

Teaching the Teacher: Python

Day 3 – Afternoon: »APIs and scraping«

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Afdeling Communicatiewetenschap
Universiteit van Amsterdam

Today

Data in our teaching

A first intro to parsing webpages

Modern approaches to web scraping

XPATH vs CSS selector

Scaling up

Next steps

Data in our teaching

ooo

A first intro to parsing webpages

oooooooooooo

Modern approaches to web scraping

oooooooooooooooooooooooooooo

Scaling up

oooooo

Next steps

ooo

Everything clear from this morning?

Data in our teaching

What do we expect from students? i

Digital analytics

- Twitter API
- Other social media and/or use existing APIs (e.g., YouTube Data Tools)
- Find datasets online (e.g., Kaggle)
- Request a simulated dataset on the basis of a format (student is responsible to justify how the dataset looks like)

What do we expect from students? ii

Data Journalism

- Datasets from Google Dataset Search (datasetsearch.research.google.com) or similar
- Data from CBS or similar institutions

What do we expect from students? iii

BDACA

- Any API, even if not covered in class
- Webscraping
- In particular: combination of sources

A first intro to parsing webpages

Let's have a look of a webpage with comments and try to understand the underlying structure.

Websites change constantly!

The examples on these slides are meant to illustrate the principles and approaches and are *not* meant as a practical guide for scraping the specific websites mentioned here. Websites change their structure quite regularly, and you cannot assume that scraping code written once keeps working in the future.

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184 files - 236147 leden / 104 km 2014 bijgevoegd

Vreemde vogel vogelvrij bij dodenherdenking Dam

Vreemde vogel bij dodenherdenking

0:00 / 4:38 YouTube

HEADLINES

05-05
Daar is pathologische lousenaar Rehwinkel weer!
Kijk, zo leren kindjes in Tsjechoe over de EU

Goodkoopste Sony Samsung en iPhone
GEHORE
www.veerommede.nl
Gezocht. Dief met tatoeage en motorfiets
Wierfjes: 'Hey poppen, de EU is fantastisch hoor'
Aanrijfel
Wildebasen is ook vrijheid
Vreemde vogel vogelvrij bij dodenherdenking Dam
Aangifte tegen GeenStijl - De Q en A Kloosterd
Generaal van Uhm: 'Polderjacht' hadken zijn

Filmpje uit het rauwrealistische archief van Amsterdamse stadsheest Frank Buis. En met 'rauwrealistisch' bedoelen we: de beelden die u niet ziet op de stream-met-nietszegend-commentaar-in-stormige-fluisterboon van de Staatsomroep. Vak voor de Dodenherdenking dood bovenstaande foto op de Dam op. Plastic Hannibal Leder maskertje voor de mond. Rans oranje klomp aan de voet. Koppelbuisen in de kroon. Daar wilde de politie wel even mee babbelen, zo vlak voor de aankomst van de koninklijke nazi-naast en zijn Junta-meisje. Want doden herdenken op je eigen manier is 1 ding. Maar jezelf daarbij koddig kleden valt buiten de voorschriften van de vrijheid. Wat moesten die 69 kindjes in het buitenlandse gasten-vak wel niet denken? Daarom. Goed dat de politie deze malle meneer en zijn aluminium lunchpakketje eveneens naar een veilige afstand van de vrijheidsviering voerde. (Video: Frank Buis/Royal Press Amsterdam)

Van Rossem | 05-05-14 | 11:11 | Link | 100 reacties |

REAQUURSELS

Tija, ik zou m ook niet in mn buurt willen hebben, die vreemde vogel.

Lepo | 05-05-14 | 11:13

Volgend jaar strodascontrole voor de heren en hoedjescheck voor de dames. De volledige lijst van goedgekeurde kleding kunt u vinden op Postbus1.nl.

DUMPERT

DE BESTE DEALS!
kortingen tot 80%

De Telegraaf **BEKIJK DEALS >**

POWNEWS

POWNEWS - ELKE WERKDAY, 22-45, NED3
Eerder: Delft strijdt tegen Vollett

16:40 Jongens melden zich na mishandeling
16:27 Polio gaat wereld slopen
16:24 Verkeersongepast plaatsen niet
15:40 Stormfe - celstraf in Zuid-Afrika
15:36 Update: onbewateringen bevestigd
15:26 Timmermans dipt op rijm over Rode
15:16 Tienallen migranten verdronken
15:13 Netze vrouwen op superglijbaan

GEENSTIJL TV

DASKAPITAL

16:50 Pensioenspolder jaagt fondsen naar België

REAGUURSELS

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Lepo | 05-05-14 | 11:13



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Uiteraard bent u extra welkom als u Abercrombie & Fitch draagt.

rara | 05-05-14 | 11:15



Gewoon even de afdeling psychiatrie bellen, wie ze missen: Klaar!

Mazzeltov | 05-05-14 | 11:16



netjes opgelost toch?

--sql error-- | 05-05-14 | 11:16





view-source:https://www.geenstijl.nl/3945571/das_toch_niet_normaal/



Aan de slag



Press This



Atlassian Cloud

```
n class="divider">|</span>
n class="datetime">05-05-14 | 23:34</span>
```

```
class="reportcomment" title="Deze reactie is in overtreding met de huisregels."></a>
er>
```

```
e>
```

```
article class="comment col-xs-12 no-y-padding"
commentid="192631041"
192631041">
ss="anchor-pos" id="cid_192631041"></div>
```

```
class="cmt-content"><p>Een VZ800 Marauder, wat een giga kutmotor is dat. Na 10 km. heb je al
```

```
er>
```

```
span class="username">tiswat</span>
```

Let's make a plan!

Which elements from the page do we need?

- What do they mean?
- How are they represented in the source code?

How should our output look like?

- What *lists* do we want?
- ...

And how can we achieve this?

A first plan

1. Download the page
2. Try to isolate the comments
3. Hopefully, we have a list of comments now that we can work with.

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- Possibly taking measures to deal with cookie walls, being blocked, etc.

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 - Do we see any pattern in the source code? *⇒ two weeks ago: if we can see a pattern, we can describe it with a regular expression*
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1. Download the page
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```
1 import requests
2 import re
3
4 URL = 'http://www.geenstijl.nl/mt/archieven/2014/05/
      das_toch_niet_normaal.html'
5
6 # ugly workaround to circumvent cookie wall, not of interest for today
7 client = requests.session()
8 r = client.get(URL)
9 cookies = client.cookies.items()
10 cookies.append(('cpc','10'))
11 response = client.get(URL,cookies=dict(cookies))
12 # end workaround
13
14 # remove line breaks and tabs (for regexp matching later on)
15 tekst=response.text.replace("\n"," ").replace("\t"," ")
16
17 comments=re.findall(r'<div class="cmt-content">(.*?)</div>',tekst)
18 print("There are",len(comments),"comments")
19 print("These are the first two:")
20 print(comments[:2])
```

Some remarks

The regexp

- `.*?` instead of `.*` means *lazy* matching. As `.*` matches everything, the part where the regexp should stop would not be analyzed (*greedy* matching) – we would get the whole rest of the document (or the line, but we removed all line breaks).
- The parentheses in `(.*?)` make sure that the function only returns what's between them and not the surrounding stuff (like `<div>` and `</div>`)

Optimization

- Parse usernames, date, time, ...
- Replace `<p>` tags

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Optimization

- Parse usernames, date, time, ...
- Replace `<p>` tags

Doing this with other sites?

- It's basically puzzling with regular expressions.
- Look at the source code of the website to see how well-structured it is.

Modern approaches to web scraping

OK, but this surely can be done more elegantly? Yes!

Others have written these regular expressions for you!

Very few edge cases aside (broken pages, for instance), you do not write these (low-level) regular expressions yourself but use existing packages that let you describe the position of some content within a HTML file with an easier (high-level) syntax, so-called CSS Selectors and/or XPATHs (two new languages next to regexp, yeah!¹)

¹I promise they are easier!

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Scraping

The Geenstijl-example

- Worked well (and we could do it with the knowledge we already had)
- But we can also use existing parsers (that can interpret the structure of the html page)
- especially when the structure of the site is more complex

Scraping

The Geenstijl-example

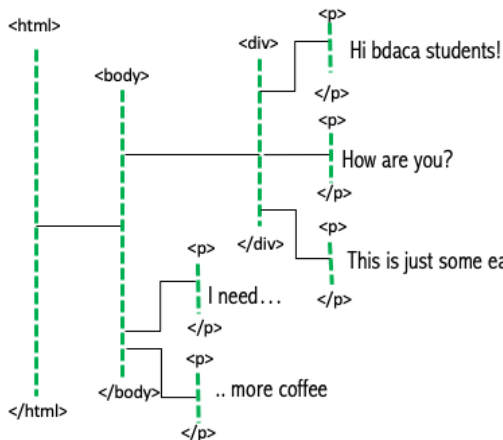
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- But we can also use existing parsers (that can interpret the structure of the html page)
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Scraping

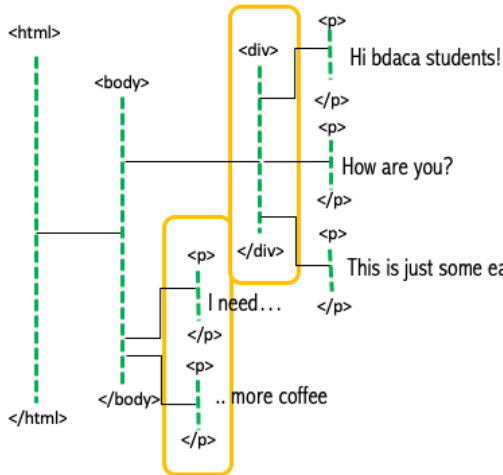
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```
<html>
<body>
  <div>
    <p>Hi bdaca students!</p>
    <p>How are you?</p>
    <p>This is just an easy HTML example</p>
  </div>
  <p> I need ...</p>
  <p>...more coffee</p>
</body>
</html>
```



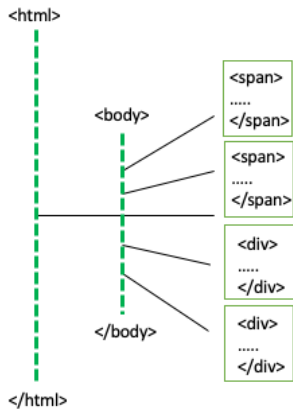
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```

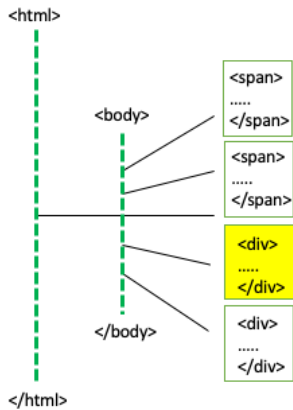
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XPATH = `"/html/body/div[1]"` refers to which element?



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What do we need?

- the URL (of course)
- the XPATH of the element we want to scrape (you'll see in a minute what this is)

The following example is based on <https://www.kieskeurig.nl/smartphone/product/3518001-samsung-galaxy-a5-2017-goud/reviews>. It uses the module `lxml`

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Samsung Galaxy A5 (2017) zwart / 16 GB - Reviews

[Reviewscore](#) | **8,7** [Lees 1049 reviews](#) [Schrijf een review](#)[Favorieten](#) [⬆ Vergelijk](#) [Prijzalert](#)

6 Afbeeldingen

✓ Testpanel score 8,2 - april 2017

Laagste prijzen

-1% prijsdaling

➤ Mediamarkt	€ 267,00
➤ Betsimpe.nl	€ 275,00
➤ Mobiel.nl	€ 279,00

Specificaties

4,7 inch scherm
16 GB opslag
Android

[Bekijk 3 andere uitvoeringen](#)

Samsung Galaxy A5 (2017) zwart / 16 GB

[Prijzen \(9\)](#)[Overzicht](#)[Abonnementen](#)[Specificaties](#)[Reviews \(1049\)](#)Review type: **Consumenten reviews (1049)**

Gemiddelde beoordeling

8,7

De gemiddelde beoordeling is gebaseerd op de 1049 reviews die zijn achtergelaten op Kieskeurig.nl.

Help anderen en geef jouw mening over dit product. We verloten iedere maand onder alle reviewers 2 x € 250,-

[Schrijf een review](#)

Kieskeurig.nl review criteria:

Geluidskwaliteit	<div></div>	Goed
Mogelijkheden	<div></div>	Goed
Gebruiksgemak	<div></div>	Uitstekend
Vormgeving	<div></div>	Uitstekend
Degelijkheid	<div></div>	Goed

Echte reviews van echte gebruikers, door ons gecontroleerd op betrouwbaarheid.

Sorteer op: [Meest nuttig eerst](#)BartTilburg
21-03-2017

· Product paar weken in bezit

Verliefd op de Samsung Galaxy A5 2017

✓ Ja, ik beveel dit product aan

Wat een fenomenale smartphone is de nieuwe Samsung Galaxy A5 2017 geworden, lees hier waarom.

Bij het openen van de verpakking valt direct op dat dit toestel niet onder doet voor een smartphone uit het duurste segment. Ik heb gekozen voor de kleur sand/gold, een mooie champagneachtige gouden kleur die erg opvalt. Het toestel heeft een aluminium behuizing en zowel de voorkant als de achterkant van de Samsung Galaxy A5 2017 zijn geheel van glas en er is zelfs een

Algemene score

[Reviewscore](#) | 10,0

Review criteria:

Geluidskwaliteit	<div></div>	Uitstekend
Mogelijkheden	<div></div>	Uitstekend
Gebruiksgemak	<div></div>	Uitstekend

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Algemene score

Reviewscore | 10

Review criteria

Geluidskwaliteit

Mogelijkheden

Gebruiksgemak

Copy

Select All

Search Google for "Wat een fenomen..."

View Selection Source

Inspect Element (Q)



Hebben!

BartTilburg
21-03-2017

Product paar weken in bezit

Verliefd op de Samsung Galaxy A5 2017

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div.reviews-single__text | 477.5 x 909

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Algemeen
Reviews

Review
Geluid

Mogelijk

Gebruik

Verpakking

Inspector

Console

Debugger

{ } Style Editor

Performance

Memory

Network

Storage

Search HTML

Rules

```
<div id="6025675" class="reviews-single" data-expand="more-reviews">
  <div class="reviews-single__meta"></div>
  <div class="reviews-single__content-wrap">
    <div class="reviews-single__hero"></div>
    <div class="reviews-single__content">
      <div class="reviews-single__text"></div>
      <div class="reviews-single__individual-rating"></div>
      <div class="reviews-single__comments-votes"></div>
      <div id="review-6025675" class="reviews-single__comments-wrapper" data-context="review-6025675"></div>
    </div>
  </div>
```

> div#6025675.reviews-single > div.reviews-single__content-wrap > div.reviews-single__content > div.reviews-single__text

Samsung Galaxy A5 (2017) [Software Updater]

Hebben!



Inspector



Console



Debugger

```
▼ <div id="6025675" class="review
  ▶ <div class="reviews-single_m
    ▼ <div class="reviews-single_c
      ▶ <div class="reviews-single_
        ▼ <div class="reviews-single
          ▶ <div class="reviews-single
```

```
    ▶ <div class="reviews-single__individual-rating">⌵</div>
    ▶ <div class="reviews-single__comments-votes">⌵</div>
    ▶ <div id="review-6025675" class="reviews-single_comments-wrapper" data-context="review-
```

Delete Node

Attributes

hover

active

focus

Copy

Paste

Expand All

Collapse

Scroll Into View

Screenshot Node

Use in Console

Show DOM Properties

Inner HTML

Outer HTML

CSS Selector

CSS Path

XPath

Image Data-URL

Note that each *tag* (such as `div`) can have
attributes (such as `class` or `id`!)

But you can also create your XPATH yourself

There are multiple different XPATHs to address a specific element.

Some things to play around with:

- `//` means 'arbitrary depth' (=may be nested in many higher levels)
- `*` means 'anything'. (`p[2]` is the second paragraph, `p[*]` are all)
- If you want to refer to a specific attribute of a HTML tag, you can use `@`. For example, every `*[@id="reviews-container"]` would grap a tag like `<div id=reviews-container" class=""user-content'`
- Let the XPATH end with `/text()` to get all text
- Have a look at the source code (via 'inspect elements') of the web page to think of other possible XPATHs!

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- Let the XPATH end with `/text()` to get all text
- Have a look at the source code (via 'inspect elements') of the web page to think of other possible XPATHs!

Let's test it!

[https://www.kieskeurig.nl/wasmachine/product/
2483630-siemens-wmn16t3471/reviews](https://www.kieskeurig.nl/wasmachine/product/2483630-siemens-wmn16t3471/reviews)

Let's scrape them!

```
1 from lxml import html
2 import requests
3
4 response = requests.get('https://www.kieskeurig.nl/wasmachine/product
    /2483630-siemens-wmn16t3471/reviews')
5 tree = html.fromstring(response.text)
6
7 # we extract all relevant elements using their XPATH
8 reviews = tree.xpath('//div[@class="reviews-single__text"]')
9 # alternatively, we can use their CSS selector:
10 # reviews = tree.cssselect("div.reviews-single__text")
11
12 # but we don't want the elements, we want their text
13 review_texts = [e.text_content().strip() for e in reviews]
14
15 print (f"{len(reviews)} reviews scraped. Showing the first 60 characters
    :")
16 for i, review in enumerate(review_texts):
17     print(f"Review {i}: {review[:60]}")
```

The output – perfect!

```
1 20 reviews scraped. Showing the first 60 characters:
2 Review 0 : Siemens WMN16T3471 nu 4 maanden in gebruik in massagesalon.
3 Review 1 : Na een eerder positief review kort na aankoop nu een bijgest
4 Review 2 : Helaas ben ik teleurgesteld in dit product wegens de navolge
5 Review 3 : Ik ben heel blij met mijn nieuwe wasmachine:
6
7 Wat is hij st
8 Review 4 : Ik heb de wasmachine nu net een paar dagen in huis en heb al
9 Review 5 : Na 25 jaar hebben we afscheid moeten nemen van onze degelijk
```

Modern approaches to web scraping

XPATH vs CSS selector

Two ways of expressing the same thing

```
1 # we extract all relevant elements using their XPATH
2 reviews = tree.xpath('//div[@class="reviews-single__text"]')
```

```
1 # alternatively, we can use their CSS selector:
2 reviews = tree.cssselect("div.reviews-single__text")
```

- partly a matter of personal preferences
- Table 12.1 in the book shows both
- CSS selectors are often easier to write (and more modern)
- XPATHs are more straight-forward for describing the hierarchical position of an object
- there are some cases that cannot be described as CSS selector

⇒ Many people use CSS selectors by default and resort to XPATHs if necessary

Two ways of expressing the same thing

```
1 # we extract all relevant elements using their XPATH
2 reviews = tree.xpath('//div[@class="reviews-single__text"]')
```

```
1 # alternatively, we can use their CSS selector:
2 reviews = tree.cssselect("div.reviews-single__text")
```

- partly a matter of personal preferences
- Table 12.1 in the book shows both
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⇒ Many people use CSS selectors by default and resort to XPATHs if necessary

Scaling up

But this was on *one* page only, right?

Next step: Repeat for each relevant page.

Possibility 1: Based on url schemes

If the url of one review page is

`https://www.hostelworld.com/hosteldetails.php/
ClinkNOORD/Amsterdam/93919/reviews?page=2`

...then the next one is probably?

⇒ you can construct a list of all possible URLs:

```
1 baseurl = 'https://www.hostelworld.com/hosteldetails.php/ClinkNOORD/  
    Amsterdam/93919/reviews?page='  
2  
3 allurls = [f"baseurl{i+1}" for i in range(20)]
```

But this was on *one* page only, right?

Next step: Repeat for each relevant page.

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But this was on *one* page only, right?

Next step: Repeat for each relevant page.

Possibility 2: Based on XPATHs or CSS Selectors

Use XPATH to get the url of the next page (i.e., to get the link that you would click to get the next review)

Recap

General idea

1. Identify each element by its XPATH or CSS Selector (look it up in your browser)
2. Read the webpage into a (loooooong) string
3. Use the XPATH or CSS Selectors to extract the relevant text into a list (with a module like lxml)
4. Do something with the list (preprocess, analyze, save)
5. Repeat

Alternatives: scrapy, beautifulsoup, regular expressions, ...

Last remarks

There is often more than one way to specify an XPATH

1. Sometimes, you might want to use a different suggestion to be able to generalize better (e.g., using the *attributes* rather than the *tags*)
2. in that case, it makes sense to look deeper into the structure of the HTML code, for example with “Inspect Element” and use that information to play around with different possibilities

BartTilburg
21-03-2017

Product paar weken in bezit

Verliefd op de Samsung Galaxy A5 2017

✓ Ja, ik beveel dit product aan

div.reviews-single__text | 477.5 x 909

Wat een fenomenale smartphone is de nieuwe Samsung Galaxy A5 2017 geworden, lees hier waarom.

Bij het openen van de verpakking valt direct op dat dit toestel onder doet voor een smartphone uit het duurste segment. Ik heb gekozen voor de kleur sand/gold, een mooie champagneachtige gouden kleur die erg opvalt. Het toestel heeft een aluminium behuizing en zowel de voorkant als de achterkant van de Samsung Galaxy A5 2017 zijn geheel van glas en er is zelfs een

Console

Debugger

Style Editor

Performance

Memory

Network

Storage

Search HTML

```
id="6025675" class="reviews-single" data-expand="more-reviews">
  class="reviews-single__meta"></div>
  class="reviews-single__content-wrap">
    div class="reviews-single__hero"></div>
    div class="reviews-single__content">
      div class="reviews-single__text"></div>
    div class="reviews-single__individual-rating"></div>
    div class="reviews-single__comments-votes"></div>
    div id="review-6025675" class="reviews-single__comments-wrapper" data-context="review-6025675"></div>
  div>
v>
```

5.reviews-single

div.reviews-single__content-wrap

div.reviews-single__content

div.reviews-single__text

Samsung Galaxy A5 (20...

[Software Updater]

Next steps

Friday

- Write a scraper for a website of your choice!
- Choose an easy site where you do not have to log on and where there is no dynamically generated content (if you want to do that, you need to use `selenium` – see book.)

Every scraper is different!

Scraping can be difficult, but it is also one of the most important data collection methods. Chances are very high you'll need it as a part of your final project. It can make sense to already start to write a scraper at home, so that you can ask specific questions on Friday.

Friday

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```

In [35]: ratings = tree.xpath("//*[ @class='rating-ratingValue']/text()")
In [36]: restaurants = tree.xpath("//*[ @class='restaurantSelection-name']/text()")
In [37]: len(ratings)
Out[37]: 10
In [38]: len(restaurants)
Out[38]: 10
In [39]: for i in range(10):
    print(restaurants[i].strip(), ratings[i])
    ....:
Risto Enoteca PepeNero 9.3
Cafe Sage 9.2
The Lobby Fizeastraat Restaurant & Bar (Hotel V) 9.1
Brasserie Ambassade 9.1
Tulsi Indian restaurant 9.1
Zaza's 9
Jacobz 9
Bistrot des Alpes 9
Restaurant Jaspers 8.9
En Pluche 8.9
In [40]:
    
```

HTML

Regels

Berekend

Animaties

Stijlen filteren

Pseudo-elementen

Dit element

element {

.restaurantSelection .restaurantSelection-avgRate {

margin: 8px 0;

text-align: right;

}

.rating {

font-size: 11px;

}

per-column-lis...

li.restaurantSelectionWrapper-item.rest...

div.restaurantSelection-rateContainer

div.restaurantSelection-avgRate.rating

CSS

JS

Beveiliging

Logboekregistratie

Server

Mutation events wordt niet meer ondersteund. Gebruik in plaats daarvan MutationObserver.

ut: geen hoofdelement gevonden Locatie: https://api.realytics.io/event/track?cb=1489218342118 Regelnummer 1, kolom 1:

naar document.write() van een asynchroon geladen extern script is genegeerd.

Try it out!

Design a short (5 minute) teaching element
in which you teach one of the following
things (of your choice)

Teaching assignment

Prepare a 5-minute “lesson” in which you answer *one* of the following questions (which students frequently have?)

- What is the difference between using an API and web scraping?
- How can I find out why I cannot open my dataset?
- Do I have to write all these lists and dictionaries in my code?
[no, read from file instead!]