HTML and CSS Basics for Web Scraping
MY472 Week 3

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Plan for today

- Introduction
- Some key features of the internet
- HTML and CSS
- Fundamentals of web scraping
- Guided coding session

Introduction

Examples

An increasing amount of data is available on the web

- Speeches, biographical information …
- Social media data, articles, press releases …
- Geographic information, conflict data …

These datasets are often provided in an **unstructured format**

Web scraping is the process of extracting this information automatically and transforming it into a **structured dataset**

Why automate?

Copy & pasting is time-consuming, boring, prone to errors, and impractical for large datasets

In contrast, automated web scraping

1. Scales well for large datasets
2. Is reproducible
3. Involved adaptable techniques
4. Facilitates detecting and fixing errors

When to scrape?

1. Trade-off between your time today and your time in the future. Invest in your future self
2. Computer time is often cheap; human time more expensive

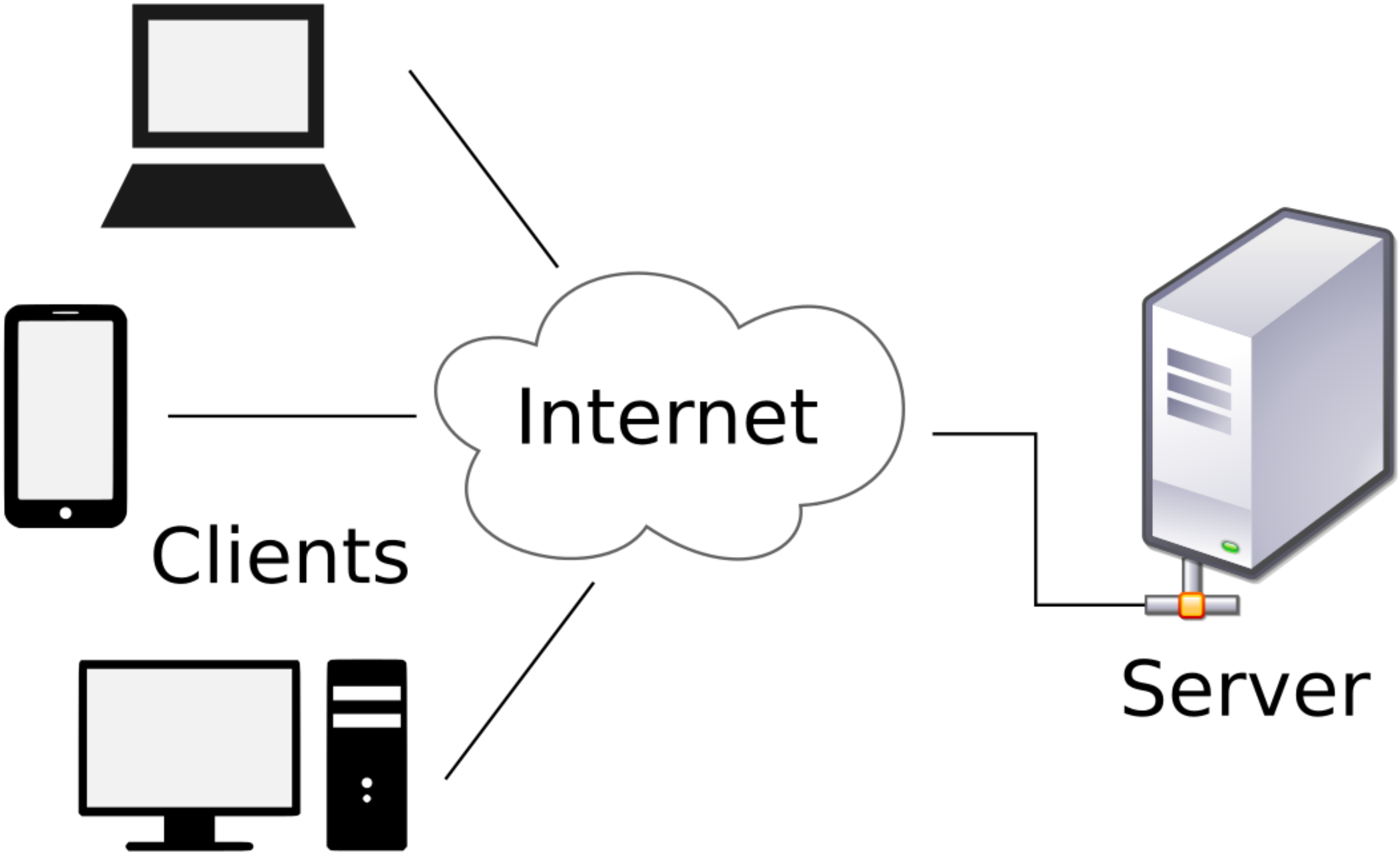
Obtaining data from the web: Two approaches

Two different approaches

1. **Screen scraping** Extract data from source code of website, with html parser and/or regular expressions
   - `rvest` package in R
2. **Web APIs** (application programming interfaces): A set of structured http requests that return JSON or XML data
   - `httr` package to construct API requests
   - Packages specific to each API: For example WDI, Rfacebook,
     - Check CRAN Task View on Web Technologies and Services for examples
   - More on APIs in week 5

Some key features of the internet

Client-server model



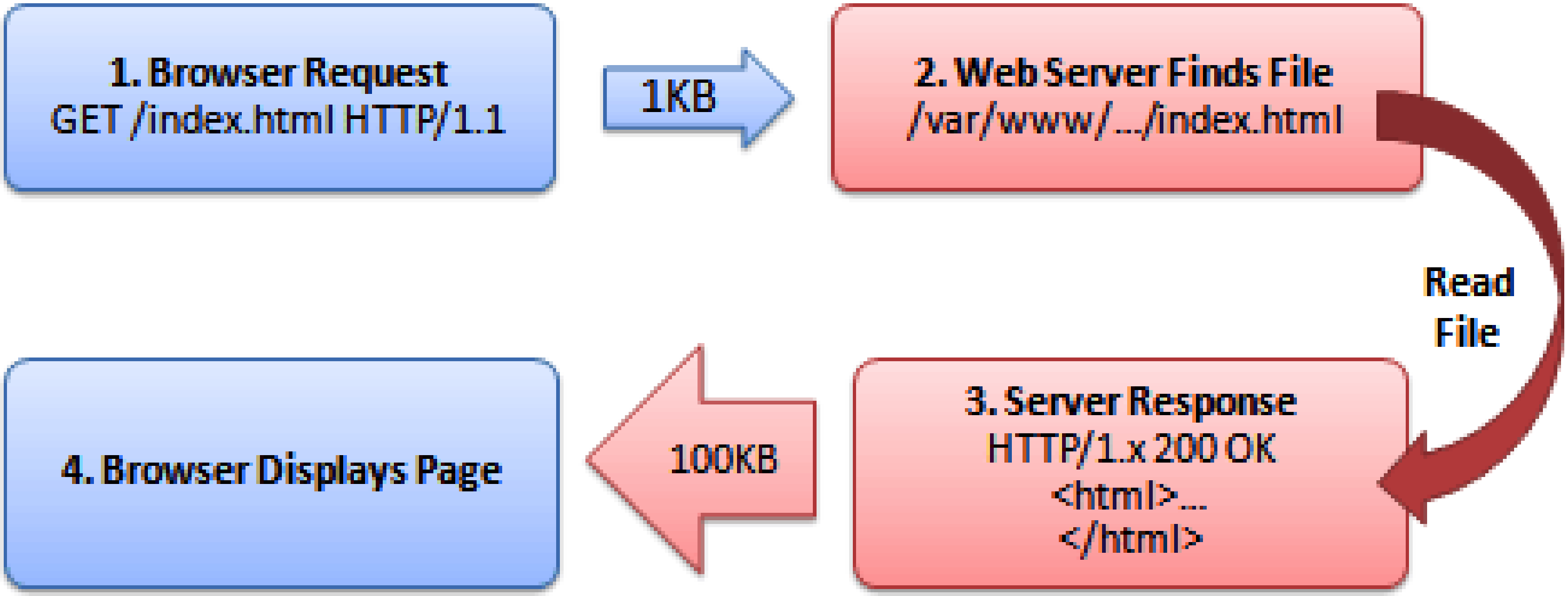
Client-server model

- Client: User computer, tablet, phone, software application, etc.
- Server: Web server, mail server, file server, Jupyter server, etc.

1. Client makes request to the server
    - Depending on what you want to get, the request might be
        - HTTP: Hypertext Transfer Protocol
        - HTTPS: Hypertext Transfer Protocol Secure
        - SMTP: Simple Mail Transfer Protocol
        - FTP: File Transfer Protocol
2. Server returns response

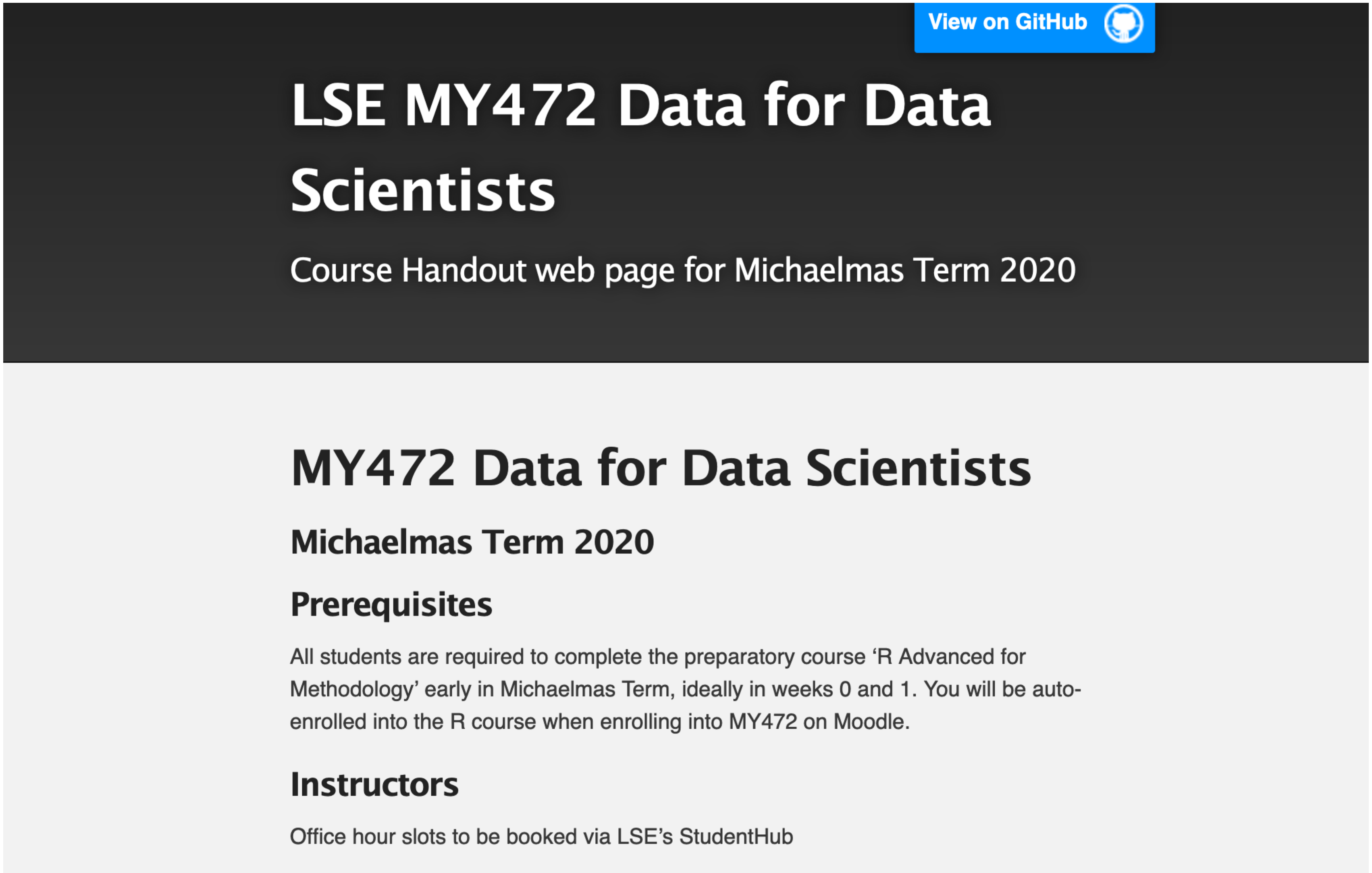
Request and response in the case of HTTP

From StackOverflow



Simple example: MY472 website

Let’s see a very simple example of https://lse-my472.github.io



LSE MY472 Data for Data Scientists

Course Handout web page for Michaelmas Term 2020

MY472 Data for Data Scientists

Michaelmas Term 2020

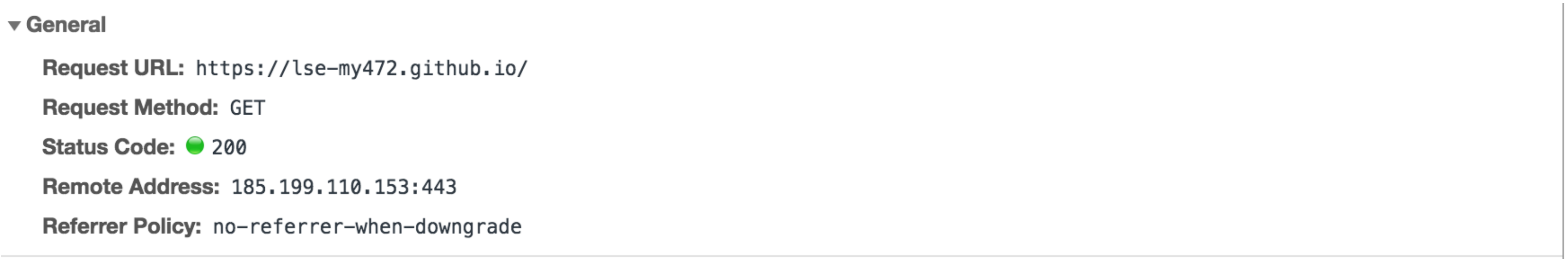
Prerequisites

All students are required to complete the preparatory course ‘R Advanced for Methodology’ early in Michaelmas Term, ideally in weeks 0 and 1. You will be auto-enrolled into the R course when enrolling into MY472 on Moodle.

Instructors

Office hour slots to be booked via LSE’s StudentHub

Simple example: MY472 website



▾ General

Request URL: `https://lse-my472.github.io/`

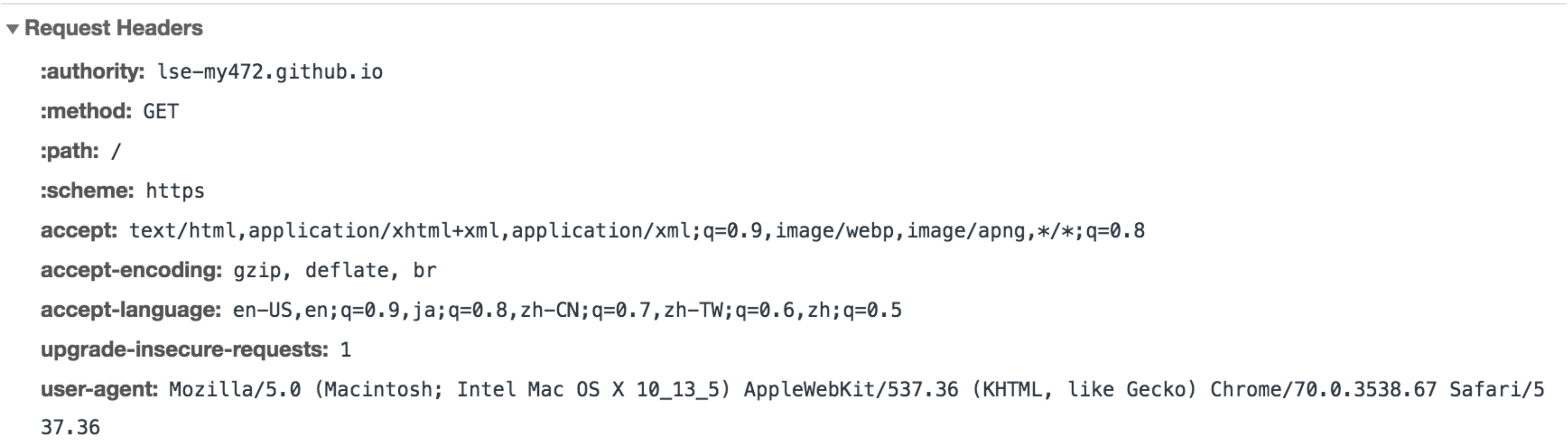
Request Method: `GET`

Status Code: ● `200`

Remote Address: `185.199.110.153:443`

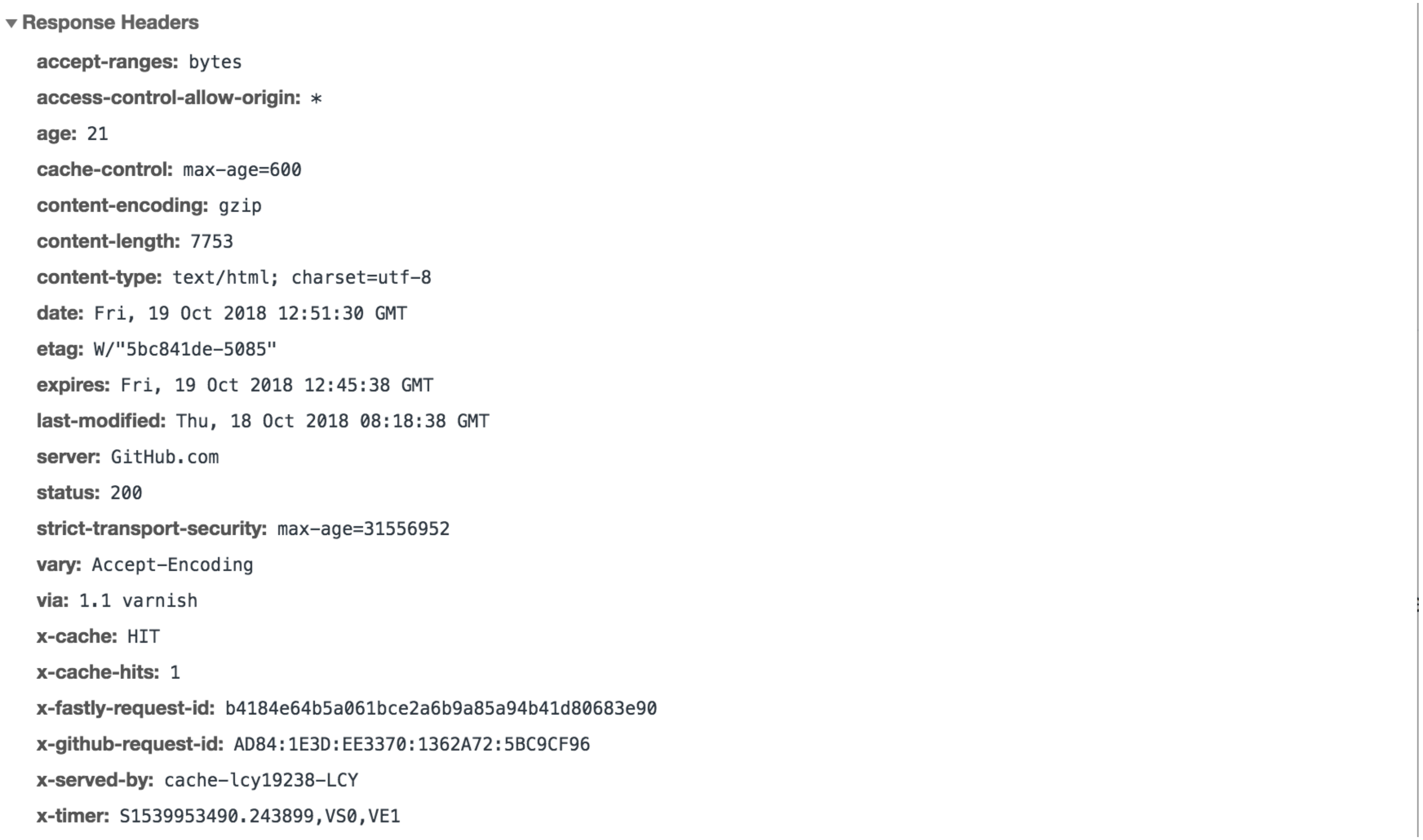
Referrer Policy: `no-referrer-when-downgrade`

Simple example: Request headers



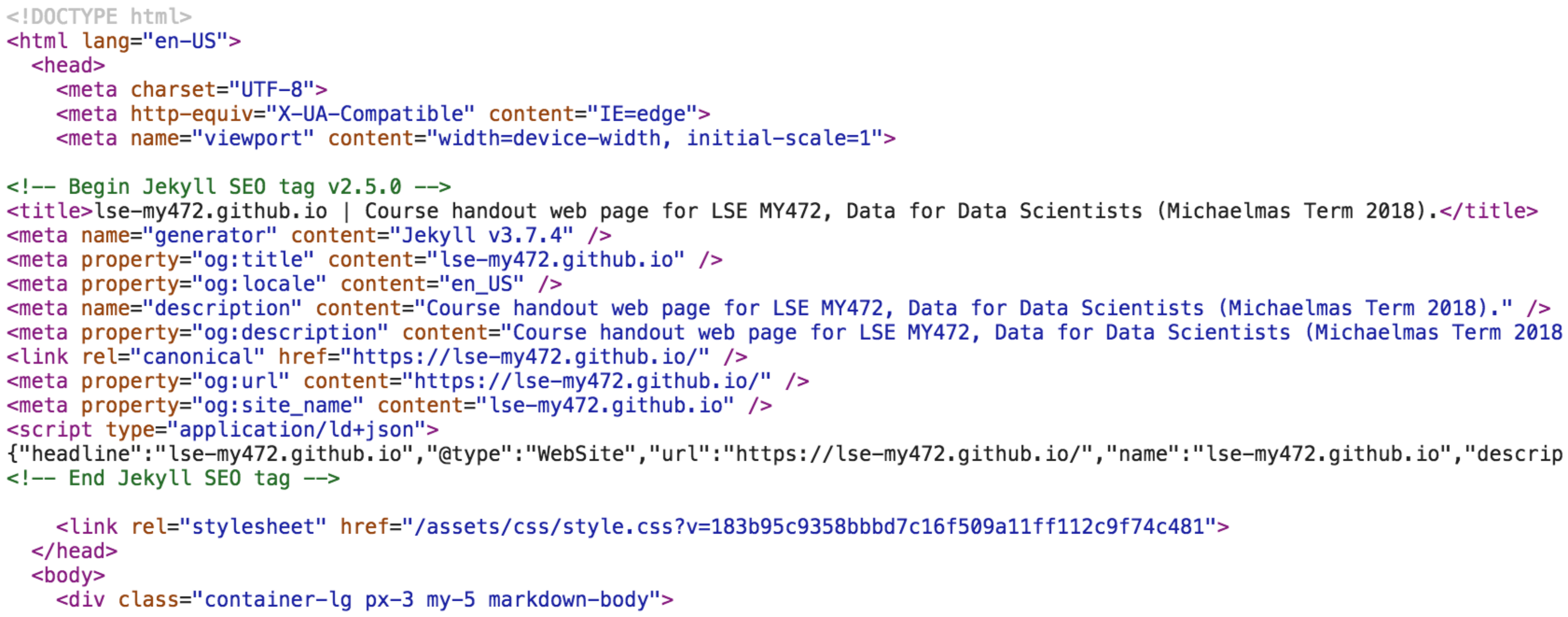
```
▾ Request Headers
    :authority: lse-my472.github.io
    :method: GET
    :path: /
    :scheme: https
    accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,image/apng,*/*;q=0.8
    accept-encoding: gzip, deflate, br
    accept-language: en-US,en;q=0.9,ja;q=0.8,zh-CN;q=0.7,zh-TW;q=0.6,zh;q=0.5
    upgrade-insecure-requests: 1
    user-agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_13_5) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/70.0.3538.67 Safari/5
    37.36
```

Simple example: Response headers



```
▾ Response Headers
    accept-ranges: bytes
    access-control-allow-origin: *
    age: 21
    cache-control: max-age=600
    content-encoding: gzip
    content-length: 7753
    content-type: text/html; charset=utf-8
    date: Fri, 19 Oct 2018 12:51:30 GMT
    etag: W/"5bc841de-5085"
    expires: Fri, 19 Oct 2018 12:45:38 GMT
    last-modified: Thu, 18 Oct 2018 08:18:38 GMT
    server: GitHub.com
    status: 200
    strict-transport-security: max-age=31556952
    vary: Accept-Encoding
    via: 1.1 varnish
    x-cache: HIT
    x-cache-hits: 1
    x-fastly-request-id: b4184e64b5a061bce2a6b9a85a94b41d80683e90
    x-github-request-id: AD84:1E3D:EE3370:1362A72:5BC9CF96
    x-served-by: cache-lcy19238-LCY
    x-timer: S1539953490.243899,VS0,VE1
```

Simple example: Reponse content



```
<!DOCTYPE html>
<html lang="en-US">
  <head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1">

<!-- Begin Jekyll SEO tag v2.5.0 -->
<title>lse-my472.github.io | Course handout web page for LSE MY472, Data for Data Scientists (Michaelmas Term 2018).</title>
<meta name="generator" content="Jekyll v3.7.4" />
<meta property="og:title" content="lse-my472.github.io" />
<meta property="og:locale" content="en_US" />
<meta name="description" content="Course handout web page for LSE MY472, Data for Data Scientists (Michaelmas Term 2018)." />
<meta property="og:description" content="Course handout web page for LSE MY472, Data for Data Scientists (Michaelmas Term 2018
<link rel="canonical" href="https://lse-my472.github.io/" />
<meta property="og:url" content="https://lse-my472.github.io/" />
<meta property="og:site_name" content="lse-my472.github.io" />
<script type="application/ld+json">
{"headline":"lse-my472.github.io","@type":"WebSite","url":"https://lse-my472.github.io/","name":"lse-my472.github.io","descrip
<!-- End Jekyll SEO tag -->

    <link rel="stylesheet" href="/assets/css/style.css?v=183b95c9358bbbd7c16f509a11ff112c9f74c481">
  </head>
  <body>
    <div class="container-lg px-3 my-5 markdown-body">
```

HTML and CSS

HTML

HTML: Hypertext Markup Language

- HTML displays mostly **static** content
- Many contents of dynamic webpages cannot be found in HTML
  - Example: Google Maps
- Understanding what is static and dynamic in a webpage is a crucial first step for web scraping

Beyond plain HTML

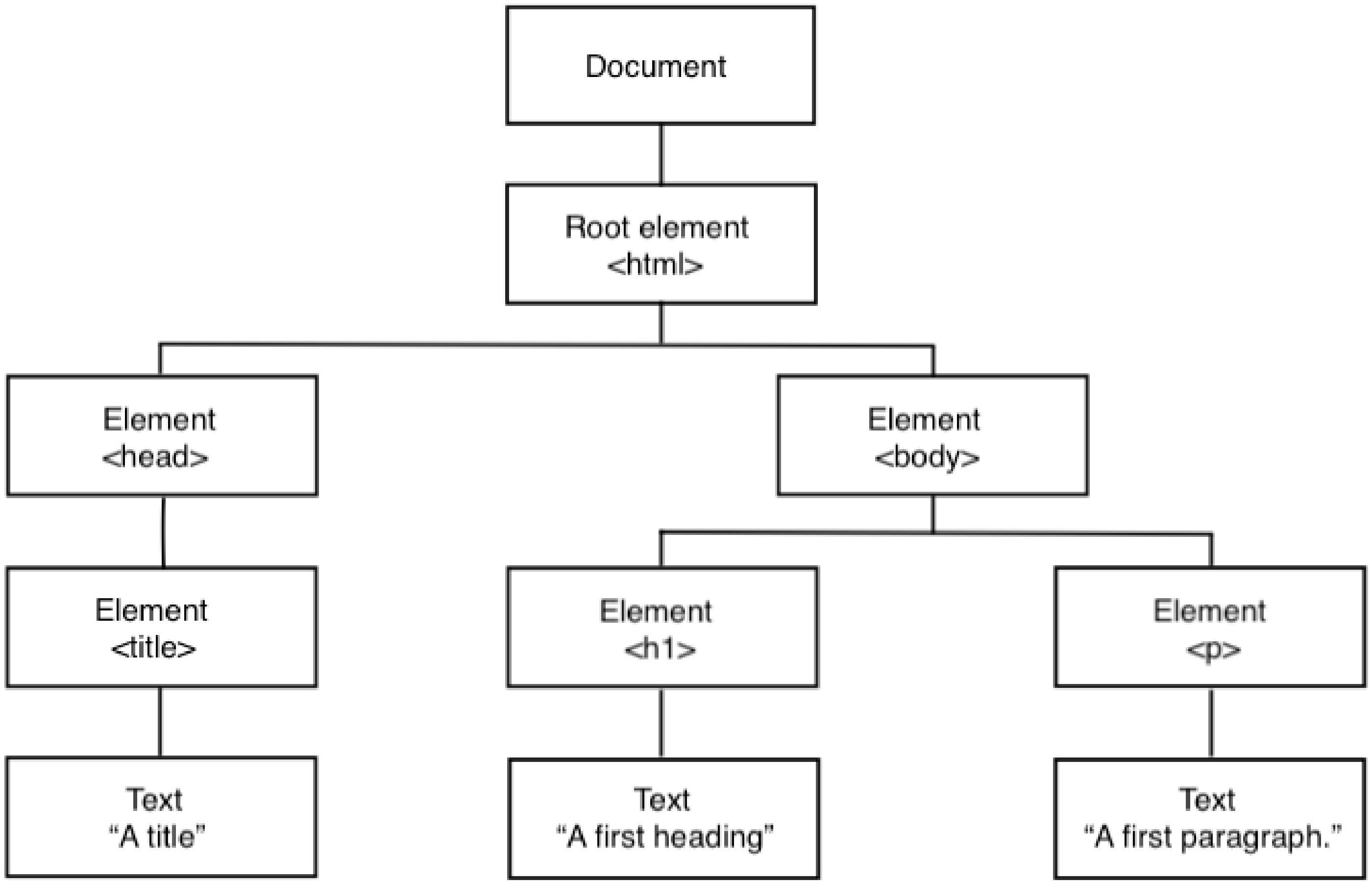
1. **Cascading Style Sheets (CSS)** Style sheet language which describes formatting of HTML components, useful for us because of selectors
2. **Javascript:** Adds functionalities to the websites, e.g. change content/structure after website has been loaded

A very simple HTML file

```
<!DOCTYPE html>
<html>
    <head>
        <title>A title</title>
    </head>
    <body>
        <h1>A first heading</h1>
        <p>A first paragraph.</p>
    </body>
</html>
```

From: https://www.w3schools.com/html/tryit.asp?filename=tryhtml_intro

HTML tree structure



Slightly more features

```
<!DOCTYPE html>
<html>
    <head>
        <title>A title</title>
    </head>
    <body>
        <h1>A first heading</h1>
        <p>A first paragraph.</p>
        <p>A second paragraph with some <b>formatted</b> text.</p>
        <p>A third paragraph with a <a href="http://www.lse.ac.uk">hyperlink</a>.</p>
    </body>
</html>
```

With some content divisions

```html
<!DOCTYPE html>
<html>
    <head>
        <title>A title</title>
    </head>
    <body>
        <div>
            <h1>Heading of the first division</h1>
            <p>A first paragraph.</p>
            <p>A second paragraph with some <b>formatted</b> text.</p>
            <p>A third paragraph with a <a href="http://www.lse.ac.uk">hyperlink</a>.</p>
        </div>
        <div>
            <h1>Heading of the second division</h1>
            <p>Another paragraph with some text.</p>
        </div>
    </body>
</html>
```

Adding some simple CSS (1/2)

```html
<!DOCTYPE html>
<html>
    <head>

        <!-- CSS start -->
        <style>
        p {
        color: green;
        }
        </style>
        <!-- CSS end -->

        <title>A title</title>
    </head>
    <body>
        <div>
            <h1>Heading of the first division</h1>
            <p>A first paragraph.</p>
            <p>A second paragraph with some <b>formatted</b> text.</p>
            <p>A third paragraph with a <a href="http://www.lse.ac.uk">hyperlink</a>.</p>
        </div>
        <div>
            <h1>Heading of the second division</h1>
            <p>Another paragraph with some text.</p>
        </div>
    </body>
</html>
```

Adding some simple CSS (2/2)

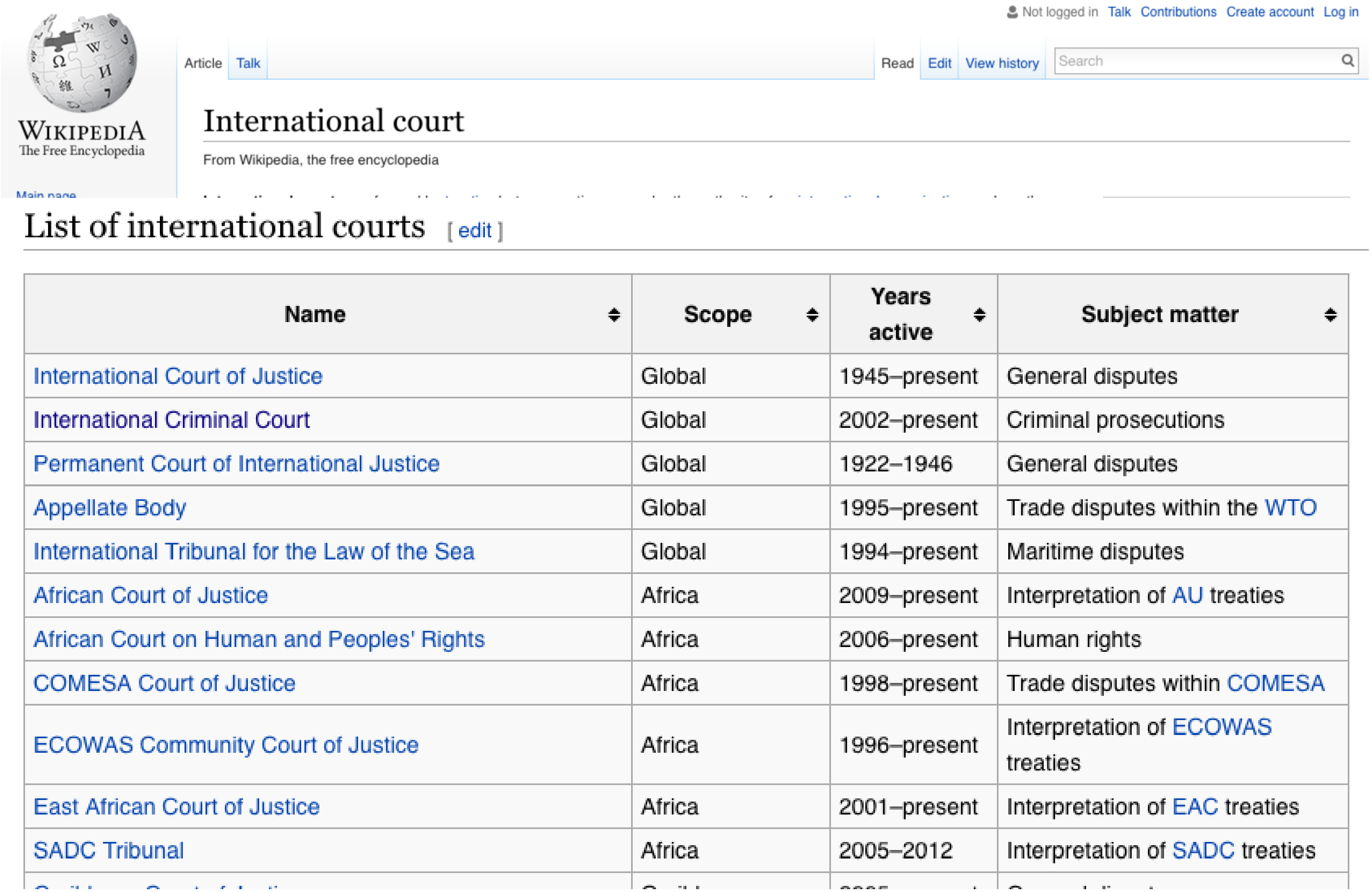
```
<!DOCTYPE html>
<html>
    <head>

        <!-- CSS start -->
        <style>
        .text-about-web-scraping {
          color: orange;
        }
        .division-two h1 {
        color: green;
          }
        </style>
        <!-- CSS end -->

        <title>A title</title>
    </head>
    <body>
        <div>
            <h1>Heading of the first division</h1>
            <p>A first paragraph.</p>
            <p>A second paragraph with some <b>formatted</b> text.</p>
            <p class="text-about-web-scraping">A third paragraph now containing some text about web scraping ...</p>
        </div>
        <div class="division-two">
            <h1>Heading of the second division</h1>
            <p>Another paragraph with some text.</p>
            <p class="text-about-web-scraping">A last paragraph discussing some web scraping ...</p>
        </div>
    </body>
</html>
```

Fundamentals of web scraping

Scenario 1: Data in table format



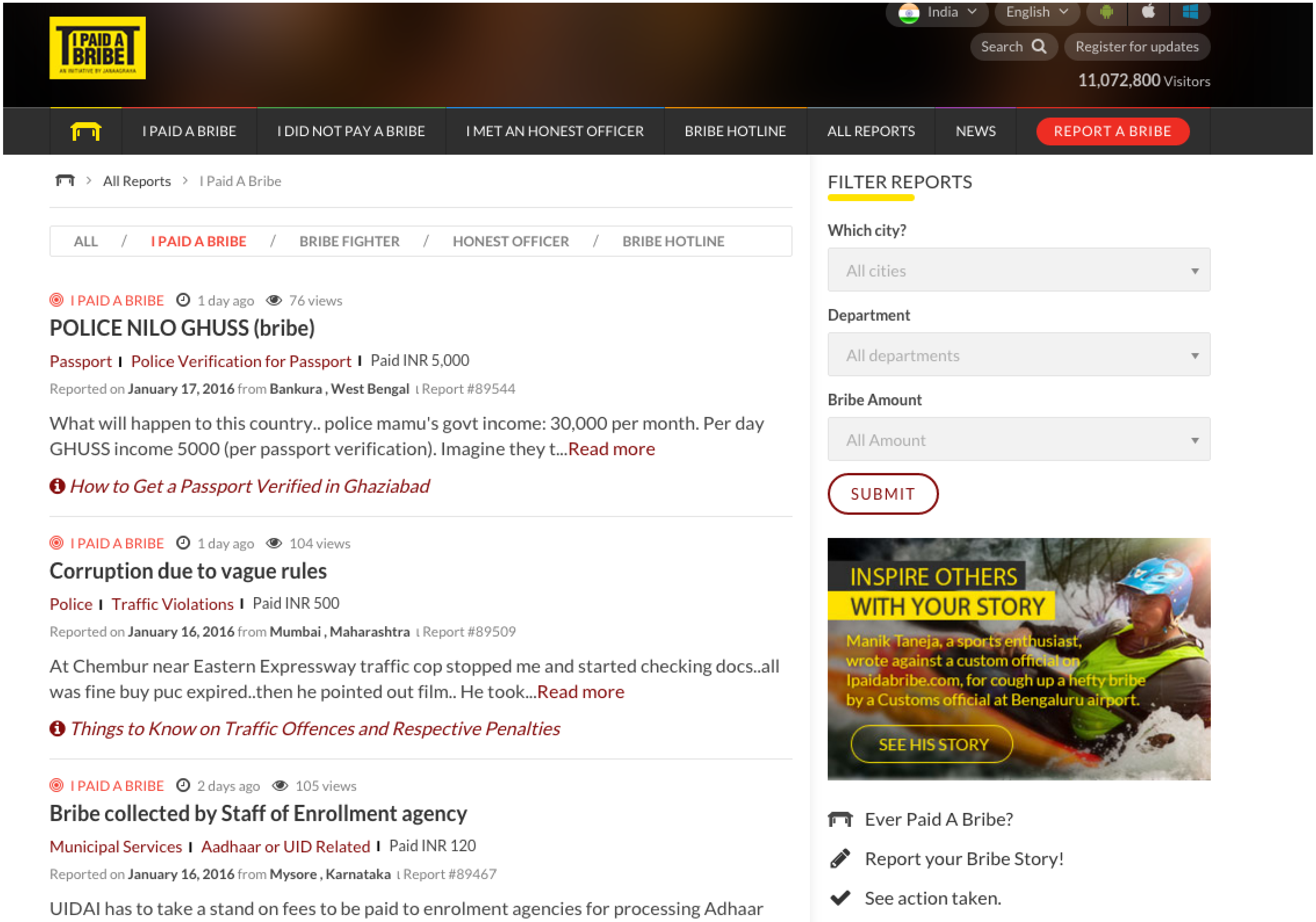
International court

From Wikipedia, the free encyclopedia

List of international courts [edit]

Name	Scope	Years active	Subject matter
International Court of Justice	Global	1945–present	General disputes
International Criminal Court	Global	2002–present	Criminal prosecutions
Permanent Court of International Justice	Global	1922–1946	General disputes
Appellate Body	Global	1995–present	Trade disputes within the WTO
International Tribunal for the Law of the Sea	Global	1994–present	Maritime disputes
African Court of Justice	Africa	2009–present	Interpretation of AU treaties
African Court on Human and Peoples' Rights	Africa	2006–present	Human rights
COMESA Court of Justice	Africa	1998–present	Trade disputes within COMESA
ECOWAS Community Court of Justice	Africa	1996–present	Interpretation of ECOWAS treaties
East African Court of Justice	Africa	2001–present	Interpretation of EAC treaties
SADC Tribunal	Africa	2005–2012	Interpretation of SADC treaties
Caribbean Court of Justice	Caribbean	2005–present	General disputes

Scenario 2: Data in unstructured format



I PAID A BRIBE 1 day ago 76 views

POLICE NILO GHUSS (bribe)

Passport | Police Verification for Passport | Paid INR 5,000

Reported on **January 17, 2016** from **Bankura , West Bengal** | Report #89544

What will happen to this country.. police mamu's govt income: 30,000 per month. Per day GHUSS income 5000 (per passport verification). Imagine they t...Read more

How to Get a Passport Verified in Ghaziabad

I PAID A BRIBE 1 day ago 104 views

Corruption due to vague rules

Police | Traffic Violations | Paid INR 500

Reported on **January 16, 2016** from **Mumbai , Maharashtra** | Report #89509

At Chembur near Eastern Expressway traffic cop stopped me and started checking docs..all was fine buy puc expired..then he pointed out film.. He took...Read more

Things to Know on Traffic Offences and Respective Penalties

I PAID A BRIBE 2 days ago 105 views

Bribe collected by Staff of Enrollment agency

Municipal Services | Aadhaar or UID Related | Paid INR 120

Reported on **January 16, 2016** from **Mysore , Karnataka** | Report #89467

UIDAI has to take a stand on fees to be paid to enrolment agencies for processing Adhaar

INSPIRE OTHERS WITH YOUR STORY

Manik Taneja, a sports enthusiast, wrote against a custom official on Ipaidabribe.com, for cough up a hefty bribe by a Customs official at Bengaluru airport.

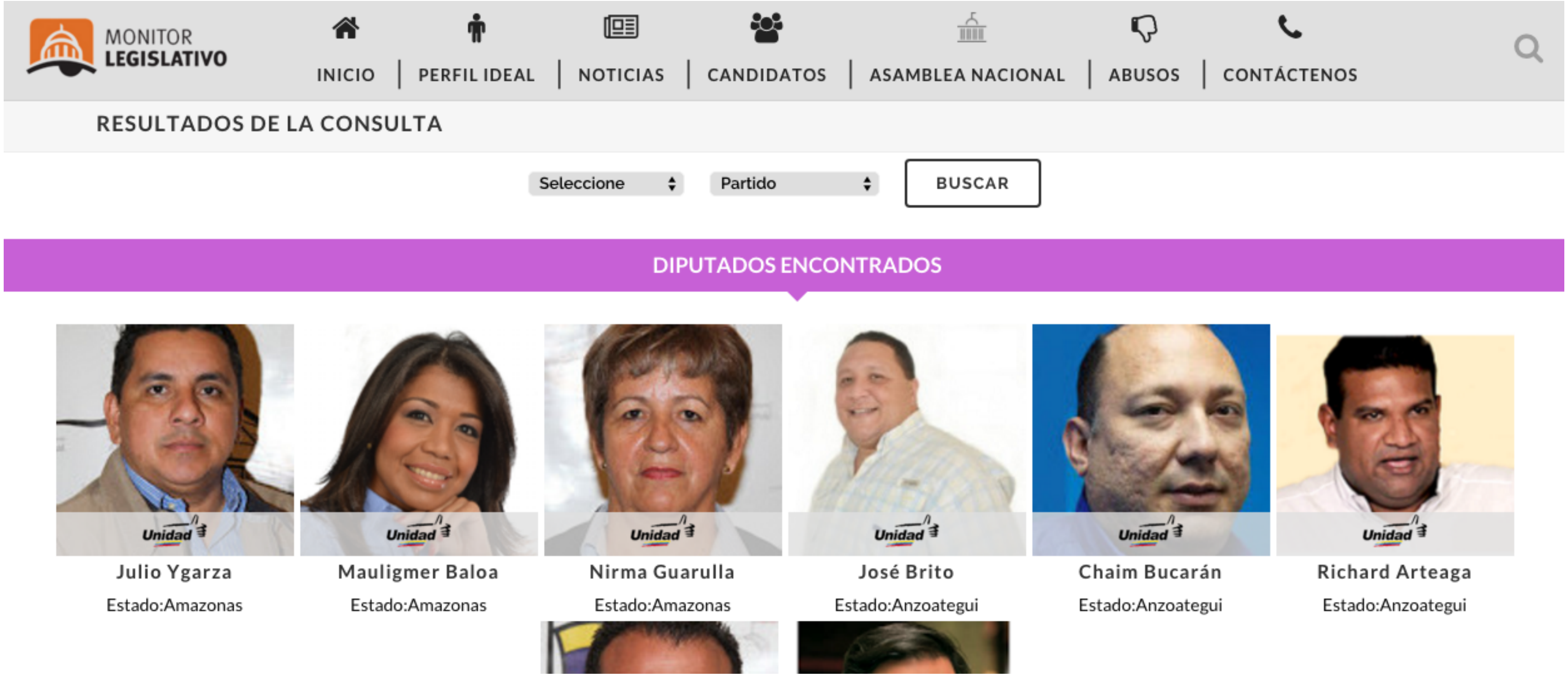
Ever Paid A Bribe?

Report your Bribe Story!

See action taken.

www.ipaidabribe.com/reports/paid

Scenario 3: Hidden behind web forms



MONITOR LEGISLATIVO
INICIO | PERFIL IDEAL | NOTICIAS | CANDIDATOS | ASAMBLEA NACIONAL | ABUSOS | CONTÁCTENOS
Seleccione
Partido
BUSCAR
Unidad

RESULTADOS DE LA CONSULTA

DIPUTADOS ENCONTRADOS

Julio Ygarza
Estado:Amazonas

Mauligmer Baloa
Estado:Amazonas

Nirma Guarulla
Estado:Amazonas

José Brito
Estado:Anzoategui

Chaim Bucarán
Estado:Anzoategui

Richard Arteaga
Estado:Anzoategui

Three main scenarios

1. Data in *table* format
    - Automatic extraction with **rvest** or select specific table with *inspect element* in browser
2. Data in *unstructured* format
    - Element identification key in this case
        - *Inspect element* in browser
        - `selectorGadget`
    - Identify the target e.g. with *CSS* (this week) or *xpath* selector (next week)
    - Automatic extraction with **rvest**
3. Data hidden *behind web forms* (next week)
    - Element identification to e.g. find text boxes, buttons, and results
    - Automation of web browser behavior with **RSelenium**

Identifying elements via CSS selector notation (1/2)

- Selecting by tag-name
  - Exemplary html code: `<h3>This is the main item</h3>`
  - Selector: `h3`
- Selecting by class
  - Exemplary html code: `<div class = 'itemdisplay'>This is the main item</div>`
  - Selector: `.itemdisplay`
- Selecting by id
  - Exemplary html code: `<div id = 'maintitle'>my main title</div>`
  - Selector: `#maintitle`

Identifying elements via CSS selector notation (2/2)

- Selecting by tag structure
  - Exemplary html code (hyperlink tag `a` inside `div` tag): `<div><a href = 'https://www.google.com'>Google Link</a></div>`
  - Selector: `div a`
- Selecting by nth child of a parent element (pseudo-class)
  - Exemplary html code: `<body><p>First paragraph</p><p>Second paragraph.</p></body>`
  - Selector of second paragraph: `body > p:nth-child(2)`

Reference and further examples: https://www.w3schools.com/cssref/css_selectors.asp

The rules of the game

1. Respect the hosting site's wishes
    - Check if an API exists or if data are available for download
    - Respect copyright; check whether republishing is allowed or not
    - Keep in mind where data comes from and give credit
    - Some websites disallow scrapers via `robots.txt` file
2. Limit your bandwidth use
    - Wait some time after each hit
    - Scrape only what you need, and just once
3. When using APIs, read documentation
    - Is there a batch download option?
    - Are there any rate limits?
    - Can you share the data?

Guided coding session

Markdown files this week

- 01-selecting-elements.Rmd
- 02-scraping-tables.Rmd