Web Programming Fundamentals

February 2019

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

Schedule:

- HTML: Background and history
- Complex selectors
- Box model
- Debugging with Chrome Inspector
- **Case study**: Squarespace Layout (will continue into Monday)

(Forgot to mention: Paths)

`img src`, `a href`, and `link href` can all take either **relative** or **absolute** paths to the resource:

- `<a href="`**about.html**`">About</a>`
- `<img src="`**http://i.imgur.com/WJToVGv.jpg**`" />`
- `<link rel="stylesheet" href="`**css/style.css**`"/>`

If you are unfamiliar with paths, check out the following:

- Absolute vs relative paths
- Unix directories and file paths
- If anything's still unclear, come to office hours!

HTML: Background and History

What HTML elements can I use?

Q: Instead of , can I create a <highlight> element?

```
<p>
  The homework is
  <highlight>due Friday</highlight>.
</p>
```

```
  highlight {
    background-color: yellow;
  }
```

Q: Does this even work?

What HTML elements can I use?

This renders correctly:

HTML

```
The homework is
<highlight>due Friday</highlight>.
```

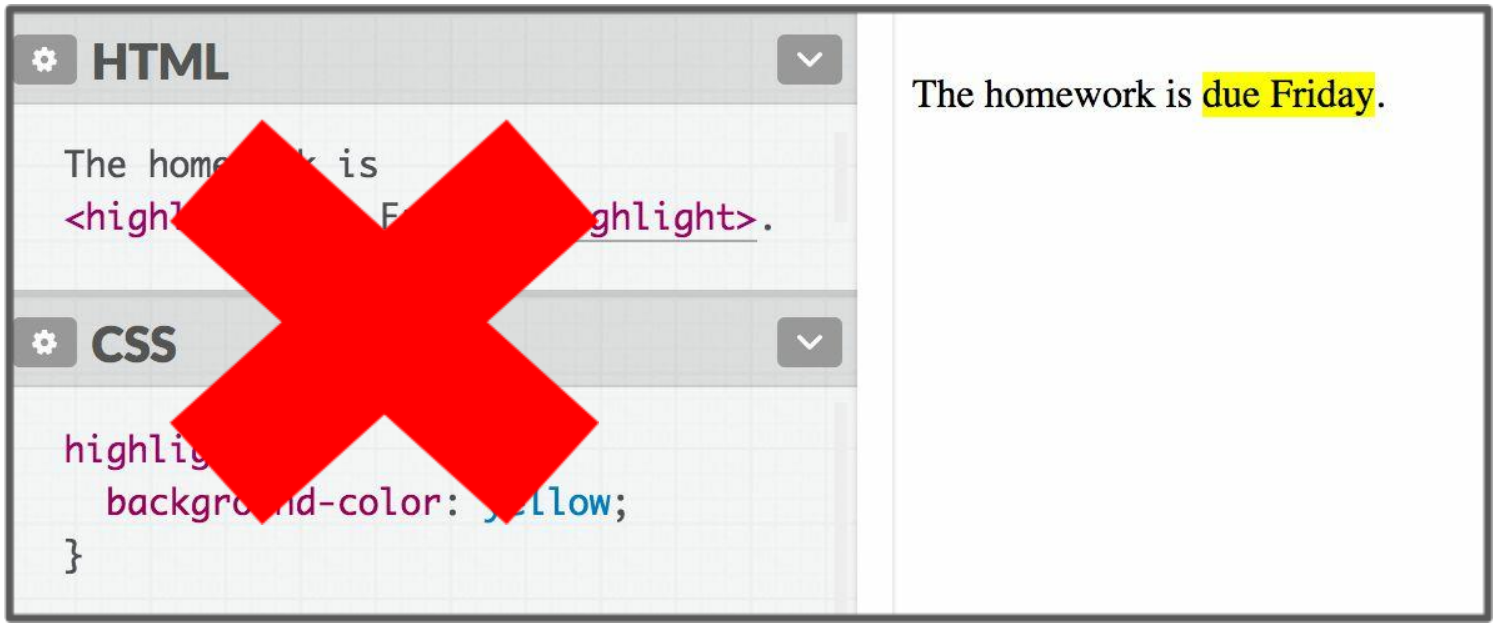
CSS

```
highlight {
  background-color: yellow;
}
```

The homework is due Friday.

What HTML elements can I use?

This renders correctly:

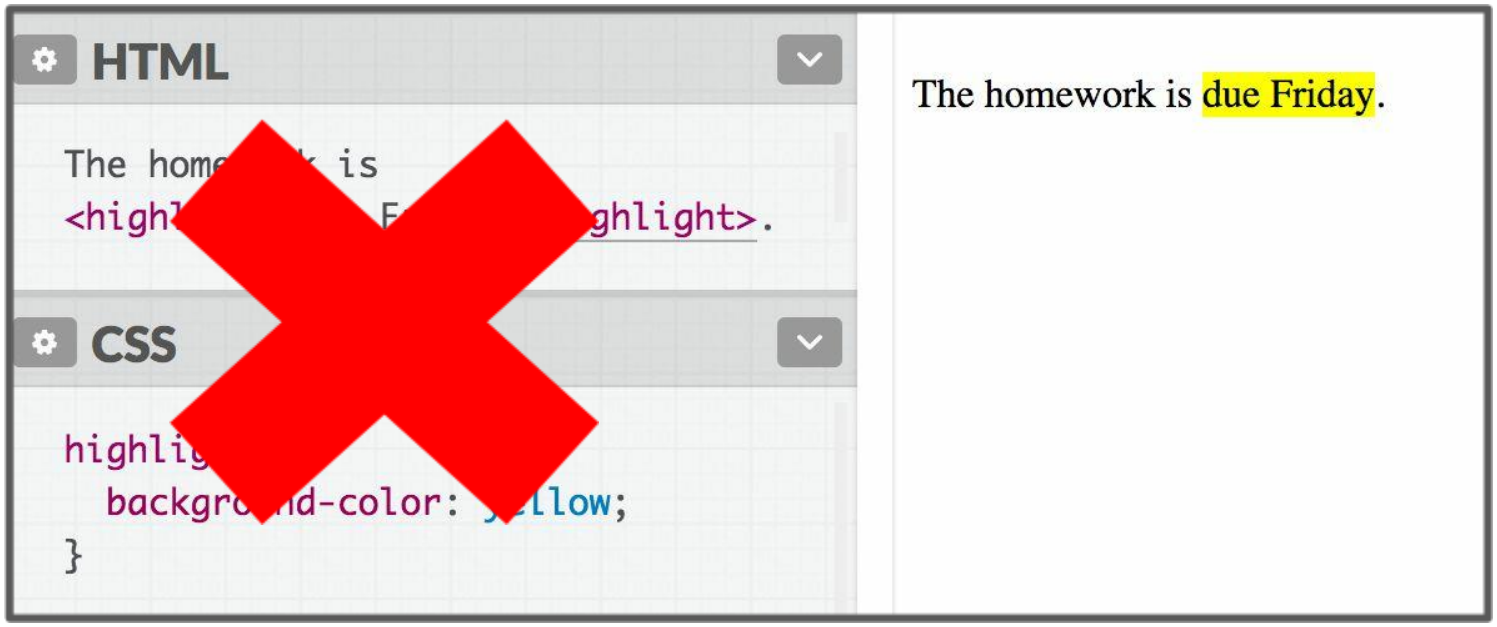


But you shouldn't do this!

It is non-standard behavior.

What HTML elements can I use?

This renders correctly:



What?!?!?

But you shouldn't do this!

It is non-standard behavior.

What?!

- What is "standard" HTML?
- Why does invalid HTML/CSS still work sometimes?
  - If my Java code is wrong, I get a compiler error… If my HTML or CSS is wrong, why don't I get an error?
- Why does it matter that I follow "standard" HTML?

A very brief history of HTML

History

Tim Berners-Lee

- 1989: World Wide Web created
  (WWW: web pages and the protocol in which they are served HTTP/HTTPS)

- 1994: World Wide Web Consortium created
  - "**W3C**": Goal to maintain and develop standards about how the web should work
  - Oversees several languages:
    - HTML, CSS, DOM, XML, etc

- 1997: "HTML4" published
  - The first major stable version of HTML

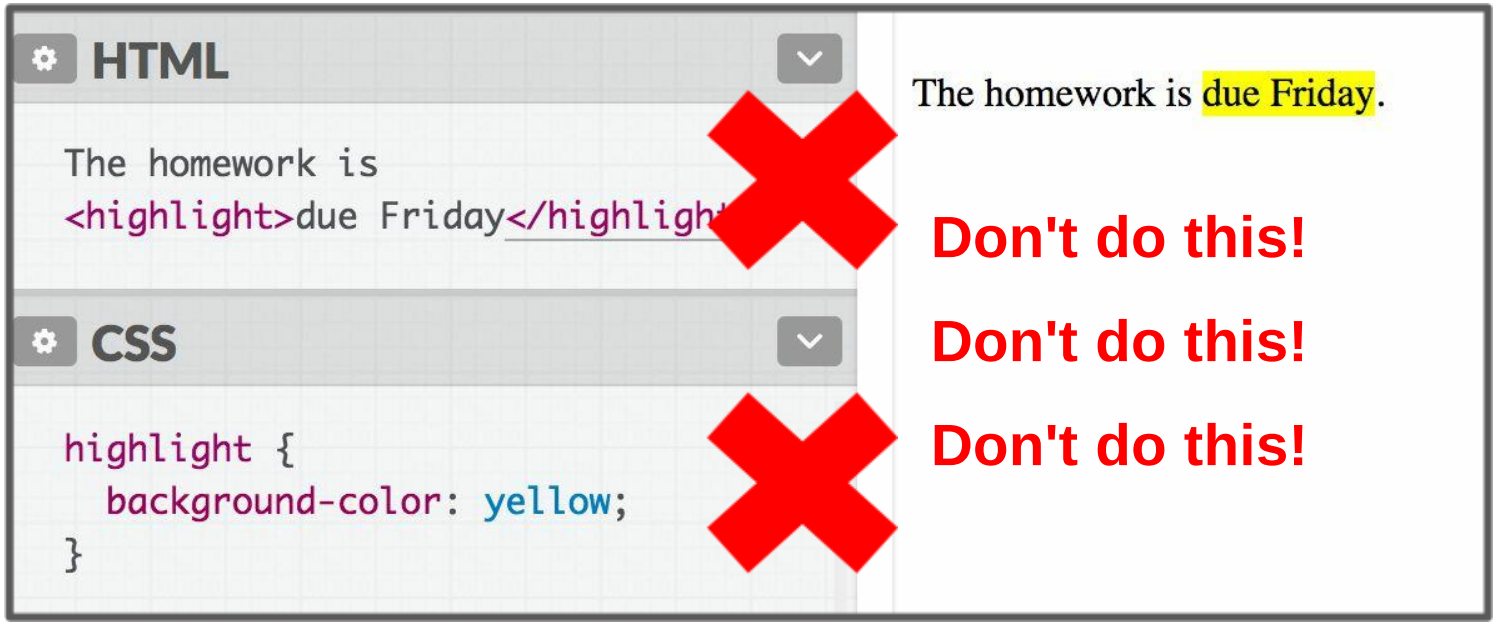
Degrading gracefully

The W3C HTML spec lists several ~~design principles~~, and one is degrading gracefully:

"An escalator can never break: it can only become stairs"

This is why browsers do a **best-effort** to render non-standard ("invalid") HTML and CSS.

Best-effort rendering



It's also why `<highlight>` "works", even though it's

Invalid HTML.

Why not enforce strict HTML?

It's super weird that:

- Browsers don't fail when given invalid HTML / CSS
- Browsers not only don't fail, but they render invalid HTML/CSS seemingly "correctly"

Q: Why doesn't the browser reject poorly written HTML/CSS?

Why not enforce strict HTML?

It's super weird that:

- Browsers don't fail when given invalid HTML / CSS
- Browsers not only don't fail, but they render invalid HTML/CSS seemingly "correctly"

Q: Why doesn't the browser reject poorly written HTML/CSS?

A: There was a (failed) attempt to enforce this, but it was too late: the Internet grew too big!

The nerdy, mostly* accurate backstory for HTML today

*I would be more accurate, but it's hard to get valid sources online… so I'm going off of what I can + the lore I've heard while working on a browser.

State of the world, 1997:

Standards say one thing,

Browsers do another thing,

Developers write weird, non-standard code.

State of the world, 1997:

Standards
one thing,

another thing,

elopers write
weird, non-standard
code.

In 1997, things are kind of a mess!

2000ish:

W3C

Oops, that "degrading gracefully" thing was a mistake.

Browsers, stop rendering pages that have invalid HTML.

(This was the proposal of XHTML 1.1)

2000ish: (not totally accurate)

W3C

Sure whatever

What?!?!

We can't do that!

That would break the internet!

2004: WHATWG formed

Let's burn everything and start from scratch with XHTML 1.1

(break approx. 64 million websites)

Let's work on HTML5

(an imperfect but realistic standard)

Fast forward 2017?!

- W3C gave up XHTML 1.1 in 2007
- W3C and WHATWG are mostly friends (I think), though they are still separate entities
- Can still find some snarky quotes on WHATWG website

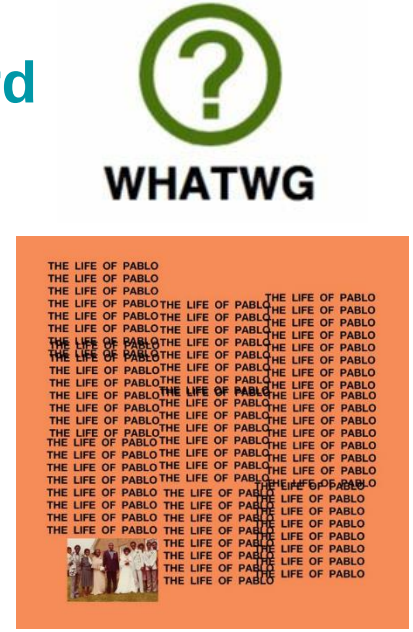
"HTML5" vs HTML

W3C maintains HTML 5

- More stable version of WHATWG's HTML
- Usually copies what WHATWG does after the dust settles

WHATWG maintains HTML: The Living Standard

- No number, no versions
- Updated frequently and being updated today!
- Most browsers implement WHATWG
- This is why I don't say "HTML5"



What you need to know

Q: What HTML elements can I choose from?

- Check MDN's list of HTML tags

Q: How do I know if an HTML tag (or CSS property, or JS feature) **is implemented on all browsers?**

- Check caniuse.com

Q: Why shouldn't I use non-standard HTML/CSS/JavaScript, even if it works in every browser?

What you need to know

Q: What HTML elements can I choose from?

- Check MDN's list of HTML tags

Q: How do I know if an HTML tag (or CSS property, or JS feature) **is implemented on all browsers?**

- Check caniuse.com

Q: Why shouldn't I use non-standard HTML/CSS/JavaScript, even if it works in every browser?

- Because it won't be guaranteed to work in the future
- Because it won't be guaranteed to work on all "user agents" (not just browsers)

What you need to know

Q: Wouldn't it be super useful to create custom elements?

- Yes! There is a spec for this currently under development.
  - (Note that custom elements are not really meant for our example; custom elements are meant for defining custom behavior and not just style. For defining style, CSS classes/ids are still most appropriate.)

Back to writing code!

CSS Selectors: Classes and Ids

Classes and ids

There are 3 basic types of CSS selectors:

Element selector (this is the one we've been using)	**p**	All **<p>** elements
✨**ID selector**✨	**#abc**	element with **id="abc"**
✨**Class selector**✨	**.abc**	elements with **class="abc"**

```
<h1 id="title">Homework</h1>
<em class="hw">HW0</em> is due Friday.<br/>
<em class="hw">HW1</em> goes out Monday.<br/>
<em>All homework due at 11:59pm.</em>
```

Other selectors

element.className

Syntax	Example	Example described
element.className	**p.abc**	**<p>** elements with abc class

HTML

```
<h1 class="hw">Homework 0</h1>
<p class="hw">Due Fri</p>
<p class="hw">Late cutoff Sun</p>
<h1>Lectures</h1>
<p>Apr 3: Syllabus</p>
<p>Apr 5: HTML+CSS</p>
```

CSS

```
p.hw {
  color: green;
}
```

Homework 0

Due Fri

Late cutoff Sun

Lectures

Apr 3: Syllabus

Apr 5: HTML+CSS

Descendent selector

Syntax	Example	Example described
selector selector	**div strong**	**** elements that are descendants of a ** **

HTML

```html
<div class="hw">
  <h1>Homework 0</h1>
  <p>Due Fri</p>
  <p>Late cutoff Sun</p>
</div>
```

CSS

```css
.hw p {
  color: green;
}
```

Homework 0

Due Fri

Late cutoff Sun

Lectures

Apr 3: Syllabus

Apr 5: HTML+CSS

Descendent selector

Syntax	Example	Example described
selector selector	**div strong**	**** elements that are descendants of a ** **

Note: The element does not have to be a direct child. The descendent may be nested many layers in.

HTML

```
<div class="hw">
  <div>
    <p>
      HW0: <strong>Due Friday</strong>
    </p>
  </div>
  HW1 out <strong>Monday</strong>
</div>
```

CSS

```
.hw strong {
  color: red;
}
```

HW0: **Due Friday**

HW1 out **Monday**

Descendent selector

Syntax	Example	Example described
selector selector	**div strong**	**** elements that are descendants of a ** **

Discouraged:

```
<h1 class="hw">Homework 0</h1>
<p class="hw">Due Fri</p>
<p class="hw">Late cutoff Sun</p>
```

vs

Preferred:

```
<div class="hw">
  <h1>Homework 0</h1>
  <p>Due Fri</p>
  <p>Late cutoff Sun</p>
</div>
```

Instead of applying a class to several adjacent elements, wrap the group in a `<div>` container and style the contents via descendent selectors.

selector, selector (comma)

Syntax	Example	Example described
selector, selector	**h2, div**	**<h2>** elements and ** **s

HTML

```
<h1>Course Info</h1>
<h2>Lectures</h2>
<p>Mon-Wed-Fri 1:30-2:20</p>
<h2>Honor code</h2>
<p>Do the right thing</p>
```

CSS

```
h1, h2 {
  font-family: Arial;
}
```

Course Info

Lectures

Mon-Wed-Fri 1:30-2:20

Honor code

Do the right thing

Selector summary

Example	Description
p	All **<p>** elements
.abc	All elements with the **abc class**, i.e. **class="abc"**
#abc	Element with the **abc id**, i.e. **id="abc"**
p.abc	**<p>** elements with **abc class**
p#abc	**<p>** element with **abc id** (**p** is redundant)
div strong	**** elements that are descendants of a ** **
h2, div	**<h2>** elements and ** **s

Grouping selectors

2 Common bugs:

`p.abc` **vs** `p .abc`

`p .abc` **vs** `p, .abc`

- A <p> element with the **abc** class **vs**
  An element with the **abc** class that descends from <**p**>

- An element with the **abc** class that descends from < **p**> **vs**
  All **<p>** elements *and* all elements with the **abc** class

Combining selectors

You can combine selectors:

```
#main li.important strong {
  color: red;
}
```

Q: What does this select?

Grouping selectors

Q: What does this select?

```
#main li.important strong {
  color: red;
}
```

A: Read from right to left:

- `<strong>` tags that are children of `<li>` tags that have an "`important`" class that are children of the element with the "`main`" id.

Colliding styles

When styles collide, the most specific rule wins (specificity)

```
div strong { color: red; }
strong { color: blue; }

<div>
   <strong>What color am I?</strong>
</div>
```

Colliding styles

When styles collide, the most specific rule wins (specificity)

```
div strong { color: red; }
strong { color: blue; }

<div>
   <strong>What color am I?</strong>
</div>
```

Colliding styles

Specificity precedence rules (details):

- `ids` are more specific than `classes`
- `classes` are more specific than element names
- Style rules that directly target elements are more specific than style rules that are inherited

Colliding styles

- If elements have the same specificity, the later rule wins.

```
strong { color: red; }
strong { color: blue; }

<div>
   <strong>What color am I?</strong>
</div>
```

Aside: The process of figuring out what rule applies to a given element is called the cascade. This is where the "C" in *Cascading* Style Sheets comes from.

Inheritance

We saw earlier that CSS styles are inherited from parent to child.

Instead of selecting all elements individually:

```
a, h1, p, strong {
  font-family: Helvetica;
}
```

You can style the parent and the children will inherit the styles.

```
body {
  font-family: Helvetica;
}
```

You can override this style via specificity:

```
h1, h2 {
  font-family: Consolas;
}
```

Inheritance

While many CSS styles are inherited from parent to child, **not all CSS properties are inherited**.

```
a {
  display: block;
  font-family: Arial;
}
```

```
<a href="/home">
  Back to <em>Home</em>
</a>
```

`<em>` inherits the `font-family` property, but not `display:`

Back to *Home*

Inheritance

While many CSS styles are inherited from parent to child, **not all CSS properties are inherited**.

- There's no rule for what properties are inherited or not; the inheritance behavior defined in the CSS spec.
- You can look it up via MDN, e.g.
  `font-family`: Inherited yes
  `display`: Inherited no
- Generally text-related properties are inherited and layout-related properties are not.
- (You can also change this via the `inherit` CSS property, which is somewhat esoteric and not often use)

<a> colors?

Hmm, MDN says color is inherited… but if I set the body `color` to `deeppink`, links don't change color:

CSS

```
body {
  color: deeppink;
  font-family: Helvetica;
}
```

HTML

```
<h1>Chocolate</h1>
<p>
  <a href="https://www.ghirardelli.com/">Ghiradelli</a>
  is not overrated
</p>
```

<a> inherits font-family...

Why doesn't <a> inherit color?

(Codepen)

User agent styles

This is because the browser has its own default styles:

- Browser loads its own default stylesheet on every webpage
- Not governed by spec, but there are recommendations

```
<!DOCTYPE html>
<html>
  <head>
    <title>CS 193X</title>
    <!--
      NOT TOTALLY ACCURATE: This isn't actually injected
      in the HTML, but it is loaded silently!
    -->
    <link rel="stylesheet" href="user-agent-style.css" />
  </head>
```

<a> colors?

So to style <a> links, we have to override the browser default link style by explicitly setting a color:

CSS

```
body {
  color: deeppink;
  font-family: Helvetica;
}

a {
  color: deeppink;
}
```

HTML

```
<h1>Chocolate</h1>
<p>
  <a href="https://www.ghirardelli.com/">Ghiradelli</a>
  is not overrated
</p>
```

Chocolate

Ghiradelli is not overrated

Link-related CSS

Since we're on the topic of links:

- How do we style **visited** links differently from **unvisited**?

CSS pseudo-classes

pseudo-classes: special keywords you can append to selectors, specifying a *state* or *property* of the selector

Syntax	Explanation
a	All anchor tags (links) in all states
a:visited	A visited link
a:link	An unvisited link
a:hover	The style when you hover over a link
a:active	The style when you have "activated" a link (downclick)

There are more **pseudo-classes** than this; have a look!

Before we move on:
A few style notes

Why not `<div>` everywhere?

Technically, you can define your entire web page using `<div>` and the `class` attribute.

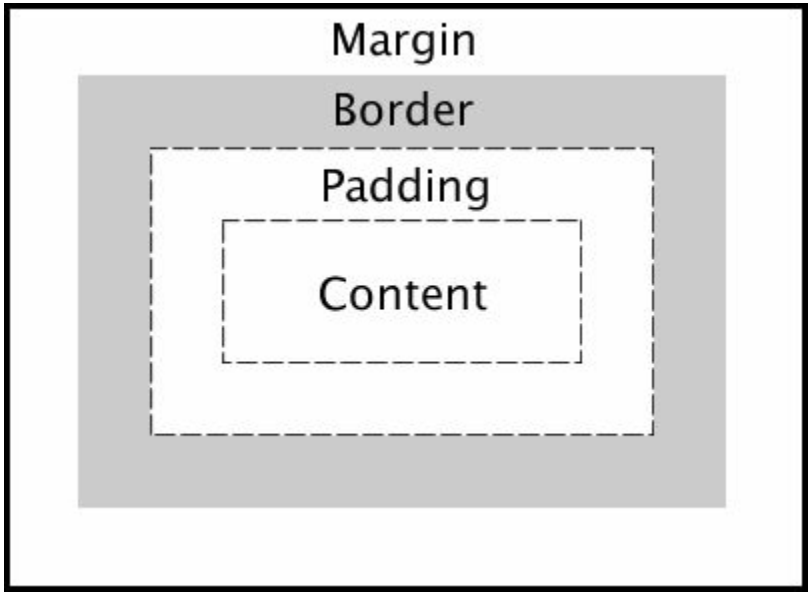
- Is this a good idea?
- Why does HTML have `ids` when you have `classes`?
- Why does HTML have `<p>`, `<h1>`, `<strong>`, etc. when you have `<div>`, `<span>`, `class`, and `id`?

CSS Box Model

The CSS Box Model

Every element is composed of 4 layers:

- the element's content
- the **border** around the element's content
- **padding** space between the content and border (inside)
- a **margin** clears the area around border (outside)



border

HTML

```
<p>
  Welcome to CS193X: Web Programmi
  In this class, you will learn mod
</p>
```

CSS

```
p {
  border: 2px solid black;
}
```

Welcome to CS193X: Web Programming Fundamentals! In this class, you will learn modern full-stack web development techniques.

We've used the shorthand:

`border:` *width style color* `;`

border

Can also specify each border individually:

```
border-top
border-bottom
border-left
border-right
```

And can set each property individually:

```
border-style: dotted;
border-width: 3px;
border-color: purple;
```

(all styles)

border

Can also specify each border individually:

```
border-top
border-bottom
border-left
border-right
```

And can set each property individually:

```
border-style: dotted;
border-width: 3px;
border-color: purple;
```

(all styles)

There are other units besides pixels (px) but we will address them in the next couple lectures.

Rounded border

Can specify the `border-radius` to make rounded corners:

```
border-radius: 10px;
```

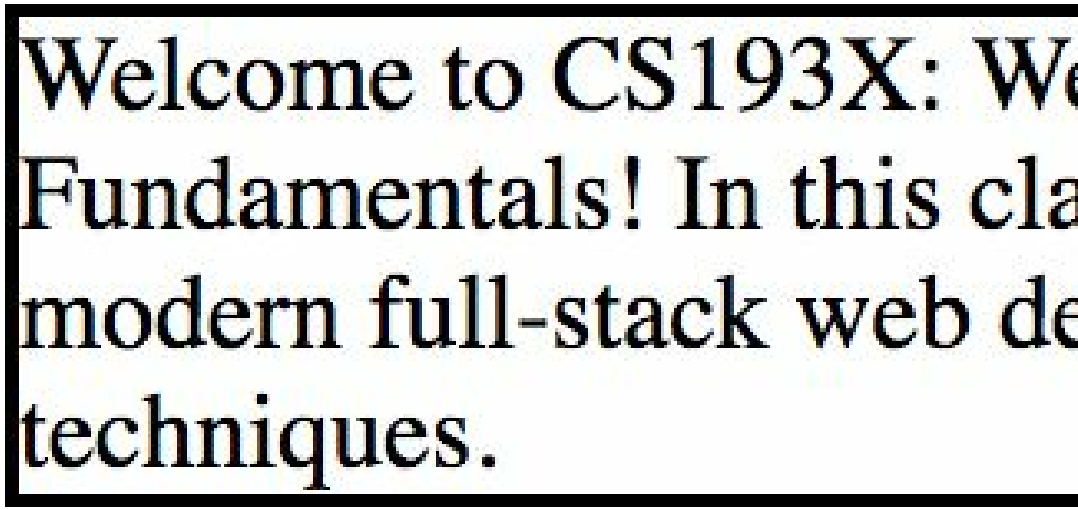
You don't actually need to set a border to use border-radius.

```
p {
  background-color: purple;
  border-radius: 10px;
  color: white;
}
```

Welcome to CS193X: Web Programming Fundamentals! In this class, you will learn modern full-stack web development techniques.

Borders look a little squished

When we add a border to an element, it sits flush against the text:



Q: How do we add space between the border and the content of the element?

padding

```
p {
  border: 2px solid black;
  padding: 10px;
}
```

Welcome to CS193X: Web Programming Fundamentals! In this class, you will learn modern full-stack web development techniques.

`padding` is the space between the border and the content.

- Can specify `padding-top`, `padding-bottom`, `padding-left`, `padding-right`
- There's also a shorthand:

  `padding: 2px 4px 3px 1px;` <- top|right|bottom|left

  `padding: 10px 2px;` <- top+bottom|left+righ

`<div>`s look a little squished

When we add a border to multiple divs, they sit flush against each other:

HTML

```
<div>
  Lectures
</div>
<div>
  Homework
</div>
```

CSS

```
div {
  border: 2px solid black;
  padding: 10px;
}
```

Q: How do we add space between multiple elements?

Lectures

Homework

margin

```
div {
  margin: 20px;
  padding: 10px;
  border: 2px solid black;
}
```

Lectures

Homework

`margin` is the space between the border and other elements.

- Can specify `margin-top`, `margin-bottom`, `margin-left`, `margin-right`
- There's also a shorthand:

  `margin: 2px 4px 3px 1px;` <- top|right|bottom|left

  `margin: 10px 2px;` <- top+bottom|left+right

More box model:
Next time!