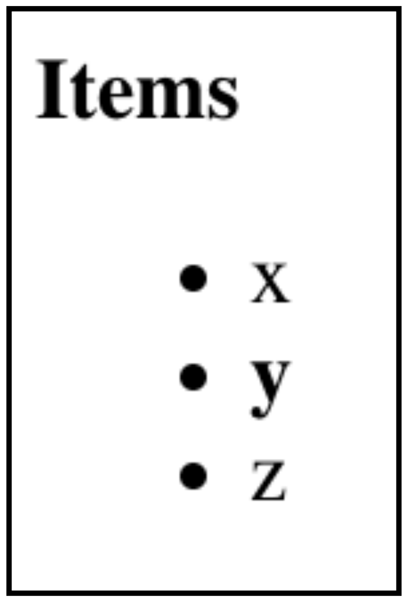
- x
- **y**
- z

Parsing HTML

```
from bs4 import BeautifulSoup

html = "<b>Items</b><ul><li>x</li><li><b>y</b></li><li>z</li></ul>"
doc = BeautifulSoup(html, "html.parser")
```

document object that
we can easily analyze

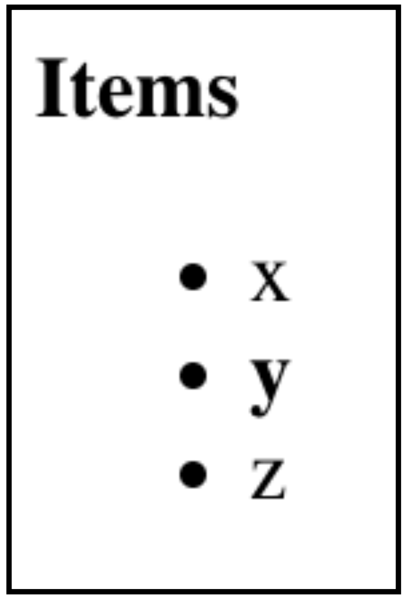




Parsing HTML

```
from bs4 import BeautifulSoup

html = "<b>Items</b><ul><li>x</li><li><b>y</b></li><li>z</li></ul>"
doc = BeautifulSoup(html, "html.parser")

print(doc.prettify())
```

```
<b>
 Items
</b>
<ul>
 <li>
  x
 </li>
 <li>
  <b>
   y
  </b>
 </li>
 <li>
  z
 </li>
</ul>
```



Items

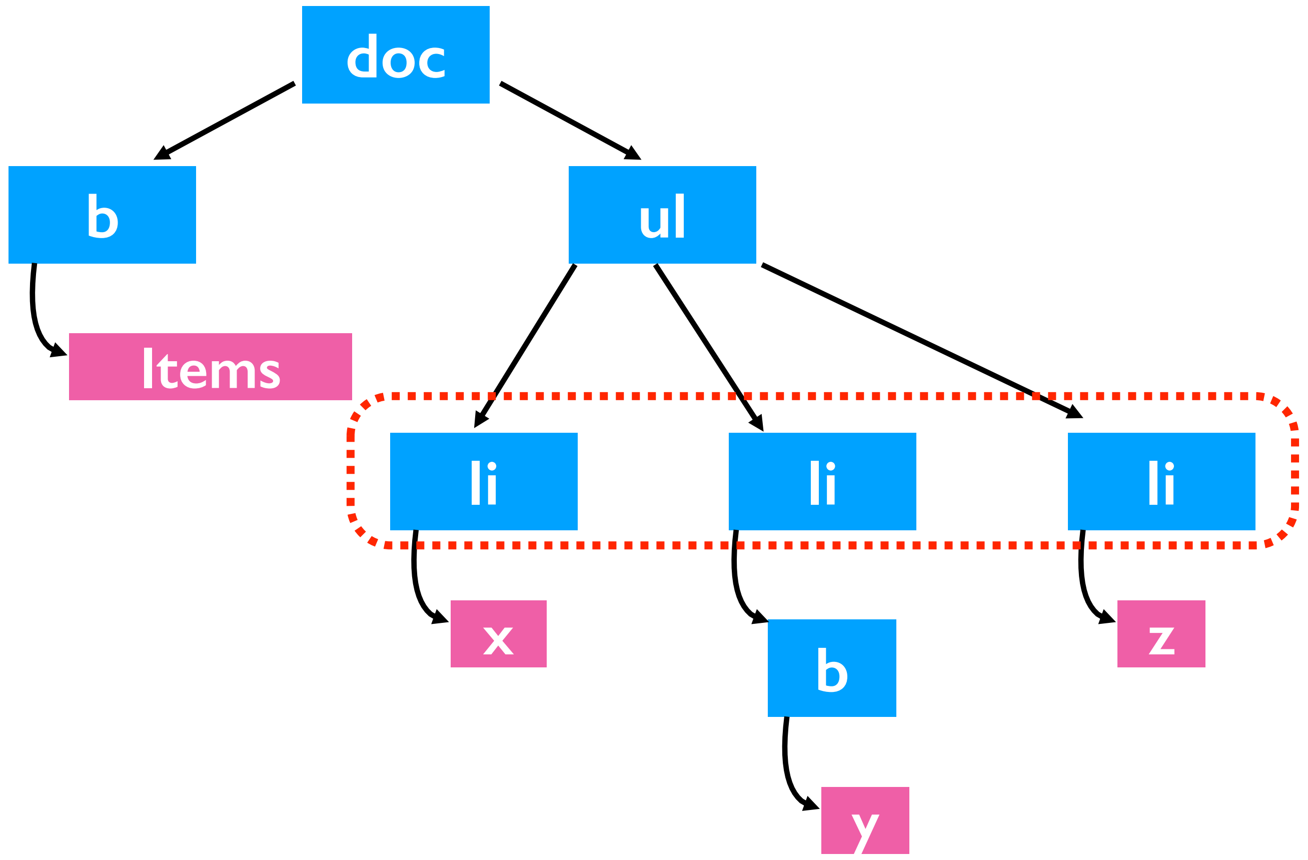
- x
- **y**
- z

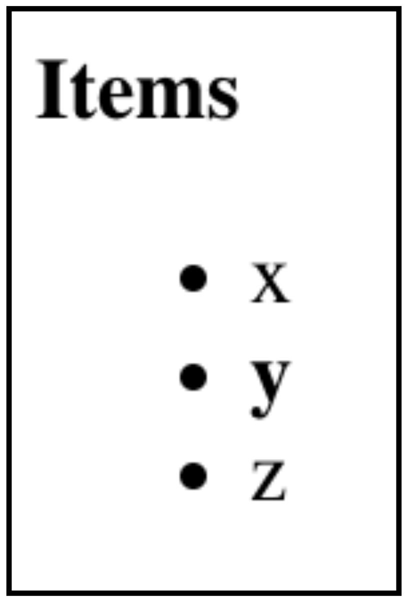
Searching for Elements

```
from bs4 import BeautifulSoup

html = "<b>Items</b><ul><li>x</li><li><b>y</b></li><li>z</li></ul>"
doc = BeautifulSoup(html, "html.parser")

elements = doc.find_all("li")
print(len(elements))
```

list of three elements

prints 3



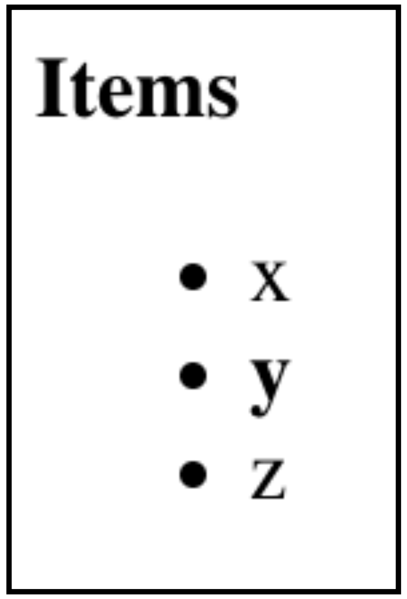


Extracting Text

```
from bs4 import BeautifulSoup

html = "<b>Items</b><ul><li>x</li><li><b>y</b></li><li>z</li></ul>"
doc = BeautifulSoup(html, "html.parser")

elements = doc.find_all("li")
print(len(elements))

for e in elements:
    print(e.get_text())
```

Prints:

```
x
y
z
```



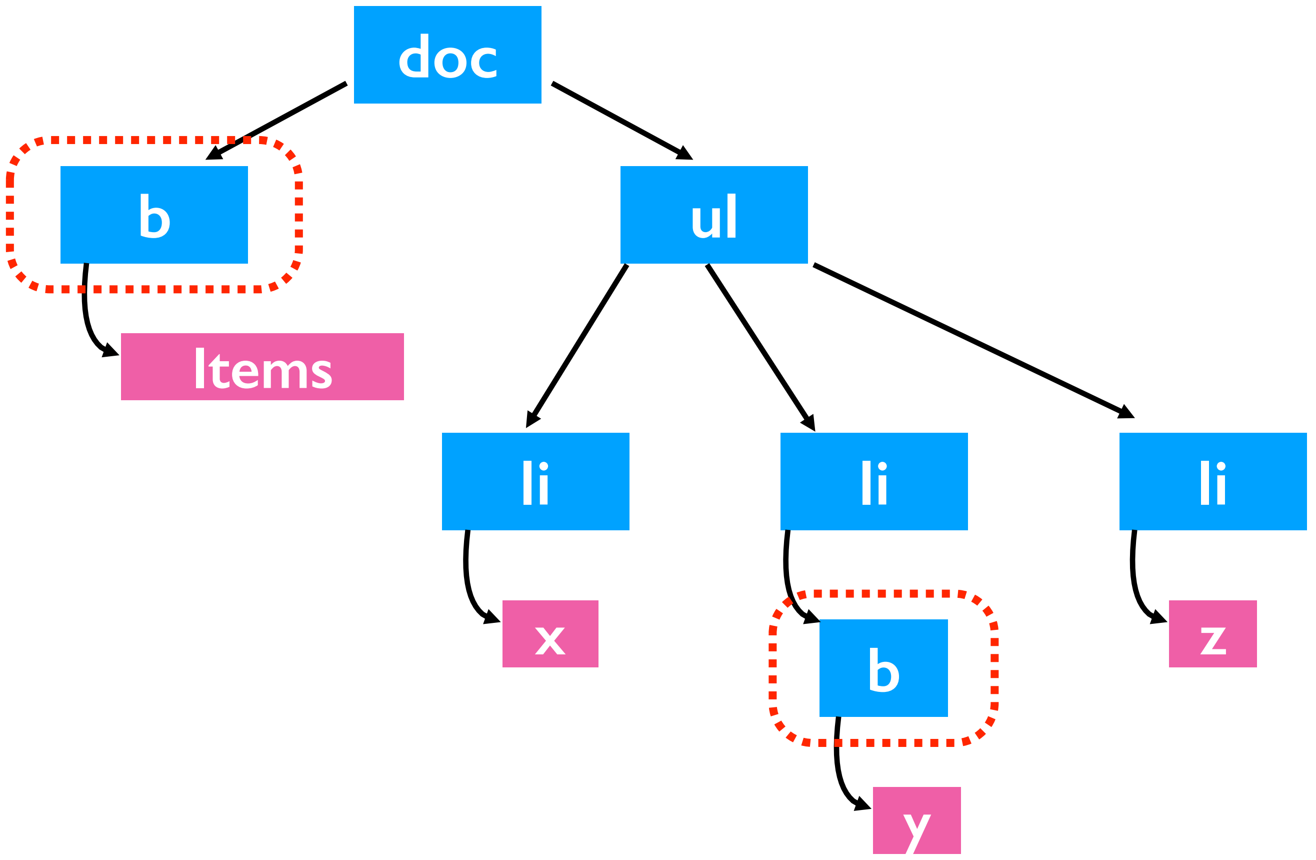
Searching for Elements

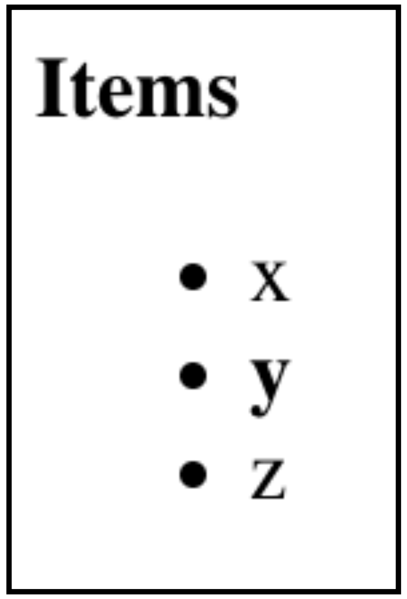
```
from bs4 import BeautifulSoup

html = "<b>Items</b><ul><li>x</li><li><b>y</b></li><li>z</li></ul>"
doc = BeautifulSoup(html, "html.parser")

elements = doc.find_all("b")
print(len(elements))
```

list of two elements

prints 2

now look for all bold elements

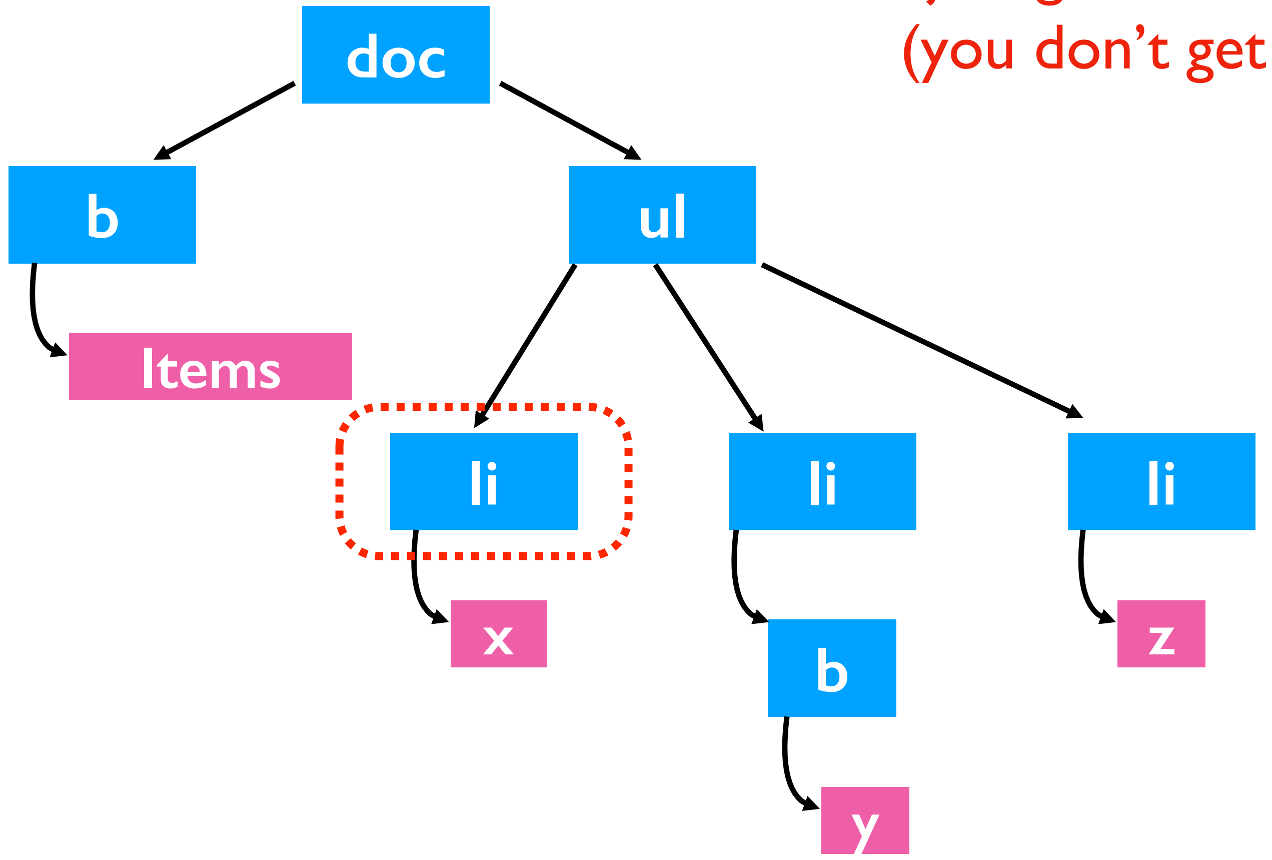


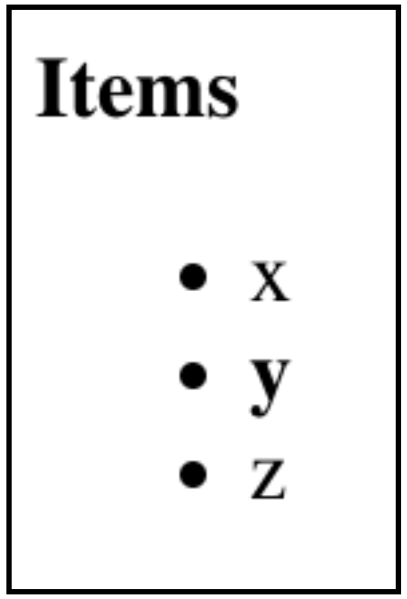


Find One

```
from bs4 import BeautifulSoup

html = "<b>Items</b><ul><li>x</li><li><b>y</b></li><li>z</li></ul>"
doc = BeautifulSoup(html, "html.parser")

li = doc.find("li")
assert(li != None)
```

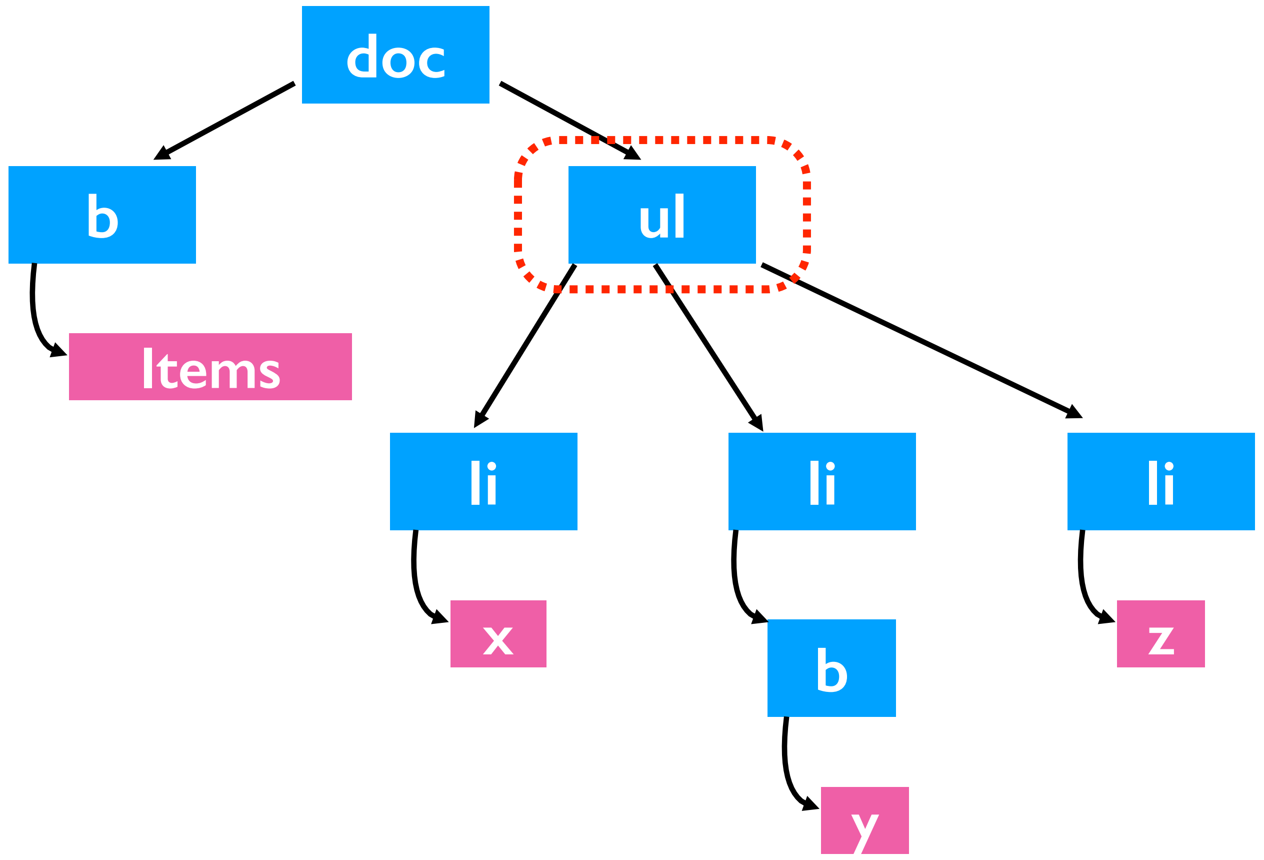
find just grabs the first one
(you don't get a list)

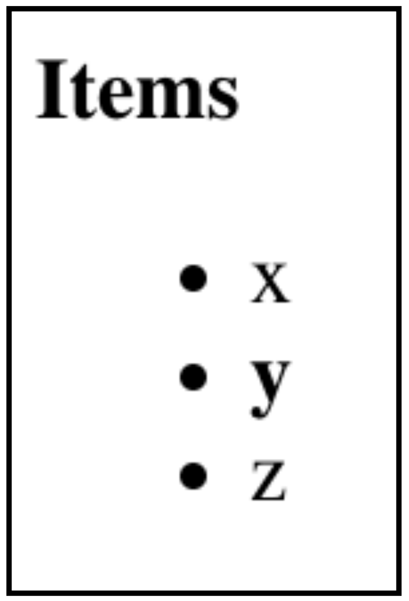




Find One

```
from bs4 import BeautifulSoup

html = "<b>Items</b><ul><li>x</li><li><b>y</b></li><li>z</li></ul>"
doc = BeautifulSoup(html, "html.parser")

ul = doc.find("ul")
assert(ul != None)
```

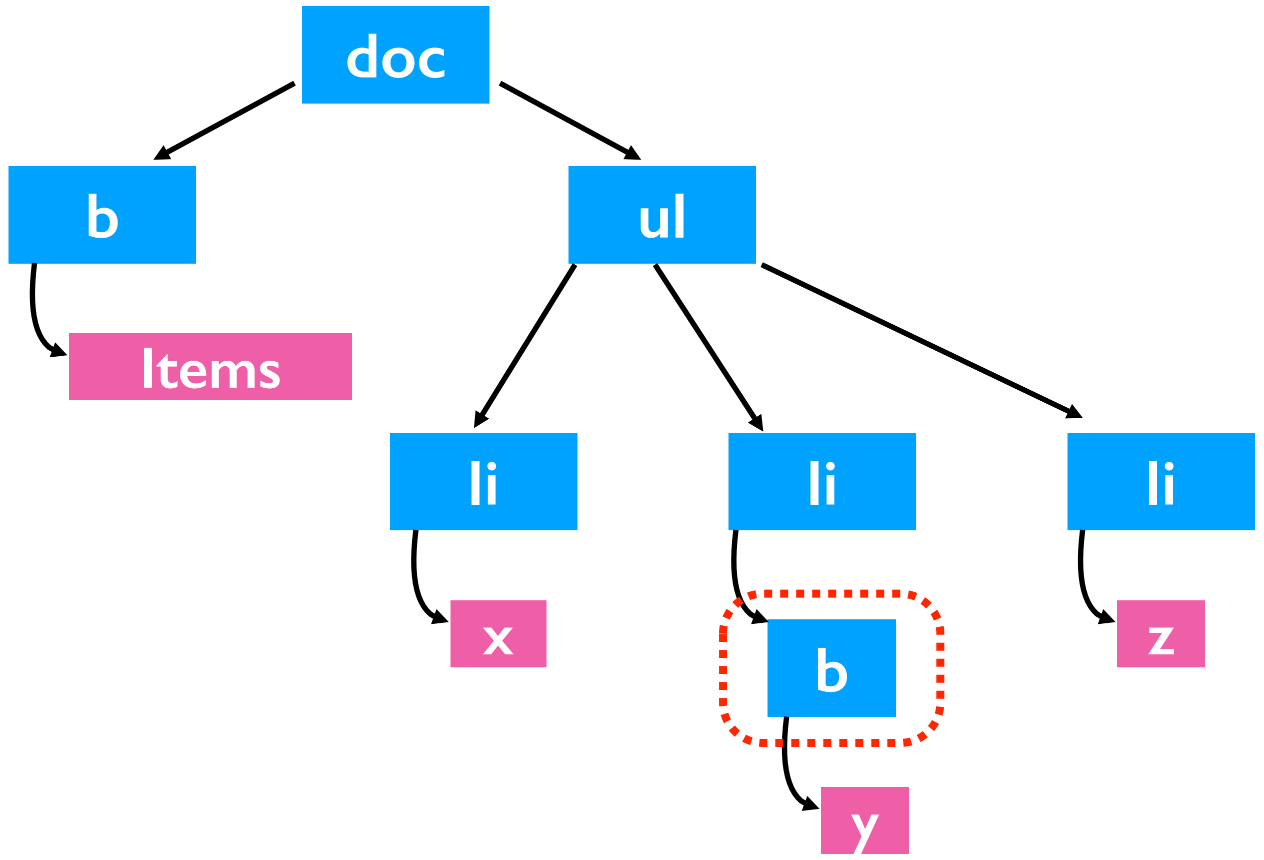


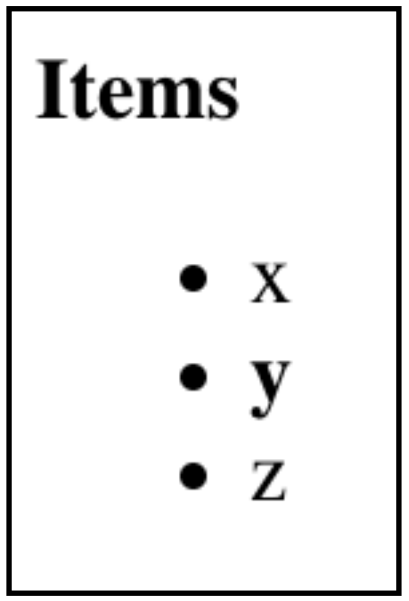


Search Within Search Results

```
from bs4 import BeautifulSoup

html = "<b>Items</b><ul><li>x</li><li><b>y</b></li><li>z</li></ul>"
doc = BeautifulSoup(html, "html.parser")

ul = doc.find("ul")
bold = ul.find_all("b")
```

find all bold text in the unordered list

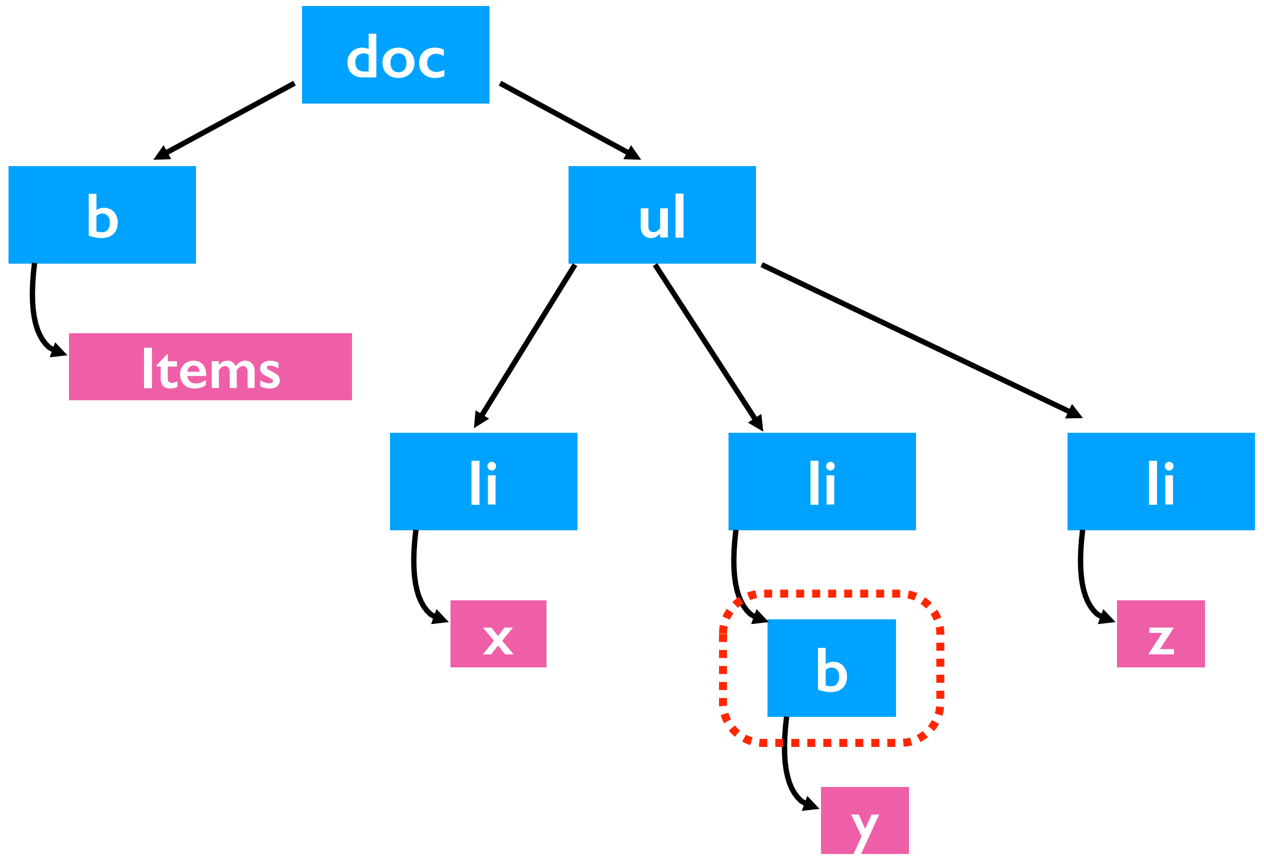


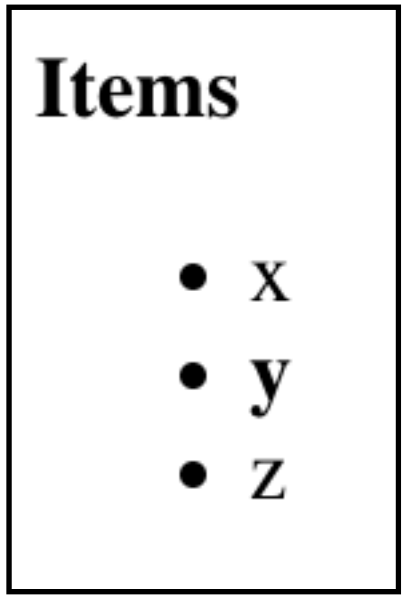


Search Within Search Results

```
from bs4 import BeautifulSoup

html = "<b>Items</b><ul><li>x</li><li><b>y</b></li><li>z</li></ul>"
doc = BeautifulSoup(html, "html.parser")

bold = doc.find("ul").find_all("b")
```

find all bold text in the unordered list





Inspecting an Element

Remember! Elements may contain:

- attributes
- text
- other elements

Inspecting an Element

Remember! Elements may contain:

- attributes
- text
- other elements

[what you see]

please click **here**

[HTML]

```
<a href="schedule.html"><i>please</i> click <b>here</b></a>
```

[Python]

```
link = doc.find("a")
list(link.children)
```

Result:

italic element	click text	bold element

(list)

Inspecting an Element

Remember! Elements may contain:

- attributes
- text
- other elements

[what you see]

please click **here**

[HTML]

```
<a href="schedule.html"><i>please</i> click <b>here</b></a>
```

[Python]

```
link = doc.find("a")
link.get_text()
```

Result: please click here

(str)

Inspecting an Element

Remember! Elements may contain:

- attributes
- text
- other elements

[what you see]

please click **here**

[HTML]

```
<a href="schedule.html"><i>please</i> click <b>here</b></a>
```

[Python]

```
link = doc.find("a")
link.attrs
```

Result: `{'href': 'schedule.html'}`
(dict)

Outline

Document Object Model

BeautifulSoup module

Scraping States from Wikipedia

Demo Stage 1: Extract Links from Wikipedia

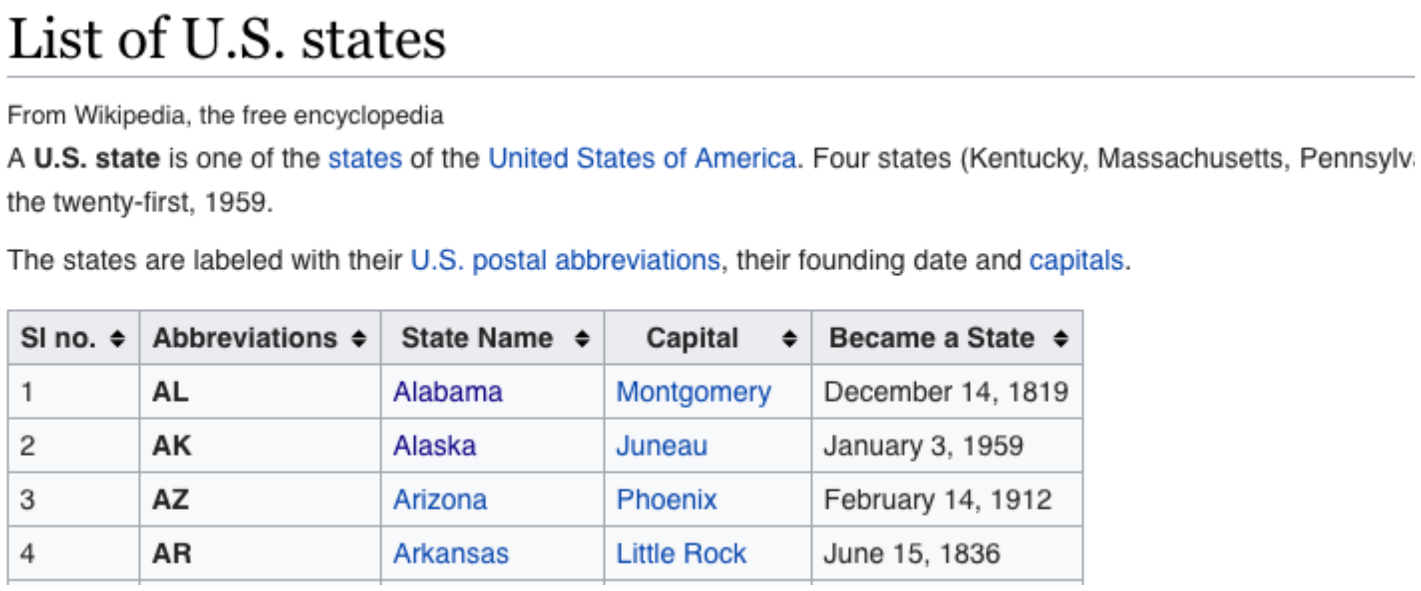
Goal: scrape links to all articles about US states from a table on a wiki page (check this: https://simple.wikipedia.org/robots.txt)

Input:

- https://simple.wikipedia.org/wiki/List_of_U.S._states

Output:

- https://simple.wikipedia.org/wiki/Alabama
- https://simple.wikipedia.org/wiki/Alaska
- etc



List of U.S. states

From Wikipedia, the free encyclopedia

A **U.S. state** is one of the states of the United States of America. Four states (Kentucky, Massachusetts, Pennsylv

the twenty-first, 1959.

The states are labeled with their U.S. postal abbreviations, their founding date and capitals.

Sl no.	Abbreviations	State Name	Capital	Became a State
1	**AL**	Alabama	Montgomery	December 14, 1819
2	**AK**	Alaska	Juneau	January 3, 1959
3	**AZ**	Arizona	Phoenix	February 14, 1912
4	**AR**	Arkansas	Little Rock	June 15, 1836

Demo Stage 2: Download State Pages

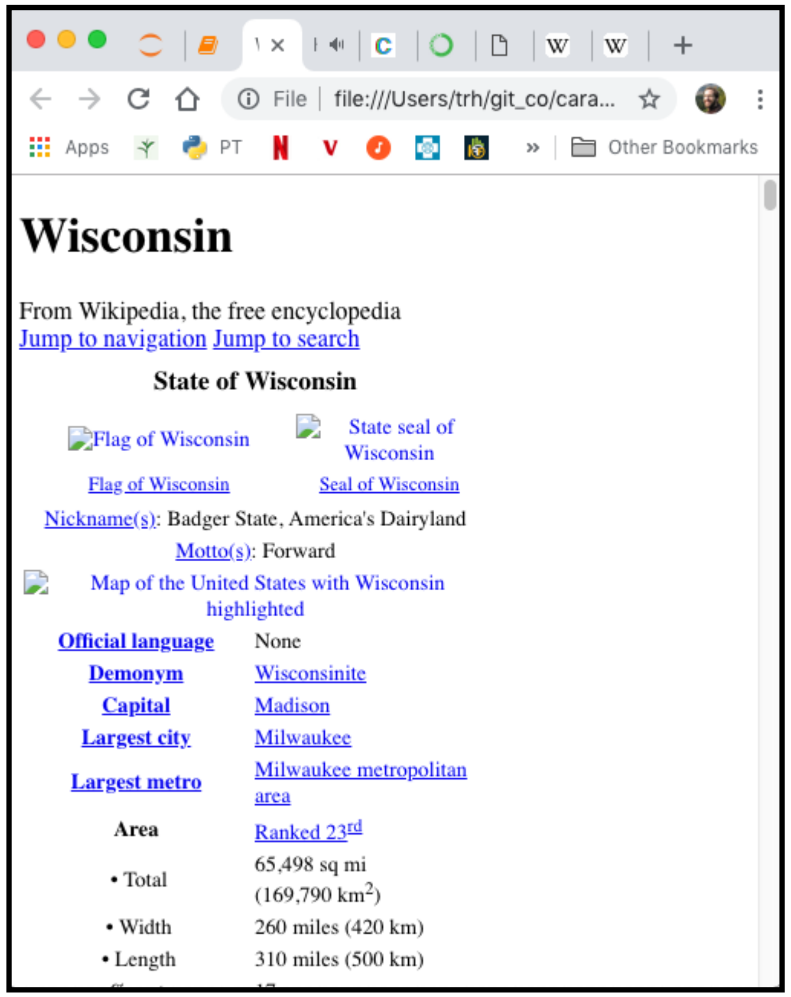
Goal: download all Wiki pages for the states

Input:

- Links generated in stage 1:
- https://simple.wikipedia.org/wiki/Alabama
- https://simple.wikipedia.org/wiki/Alaska
- etc

Output Files:

- Alabama.html
- Alaska.html
- etc



Wisconsin

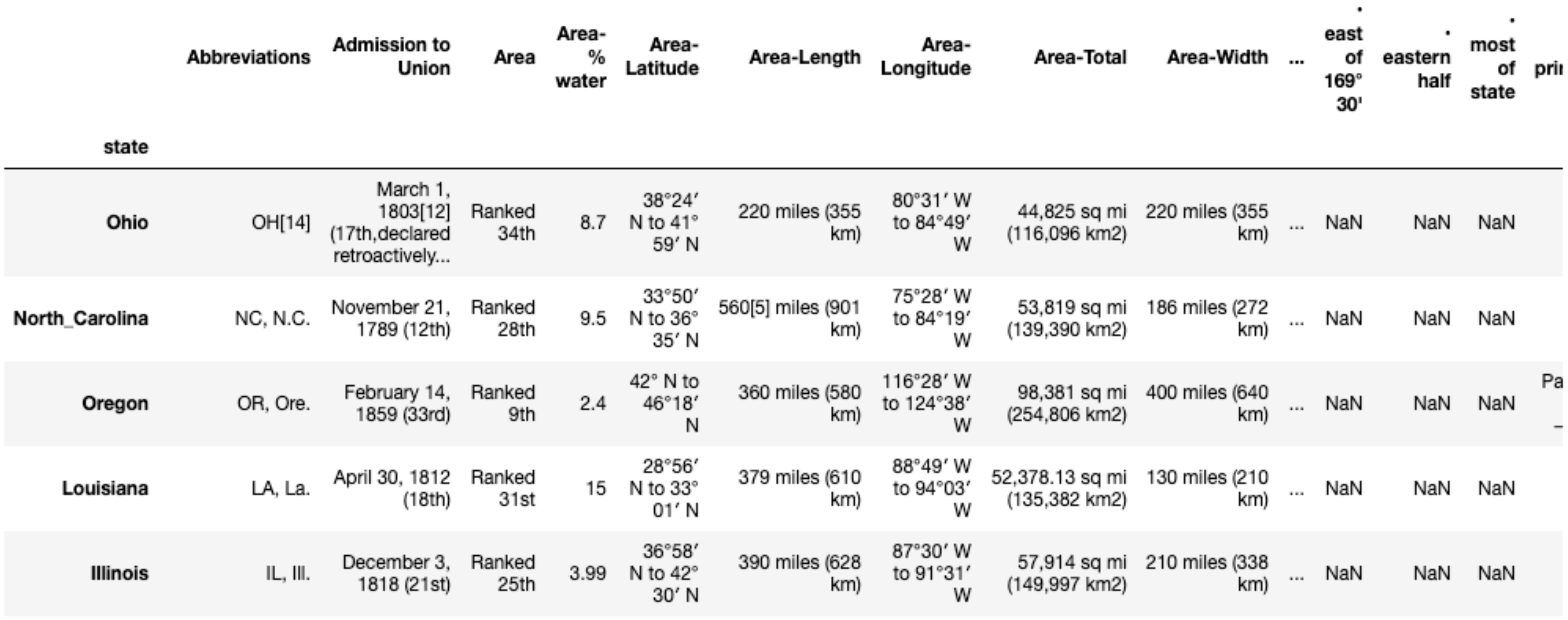
From Wikipedia, the free encyclopedia
Jump to navigation Jump to search

State of Wisconsin

Flag of Wisconsin State seal of Wisconsin
Flag of Wisconsin Seal of Wisconsin
Nickname(s): Badger State, America's Dairyland
Motto(s): Forward
Map of the United States with Wisconsin highlighted

Official language	None
Demonym	Wisconsinite
Capital	Madison
Largest city	Milwaukee
Largest metro	Milwaukee metropolitan area
Area	Ranked 23rd
• Total	65,498 sq mi (169,790 km^2)
• Width	260 miles (420 km)
• Length	310 miles (500 km)

Demo Stage 3: Convert to DataFrame



	Abbreviations	Admission to Union	Area	Area-% water	Area-Latitude	Area-Length	Area-Longitude	Area-Total	Area-Width	...	• east of 169° 30'	• eastern half	• most of state	pri
state														
Ohio	OH[14]	March 1, 1803[12] (17th,declared retroactively...	Ranked 34th	8.7	38°24′ N to 41° 59′ N	220 miles (355 km)	80°31′ W to 84°49′ W	44,825 sq mi (116,096 km2)	220 miles (355 km)	...	NaN	NaN	NaN	
North_Carolina	NC, N.C.	November 21, 1789 (12th)	Ranked 28th	9.5	33°50′ N to 36° 35′ N	560[5] miles (901 km)	75°28′ W to 84°19′ W	53,819 sq mi (139,390 km2)	186 miles (272 km)	...	NaN	NaN	NaN	
Oregon	OR, Ore.	February 14, 1859 (33rd)	Ranked 9th	2.4	42° N to 46°18′ N	360 miles (580 km)	116°28′ W to 124°38′ W	98,381 sq mi (254,806 km2)	400 miles (640 km)	...	NaN	NaN	NaN	Pa –
Louisiana	LA, La.	April 30, 1812 (18th)	Ranked 31st	15	28°56′ N to 33° 01′ N	379 miles (610 km)	88°49′ W to 94°03′ W	52,378.13 sq mi (135,382 km2)	130 miles (210 km)	...	NaN	NaN	NaN	
Illinois	IL, Ill.	December 3, 1818 (21st)	Ranked 25th	3.99	36°58′ N to 42° 30′ N	390 miles (628 km)	87°30′ W to 91°31′ W	57,914 sq mi (149,997 km2)	210 miles (338 km)	...	NaN	NaN	NaN	