Web Programming Fundamentals

February 2019

Botwe Emmanuel
noelnuel44@gmail.com

These slides are based on Victoria Kirst (vrk@stanford.edu) course CS193X. You can equally check out here (https://cs193x.stanford.edu) for the original course materials

Today's schedule

- Syllabus
- Course Info
- Browsers! The Internet!
- A little bit about HTML and CSS

- Homework 0 assigned and due **this Friday 4/7**

Check out the course website for all this and more:

https://cs193x.stanford.edu

Syllabus

What is WPF?

Web Programming "Fundamentals"

- An introduction to web programming

Q: What does that mean, exactly?

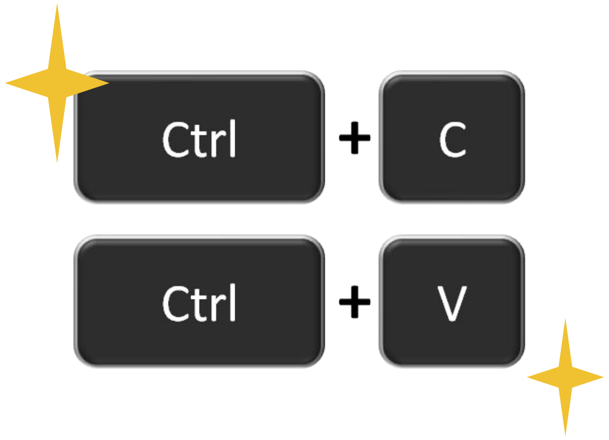
Who are you?

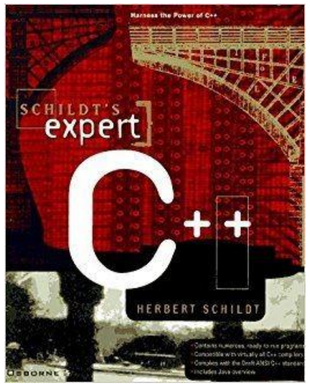
You are:

- A copy/paste programmer of JavaScript, HTML, CSS
  (or you've never used these languages)

- A good programmer in at least one real* programming language
  (Java, C++, etc)

- Frustrated
  (maybe)





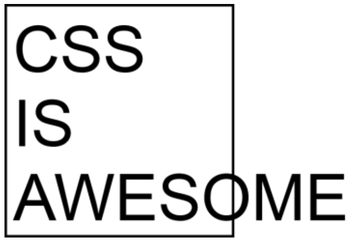
*In case it's unclear, I'm being facetious

Frustrated?

Every beginner CSS tutorial makes CSS look trivially easy:

```css
body {
  background-color: red;
}
```

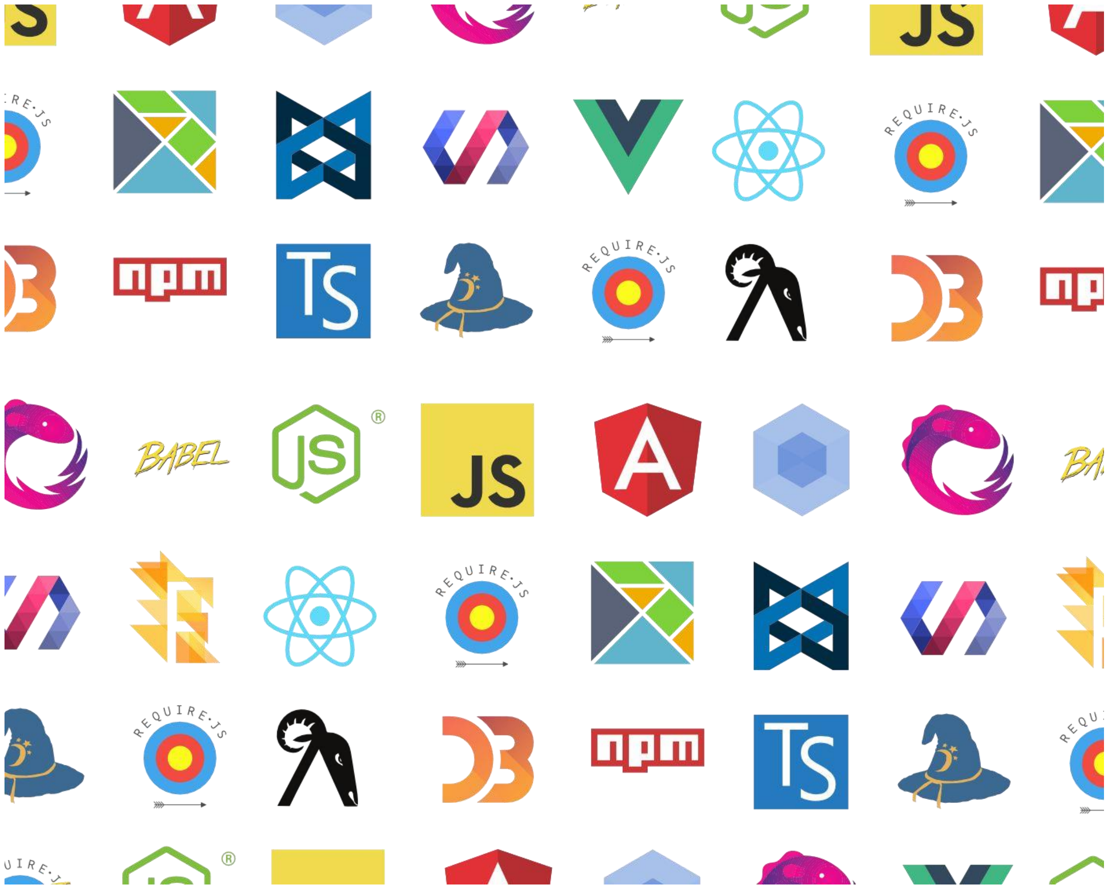
But then when you try to write CSS, literally nothing works:



CSS
IS
AWESOME

Frustrated?

You want to learn JavaScript...



...but you're overwhelmed by all the frameworks, libraries, tools, etc and have no idea where to start.

What is this course about?

Opinionated:

- There are many ways to do things on the web: can't learn them all at once!
- What I think you need to know as a beginner

Hopefully frustration-free:

- We will go slowly through the essential concepts and speed through the obvious stuff
- You are **not** expected to fill in the gaps via Google and StackOverflow

Goals

If you never take another web programming class again, you will leave this course with the following skills:

- Create **attractive, small scale web sites or apps** that at least mostly work on phones
- Have the **vocabulary and background knowledge** to understand technical writing/discussions about the web (e.g. web API documentation; random blog posts)
- Have the **foundation** to pursue the areas of web programming that you're interested in (if you choose)

in detail

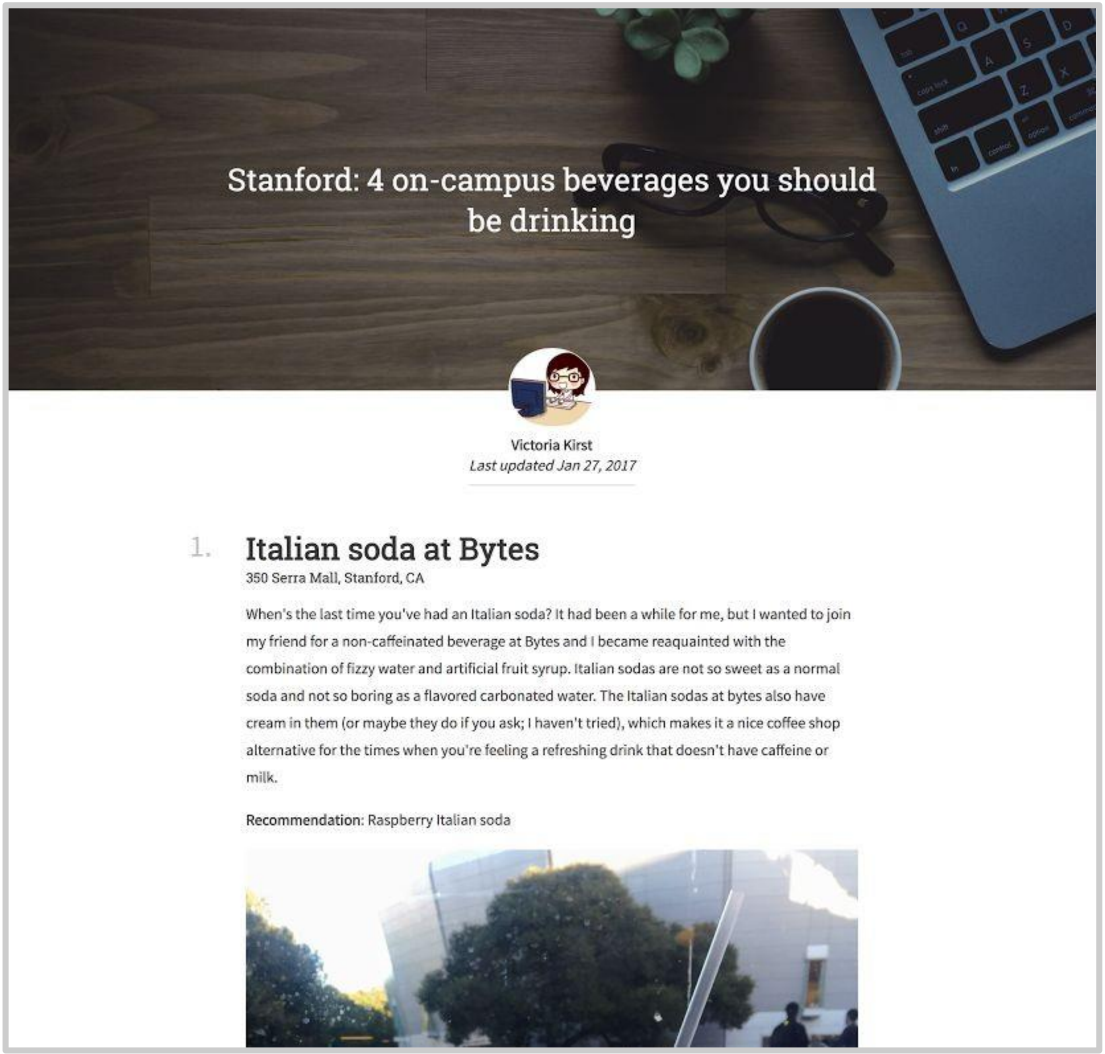
- HTML
- CSS
- JavaScript
- Backend basics
    - Server on NodeJS + Express
    - Database via MongoDb and Mongoose

(Uh…)

CSS, applied

HW1 will ask you to make a webpage that looks like this-ish:

(Note: HW1 is not released yet.)



Stanford: 4 on-campus beverages you should be drinking

Victoria Kirst
Last updated Jan 27, 2017

1. **Italian soda at Bytes**

   350 Serra Mall, Stanford, CA

   When's the last time you've had an Italian soda? It had been a while for me, but I wanted to join my friend for a non-caffeinated beverage at Bytes and I became reaquainted with the combination of fizzy water and artificial fruit syrup. Italian sodas are not so sweet as a normal soda and not so boring as a flavored carbonated water. The Italian sodas at bytes also have cream in them (or maybe they do if you ask; I haven't tried), which makes it a nice coffee shop alternative for the times when you're feeling a refreshing drink that doesn't have caffeine or milk.

   Recommendation: Raspberry Italian soda

CSS

HTML (~1 day)

- Key concepts: inline, block, inline-block

CSS (~1.5 weeks)

- Multiple rendering styles: natural, flex, positioned, float
- Mobile layouts
- Transforms and animations
- **FYI: No libraries or compiled CSS**

Modern JS / ES6+

Later in the quarter, we will read and write JavaScript that looks sort of like this:

```
(async () => {
  let choice = 'e';
  do {
    choice = await askQuestion('Enter choice');
    await processChoice(choice);
  } while (choice != 'e');
})();
```

Modern JS / ES6+

JavaScript (~5 weeks)

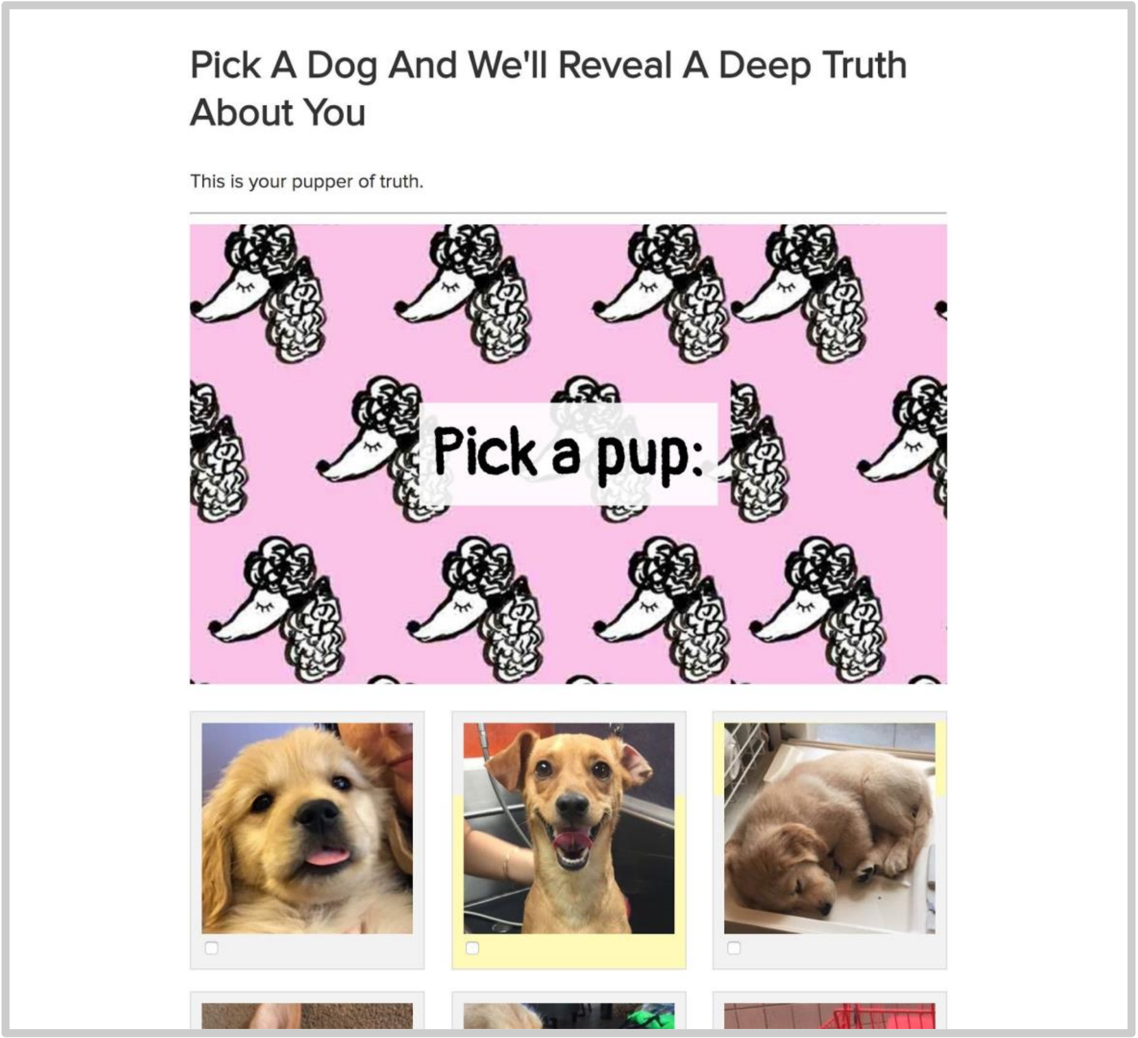
- JavaScript classes
- Relevant functional programming
    - Lambdas
    - Generator functions and async/await
    - "Fat arrow" vs function
    - Closures
- Creating and using Promises
- Understanding the Event Loop
- Modules and encapsulation

NO frontend framework; minimal libraries

No Angular/React/JQuery/etc

JavaScript, applied

HW2 will ask you to make a webpage that looks like this-ish:



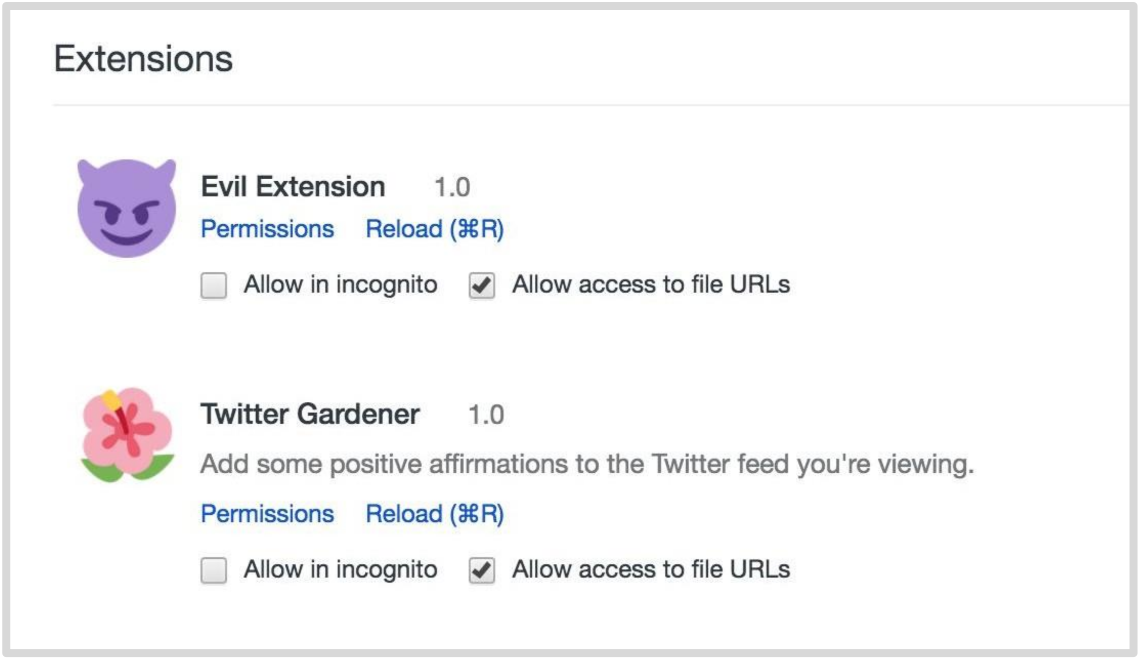
Pick A Dog And We'll Reveal A Deep Truth About You

This is your pupper of truth.

JavaScript, applied

And HW2 will also ask you to write two small Chrome extensions:

(Note: HW2 is also not released yet.)



Extensions

Evil Extension 1.0

Permissions Reload (⌘R)

☐ Allow in incognito ☑ Allow access to file URLs

Twitter Gardener 1.0

Add some positive affirmations to the Twitter feed you're viewing.

Permissions Reload (⌘R)

☐ Allow in incognito ☑ Allow access to file URLs

Baby's first backend

coverage of server-side programming will be light.

<u>Backend stack:</u>

NodeJS + Express + MongoDB via Mongoose (~3 weeks)

- What is a server
- What is npm
- How to serve static web pages
- How to server JSON via REST APIs
- Writing to and loading from a database
- Authentication via OAuth2 (i.e. login via Gmail account)

Structure

"Homework 0" + 6 homeworks

- Each homework will be a standalone web page or a very small standalone web app
- Each homework with have a multiple choice "mini-homework" attached to it
- **Individual** assignments; pairing allowed

1 final project

- Open-ended! Details to come.
- ~1 week in scope
- **Individual** project; groups allowed

Course info

Disclaimer

This is the second ever offering of this course , meaning:

- **Everything is subject to change.** Including everything I've just told you and everything I'm about to tell you.

- **There will be all the mistakes of a new course!**
  - Bugs in homework
  - Awkward lectures
  - Things that are too hard / too easy

Please be patient with us! We are also soliciting your constructive feedback.

Browser and Text editor/IDE

- **Text editor:** You can use whatever you want. We recommend Visual studio code.

- **Browser:** Your code must work on Chrome, as that is what your TAs will use when grading your homework. It will not be tested in any other browser.

- **Homework turn-in:** We are using GitHub

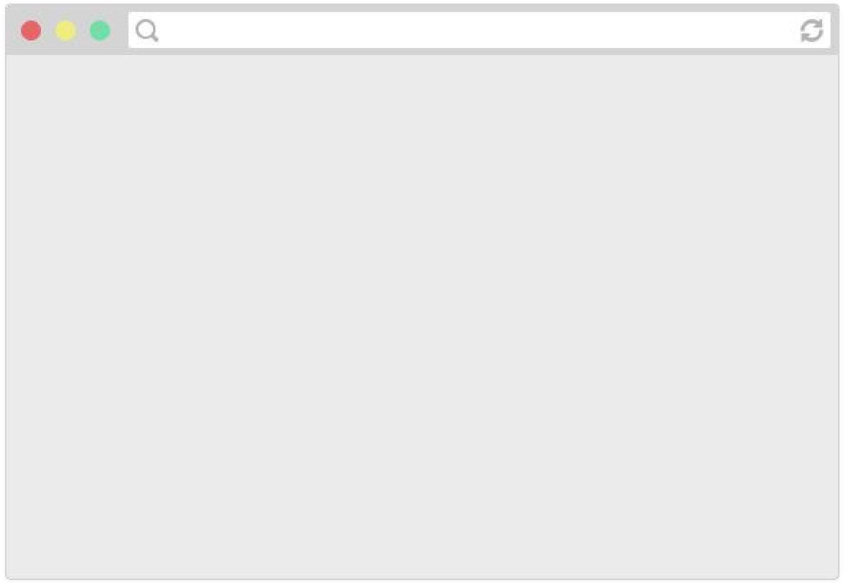
Questions?

Today's schedule

- ~~Syllabus~~
- ~~Course Info~~
- Browsers! The Internet!
- A little bit about HTML and CSS

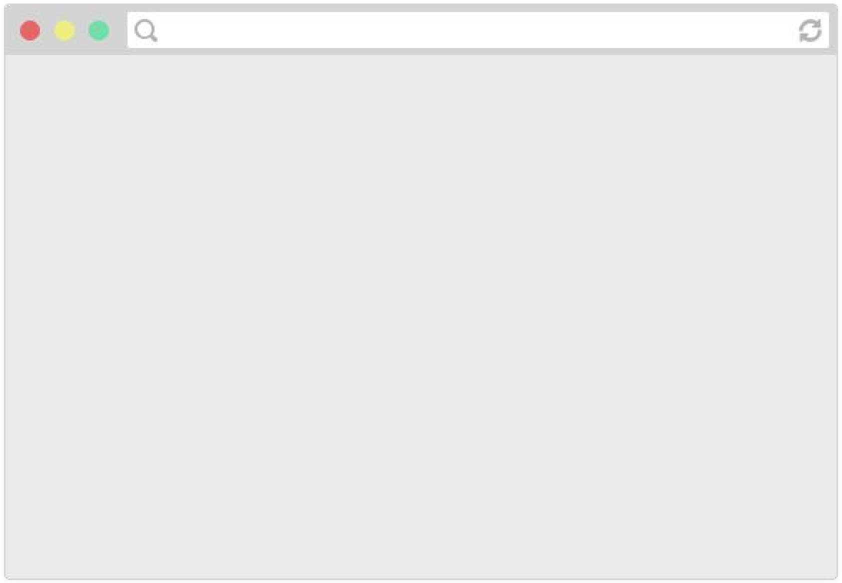
Browsers!
The Internet!
The web!

How do web pages work?



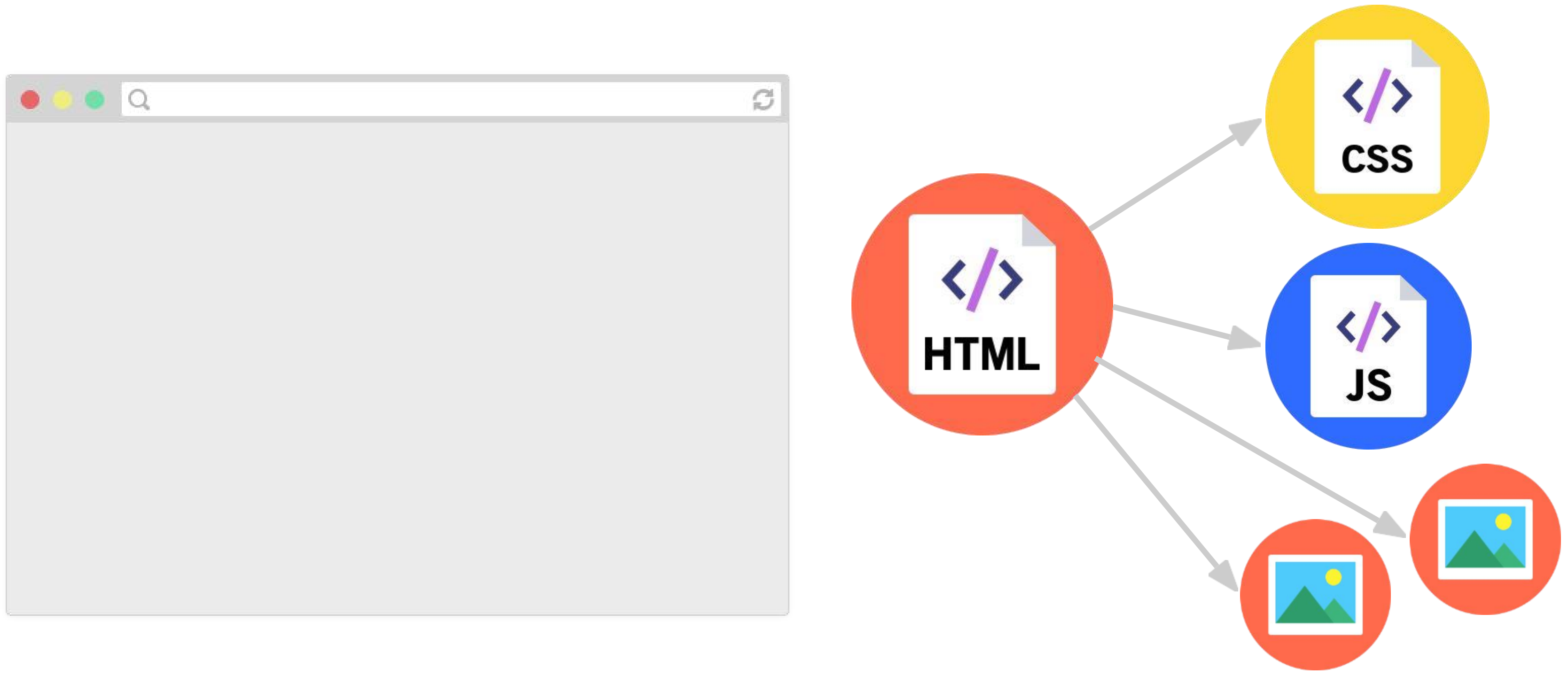
Browsers are applications that can display web pages.
E.g. Chrome, Firefox, Safari, Internet Explorer, Edge, etc.

How do web pages work?



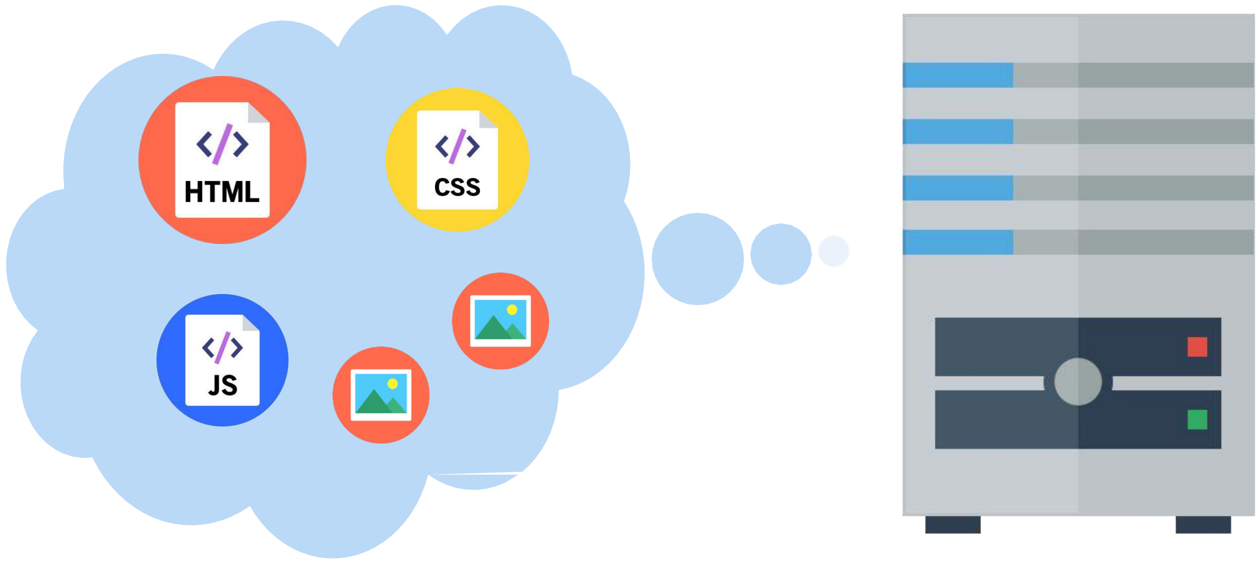
Web pages are written in a markup language called **HTML**, so browsers display a web page by reading and interpreting its HTML.

How do web pages work?



The HTML file might link to other resources, like images, videos, as well as **JavaScript** and **CSS** (stylesheet) files, which the browser then also loads.

How do web pages work?

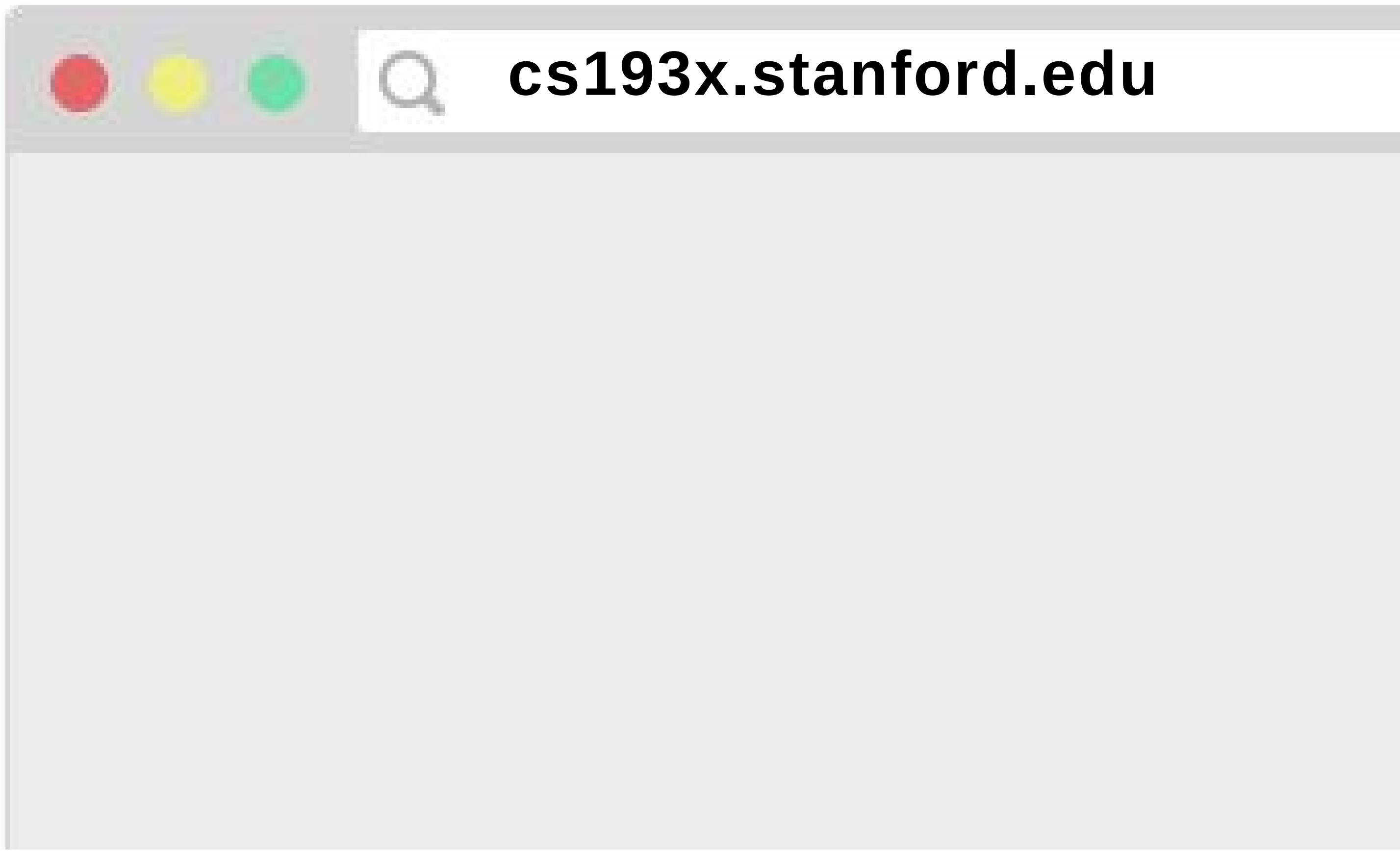


A **web server** is a program running on a computer that delivers web pages in response to requests.

It either stores or generates the web page returned.

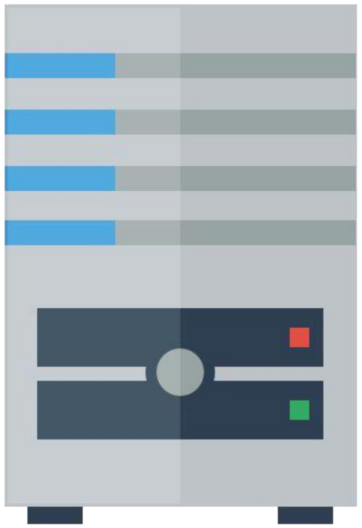
How do web pages work?

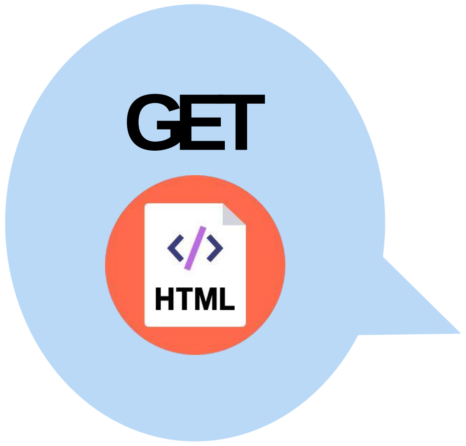
1. You type in a URL, which is the address of the HTML file on the internet.

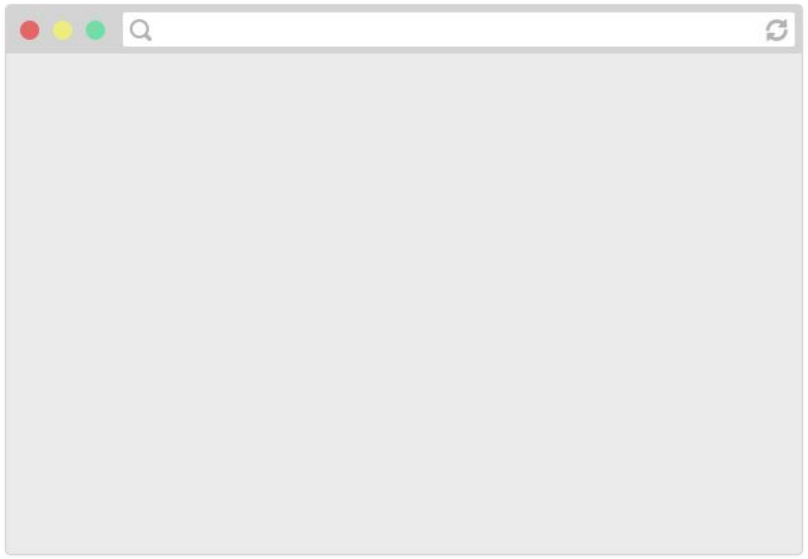


How do web pages work?

2. The browser asks the web server that hosts the document to send that document.

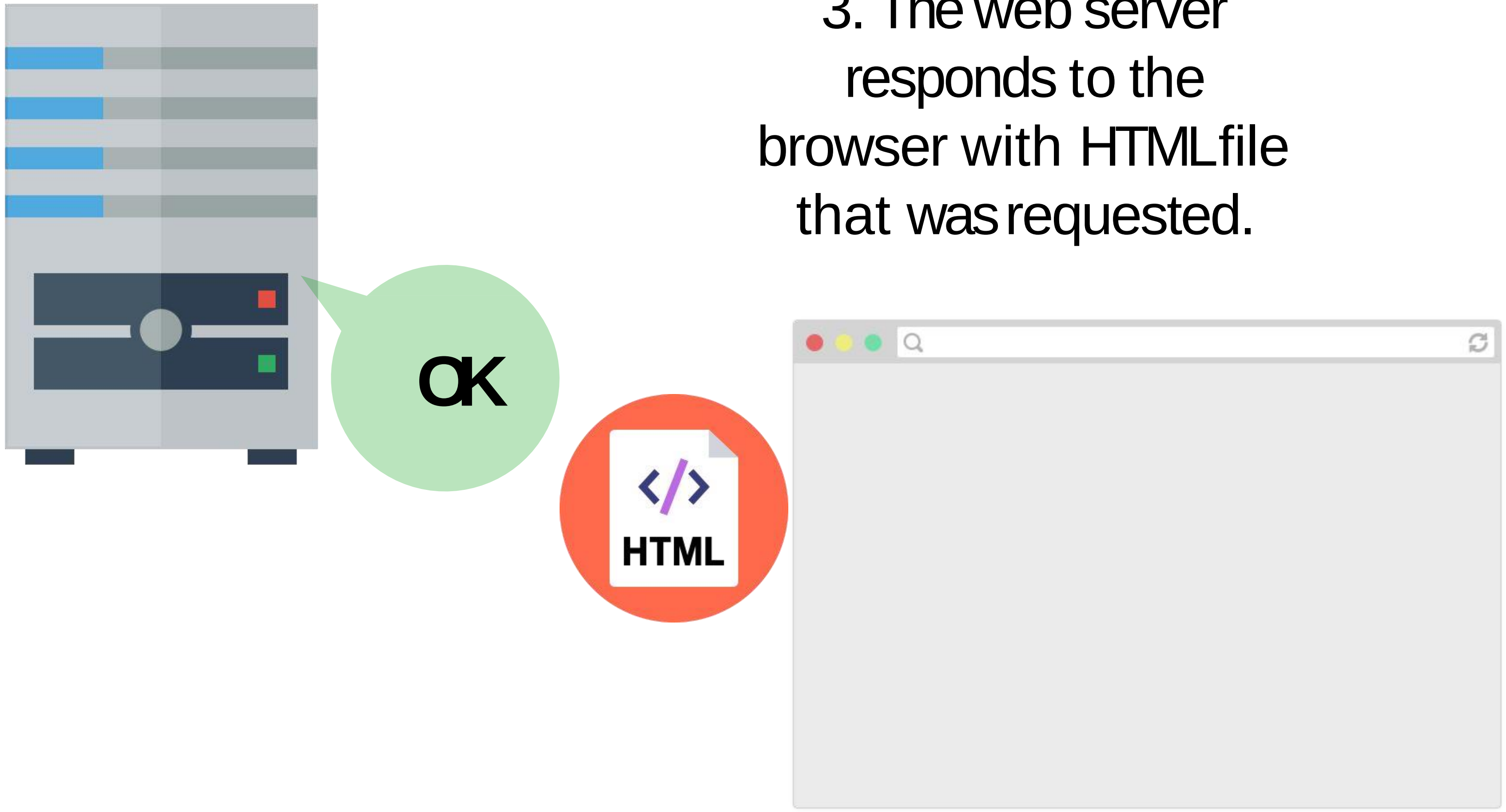






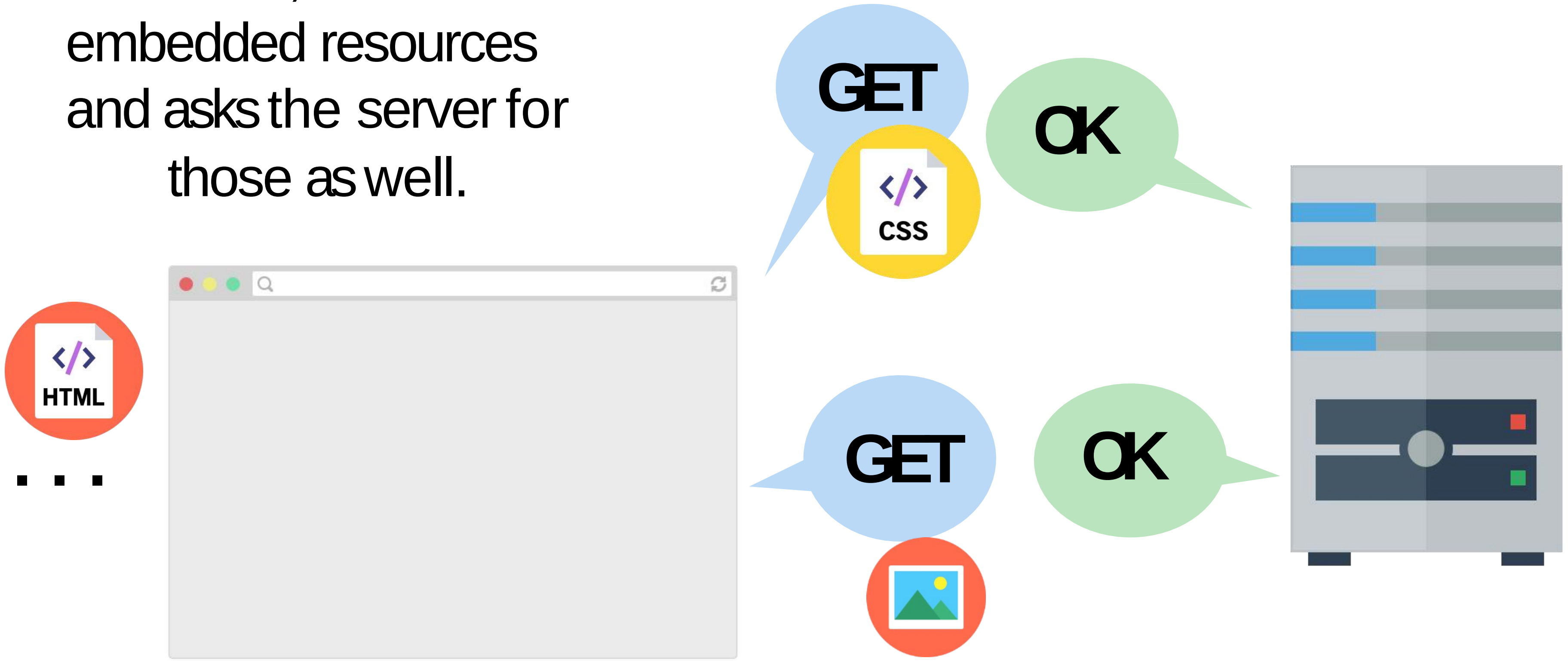
How do web pages work?

3. The web server responds to the browser with HTML file that was requested.



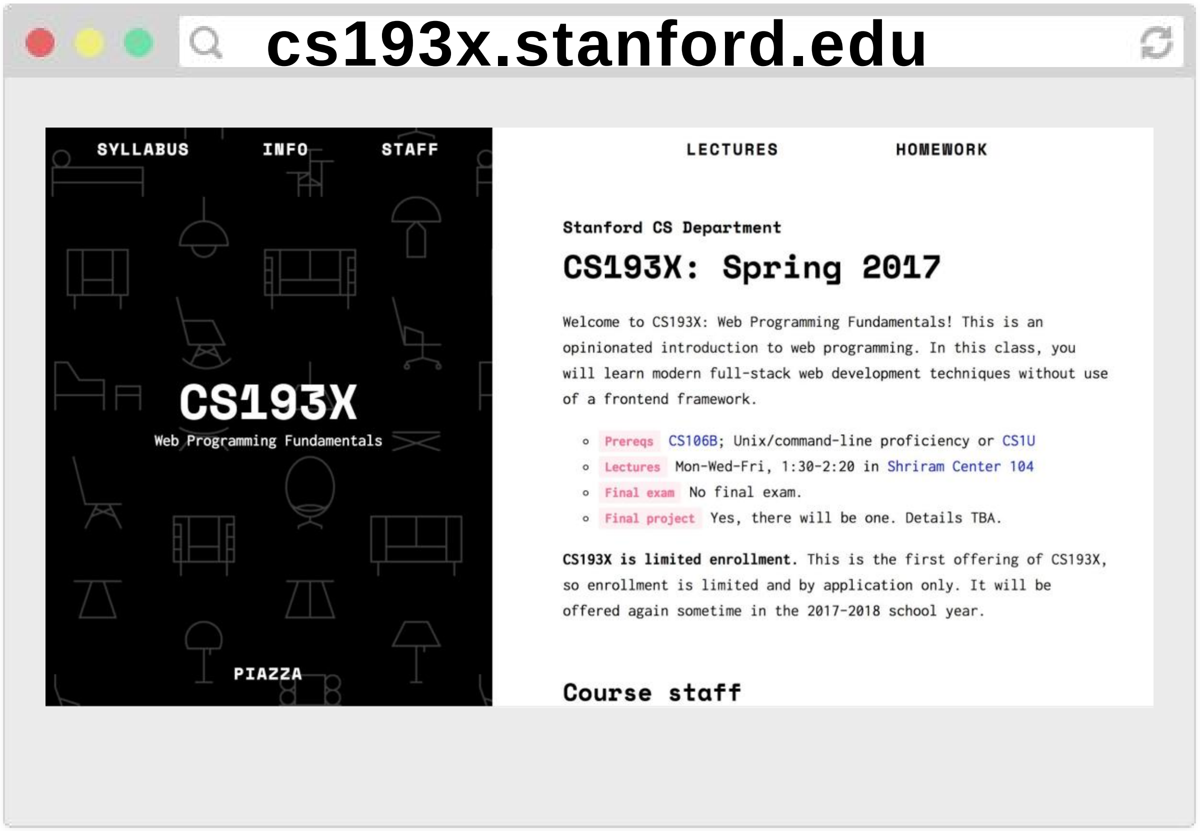
How do web pages work?

4. The browser reads the HTML, sees the embedded resources and asks the server for those as well.



How do web pages work?

5. The web page is loaded when all the resources are fetched and displayed.



Stanford CS Department

CS193X: Spring 2017

Welcome to CS193X: Web Programming Fundamentals! This is an opinionated introduction to web programming. In this class, you will learn modern full-stack web development techniques without use of a frontend framework.

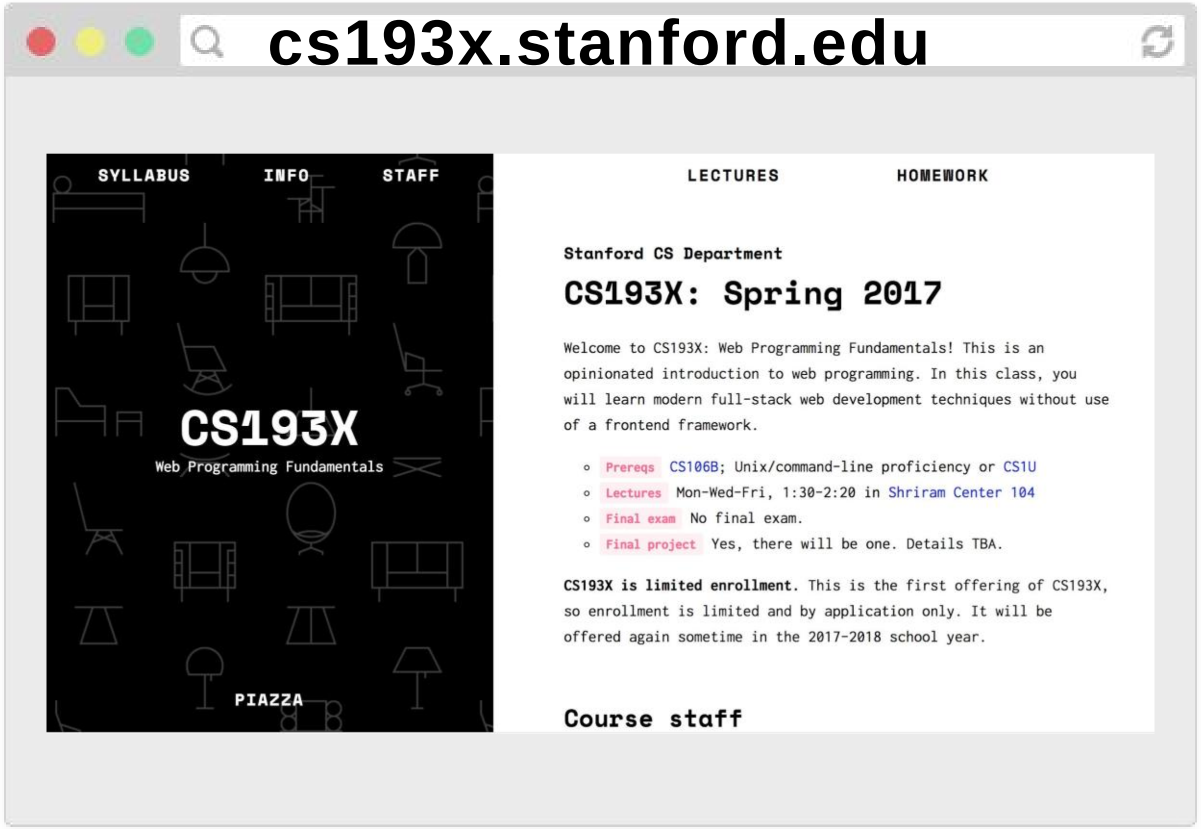
- Prereqs CS106B; Unix/command-line proficiency or CS1U
- Lectures Mon-Wed-Fri, 1:30-2:20 in Shriram Center 104
- Final exam No final exam.
- Final project Yes, there will be one. Details TBA.

CS193X is limited enrollment. This is the first offering of CS193X, so enrollment is limited and by application only. It will be offered again sometime in the 2017-2018 school year.

Course staff

P.S.

(That was obviously very hand-wavy. We'll get more detailed when we talk about servers later in the quarter.)



Stanford CS Department

CS193X: Spring 2017

Welcome to CS193X: Web Programming Fundamentals! This is an opinionated introduction to web programming. In this class, you will learn modern full-stack web development techniques without use of a frontend framework.

- Prereqs CS106B; Unix/command-line proficiency or CS1U
- Lectures Mon-Wed-Fri, 1:30-2:20 in Shriram Center 104
- Final exam No final exam.
- Final project Yes, there will be one. Details TBA.

CS193X is limited enrollment. This is the first offering of CS193X, so enrollment is limited and by application only. It will be offered again sometime in the 2017-2018 school year.

Course staff

HTML and CSS

HTML and CSS strategy

Assumption: Most people have cursory familiarity with HTML and CSS. Therefore we will:

- **Speed through** the obvious stuff
- **Skip** self-explanatory syntax
- **Skip** the parts you can look up easily through Google

✦ **Therefore, be aggressive with questions!** ✦

What is HTML?

HTML (**H**ypertext **M**arkup **L**anguage)

- Describes the **content** and **structure** of a web page; not a programming language.
- Made up of building blocks called **elements**.

```
<p>
   HTML is <em>awesome!!!</em>
   <img src="puppy.png" />
</p>
```

Basic HTML page structure

(i.e. copy/paste boilerplate)

```
<!DOCTYPE html>
<html>
    <head>
      <title>CS 193X</title>
    </head>

    <body>
      ... contents of the page...
    </body>
</html>
```

Saved in a *filename*.**html** file.

Basic HTML page structure

(i.e. copy/paste boilerplate)

```
<!DOCTYPE html>
<html>
  <head>
    <title>CS 193X</title>
  </head>
  <body>
    ... contents of the page...
  </body>
</html>
```

Metadata that doesn't appear in the viewport of the browser

E.g. **<title>** shows up as the name of the tab

Contents that render in the viewport of the browser

HTML elements

```
<p>
    HTML is <em>awesome!!!</em>
    <img src="puppy.png" />
</p>
```

- An element usually has start and ending tags (**<p>** and **</p>**)
  - **content**: stuff in between start and end tags
- An element can be self-closing (**img**)
- An element can have attributes (**src="puppy.jpg"**)
- Elements can contain other elements (**p** contains **em** and **img**)

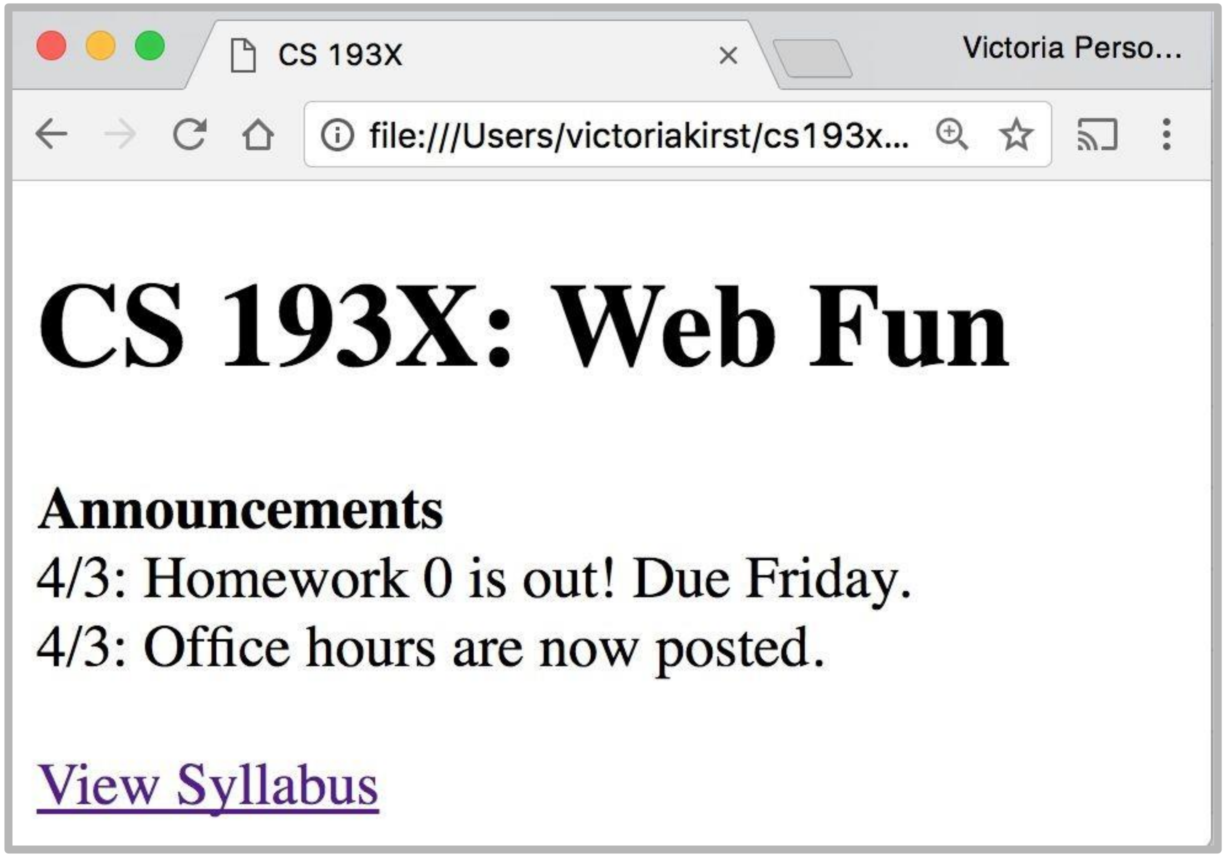
Some HTML elements

(to place within **<body>**)

Top-level heading **h1, h2, ... h6**	**<h1>**Moby Dick**</h1>**
Paragraph	**<p>**Call me Ishmael.**</p>**
Line break	since feeling is first**<br/>** who pays any attention
Image	**<img src="cover.png" />**
Link	**<a href="google.com">**click here!**</a>**
Strong (bold)	**<strong>**Be BOLD**</strong>**
Emphasis (italic)	He's my **<em>**brother**</em>** and all

Exercise: Course web page

Let's write some HTML to make the following page:



CS 193X: Web Fun

Announcements

4/3: Homework 0 is out! Due Friday.

4/3: Office hours are now posted.

View Syllabus

Exercise: Course web page

HTML boilerplate

```
<!DOCTYPE html>
<html>
  <head>
    <title>CS 193X</title>
  </head>

  <body>
   ...
  </body>
</html>
```

Plaintext contents of the page

```
CS 193X: Web Fun

Announcements
4/3: Homework 0 is out!
     Due Friday.
4/3: Office hours are
     now posted.

View Syllabus
```

JSBin

Solution

```
<!DOCTYPE html>
<html>
  <head>
    <title>CS 193X</title>
  </head>
  <body>
    <h1>CS 193X: Web Fun</h1>
    <strong>Announcements</strong><br/>
    4/3: Homework 0 is out!<br/>
    4/3: Office hours are now posted.<br/>
    <br/>
    <a href="http://cs193x.stanford.edu/syllabus">
      View Syllabus
    </a>
  </body>
</html>
```

That was weird

- We saw that HTML whitespace collapses into one space…

```
<h1>CS 193X: Web Fun</h1>
<strong>Announcements</strong><br/>
4/3: Homework 0 is out!<br/>
```

- Except weirdly the **<h1>** heading was on a line of its own, and **<strong>** was not.

Hmmm… strange…
Oh well, it works! Let's move on!!!

CSS

CSS

CSS: **C**ascading **S**tyle Sheets

- Describes the **appearance** and **layout** of a web page
- Composed of CSS **rules**, which define sets of styles

```
selector {
    property:  value;
}
```

CSS

A CSS file is composed of **style rules**:

```
selector {
    property:  value;
}
```

selector: Specifies the HTML element(s) to style.
property: The name of the CSS style.
value: The value for the CSS style.

Saved in a *filename***.css** file.

CSS

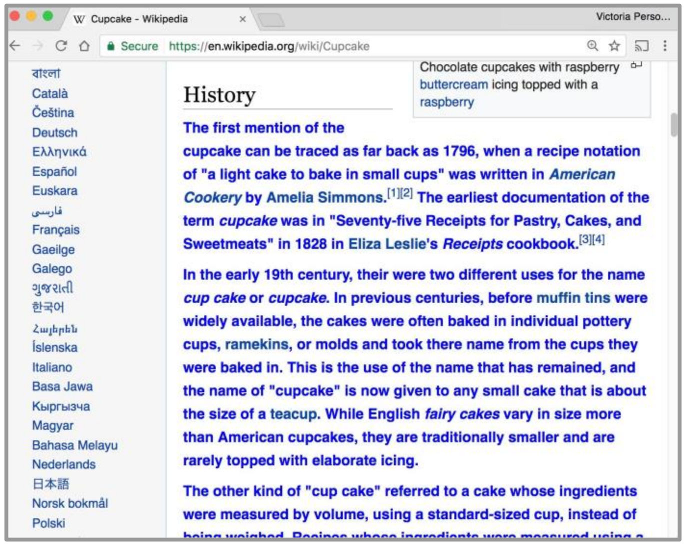
```
// NOT REAL CSS
fork {
  color: gold;
}
```

"All forks on the table should be gold"

CSS

```
p {
  color: blue;
  font-weight: bold;
}
```

"All **<p>** elements on the page should be blue and bold"



বাংলা
Català
Čeština
Deutsch
Ελληνικά
Español
Euskara
فارسی
Français
Gaeilge
Galego
ગુજરાતી
한국어
Հայերեն
Íslenska
Italiano
Basa Jawa
Кыргызча
Magyar
Bahasa Melayu
Nederlands
日本語
Norsk bokmål
Polski

Chocolate cupcakes with raspberry buttercream icing topped with a raspberry

History

The first mention of the cupcake can be traced as far back as 1796, when a recipe notation of "a light cake to bake in small cups" was written in *American Cookery* by Amelia Simmons.[1][2] The earliest documentation of the term *cupcake* was in "Seventy-five Receipts for Pastry, Cakes, and Sweetmeats" in 1828 in Eliza Leslie's *Receipts* cookbook.[3][4]

In the early 19th century, their were two different uses for the name *cup cake* or *cupcake*. In previous centuries, before muffin tins were widely available, the cakes were often baked in individual pottery cups, ramekins, or molds and took there name from the cups they were baked in. This is the use of the name that has remained, and the name of "cupcake" is now given to any small cake that is about the size of a teacup. While English *fairy cakes* vary in size more than American cupcakes, they are traditionally smaller and are rarely topped with elaborate icing.

The other kind of "cup cake" referred to a cake whose ingredients were measured by volume, using a standard-sized cup, instead of being weighed. Recipes whose ingredients were measured using a

Linking CSS in HTML
(i.e. copy/paste boilerplate)

```
<!DOCTYPE html>
<html>
  <head>
    <title>CS 193X</title>
    <link rel="stylesheet" href="filename.css" />
  </head>

  <body>
   ... contents of the page...
  </body>
</html>
```

Some CSS properties

There are over 500 CSS properties! Here are a few:

Font face (mdn)	`font-family: Helvetica;`
Font color (mdn)	`color: gray;`
Background color (mdn)	`background-color: red;`
Border (mdn)	`border: 3px solid green;`
Text alignment (mdn)	`text-align: center;`

Aside: Mozilla Developer Network (MDN) is the best reference for HTML elements and CSS properties

- The actual W3 spec is very hard to read (meant for browser developers, not web developers)

Main ways to define CSS colors:

140 predefined names (list)

```
color: black;
```

rgb() and rgba()

```
color: rgb(34, 12, 64);
color: rgba(0, 0, 0, 0.5);
```

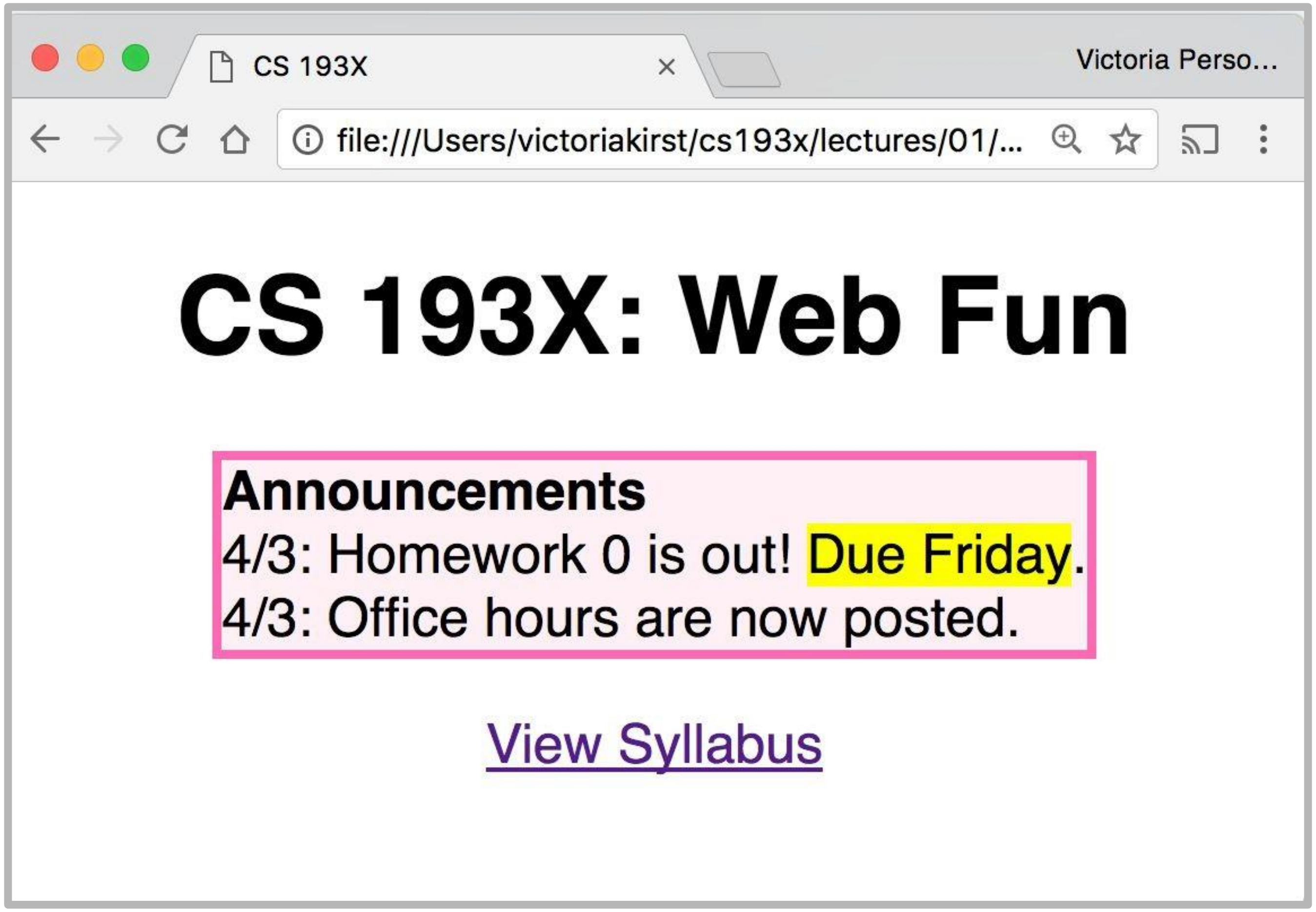
Hex values

```
color: #00ff00;
color: #0f0;
color: #00ff0080;
```

- The "a" stands for **alpha channel** and is a **transparency** value
- Generally prefer more descriptive over less:
  1. Predefined name
  2. `rgb` / `rgba`
  3. Hex

Exercise: Course web page

Let's write some CSS to style our page:


CS 193X

Victoria Perso...

file:///Users/victoriakirst/cs193x/lectures/01/...

CS 193X: Web Fun

Announcements

4/3: Homework 0 is out! Due Friday.

4/3: Office hours are now posted.

View Syllabus

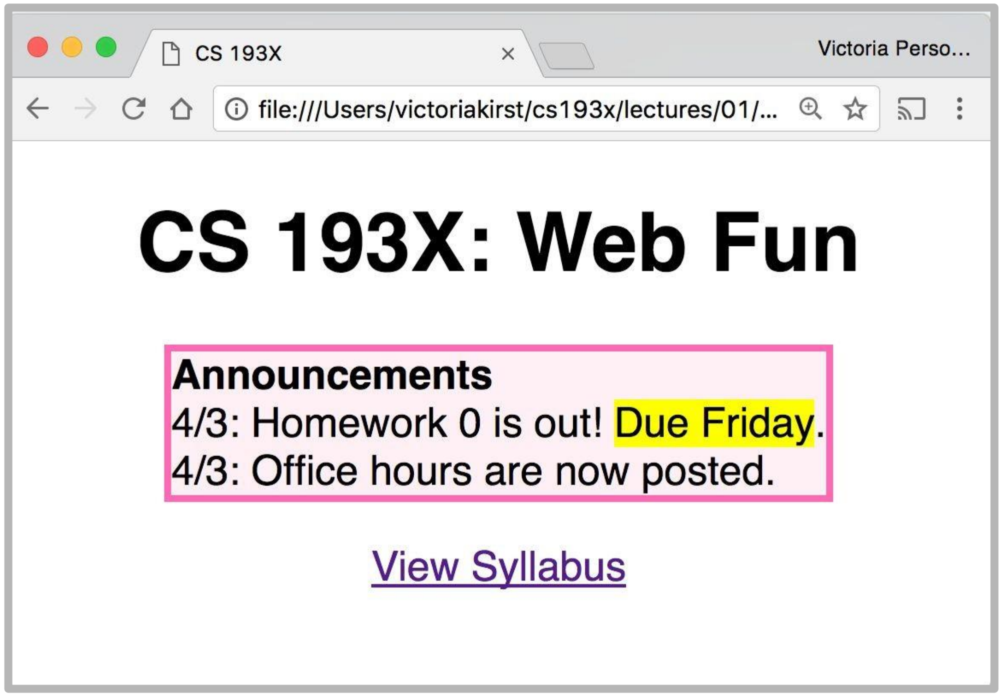
Exercise: Course web page

Let's write some CSS to style our page:

Font face: Helvetica

Border: hotpink 3px
Background color: lavenderblush
Highlight: yellow

- Box is **centered**
- Header and link are **centered**
- Box contents are **left-aligned**



CS 193X: Web Fun

Announcements
4/3: Homework 0 is out! Due Friday.
4/3: Office hours are now posted.

View Syllabus

JSBin

CSS exercise debrief

Some **key techniques:**

- Add invisible containers in HTML to select groups of elements in CSS.
- Apply styles to parent / ancestor element to style parent and all its children. (Will talk more about this later.)

But we encountered **more weirdness**...

- Couldn't set `text-align: center;` to the <a> or `<strong>` tags directly, but could center <p> and <h1>
- Had to set a `width` on the box to make it hug the text … any other way to do this?
- How to center the box?! How do you highlight?!

Q: Why is HTML/CSS so bizarre??

A: There is one crucial set of rules we haven't learned yet...

block vs **inline** display

Next time!

Homework 0 is
out now, due this Friday
April 7

Overflow slides

Q: Why is HTML/CSS so bizarre??

A: There is one crucial set of rules we haven't learned yet...

block vs **inline** display

What is HTML?

HTML (**H**ypertext **M**arkup **L**anguage)

- Describes the **content** and **structure** of a web page
- Made up of building blocks called **elements**.

```
<p>
    HTML is <em>awesome!!!</em>
    <img src="puppy.png" />
</p>
```

And there are 3 basic types.

Types of HTML elements

Each HTML element is categorized by the HTML spec into one of three-ish categories:

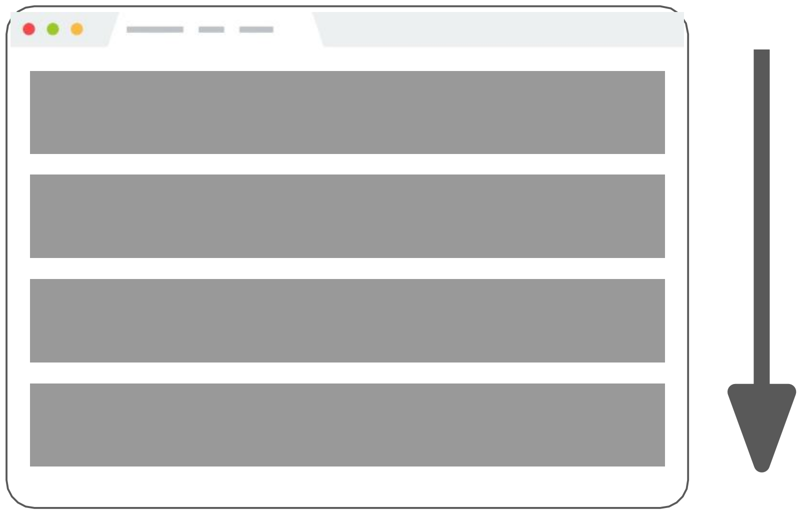
1. **block:** large blocks of content, has height and width
   <p>, **<h1>**, <blockquote>, <ol>, <ul>, <table>
2. **inline:** small amount of content, no height or width
   <a>, <em>, **<strong>**,<br>
   a. **inline block:** inline content with height and width
      <img>
3. metadata: information about the page, usually not visible
   <title>, <meta>

Block elements

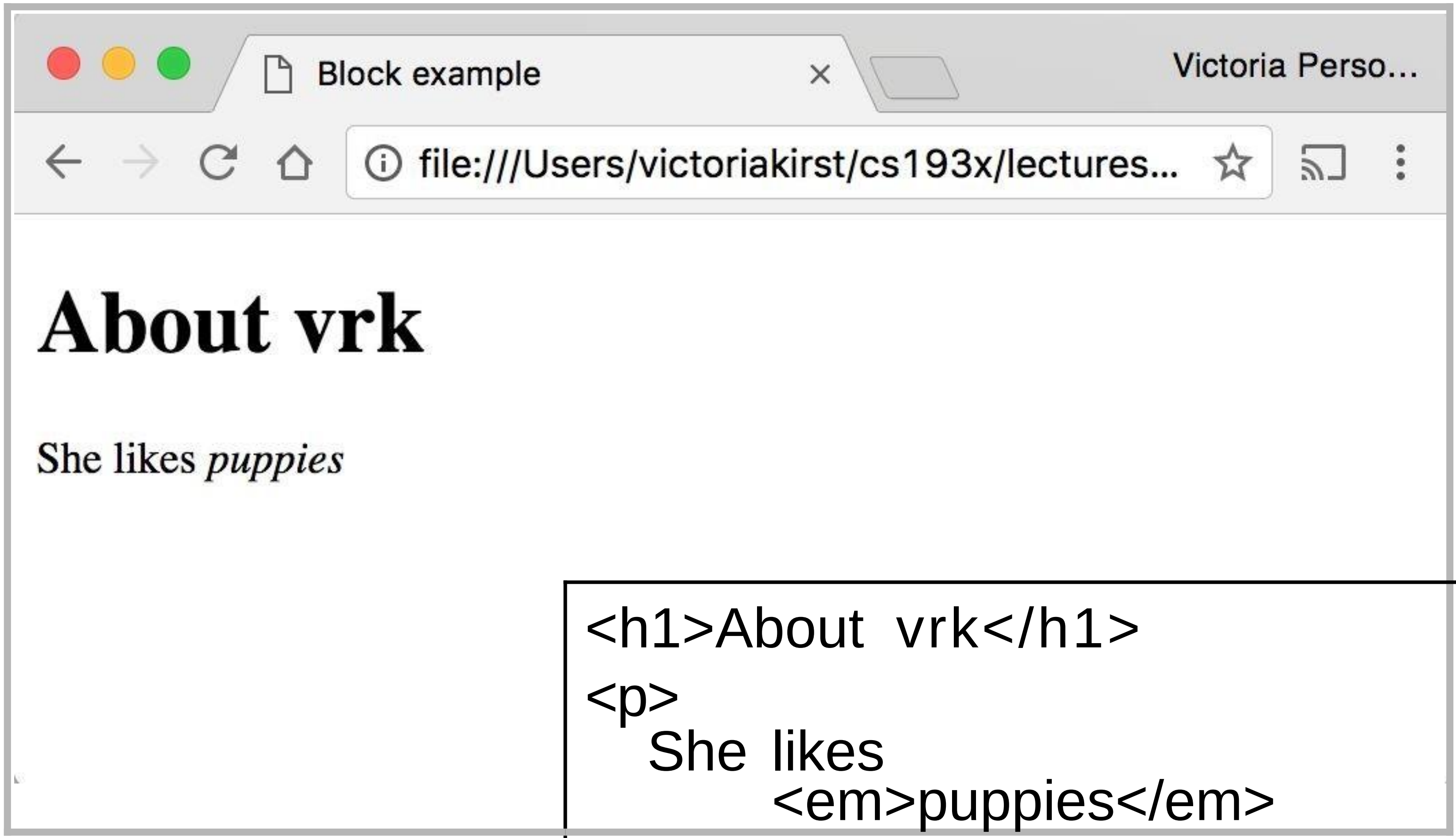
Examples:

<p>, <h1>, <blockquote>, <ol>, <ul>, <table>

- Take up the full width of the page (**flows top to bottom**)
- Have a height and width
- Can have block or inline elements as children



Example: Block


Block example

Victoria Perso...

file:///Users/victoriakirst/cs193x/lectures...

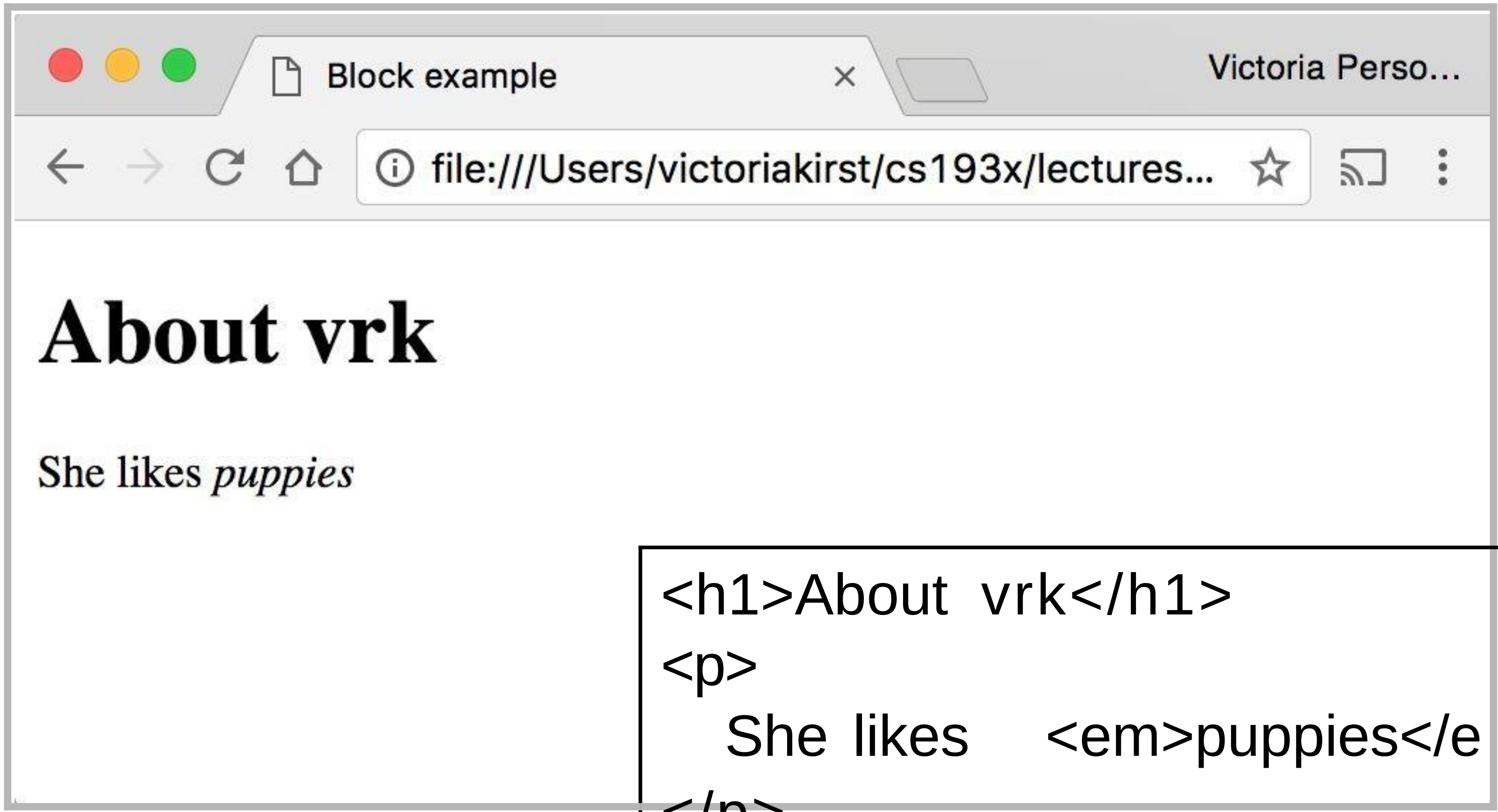
About vrk

She likes *puppies*

```
<h1>About  vrk</h1>
<p>
  She  likes
        <em>puppies</em>
</p>
```

Q: What does this look like in the browser?

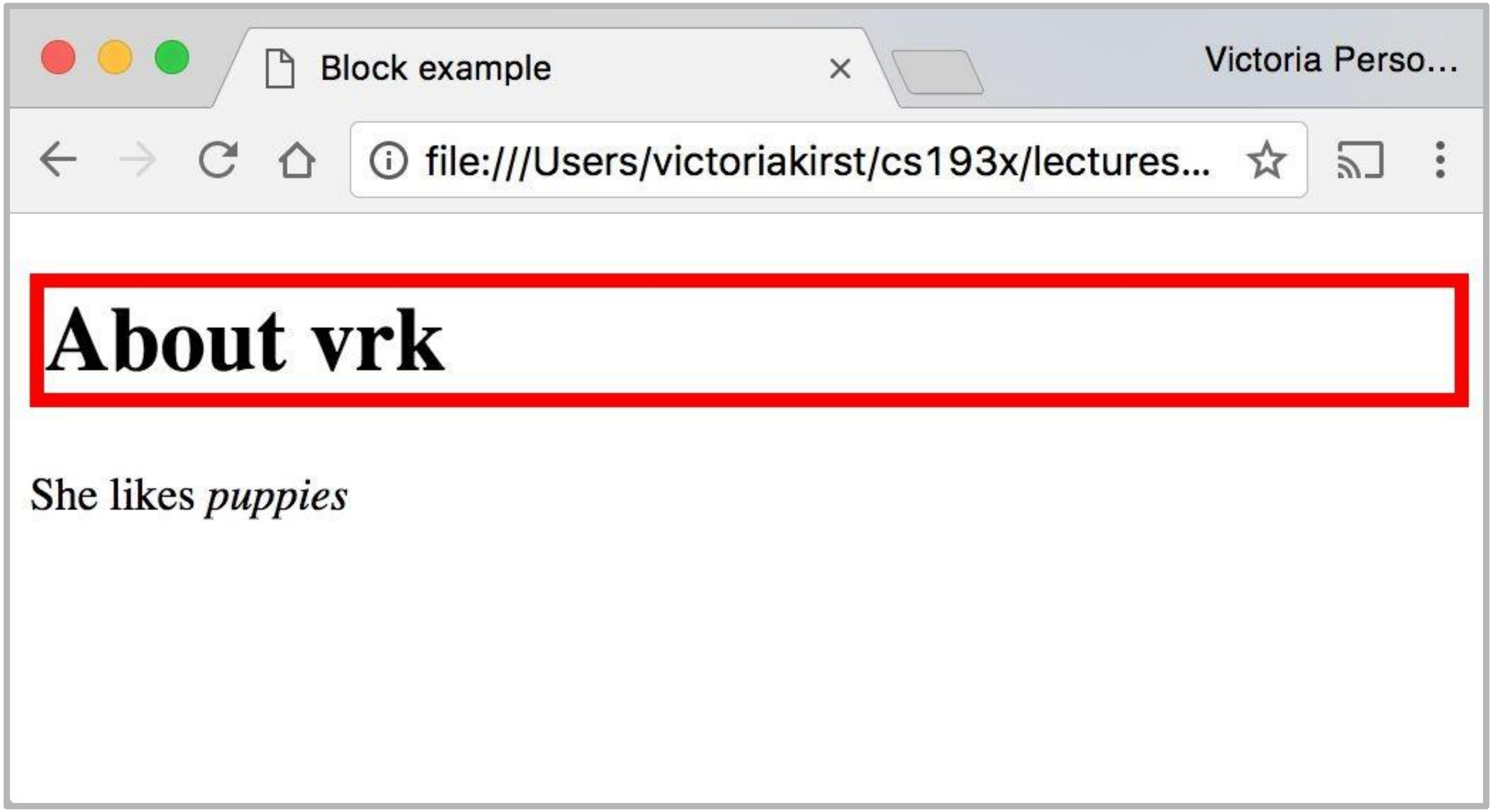
```
h1 {
  border: 5px solid red;
}
```



About vrk

She likes *puppies*

```
<h1>About vrk</h1>
<p>
  She likes <em>puppies</em>
</p>
```



About vrk

She likes *puppies*

Block-level:
extends the full width of the page

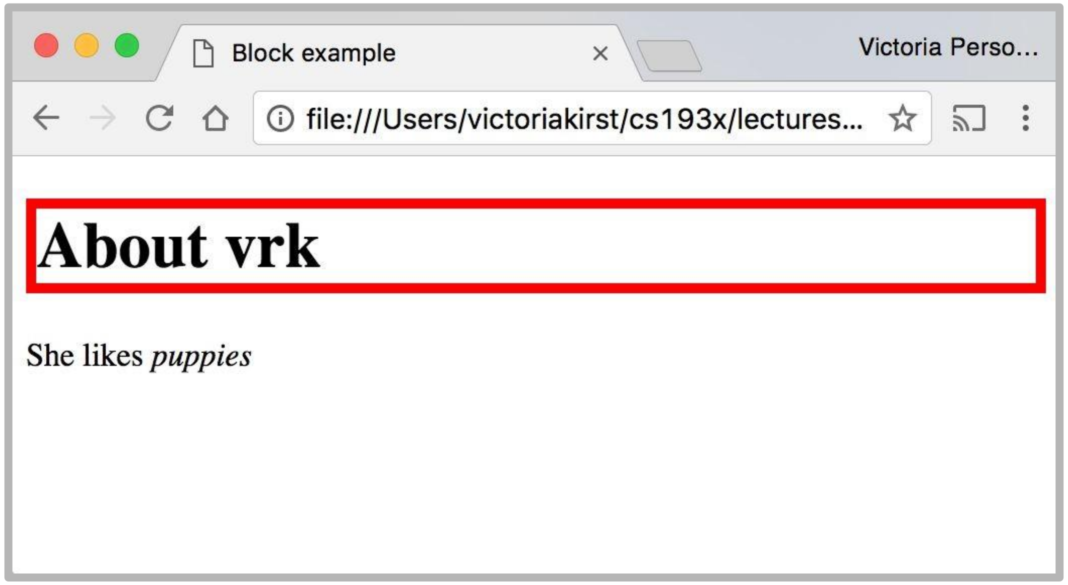
```
h1 {
  border: 5px solid red;
}
```

```
<h1>About vrk</h1>
<p>
  She likes <em>puppies</em>
</p>
```

`<h1>` is block-level, so it extends the full width of the page by default

Note how block-level elements (**`h1`**, **`p`**) flow top to bottom

See: JSBin

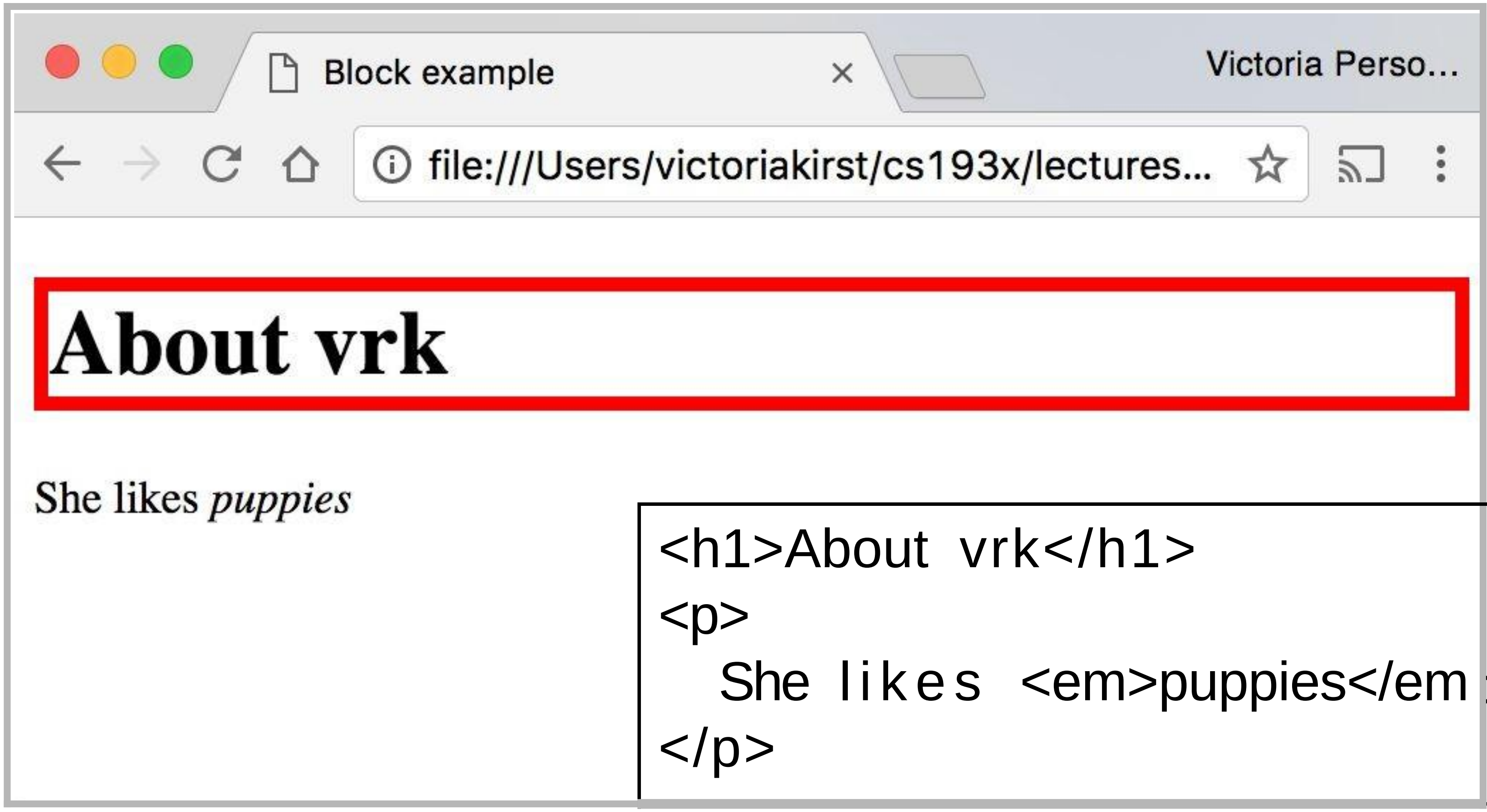


About vrk

She likes *puppies*

Q: What does this look like in the browser?

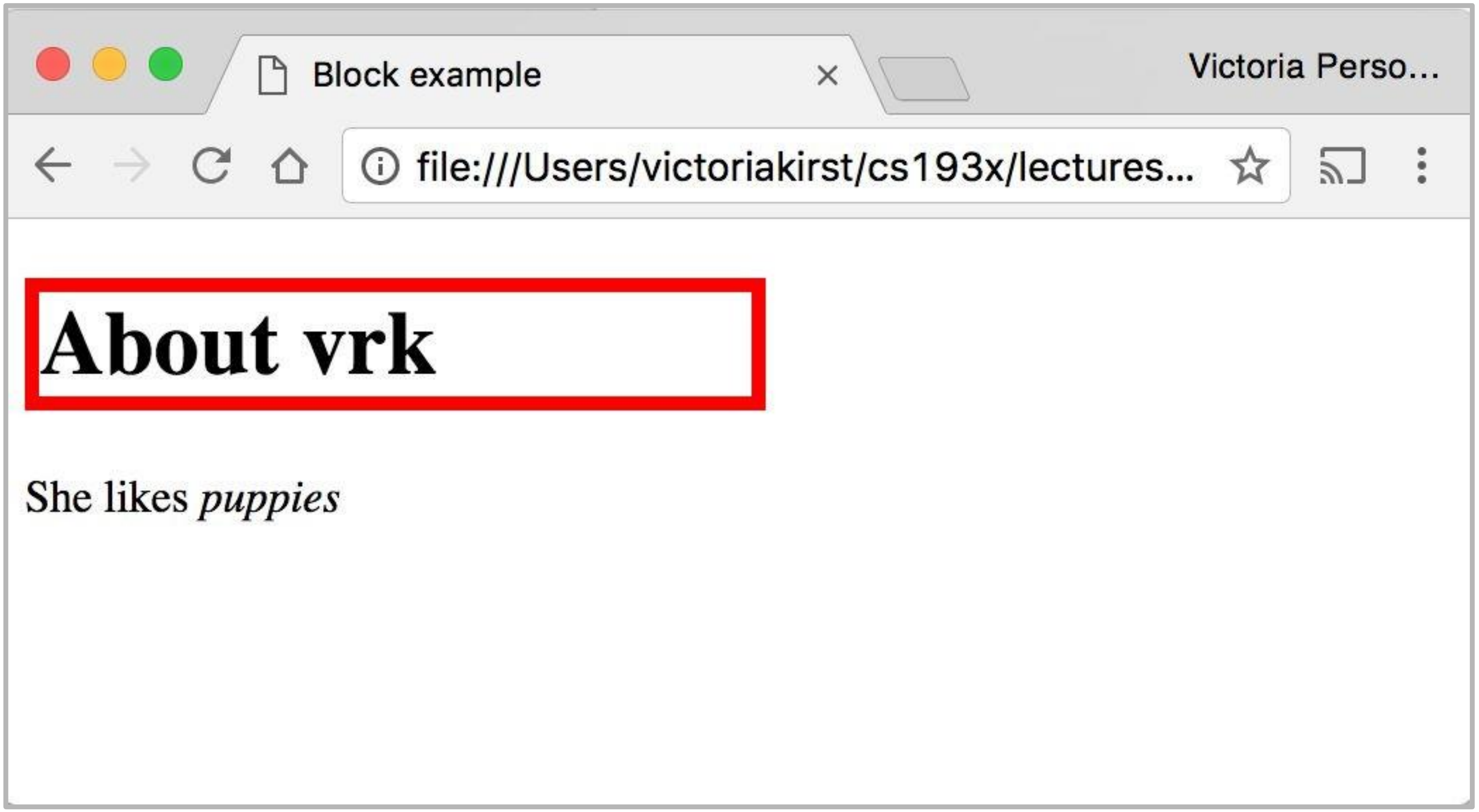
```
h1 {
  border: 5px solid red;
  width: 50%;
}
```



About vrk

She likes *puppies*

```
<h1>About vrk</h1>
<p>
  She likes <em>puppies</em>
</p>
```



About vrk

She likes *puppies*

Block-level

width can be modified

```
h1 {
   border:  5px solid red;
   width:
              50%
   ;
}
```

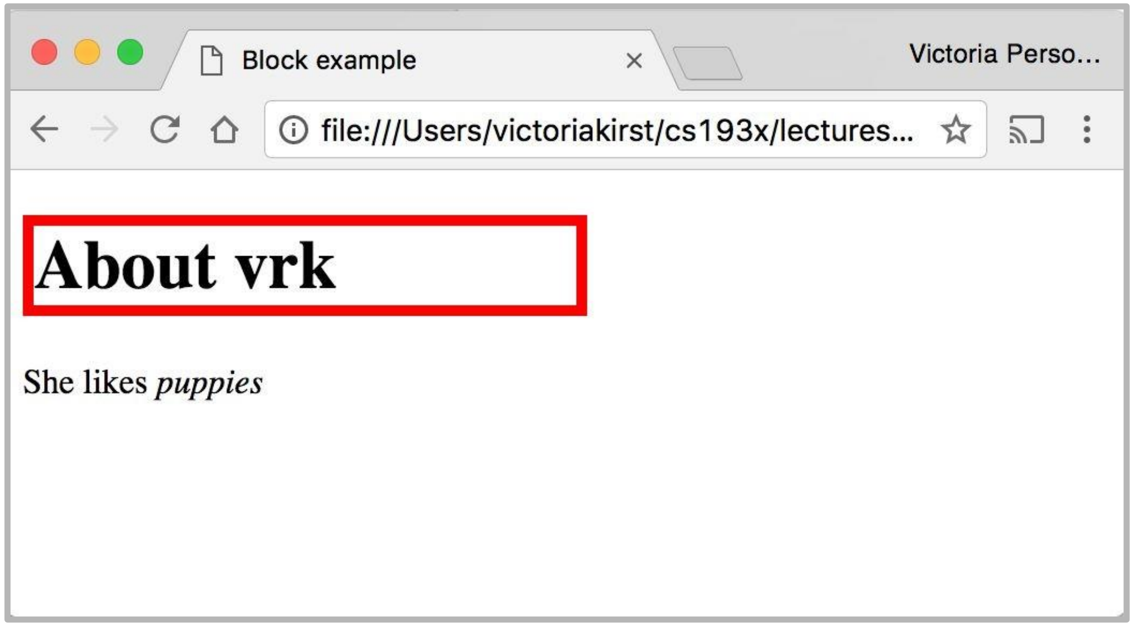
```
<h1>About vrk</h1>
<p>
   She likes <em>puppies</em>

</p>
```

`<h1>` is block-level, so its **`width`** can be modified

Block-level elements still flow top to bottom

See: [JSBin]



About vrk

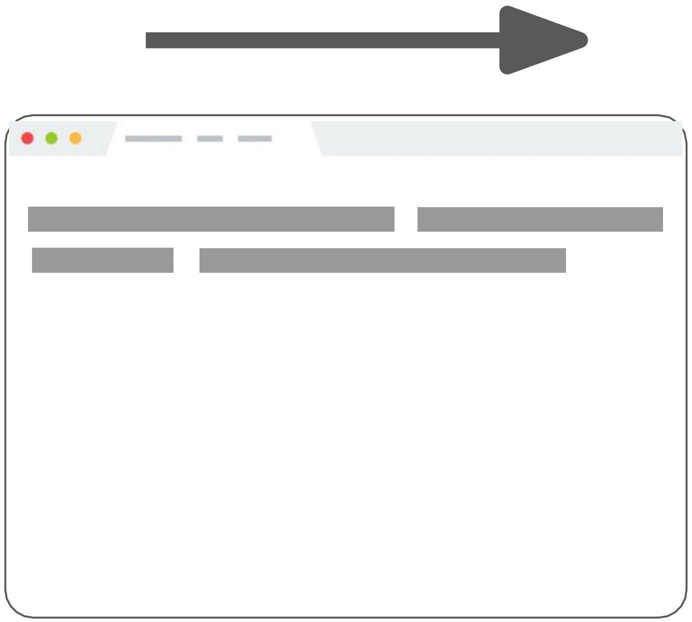
She likes *puppies*

Inline elements

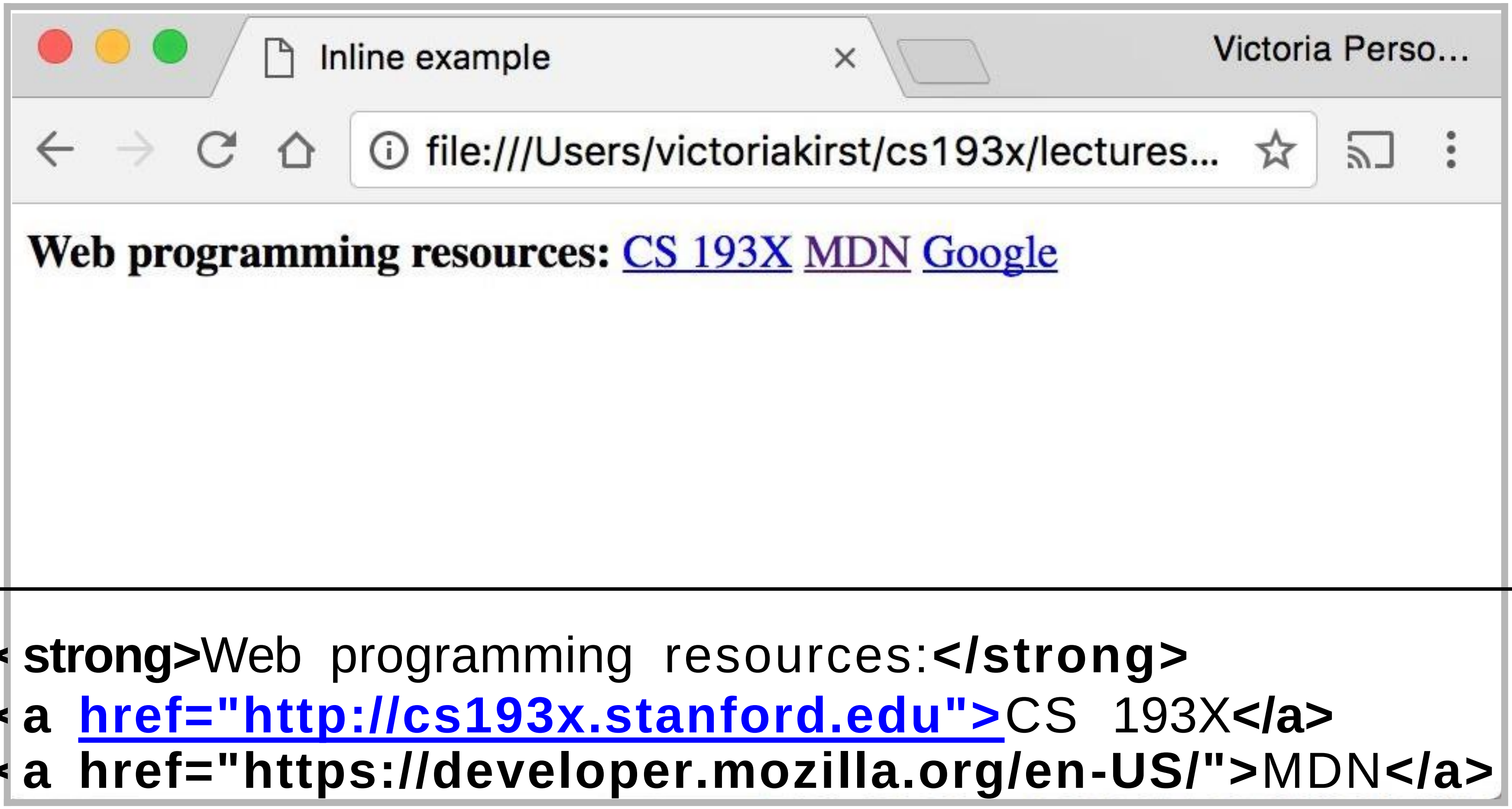
Examples:

`<a>, <em>, <strong>, <br>`

- Take up only as much width as needed (flows left to right)
- **Cannot** have `height` and `width`
- **Cannot** have a block element child
- **Cannot** be positioned (i.e. CSS properties like `float` and `position` do not apply to inline elements)
  - Must position **its containing block element** instead



Example: Inline

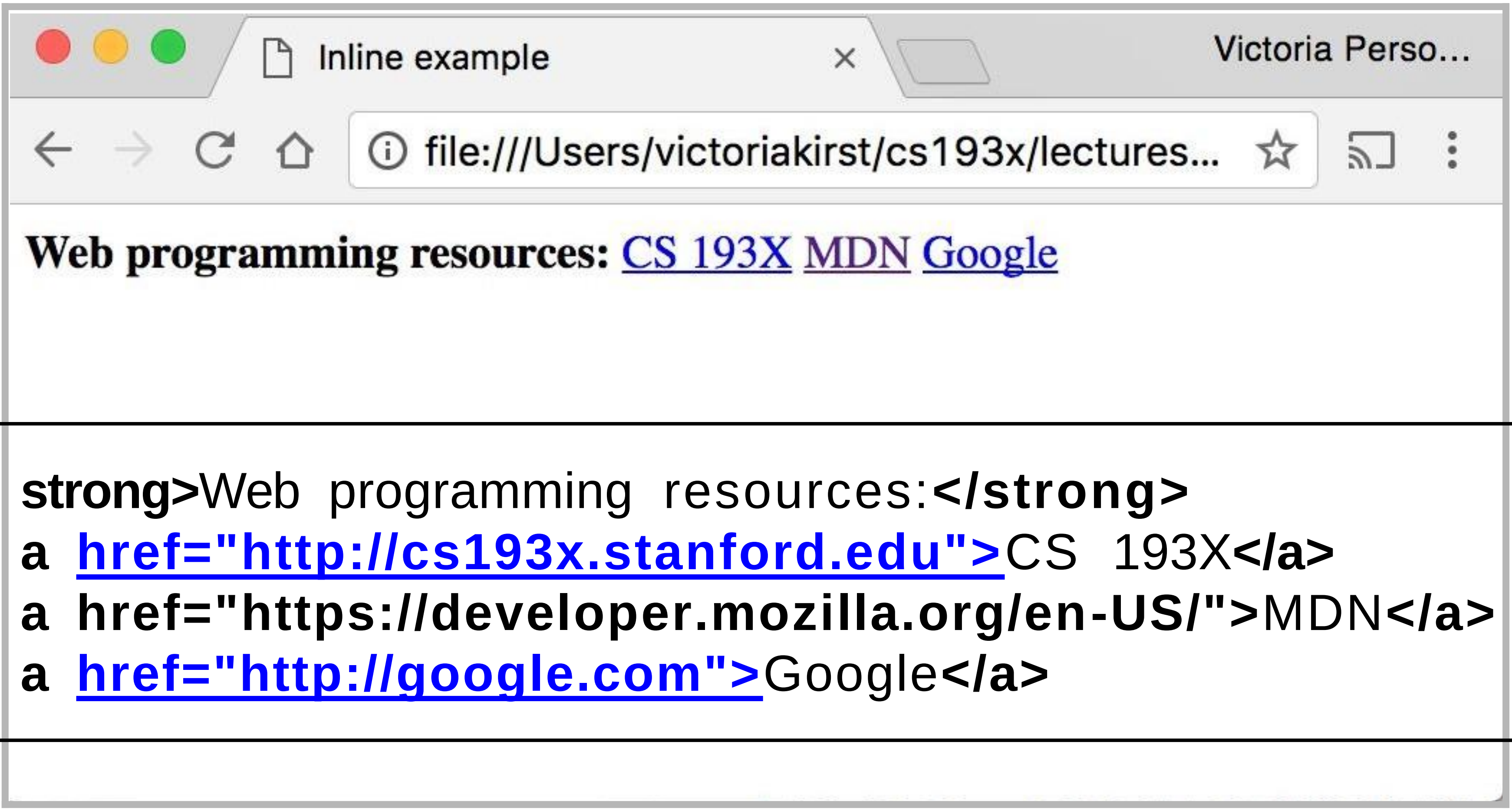


Web programming resources: CS 193X MDN Google

```
<strong>Web programming resources:</strong>
<a href="http://cs193x.stanford.edu">CS 193X</a>
<a href="https://developer.mozilla.org/en-US/">MDN</a>
<a href="http://google.com">Google</a>
```

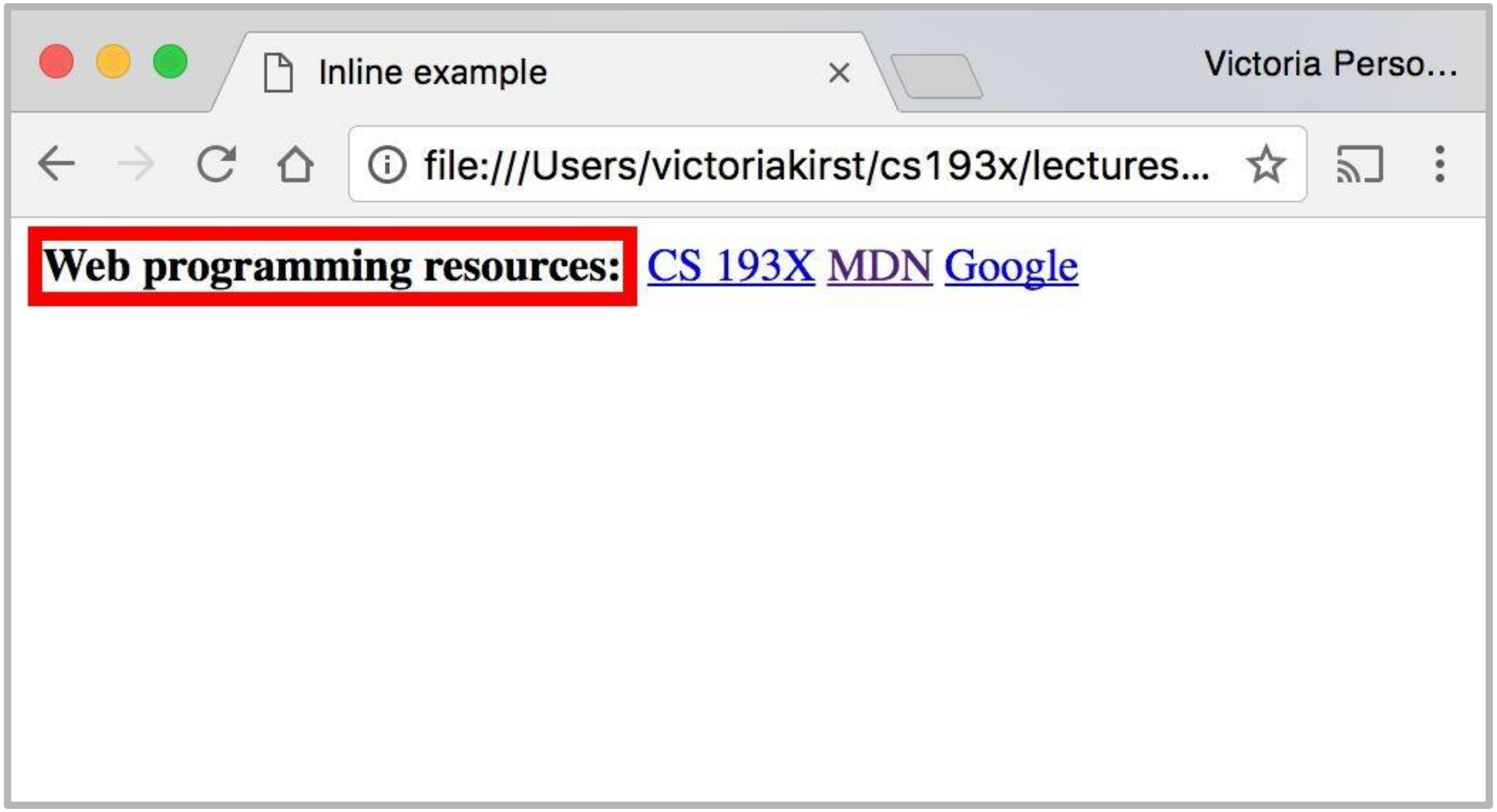
Q: What does this look like in the browser?

```
strong {
  border:5px  solid  red;
  width:  1000px;
}
```



Web programming resources: CS 193X MDN Google

```
strong>Web programming resources:</strong>
a href="http://cs193x.stanford.edu">CS 193X</a>
a href="https://developer.mozilla.org/en-US/">MDN</a>
a href="http://google.com">Google</a>
```



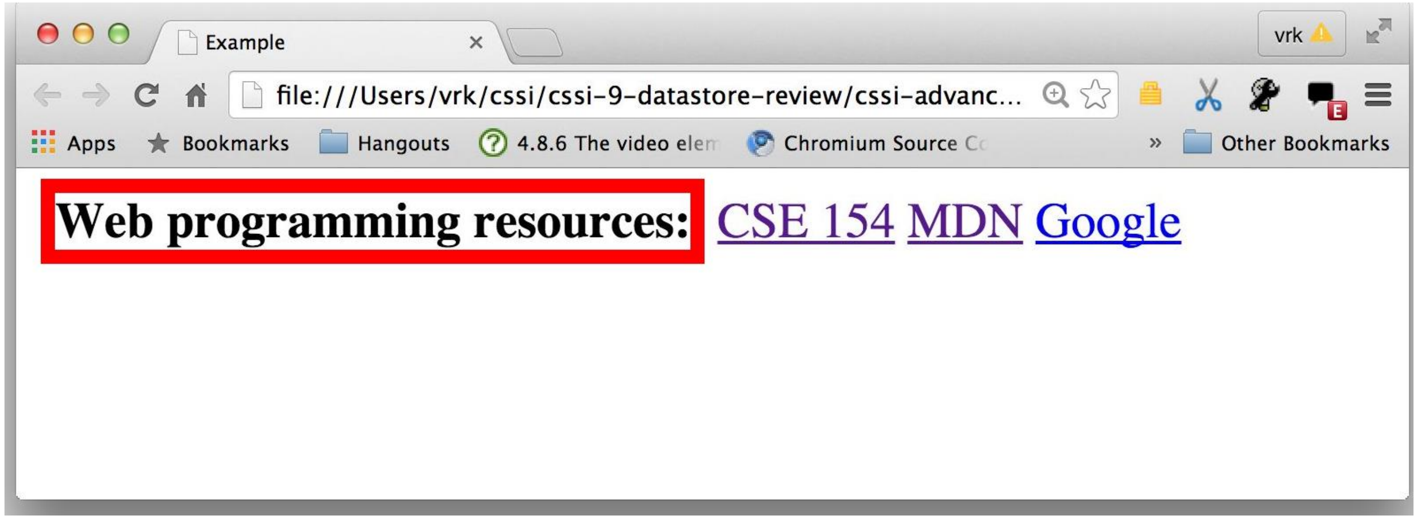
Web programming resources: CS 193X MDN Google

Inline elements ignorewidth

width cannot be modified

```
strong {
  border: 5px solid red;
  width: 1000px;
  /* Will notwork; strong is
     inline! */
}
```

```
<strong>Web programming reso
<a href="http://cs193x.stanf
<a href="https://developer.m
<a href="http://google.com">
```


Example

file:///Users/vrk/cssi/cssi-9-datastore-review/cssi-advanc...

Apps Bookmarks Hangouts 4.8.6 The video elem Chromium Source Co Other Bookmarks

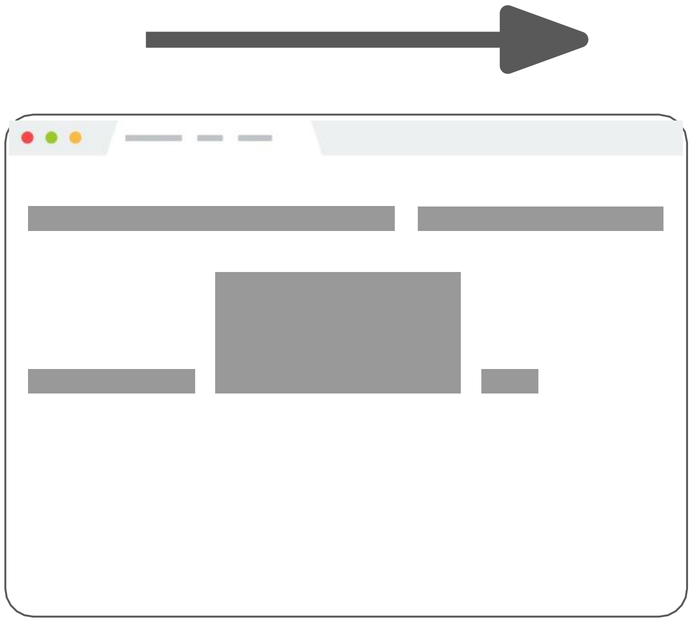
Web programming resources: CSE 154 MDN Google

Cannot set **width** on inline element, so it is ignored (JSBin)

inline-block

Examples: `<img>`, any element with `display: inline-block;`

- Take up only as much width as needed (flows left to right)
- **Can** have `height` and `width`
- **Can** have a block element as a child
- **Can** be positioned (i.e. CSS properties like `float` and `position` apply)



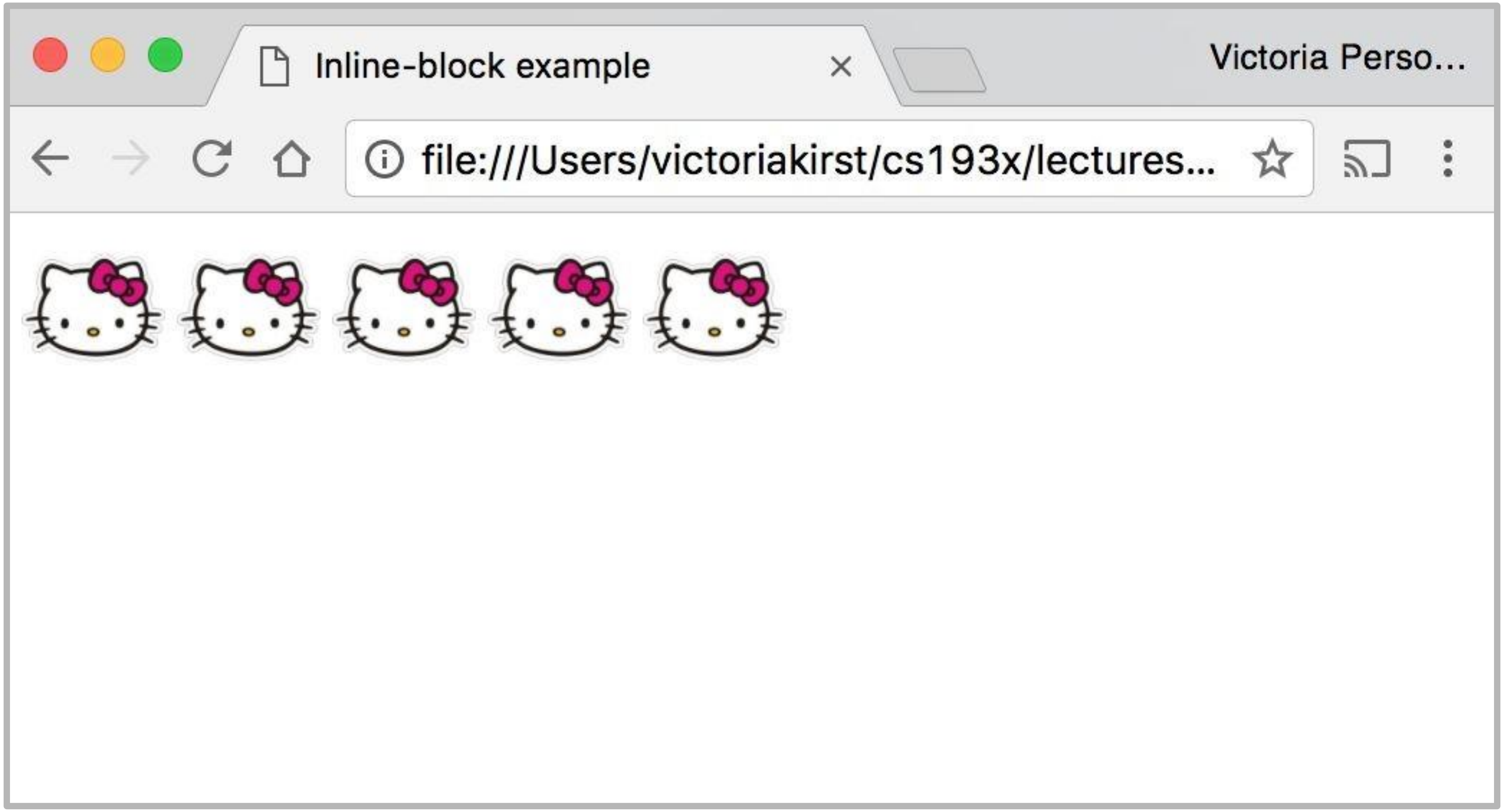
Example: Inline-block

```
img {
   width: 50px;
}
```

Q: What doesthis look like in the browser?

```
<img src="http://i.imgur.com/WJToVGv.jpg" />
<img src="http://i.imgur.com/WJToVGv.jpg" />
<img src="http://i.imgur.com/WJToVGv.jpg" />
<img src="http://i.imgur.com/WJToVGv.jpg" />
<img src="http://i.imgur.com/WJToVGv.jpg" />
```

http://i.imgur.com/WJToVGv.jpg =

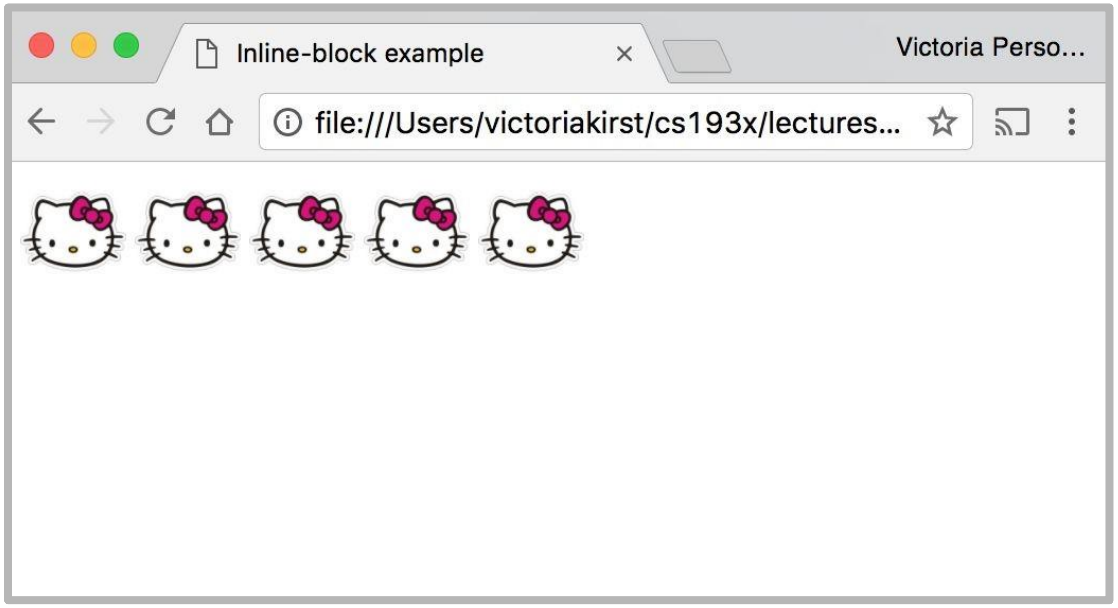

Inline-block example
Victoria Perso...
file:///Users/victoriakirst/cs193x/lectures...

Inline-block

Has width and height; flows left to right

Can set **width** on inline-block element, so image width is set to 50px. (JSBin)

inline-block flows left to right, so images are right next to each other.



```
img {
  width: 50px;
}
```

```
<img src="http://i.imgur.com/WJToVGv.jpg" />
<img src="http://i.imgur.com/WJToVGv.jpg" />
<img src="http://i.imgur.com/WJToVGv.jpg" />
<img src="http://i.imgur.com/WJToVGv.jpg" />
<img src="http://i.imgur.com/WJToVGv.jpg" />
```

The `display` CSS property

You can change an element's default rendering type by changing the **`display`** property. Examples:

```
p {
  display: inline;
}
```

```
a {
  display: block;
}
```

Possible values for `display`:

- `block`
- `inline`
- `inline-block`
- some others: link

Review

1. **block:** flows **top-to-bottom**; **has** **height** and **width**
   <p>, <h1>, <blockquote>, <ol>, <ul>, <table>
2. **inline:** flows **left-to-right**; **does not have** **height** and **width**
   <a>, <em>, <strong>,<br>
   a. **inline block:** flows **left-to-right**; **has** **height** and **width**
      <img>

Questions?

Moral of the story:
If your CSS isn't working, see if you're trying to apply block-level properties to inline elements