# Web Dev Basics 3

## CS571: Building User Interfaces

Cole Nelson

# Before Lecture

- Clone today's code to your machine.

# Learning Objectives

1. Understand the difference between imperative and declarative programming.
2. Be able to use declarative functions such as `map`, `filter`, `reduce`, ...
3. Know of other JavaScript syntactic sugars.
4. Be able to work with CSS libraries.

# Declarative vs Imperative Programming

We typically prefer *declarative* (what) programming over *imperative* (how) programming.

Declarative array functions include `filter`, `map`, `some`, `every`, and `reduce`.

These take a *callback function* as an argument.

# Warmup Problem

Given the following array, narrow the elements down such that we only keep elements that are numbers.

```
const things = ["dogs", 1.2, 0, false, {name: "Alice"}, -7]
```

Can you do this *imperatively*? Use `for (... of ...)`

Can you do this *declaratively*? Use `filter`

# Solution

Done *imperatively*... (how)

```
const newThings = [];
for(let thing of things) {
  if (typeof thing === 'number') {
    newThings.push(thing);
  }
}
```

Done *declaratively*... (what)

```
const newThings = things.filter((thing) => typeof thing === 'number')
```

StackBlitz

# `filter`

`filter` performs a function on each element of an array and *returns* an array of those elements whose function call returned true.

```
const shortNames = ["Bessy", "Rob", "Bartholomew"].filter(name => {
  if (name.length <= 5) {
    return true;
  } else {
    return false;
  }
});
console.log(shortNames);
```

StackBlitz

# `filter`

Using *implicit* returns, this simplifies to...

```
const shortNames = ["Bessy", "Rob", "Bartholomew"].filter(name => name.length <= 5);
const longNames = ["Bessy", "Rob", "Bartholomew"].filter(name => name.length > 5);
console.log(shortNames);
console.log(longNames);
```

StackBlitz

# `map`

`map` performs a function on each element of an array and *returns* an array of the the return of those function calls.

```
const nameLengths = ["Bessy", "Rob", "Bartholomew"].map(n => n.length);
console.log(nameLengths);
```

StackBlitz

# Chaining Declarative Functions

Of those with short names, how many letters are in their name?

```
["Bessy", "Rob", "Bartholomew"]
  .filter(name => name.length <= 5)
  .map(name => name.length);
```

StackBlitz

# Chaining Declarative Functions

Of those with short names, what are their names and do they have a *very* short name?

```
["Bessy", "Rob", "Bartholomew"]
  .filter(n => n.length <= 5)
  .map(n => {
    return {
      name: n,
      isVeryShort: n.length <= 3
    }
  });
```

StackBlitz

# Your Turn!

Let's re-visit last lecture's data and use some of these declarative functions...

1. Can you `filter` to only show the 5-star reviews?
2. Can you `map` to only show the text before a ":" in the recipe's instructions?
3. Can you `map` to display the ingredients as a string?
   a. **Hint:** `Object.keys` returns an array!

# `some(cb)` and `every(cb)`

`some(cb)` returns `true` if the callback returns true for *some* element of the array, `false` otherwise.

```
["sam", "jacob", "jess"].some(p => p === "jess"); // true!
```

`every(cb)` returns `true` if the callback returns true for *every* element of the array, `false` otherwise.

```
["sam", "jacob", "jess"].every(p => p === "jess"); // false!
```

# `reduce(cb, start)`

`reduce` takes a 2-parameter callback (previous and current values) and a starting value.

```
[2, 4, -1.1, 7.2].reduce((prev, curr) => prev + curr, 1.2); // 13.3
```

PythonTutor

# Your turn!

Let's re-visit last lecture's data and use some of these declarative functions...

1. Is there `some` instruction to bake?
2. Is `every` review 4 or 5 stars?
3. Using `reduce`, what is the average review rating?

# Syntactic Sugar 

Just some "nice-to-haves"

# ` Template Literals

Shorthand for string concatenation; `${expr}` interpolates a JS expression.

```
const name = "Aven";
const website = "cs571.org";
const dt = new Date().toLocaleTimeString();
console.log("Hello " + name + ", welcome to " + website + "! It is currently " + dt + ".");
console.log(`Hello ${name}, welcome to ${website}! It is currently ${dt}.`);
```

# `?` Ternary Operator

`if`, but shorthand! `expr ? ifTrue : ifFalse`

```
const age = 17;
let msg;
if (age >= 18) {
  msg = "You are old enough to vote";
} else {
  msg = "You are not old enough"
}
```

```
const age = 17;
const msg = age >= 18 ? "You are old enough to vote" : "You are not old enough";
```

# ? Optional Chaining

Useful when you are uncertain if an object has a certain property.

```
const mgmt = { cfg: { options: { src: { port: 3761 } } } }

const port = mgmt?.cfg?.options?.src?.port;
```

Otherwise we would have to...

```
let port;
if (mgmt && mgmt.cfg && mgmt.cfg.options && mgmt.cfg.options.src) {
  port = mgmt.cfg.options.src.port;
}
```

# `??` Null Coalescing Operator

If left-hand is `null` or `undefined`, use right-hand.

```
const IS_ENABLED = env.IS_ENABLED ?? true;

const USERNAME = document.getElementById("username").value ?? "";
```

How does this compare to ternary?

```
const IS_ENABLED = env.IS_ENABLED ? env.IS_ENABLED : true; // always true!
```

Try it on MDN

# `...` Spread Operator

Used to create something new with existing data.

We can spread arrays...

```
const cats = ["apricat", "barnaby", "bucky", "colby"];

const newCats = [...cats, "darcy"];
```

# `...` Spread Operator

```
const defs = {
  erf: "a plot of land",
  popple: "turbulent seas"
}

const newDefs = {
  ...defs,
  futz: "waste of time"
}
```

... and also objects! These are both *shallow* copies.

# Copying

```
let myComplexObj = {name: "Cole", pets: ["pepper", "spud"]};

let refCopy = myComplexObj;              // not really a copy at all!
let shallowCopy = {...myComplexObj};     // nested attributes not copied
let deepCopy = JSON.parse(JSON.stringify(myComplexObj)); // full copy!
```

Interactive Example - Reference Copy

Interactive Example - Shallow Copy

Interactive Example - Deep Copy

# Note: JavaScript changes quickly!

Both `...` and `??` are not yet supported by the interactive example tool!

# Working with CSS Libraries

# What are CSS Libraries?

**Definition:** Software libraries that abstract away the low-level CSS implementation of user-facing elements.

Some popular libraries include...

- Bootstrap
- Foundation
- Semantic UI
- Pure
- UIkit

# Bootstrap

getbootstrap.com

# Why does the web look alike?

Many, many, many (new) websites use Bootstrap!
CS571 being one of them.

**Bootstrap:** get (oneself or something) into or out of a situation using existing resources.

Oxford Dictionary

# How Bootstrap Works

Bootstrap provides us with...

- Layouts
- Content
- Components
- Utilities

There is much more!

# Bootstrap Categories: Layouts

**Containers** are the most basic element of layouts.

```
<div class="container">
  ...
</div>
```

```
<div class="container-fluid">
  ...
</div>
```

# Grids

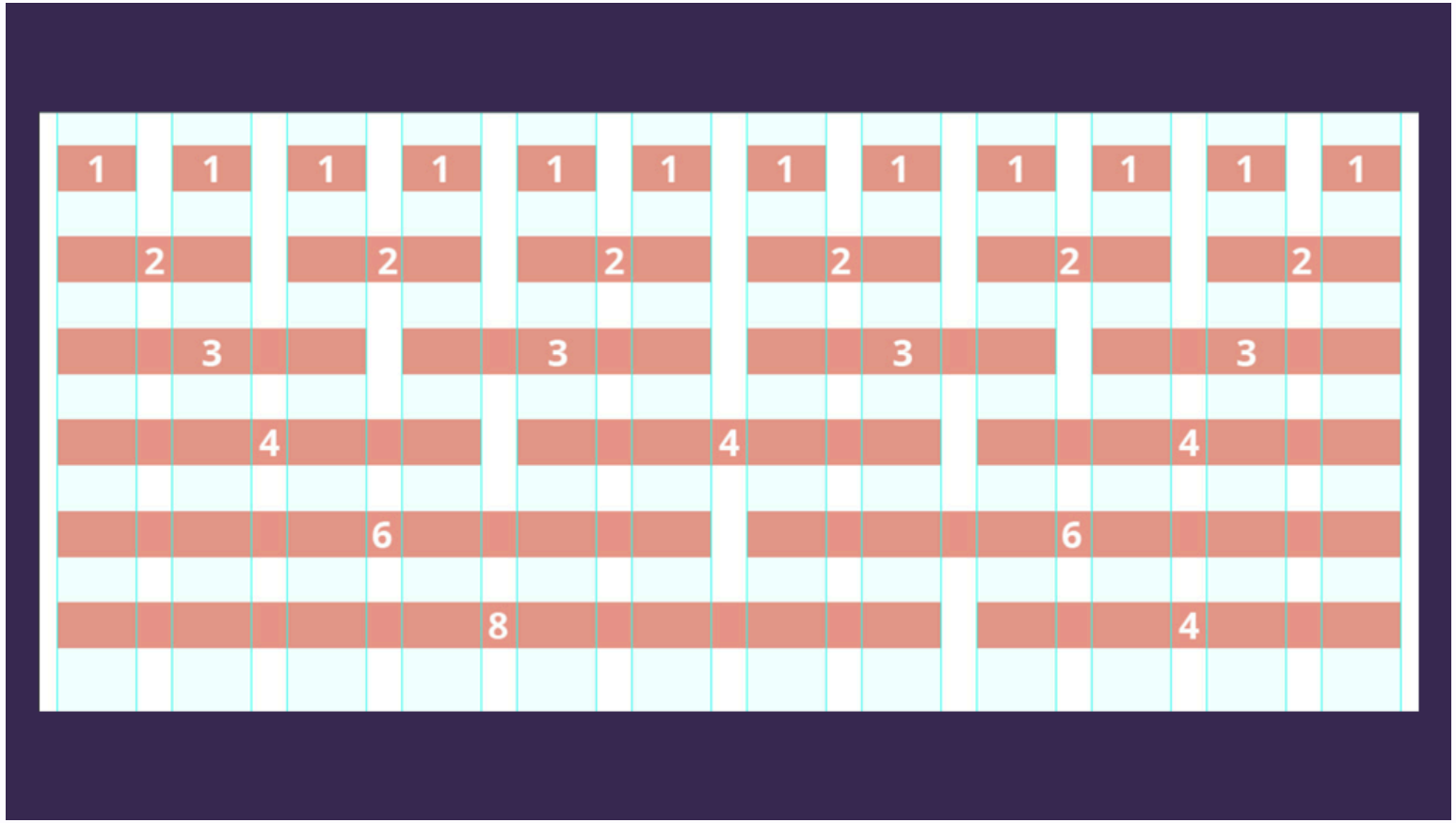
Often, containers will contain **rows** and **columns** to form a grid...

```
<div class="container">
  <div class="row">
    <div class="col-*"></div>
    <div class="col-*"></div>
  </div>
</div>
```

Where `*` is the *column span*.

StackBlitz

# Grid System




Medium

# Responsive Design

**Definition:** Responsive design adapts content to a variety of devices and screen sizes.

Width breakpoints determine whether the design will scale or be reorganized.

InVision

# Responsive Design

What if we want our webpage to respond to different screen sizes, e.g. phone, tablet, and monitor?

```
<div class="container">
  <div class="row">
    <div class="col-12 col-md-6 col-lg-3"></div>
    <div class="col-12 col-md-6 col-lg-3"></div>
    <div class="col-12 col-md-6 col-lg-3"></div>
    <div class="col-12 col-md-6 col-lg-3"></div>
  </div>
</div>
```

Responsive Design Example

| | Extra small<br><576px | Small<br>≥576px | Medium<br>≥768px | Large<br>≥992px | Extra large<br>≥1200px |
|---|---|---|---|---|---|
| **Max container width** | None (auto) | 540px | 720px | 960px | 1140px |
| **Class prefix** | `.col-` | `.col-sm-` | `.col-md-` | `.col-lg-` | `.col-xl-` |
| **# of columns** | 12 | | | | |
| **Gutter width** | 30px (15px on each side of a column) | | | | |
| **Nestable** | Yes | | | | |
| **Column ordering** | Yes | | | | |

# Bootstrap Categories: Content

Content styling includes basic HTML elements, typography, code, images, tables, figures.

Basic HTML examples:

```
<h1></h1>
<ul></ul>
<input/>
<button></button>
```

These will get the default Bootstrap styling.

# Styling of other elements

```
<img src="..." class="img-fluid">
```

```
<table class="table">
  <thead class="thead-dark">
    <tr>
      <th scope="col">...</th>
      ...
```

```
<div class="table-responsive-sm">
  <table class="table">
  ...
```

# Bootstrap Categories: Components

Components include all other visual/interactive elements that make up the design, e.g., buttons, forms, navbar, tooltips, etc.

```
<button type="button" class="btn btn-primary">Fill button</button>

<button type="button" class="btn btn-outline-primary">Outline button</button>

<div class="btn-group-toggle" data-toggle="buttons">
  <label class="btn btn-secondary active">
    <input type="checkbox" checked autocomplete="off"> Switch
  </label>
</div>
```

# Bootstrap Categories: Utilities

Utilities are not elements themselves, but they modify/control other elements, e.g., adding rounded corners to an image.

```
<img src="..." class="rounded">
```

```
<div class="shadow p-3 mb-5 bg-white rounded">Shadow</div>
```

# Your Turn!

Use Bootstrap to make your recipes *responsive*.

# Example Home Page

See in CodePen

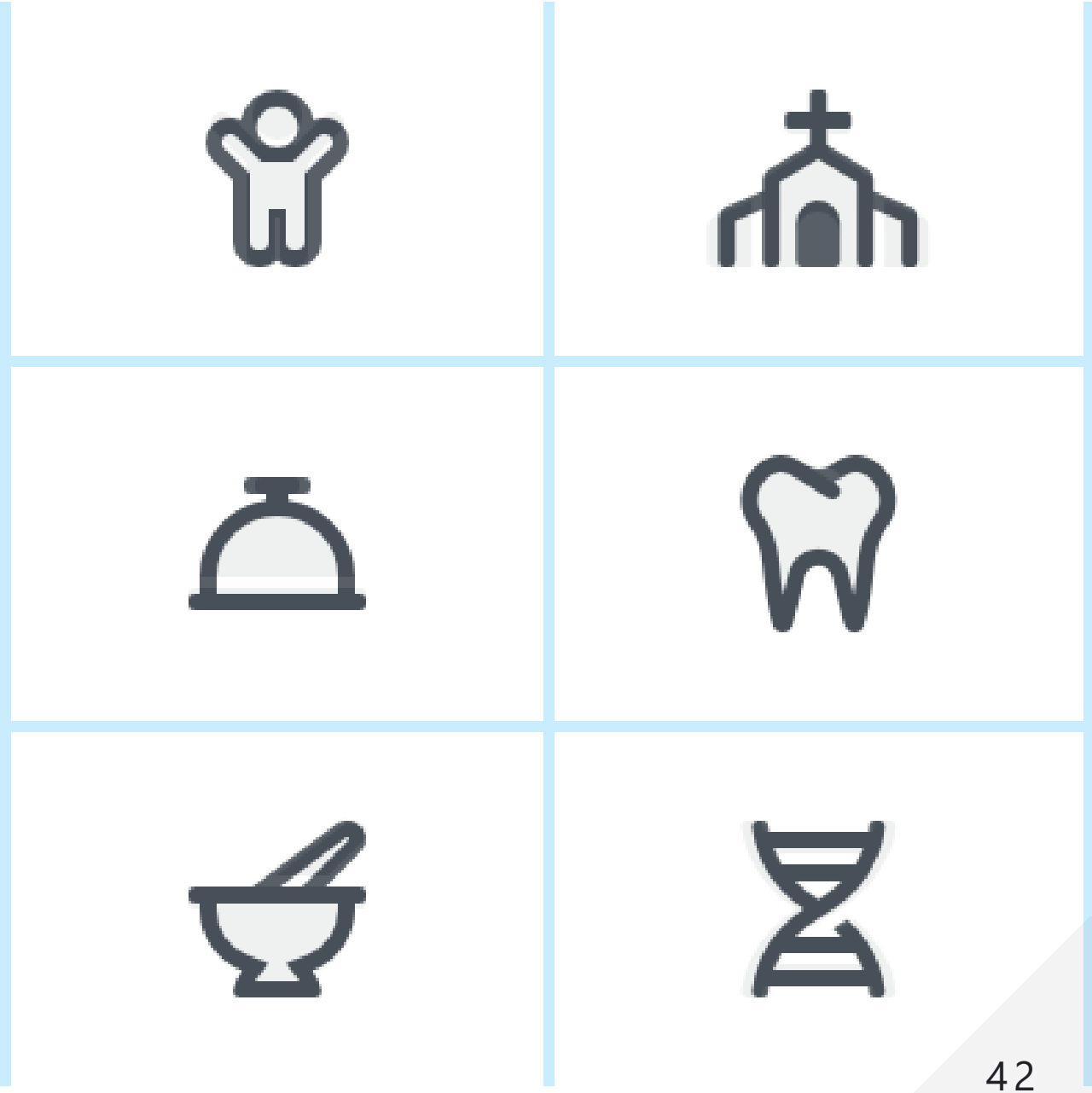
Also, see cs571.org for responsive design.

# Assets

Asset libraries, e.g., icons, are usually used in conjunction with frameworks such as Bootstrap.

See icon libraries.

Image Source



# Questions?