



Flask

web development,
one drop at a time

Brewing Up Web Apps
with Flask

Technica 2019 — November 8th
Yashas Lokesh

Agenda

- Basic HTML
- CSS selectors & styles
- Python intro
- Flask intro
- 20 minutes for first three topics, 30 for Flask
- <https://github.com/yashaslokesh>

Starting Off...

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width,
initial-scale=1.0">
  <meta http-equiv="X-UA-Compatible" content="ie=edge">
  <title>Document</title>
</head>
<body>
  <div>
    <h2>This is a barebones HTML5 page</h2>
    <p>I hope you enjoy your stay</p>
  </div>
  <div>
    <article>
      <h3>Harry, Harry, Harry Potter</h3>
      <p>Potter pick a peck of pickled peppers! Did
Potter picked a peck of pickled peppers? If Potter picked a
peck of pickled peppers, Where's the peck of pickled
peppers Harry Potter picked?</p>
    </article>
  </div>
  <p>
    Follow us on social media!
  </p>
  <p>
    <a href="https://twitter.com">Twitter</a>
  </p>
  <p>
    <a href="https://youtube.com">YouTube</a>
  </p>
</body>
</html>
```

HTML



Starting Off...

```
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    Follow us on social media!
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  <p>
    <a href="https://twitter.com">Twitter</a>
  </p>
  <p>
    <a href="https://youtube.com">YouTube</a>
  </p>
</body>
</html>
```

This is a barebones HTML5 page

I hope you enjoy your stay

Harry, Harry, Harry Potter

Potter pick a peck of pickled peppers! Did Potter picked a peck of pickled peppers? If Potter picked a peck of pickled peppers, Where's the peck of pickled peppers Harry Potter picked?

Follow us on social media!

[Twitter](https://twitter.com)

[YouTube](https://youtube.com)

HTML (Hypertext Markup Language)

- Describes the structure and meaning of a page
- Is a markup language; we use tags to define elements
- Elements **paired** (<p></p>) or **unpaired** (
,)
- Hypertext is text with links to the same or other pages
- Just a text-formatting language, not a full programming language, so no loops or conditionals

HTML Elements - the outline

- **<!DOCTYPE html>** - tells the browser that we are sending an HTML document
- **<html>** - top-level element, encloses all other content
- **<head>** - contains links to CSS, JS files, info about our website for search engines/browsers, and the title
- **<body>** - content of our document, i.e. all the visible stuff
- **<!-- -->** - comments

Head Elements - not visible to user

<code><link></code>	Link to CSS files, and set favicon, the icon for a website you see in the tab, or other resources
<code><meta></code>	For metadata, describes the document, to browser and search engines
<code><style></code>	Contains CSS to style the webpage
<code><title></code>	Document title that you see in a browser tab or bookmarks bar

Section organization Elements

<code><h1>-<h6></code>	Section headings, with <code><h1></code> the largest
<code><nav></code>	Section of page providing navigation links, like a TOC
<code><header></code>	Intro material, perhaps an introductory stanza on your website or author info
<code><footer></code>	Typically copyright data, links to related websites, or just additional info.
<code><main></code>	Main content of your webpage

Except for headings and `<nav>`, I don't really use the others

Text organization Elements

<code><div></code>	Groups other content, provides a line break by default
<code><hr></code>	A break between paragraphs or parts of a website, adds a horizontal line
<code></code>	An item in a list (see below)
<code>/</code>	An ordered list (numbered or lettered) and an unordered list (bulleted)
<code><p></code>	A paragraph

Various other elements (so we can move forward)

<code></code>	A link, put the URL in the href quotes
<code>
</code>	Line break
<code></code>	An image, with path to image in src
<code><script></code>	Link or add executable JS code
<code><iframe></code>	Embed websites' content, like YouTube videos
<code></code>	Group in-line elements, for styling later on
<code><table></code>	A table, uses below elements for structure
<code><tr>/<td>/<th></code>	Table row , data (single cell), and header
<code></code>	Indicates strong importance (rendered bold)

A page with more elements

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-
scale=1.0">
  <meta http-equiv="X-UA-Compatible" content="ie=edge">
  <title>Our website</title>
</head>
<body>
  <header>
    <h1>A minimal, great website</h1>
  </header>
  <!-- Main website content -->
  <main>
    <p>
      Lorem ipsum dolor sit amet, consectetur adipiscing elit.
      Morbi id odio maximus, sodales lacus non, fringilla nunc. Cras
      convallis eget mauris sit amet pharetra.
    </p>

    <hr>

    <p>
      Aliquam erat volutpat. Phasellus mollis, nulla non porta
      rutrum, dui arcu vulputate erat, ac interdum velit ipsum a odio.
      Nulla tempus tristique risus.
    </p>
  </main>
  <!-- Social Media links -->
  <div>
    <strong>Follow us on social media!</strong>
    <ul>
      <li><a href="https://twitter.com">Twitter</a></li>
      <li><a href="https://youtube.com">YouTube</a></li>
    </ul>
  </div>
</body>
</html>
```

A minimal, great website

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Morbi id odio maximus, sodales lacus non, fringilla nunc. Cras convallis eget mauris sit amet pharetra.

Aliquam erat volutpat. Phasellus mollis, nulla non porta rutrum, dui arcu vulputate erat, ac interdum velit ipsum a odio. Nulla tempus tristique risus.

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CSS (Cascading Style Sheets)

- A stylesheet language, can be used to style HTML, SVG (image format) or MathML (for math formulas)
- Allows you to describe how your website should be presented, by altering:
 - Text color, font, background color, margins, borders, height, column width, padding
 - Behavior when you hover over a link, the color of disabled elements, etc.

Inspecting a webpage using your Browser

- Using your browser, navigate to your favorite website.
- Right-click on a part of the website where you have the default mouse pointer, and click “Inspect”
- We'll look at the gotechnica.org page

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Available on the
App Store

ANDROID APP ON
Google Play

Elements Console Sources Network

```
<!doctype html>
<html lang="en" dir="ltr">
  <head>...</head>
  <body>
    <nav id="navbar" class="navbar navbar-expand-sm fixed-top">...</nav>
    <!-- Hero -->
    <article class="hero title-gradient">
      <div class="star-layer">
        <div class="night">...</div>
        <div class="space stars1"></div>
        <div class="space stars2"></div>
        <div class="space stars3"></div>
        ...
      <div class="container"> == $0
        
        <div class="header">...</div>
        <!-- <div class="row bus-link"><div class="col-md-12"><strong><a
href="travel.html">Bus Schedule</a></strong></div></div> -->
        </div>
        
        </div>
      </article>
      <!-- Registration -->
      <article class="body">
        <!-- <div class="container"> -->
        <section class="intro intro-gradient">
          <div class="container">
            <div class="text-container round-frame">
              <div class="heading">...</div>
              <div class="row">
```

html body article.hero.title-gradient div.star-layer div.container div.header

Styles Event Listeners DOM Breakpoints Properties Accessibility

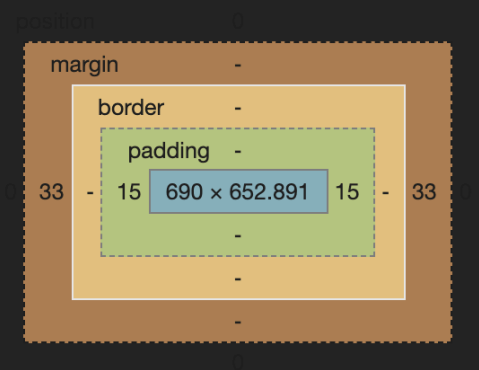
Filter :hov .cls +

```
element.style {
}

article.hero .container {
  position: relative;
  z-index: 5;
}

@media (min-width: 768px)
.container {
  max-width: 720px;
}

@media (min-width: 576px)
.container {
  max-width: 540px;
```



Filter Show all

► box-sizing

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div.space.stars2 1452.22 x 1290.35

Elements

Console

Sources

Network

6 2

```
<!doctype html>
<html lang="en" dir="ltr">
  <head>...</head>
  <body>
    <nav id="navbar" class="navbar navbar-expand-sm fixed-top">...</nav>
    <!-- Hero -->
    <article class="hero title-gradient">
      <div class="star-layer">
        <div class="night">...</div>
        <div class="space stars1"></div>
        <div class="space stars2"></div> == $0
        <div class="space stars3"></div>
      <div class="container">
        
        <div class="header">...</div>
        <!-- <div class="row bus-link"><div class="col-md-12"><strong><a
href="travel.html">Bus Schedule</a></strong></div></div> -->
        </div>
        
      </div>
    </article>
    <!-- Registration -->
    <article class="body">
      <!-- <div class="container"> -->
      <section class="intro intro-gradient">
        <div class="container">
          <div class="text-container round-frame">
            <div class="heading">...</div>
            <div class="row">
```

html

body

article.hero.title-gradient

div.star-layer

div.space.stars2

Styles

Event Listeners

DOM Breakpoints

Properties

Accessibility

Filter :hov .cls +

element.style {
}

.stars2 {
 z-index: 0;
 animation: ▶ space 240s ease-in-out infinite;
 background-image: radial-gradient(1px 1px at 75px 125px, white, rgba(255, 255, 255, 0)), radial-gradient(1px 1px at 100px 75px, white, rgba(255, 255, 255, 0)), radial-gradient(1.5px 1.5px at 199px 100px, white, rgba(255, 255, 255, 0)), radial-gradient(2px 2px at 20px 50px, white, rgba(255, 255, 255, 0)), radial-gradient(2.5px 2.5px at 100px 5px, white, rgba(255, 255, 255, 0));
}

main.css:442

position 0

margin -

border -

padding -

786 x 1223.330

Filter Show all

▶ animation-delay

SUNDAY

Time	Events	Room
8:00AM-10:00AM	Participant Check-In	Armory Entrance
8:30AM-10:00AM	Breakfast	Hacker Floor
9:00AM-10:00AM	Sponsorship Fair	Hacker Floor
10:00AM-11:00AM	Opening Ceremony	Stage
11:00AM-11:30AM	Hacking Begins	Hacker Floor
11:30AM	Team Formation	Hacker

The screenshot displays the Chrome DevTools interface. The top bar shows the 'Elements' tab, with a breadcrumb trail: `html > body > article > #schedule > div > div > div.sched-box > div.img-holder > img`. The main pane shows the HTML tree, with the selected `` element highlighted. The right sidebar shows the 'Styles' panel, displaying the following CSS rules:

```
element.style {  
}  
  
section.sched div.img-holder img {  
  width: 19rem;  
}  
  
img {  
  vertical-align: middle;  
  border-style: none;  
}  
  
*, ::after, ::before {  
  box-sizing: border-box;  
}
```

Below the code, a box model diagram is shown, illustrating the dimensions of the element and its surrounding boxes. The diagram includes labels for 'margin', 'border', and 'padding', with a central box indicating the dimensions '182.391 x 140.078'.

CSS Selectors

- Specify what elements a style applies to

Element	<code>p { ... }</code>	Styles the <code><p></code> element
id	<code>#important { ... }</code>	Styles elements with 'id=importance'
class	<code>.active { ... }</code>	Styles elements with 'class=active'
combinators	<code>div > p { ... }</code>	Styles <code><p></code> elements found directly inside <code><div></code> elements
group	<code>h1, p, .class { ... }</code>	Styles all elements belonging to any of these groups
pseudo-class	<code>a:hover { ... }</code>	Styles <code><a></code> elements when you hover over them

A CSS example — the HTML part

```
<!DOCTYPE html>
<html lang="en">
<head>
  <!-- Head content -->

</head>
<body>
  <header>
    <h1 id="intro">A minimal, great website</h1>
  </header>
  <!-- Main website content -->
  <main>
    <p>
      Lorem ipsum dolor sit amet, consectetur adipiscing
      elit. Morbi id odio maximus, sodales lacus non, fringilla
      nunc. Cras
      convallis eget mauris sit amet pharetra.
    </p>

    <hr>

    <p class="second">
      Aliquam erat volutpat. Phasellus mollis, nulla non
      porta rutrum, dui arcu vulputate erat, ac interdum velit ipsum
      a odio.
      Nulla tempus tristique risus.
    </p>
  </main>
  <!-- Social Media links -->
  <div>
    <strong>Follow us on social media!</strong>
    <ul>
      <li><a href="https://twitter.com">Twitter</a></li>
      <li><a href="https://youtube.com">YouTube</a></li>
    </ul>
  </div>
</body>
</html>
```

A minimal, great website

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Morbi id odio maximus, sodales lacus non, fringilla nunc. Cras convallis eget mauris sit amet pharetra.

Aliquam erat volutpat. Phasellus mollis, nulla non porta rutrum, dui arcu vulputate erat, ac interdum velit ipsum a odio. Nulla tempus tristique risus.

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A CSS example — the style tag

```
<!DOCTYPE html>
<html lang="en">
<head>
  <!-- Meta and title -->
  <style>
    p {
      color: blue;
    }

    p.second {
      color: chocolate;
    }

    div > strong {
      font-family: Impact,
Haettenschweiler, 'Arial Narrow Bold', sans-
serif;
    }

    a:hover {
      color: darkgreen;
    }

    #intro {
      background-color: coral;
    }
  </style>
</head>
<body>
  <!-- Content from before -->
</body>
</html>
```

A minimal, great website

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Morbi id odio maximus, sodales lacus non, fringilla nunc. Cras convallis eget mauris sit amet pharetra.

Aliquam erat volutpat. Phasellus mollis, nulla non porta rutrum, dui arcu vulputate erat, ac interdum velit ipsum a odio. Nulla tempus tristique risus.

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A better way to organize

- Adding many styles to our website will lead to the HTML file becoming bloated and hard to navigate.
- A better idea 🤔 - Move all of your styles to a file called `custom_styles.css`
- Link to this file in the head, as such:
 - `<link rel="stylesheet" href="custom_custom.css">`

How to speed development up?

- Use Bootstrap, <https://getbootstrap.com/>
- Bootstrap comes with CSS and JS, you just add the classes and relevant IDs
- We won't go over Bootstrap, or more HTML/CSS, but you can find the references:

Bootstrap	https://getbootstrap.com/docs/4.3/getting-started/introduction/
HTML	https://developer.mozilla.org/en-US/docs/Web/HTML
CSS	https://developer.mozilla.org/en-US/docs/Web/CSS



-
- Dynamically typed
 - Emphasizes readability w/ mandatory indentation
 - Automatic Memory Management
 - Supports OO, functional, reflective, imperative paradigms
 - Uses `pip` as package management system, you can use it like this `'pip install package_name'`

A quick primer on Python

```
x = 4
```

```
# Conditionals
```

```
if x > 5:
    print('Greater')
else:
    print('Lesser or Equal To')
print()
```

```
for i in range(0, 10, 2):
    print(i)
print()
```

```
# Strings
```

```
s = "Technica"
```

```
print(len(s))
print(s[5:])
print(s[:5])
print(s[::-1])
print()
```

```
# Lists
```

```
l = ['Zebra', 2, 3, ['Nested List', 5.0], 2.0]
```

```
print('Zebra' in l)
print('Nested List' in l)
print('Nested List' in l)
print()
```

```
# Dictionaries (like maps or hash tables)
```

```
d = {1: 'one', 2: 'two', 3: 'three'}
print(type(dict))
print()
```

```
l = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
```

```
# Built in functions
```

```
print(sum(l))
print(sum(range(10)))
```

```
print(max([3, 4, 8, 1, 2, 6, 8]))
```

```
print(map(lambda x: x % 2 == 0, l))
```

```
print(filter(lambda x: x % 2 == 0, l))
```

Lesser **or** Equal **To**

0

2

4

6

8

8

ica

Techn

acinhceT

True

False

False

<**class** 'type'>

55

45

8

[**False, True, False, True,**
False, True, False, True,
False, True]

[2, 4, 6, 8, 10]



- A micro-framework for building websites w/ Python, HTML/CSS, and JS
- Uses the `Jinja2` templating engine
- Doesn't support form validation, user management, database integration, or other functions out-of-the-box
- Instead, gives you the freedom to choose what to use, and there are many up-to-date Flask extensions
- `pip install Flask`

Hello, Flask! (hello_flask.py)

```
from flask import Flask

app = Flask(__name__)

@app.route('/blue')
def hello():
    return('Hello, Flask!')

if __name__ == '__main__':
    app.run(debug=True)
```

← → ↻ ⬆ ⓘ 127.0.0.1:5000 🔍 ☆

Hello, Flask!

Flask App & Route

- Run using `python hello_flask.py`
- `app = Flask(__name__)` creates an instance of the Flask class, with the name of the Python file as a parameter
- `@app.route('/')` is added above our `hello()` function. `hello()` returns 'Hello, Flask!', and `@app.route('/')` causes it to appear in the index
- Try changing the string inside the quotes (but keep the `/` in front) and navigate to your new page.

Flask - Templating

- We don't want to copy-paste that pesky `<head>` element on every page of our website
- Solution: use HTML files modified with `Jinja2` and render them using the `render_template()` function from flask
- I'll show an example website now, just know that in `Jinja2`, `{% ... %}` indicates statements, and `{{ ... }}` indicates expressions.

SQLAlchemy

- We make models by subclassing `db.Model`
- We'll go into examples to see how to use it

Further Resources

- <https://github.com/UMD-CS-STICs/CMSC388J-f19> - Lectures and sample code for making forms, accessing database, and other functions.
- <http://flask.palletsprojects.com/en/1.1.x/> - Flask docs