TODO:
- React documentation (not the React tutorial)
    - Apparently the React tutorial is “not very good”
- FCC (close)
- University of Helsinki’s Full Stack Open course

Introduction

ReactJs is:
- an open source JavaScript “view library” for creating user interfaces.
- It was created and maintained by Facebook.
- It lets you write readable HTML directly within JavaScript.

React - Set Up

React uses its own markup language 'JSX' (a “syntax extension to JavaScript”)

JSX code must be compiled into vanilla JavaScript using a 'transpiler' like Babel.

To use React in your page you have two options:

1. you can just use completely JavaScript syntax in a .js file (natively supported/understood by the browser) plus cdns for React - but the syntax is more complex/harder (writing React as "pure JavaScript" without using JSX). No one with a sound mind would actually do this.

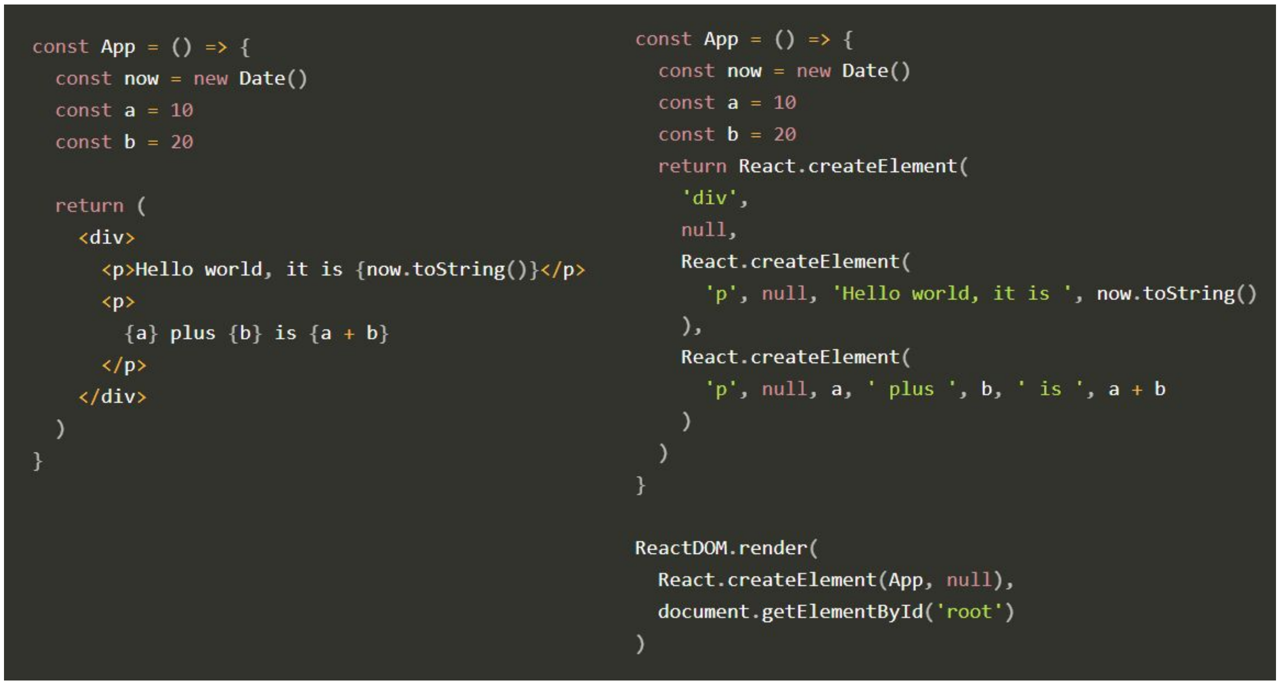
2. Or equivalently, you can use "JSX" code (an actual *syntax extension* to javascript) which is neater/cleaner but requires a transpiler.

For a quick cdn, use:
`<script src="https://unpkg.com/babel-standalone@6/babel.min.js"></script>` and add `type = "text/babel"` to any script tag you want to use JSX in. However, this is slow

Faster/more complicated method is to download (with npm) a preprocessor that will convert your file to plain js.

Follow this

Remember - You need CDNs for React as well as for the transpiler! There are three in total!



```
const App = () => {
  const now = new Date()
  const a = 10
  const b = 20

  return (
    <div>
      <p>Hello world, it is {now.toString()}</p>
      <p>
        {a} plus {b} is {a + b}
      </p>
    </div>
  )
}
```

```
const App = () => {
  const now = new Date()
  const a = 10
  const b = 20
  return React.createElement(
    'div',
    null,
    React.createElement(
      'p', null, 'Hello world, it is ', now.toString()
    ),
    React.createElement(
      'p', null, a, ' plus ', b, ' is ', a + b
    )
  )
}

ReactDOM.render(
  React.createElement(App, null),
  document.getElementById('root')
)
```

Full Stack Open 2019 Method

https://create-react-app.dev/

- Tool is called create-react-app
- Installed in cmd (with npm and node.js already installed) with:

  `npm install create-react-app`

- To create an application:

```
$ npx create-react-app part1
$ cd part1
```

- To run the application

```
$ npm start
```

- By default, the application runs in localhost port 3000 with the address http://localhost:3000
- Configured to compile with Babel automatically

NB: if you have cloned a create-react-app project from GitHub, you have to run the `npm install` command before starting the application with `npm start` (destroy the node_modules directory and install the dependencies again)

For React to run, you always have to import:

```
import React from 'react'
import ReactDOM from 'react-dom'
```

Commenting

To add comments use `{/*  */}`

To write vanilla JavaScript within JSX use curly brackets:

```
          { //blah blah blah this is some JavaScript }
```

React Elements

To create a React element:

```
const bro = <div> Hello World! </div>

const bro = (
    <div>
```

```
        <h1>This is a block of JSX</h1>
        <p>Here's a subtitle</p>
    </div>
);
//best practice to use parentheses
```

You cannot use "class" to define HTML classes in JSX (class is a reserved for object constructor functions in JavaScript). Use `className` instead (remember camelCase for everything)

```
const bro = (
    <div className = 'myDiv'>
        <h1>Add a class to this div</h1>
    </div>
);
```

In JSX, every tag can be self closing i.e. instead of `<div> </div>` you can just use `<div />`

Every tag needs to be closed, including `<br />`

These are simple React elements representing HTML tags. *You can also create React elements representing user-defined components (below).*

Rendering to HTML DOM

You need to render your JSX to the HTML DOM using React's rendering API - ReactDOM. ⇒ It is an object containing a `.render()` method you can use to render React elements to the DOM like this:
`ReactDOM.render(componentToRender, targetNode)`.

`componentToRender` = React element you want to render, `targetNode` = DOM node that you want to render the component to.

The render must be declared after the JSX element declarations (like how you must declare variables before you use them)!

```
const bro = (
    <div>
        <h1>Hello World</h1>
        <p>Lets render this to the DOM</p>
    </div>

ReactDOM.render(bro, document.getElementById('target'));
```

Remember: You have to re-render every time you want the UI to update.

```
const App = (props) => {
  const { counter } = props
  return (
    <div>{counter}</div>
  )
}

let counter = 1

const refresh = () => {
  ReactDOM.render(<App counter={counter} />,
  document.getElementById('root'))
}

refresh()
counter += 1
refresh()
counter += 1
refresh()
```

If you want to set a delay between each call to the ReactDOM.render-method, use `setInterval(function, delay)`

```
setInterval(() => {
  refresh()
  counter += 1
}, 1000)
```

This is not a good way to re-render components (better way is to use state).

React Components

React 'components' are (conceptually) like JS functions → they accept inputs (called "props") and return React elements (determining what is shown on the screen). By using components, you “split the UI” into independent, reusable pieces.

There are two ways to create a React component.

1) use a JavaScript function ⇒ creates a stateless 'functional' component.
We call these “function” components, because they are literally JavaScript functions.
'Stateless' because it can receive data and render it, but does not manage or track changes to that data (can’t add state).

```
function Welcome(props) {
  return <h1>Hello, {props.name}</h1>;
}


const DemoComponent = function() {
    return (
        <div className='customClass' />
    );
};
```

2) Using the ES6 class syntax (for object constructor functions) to define a component:

```
class Welcome extends React.Component {
  render() {
    return <h1>Hello, {this.props.name}</h1>;
  }
```

```
}


class Kitten extends React.Component {
  constructor(props) {
    super(props);

  render() {
    return (
      <h1>Hi</h1>
    );
  }
}
```

Class constructor calls super(), which calls the constructor of the parent class (React.Component). (Constructor is a special method called during the initialisation of objects created using class). Best practice is to call a component's constructor with super, and pass props to both. (This makes sure the component is initialized properly).

React elements can also represent user-defined components:

```
const element = <div />;
const element = <Welcome name="Sara" />;
```

When React sees an element representing a user-defined component, it passes JSX attributes to this component as a single object. We call this object "props".

```
function Welcome(props) {
    return <h1>Hello, {props.name}</h1>;
}

const element = <Welcome name="Sara" />;

ReactDOM.render(
  element,
  document.getElementById('root')
);
```

You can render dynamic content inside a component:

```
const App = () => {
  const now = new Date()
  const a = 10
  const b = 20

  return (
    <div>
      <p>Hello world, it is {now.toString()}</p>
      <p>
        {a} plus {b} is {a + b}
      </p>
    </div>
  )
}
```

Remember: functions in React must begin with a capital!
Remember: a React component must return only one root element! ("a root element is stipulated") (e.g. wrapped inside a <div/>),

or an array of components!

```
const App = () => {
  return [
    <h1>Greetings</h1>,
    <Hello name="Maya" age={26 + 10} />,
    <Footer />
  ]
}
```

You can avoid having pointless extra "<div> </div>"s in the DOM tree by wrapping with fragments (empty elements) instead:

```
const App = () => {
  const name = 'Peter'
  const age = 10

  return (
    <>
      <h1>Greetings</h1>
      <Hello name="Maya" age={26 + 10} />
      <Hello name={name} age={age} />
      <Footer />
    </>
  )
}
```

Component composition/Multiple components

A component (*parent*) can render other components as *children*

```
const ChildComponent = () => {
  return (
    <div>
      <p>I am the child</p>
    </div>
  );
};

class ParentComponent extends React.Component {
  constructor(props) {
    super(props);
  }
  render() {
    return (
      <div>
        <h1>I am the parent</h1>
        <ChildComponent />
      </div>
    );
```

```
   }
 };
```

You can use a component multiple times! Here we’re defining a component “Hello” and using it inside another component “App”:

```
const Hello = () => {
 return (
   <div>
     <p>Hello world</p>
   </div>
 )
}

const App = () => {
  return (
    <div>
      <h1>Greetings</h1>
     <Hello />
     <Hello />
     <Hello />
   </div>
  )
}

ReactDOM.render(<App />, document.getElementById('root'))
```

To render React components to the DOM (by making a call to the ReactDOM API) - create a React element representing the component

```
let my-element = < component-name />;
ReactDOM.render(element, document.getElementById("target"));
```

or just go

```
ReactDOM.render(< component-name />, document.getElementById("target"))
```

Composing complex applications is kept manageable by using many specialized reusable components (the core philosophy of React).

By convention: the root component at the top of the component tree of the application is called *App*.

Props

You can pass data to components using “props”.

You simply give the function defining the component a parameter/argument that represents the “props” object. (it’s standard practice to call the object itself “props”).

```
const Hello = (props) => {
 return (
     <div>
     <p>Hello {props.name}</p>
    </div>
   )
}
```

The function (defining the component) receives an object which has fields containing all the props the user of the component defines WHEN THE COMPONENT IS USED!

For example:

```
const Hello = (props) => {
  return (
    <div>
      <p>
       Hello {props.name}, you are {props.age} years old
     </p>
    </div>
  )
}

const App = () => {
 const name = 'Peter'
 const age = 10

  return (
    <div>
      <h1>Greetings</h1>
      <Hello name="Maya" age={26 + 10} />
      <Hello name={name} age={age} />
   </div>
  )
}
```

Another example:

```
 const Welcome = (props) => <h1>Hello, {props.user}!</h1>

 const App = () => {

   return (
     <div>
       <Welcome user = 'Mark' />
    </div>
   )
 }
```

Like any argument, you can modify the “props” object’s values however you like (e.g. calling array methods like `.join()` for example)

```
 const List = (props) => {
   return <p>{props.tasks.join(", ")}</p>
 };

 class ToDo extends React.Component {
   constructor(props) {
     super(props);
   }
   render() {
     return (
       <div>
         <h1>To Do Lists</h1>
         <h2>Today</h2>
         <List tasks = {["join the gym", "join the army", "go to
 dinner"]}/>
         <h2>Tomorrow</h2>
         <List tasks = {["walk dog", "wonder about life", "do a
 pullup"]}/>
       </div>
     );
   }
 };
```

You can use ES6’s destructuring assignment on the props object:

```
const Hello = ({ name, age }) => {
   return (
    <div>
      <p>
        Hello {name}, you are {age} years old
      </p>
    </div>
  )
}
```

To pass props to an ES6 class component: use the this keyword to refer to the class component itself within itself, to access props use this.props.propName.

```
class ReturnTempPassword extends React.Component {
  constructor(props) {
    super(props);
  }

  render() {
    return (
        <div>
            <p>Your temporary password is:
>strong>{this.props.tempPassword}</p>
        </div>
    );
  }
};

class ResetPassword extends React.Component {
  constructor(props) {
    super(props);

  }
  render() {
    return (
        <div>
          <h2>Reset Password</h2>
          <h3>We've generated a new temporary password for you.</h3>
          >h3>Please reset this password from your account settings
ASAP.</h3>
          <ReturnTempPassword tempPassword = "mypassword" />
        </div>
    );
  }
};
```

Class components should always call the base constructor with props. Pass props to the base constructor. Best practice is to call the parent class React.component's constructor method with super (inside the component's own constructor method), and pass props to both (as mentioned before).

Default props

You can use default props (only assigned "if necessary" i.e. you haven't manually set it when the component is called) by accessing the component's defaultProps property (which is itself an object) e.g.

```
const ShoppingCart = (props) => {
   return (
     <div>
       <h1>Shopping Cart Component</h1>
     </div>
   )
 };

ShoppingCart.defaultProps = {items: 0};
```

propTypes

To specify that a component should only receive props' objects properties/methods of a particular type, you have to import PropTypes, and modify the component's proptypes attribute.

(remember, .propTypes property has a lowercase 'p', PropTypes...isRequired has an uppercase 'P')

```
import React, { PropTypes } from 'react';

const ShoppingCart = (props) => {
      return (
        <div>
          <h1>Shopping Cart Component</h1>
        </div>
      )
```

```
    };

ShoppingCart.proptypes = {handleclick: PropTypes.func.isRequired,
free: PropTypes.bool.isRequired};
```

State

State is any information your component needs to know (like props except private and fully controlled by the component), that can change over time.

- Apps should respond to changes in state and present an updated UI ("state management").
- State allows you to track important data in your app and render a UI in response to changes in data.

- State is ‘local’ or ‘encapsulated’ → it is not accessible to any component other than the one that owns and sets it

A *stateless component* does not use internal state, a *stateful* component maintains its own internal state.

To give a React component state

- You have to use ES6 class syntax to define the component
- Declare a state 'property' in the class' constructor function
- when the class is called to create an object - 'initialising the component' - it will be created with a state property (obviously)

The state object must be set as = a javascript object (object literal) , like this:

```
class StatefulComponent extends React.Component {
  constructor(props) {
    super(props);
    this.state = {
      name: "John"
    };
  }
  render() {
    return (
      <div>
        <h1>{this.state.name}</h1>
      </div>
    );
  }
};
```

React uses a Virtual DOM to track changes behind the scenes. When state data updates, it triggers a re-render of components using that data.

In the render method, before the return statement, you can write any javascript you want, i.e. declare a function, alter the data in state or props, assign data to variables, which you have access to in the return statement.

```
class MyComponent extends React.Component {
    constructor(props) {
        super(props);
        this.state = {
            name: 'freeCodeCamp'
        }
    }
    render() {
        const name = this.state.name;
        return (
            <div>
            <h1>{name}</h1>
            <div>
    );
    }
};
```

An example using state:

```
class Clock extends React.Component {
 constructor(props) {
   super(props);
   this.state = {date: new Date()};
 }


  render() {
    return (
      <div>
        <h1>Hello, world!</h1>
        <h2>It is {this.state.date.toLocaleTimeString()}.</h2>
     </div>
    );
  }
}

ReactDOM.render(
 <Clock />,
 document.getElementById('root')
);
```

You want to make your component fully encapsulated and reusable.

Do not/NEVER modify state directly after it has been declared (it will not re-render the component), instead use `this.setState({})` elsewhere inside the class.
The only place where you assign `this.state` is in the class constructor.
setState takes an object literal as an argument (you can assign new properties however you like).
Never mutate this.state directly, as calling setState() afterwards may replace the mutation you made. Treat this.state as if it were immutable
this.setState does a shallow merge → as in when you update on property in state the other properties remain the same

```
// Wrong
this.state.comment = 'Hello';
// Correct
```

```
this.setState({comment: 'Hello'});
```

State updates may be asynchronous/ this.props and this.state may be updated asynchronously (React may bundle together multiple this.setState() calls for efficiency) - so DO NOT rely on their values for calculating the next state. Instead pass setState() a callback function that receives the previous state as the first argument, and props (at the time the update is applied) as the second argument and returns the object that you'd normally pass into setState by itself.

CONFUSINGLY: if you want to use a single-line arrow function (with just a return line), you cannot have a single line arrow function returning just an object literal because an object also uses curly brackets (like an arrow function pointing towards a normal function would). So just slap some round brackets around the object literal and you can use a single return line.

```
// Wrong
this.setState({
  counter: this.state.counter + this.props.increment,
});

// Correct
this.setState(function (state, props) {
  return {counter: state.counter + props.increment}
});

this.setState((state, props) => {
  return {counter: state.counter + props.increment}
});

this.setState((state, props) => ({
  counter: state.counter + props.increment
}));
```

Adding lifecycle methods to a class

Lifecycle methods (or lifecycle hooks) are several special methods for React components that provide opportunities to perform actions at specific points in the "lifecycle" of the component.

- before they render
- before they update

- before they receive a list of props
- before they unmount etc

`componentWillMount()` `componentDidMount()` `shouldComponentUpdate()` `componentDidUpdate()` `componentWillUnmount()`

The componentWillMount() method is called before the render() method when a component is being mounted to the DOM. → will be deprecated and removed soon.

Set up - when the clock is rendered to the DOM ("mounting")
Clear - when the DOM produced by the component is removed ("unmounting")

Declare special methods on the component class to run code when the component mounts and unmounts = these methods are called "lifecycle methods" (the lifecycle of the component).

```
class Clock extends React.Component {
  constructor(props) {
    super(props);
    this.state = {date: new Date()};
  }


 componentDidMount() {

 }



 componentWillUnmount() {
 }


  render() {
    return (
      <div>
        <h1>Hello, world!</h1>
        <h2>It is {this.state.date.toLocaleTimeString()}.</h2>
      </div>
    );
  }
}
```

componentDidMount() method runs AFTER the component has been rendered/mounted to the DOM,

- best practice is to place API calls or any calls to your server in the lifecycle method componentDidMount()
- any calls of setState() here will trigger a re-rendering of your component

componentWillUnmount() method runs when the component is removed from the DOM.

```
class Clock extends React.Component {
  constructor(props) {
    super(props);
    this.state = {date: new Date()};
  }

  componentDidMount() {
    this.timerID = setInterval(
      () => this.tick(),
      1000
    );
  }

  componentWillUnmount() {
    clearInterval(this.timerID);
  }


 tick() {
   this.setState({
     date: new Date()
   });
 }
```

```
  render() {
    return (
      <div>
        <h1>Hello, world!</h1>
        <h2>It is {this.state.date.toLocaleTimeString()}.</h2>
      </div>
    );
  }
}

ReactDOM.render(
  <Clock />,
  document.getElementById('root')
);
```

- When the component is used/rendered (a new instance of Clock), when the component is inserted into the DOM componentDidMount() is called
- It gives the component an attribute called "timerID" - an Interval
    - Other than this.props and this.state (which are reserved/have special meanings), you are free to add any additional fields to the class (this) you want
- The timerID setInterval() calls the tick() method every second
- The tick method just updates the component's state!! It uses this.setState() rather than modifying the state object directly! This is what you're supposed to do!
- tick() sets the state's date property to = a new Date object (representing the exact time and date when the Date class is called) every time it is called, as in will be a second later each time

The componentDidMount() method is the best place for event listeners!!!

React has a 'synthetic' event system → wraps the browsers 'native' event system
(e.g. synthetic event handlers like onClick())

can't use the synthetic event system if you want to attach handlers/listeners to the document/window objects

```
class MyComponent extends React.Component {
  constructor(props) {
    super(props);
    this.state = {
      message: ''
    };
    this.handleEnter = this.handleEnter.bind(this);
    this.handleKeyPress = this.handleKeyPress.bind(this);
  }
  componentDidMount() {
    document.addEventListener('keypress', this.handleKeyPress);
  }
  componentWillUnmount() {
    document.removeEventListener('keypress', this.handleKeyPress);
  }
  handleEnter() {
    this.setState({
      message: this.state.message + 'You pressed the enter key! '
    });
  }
  handleKeyPress(event) {
    if (event.keyCode === 13) {
      this.handleEnter();
    }
  }
  render() {
    return (
      <div>
        <h1>{this.state.message}</h1>
      </div>
    );
  }
};
```

Optimise re-renders (lifecycle hook)

Default behaviour: If any component receives new state or props it re-renders itself and all of its children (even if props hasn't changed)

shouldComponentUpdate() = a lifecycle method you can use to declare specifically if the component should update or not

- takes nextState and nextProps parameters
- must return a Boolean to tell React whether or not to update the component

- can compare current props (this.props) to the next props (nextProps) and return true or false

Don't need to bind shouldComponentUpdate() because we're not going to use it later with this

```
class OnlyEvens extends React.Component {
  constructor(props) {
    super(props);
  }
  shouldComponentUpdate(nextProps, nextState) {
    console.log('Should I update?');
     if (nextProps.value%2 === 0) {
       return true;
     }
    return false;
  }
  componentDidUpdate() {
    console.log('Component re-rendered.');
  }
  render() {
    return <h1>{this.props.value}</h1>
  }
};

class Controller extends React.Component {
  constructor(props) {
    super(props);
    this.state = {
      value: 0
    };
    this.addValue = this.addValue.bind(this);
  }
  addValue() {
    this.setState({
      value: this.state.value + 1
    });
  }
  render() {
    return (
      <div>
        <button onClick={this.addValue}>Add</button>
        <OnlyEvens value={this.state.value}/>
      </div>
    );
  }
};
```

useState()

React Hooks are a new way to access the core features of React (such as state) without having to use classes.
Part of the newer versions of React, available from 16.8.0 onwards.
Before the addition of hooks, there was no way to add state to functional components.
Components requiring state had to be defined as class components (using JS class syntax).
Functional components are (apparently) the future of React.

useState is one of the built-in react hooks (the state hook)
useState should be used only inside functional components
You should use useState if we need an internal state and don't need to implement more complex logic such as lifecycle methods.

useState(initialState) returns a tuple - a stateful value - we'll call it count (the current state of the counter) and a function to update it - we'll call it setCounter (method that will allow us to update the counter's state). You can use the setCounter method to update the state of count anywhere

Some rules:

- The useState function cannot be called from inside a loop, a conditional expression, or any place that is not inside a functional component

```
import React, { useState } from 'react'
import ReactDOM from 'react-dom'

const App = (props) => {
 const [ counter, setCounter ] = useState(0)

 setTimeout(
   () => setCounter(counter + 1),
   1000
 )

  return (
    <div>{counter}</div>
  )
}
```

```
ReactDOM.render(
  <App />,
  document.getElementById('root')
)
```

- Imports the useState function in the first line
- The function body that defines the component begins with a function call (useState(0))
- The function call adds state to the component
- The function returns two variables as an array
- We assign those two variables to *counter* and *setCounter* using a destructuring assignment
- *counter* is assigned to 0/set to an initial value of 0
- *setCounter* is assigned to a function (that will later be used to modify state)
- The component calls the *setTimeout()* function (just executes that code a second later), which calls a function that increases counter state by 1
- When setCounter (the state-modifying function) is called, React re-renders the component (the body of the component function gets re-executed)
- The process begins again (with counter now being 1)
- The value of the counter state is incremented by 1, which continues for as long as the application is running

You can call the stateful value and the function that modifies it whatever you want:

```
const App = (props) => {
  const [left, setLeft] = useState(0)
  const [right, setRight] = useState(0)

  return (
    <div>
      <div>
        {left}
        <button onClick={() => setLeft(left + 1)}>
          left
        </button>
        <button onClick={() => setRight(right + 1)}>
          right
        </button>
        {right}
      </div>
    </div>
  )
}
```

You can implement the same functionality by saving the click count of both the *left* and *right* buttons into a single object:

```
const App = (props) => {
  const [clicks, setClicks] = useState({
    left: 0, right: 0
  })

  const handleLeftClick = () => {
    const newClicks = {
      left: clicks.left + 1,
      right: clicks.right
    }
    setClicks(newClicks)
  }

  const handleRightClick = () => {
    const newClicks = {
      left: clicks.left,
      right: clicks.right + 1
    }
    setClicks(newClicks)
  }

  return (
    <div>
      <div>
        {clicks.left}
        <button onClick={handleLeftClick}>left</button>
        <button onClick={handleRightClick}>right</button>
        {clicks.right}
      </div>
    </div>
  )
}
```

The initial value doesn't have to be an integer. You can set it as an array, for example. Uses concat rather than push to copy the array (as you are not allowed to modify state directly) → as in copy the array "allClicks" or whatever it's called (with the spread operator, slice(0), or [].concat(allClicks)), modify your copy, THEN pass the copy into function that updates allClicks (doing this will update allClicks to be the same as the copy, and re-render the component).

```
const App = (props) => {
  const [left, setLeft] = useState(0)
  const [right, setRight] = useState(0)
  const [allClicks, setAll] = useState([])

 const handleLeftClick = () => {
   setAll(allClicks.concat('L'))
   setLeft(left + 1)
 }

 const handleRightClick = () => {
   setAll(allClicks.concat('R'))
   setRight(right + 1)
 }

  return (
    <div>
      <div>
        {left}
        <button onClick={handleLeftClick}>left</button>
        <button onClick={handleRightClick}>right</button>
        {right}

       <p>{allClicks.join(' ')}</p>
     </div>
    </div>
  )
}
```

Events

- You must define event handlers in React Elements with camelCase, rather than lower case
- In JSX, you pass a function to the event handler rather than a string

```
//incorrect
let myElement = <button onclick="activateLasers()">Activate Lasers</button>

//correct
let myElement = <button onClick={activateLasers}>Activate Lasers</button>
```

Good idea to/common practice is to give the component (defined with class) a method (which is passed to the event handler/is the event handler). A cool example:

```
class Toggle extends React.Component {
  constructor(props) {
    super(props);
    this.state = {isToggleOn: true};

   // This binding is necessary to make `this` work in the callback
   this.handleClick = this.handleClick.bind(this);
 }


 handleClick() {
   this.setState(state => ({
     isToggleOn: !state.isToggleOn
   }));

 }
```

```
  render() {
    return (
     <button onClick={this.handleClick}>
       {this.state.isToggleOn ? 'ON' : 'OFF'}
      </button>
    );
  }
}

ReactDOM.render(
  <Toggle />,
  document.getElementById('root')
);
```

You can define any methods you'd like in the component class.
The method typically needs to use the this keyword so it can access the class' properties (like state and props). In javascript, class methods are not bound to this by default. You have to explicitly bind this in the constructor to the class methods (they will become bound once the component is initialised and the constructor method is called).

```
this.handleClick = this.handleClick.bind(this)
```

Use this.methodName.bind(this) in order to refer to the method later without ().
(otherwise, you can use the experimental public class fields syntax enabled by default in create-react-app, or use an arrow function in the callback).

To pass arguments to event handlers:

```
<button onClick={(e) => this.deleteRow(id, e)}>Delete Row</button>
<button onClick={this.deleteRow.bind(this, id)}>Delete Row</button>
```

Example using a functional component:
- NB: don't have to use/bind this

```
const App = (props) => {
  const [ counter, setCounter ] = useState(0)
  const handleClick = () => {
    console.log('clicked')
  }

  return (
    <div>
      <div>{counter}</div>

     <button onClick={handleClick}>
       plus
     </button>
   </div>
  )
}



const App = (props) => {
  const [ counter, setCounter ] = useState(0)

  return (
    <div>
      <div>{counter}</div>
      <button onClick={() => setCounter(counter + 1)}>
        plus
      </button>

     <button onClick={() => setCounter(0)}>
       zero
     </button>
   </div>
  )
}
```

- The value of counter is increased AND the component is re-rendered every time the button is clicked

Or

```
const App = (props) => {
  const [ counter, setCounter ] = useState(0)


 const increaseByOne = () =>
   setCounter(counter + 1)

  const setToZero = () =>
   setCounter(0)

  return (
    <div>
      <div>{counter}</div>

     <button onClick={increaseByOne}>
       plus
      </button>

     <button onClick={setToZero}>
       zero
      </button>
    </div>
  )
}
```

```
The event handler must reference a function and not a function call
(function call will re-render the page and get stuck in a loop)
```

Passing state to child components (lifting the state up)

Passing the state as props to child components.
You want to write small, reusable components.

Best practice in React is to “lift the state up” as high as possible in the component hierarchy (ideally to the App root component)
If components reflect the same changing data, lift the state up to their closest common ancestor.

A common pattern is to have a stateful component containing the state important to your app, that then renders child components. You want these child components to have access to some pieces of that state, which are passed in as props.
For example, maybe you have an App component that renders a Navbar, among other components. In your App, you have state that contains a lot of user information, but the Navbar only needs access to the user's username so it can display it. You pass that piece of state to the Navbar component as a prop.

Called “unidirectional” data flow. State flows in one direction down the tree of your application's components, from the stateful parent component to child components. The child components only receive the state data they need.

```
class MyApp extends React.Component {
  constructor(props) {
    super(props);
    this.state = {
      name: 'CamperBot'
    }
  }
  render() {
    return (
       <div>
         <Navbar name = {this.state.name} />
       </div>
    );
  }
};

class Navbar extends React.Component {
  constructor(props) {
    super(props);
  }
  render() {
    return (
    <div>
      <h1>Hello, my name is: {this.props.name} </h1>
    </div>
    );
  }
};
```

```
const Display = ({ counter }) => {
  return (
    <div>{counter}</div>
  )
}


const App = (props) => {
  const [counter, setCounter] = useState(0)
  const setToValue = (value) => setCounter(value)

  return (
    <div>

     <Display counter={counter}/>
     <button onClick={() => setToValue(counter + 1)}>
        plus
      </button>
      <button onClick={() => setToValue(0)}>
        zero
      </button>
    </div>
```

```
   )
 }
```

Conditional Rendering

If you want to render different React elements depending on the state of the application = conditional rendering
Just use if or the conditional (ternary) operator

```
function Greeting(props) {
  const isLoggedIn = props.isLoggedIn;
 if (isLoggedIn) {
   return <UserGreeting />;
 }
 return <GuestGreeting />;
}


ReactDOM.render(
  // Try changing to isLoggedIn={true}:
 <Greeting isLoggedIn={false} />,
 document.getElementById('root')
);



class LoginControl extends React.Component {
  constructor(props) {
    super(props);
    this.handleLoginClick = this.handleLoginClick.bind(this);
    this.handleLogoutClick = this.handleLogoutClick.bind(this);
    this.state = {isLoggedIn: false};
  }

  handleLoginClick() {
    this.setState({isLoggedIn: true});
  }

  handleLogoutClick() {
    this.setState({isLoggedIn: false});
  }

  render() {
    const isLoggedIn = this.state.isLoggedIn;
    let button;

   if (isLoggedIn) {
     button = <LogoutButton onClick={this.handleLogoutClick} />;
   } else {
     button = <LoginButton onClick={this.handleLoginClick} />;
   }

    return (
      <div>
       <Greeting isLoggedIn={isLoggedIn} />
       {button}
      </div>
    );
  }
}

ReactDOM.render(
  <LoginControl />,
  document.getElementById('root')
);
```

If you want a component to hide itself, have it return null instead of a React element:

```
function WarningBanner(props) {
 if (!props.warn) {
   return null;
 }
  return (
    <div className="warning">
      Warning!
    </div>
  );
}

class Page extends React.Component {
  constructor(props) {
    super(props);
    this.state = {showWarning: true};
    this.handleToggleClick = this.handleToggleClick.bind(this);
  }

  handleToggleClick() {
    this.setState(state => ({
      showWarning: !state.showWarning
    }));
  }

  render() {
    return (
      <div>
       <WarningBanner warn={this.state.showWarning} />
       <button onClick={this.handleToggleClick}>
          {this.state.showWarning ? 'Hide' : 'Show'}
        </button>
      </div>
    );
  }
}

ReactDOM.render(
  <Page />,
  document.getElementById('root')
);
```

Another example: (ES6 class component) . If else must be outside the return statement. Always outside. It cannot be inserted directly into JSX code.

```
class MyComponent extends React.Component {
  constructor(props) {
    super(props);
    this.state = {
      display: true
    }
    this.toggleDisplay = this.toggleDisplay.bind(this);
  }
  toggleDisplay() {
    this.setState({
      display: !this.state.display
    });
  }
  render() {
    if (this.state.display) {
      return (
        <div>
          <button onClick={this.toggleDisplay}>Toggle Display</button>
          <h1>Displayed!</h1>
        </div>
      );
    } else {
     return (
       <div>
         <button onClick={this.toggleDisplay}>Toggle Display</button>
       </div>
    );
  }
}
};
```

Important: More concise way (using && logical operator)

`{condition && <p>markup</p>}`

If the condition is true, the markup will be returned. If the condition is false, the operation will immediately return false after evaluating the condition and return nothing.

```
class MyComponent extends React.Component {
  constructor(props) {
    super(props);
    this.state = {
      display: true
    }
    this.toggleDisplay = this.toggleDisplay.bind(this);
  }
  toggleDisplay() {
    this.setState(state => ({
      display: !state.display
    }));
  }
  render() {
    return (
       <div>
         <button onClick={this.toggleDisplay}>Toggle Display</button>
        {this.state.display && <h1>Dislayed!</h1>}
       </div>
    );
  }
};
```

Another way! Using a ternary operator (condition? statement-if-true:statement-if-false). Can be used within JSX.

```
const inputStyle = {
  width: 235,
  margin: 5
}

class CheckUserAge extends React.Component {
  constructor(props) {
    super(props);
    this.state = {
      userAge: '',
      input: ''
    }
    this.submit = this.submit.bind(this);
    this.handleChange = this.handleChange.bind(this);
  }
  handleChange(e) {
    this.setState({
      input: e.target.value,
      userAge: ''
    });
  }
  submit() {
    this.setState(state => ({
      userAge: state.input
    }));
  }
  render() {
    const buttonOne = <button onClick={this.submit}>Submit</button>;
    const buttonTwo = <button>You May Enter</button>;
    const buttonThree = <button>You Shall Not Pass</button>;
    return (
      <div>
        <h3>Enter Your Age to Continue</h3>
        <input
          style={inputStyle}
          type="number"
          value={this.state.input}
          onChange={this.handleChange} /><br />
        {
          this.state.userAge == ''? buttonOne: this.state.userAge >= 18?
buttonTwo: buttonThree
        }
      </div>
    );
  }
};
```

Render conditionally from props

Using props to conditionally render code = is very common!

```
class Results extends React.Component {
  constructor(props) {
    super(props);
  }
  render() {
    return (
      <h1>
      {
        this.props.fiftyFifty?"You Win!":"You Lose!"
      }
      </h1>
    )
  };
};

class GameOfChance extends React.Component {
  constructor(props) {
    super(props);
    this.state = {
      counter: 1
    }
    this.handleClick = this.handleClick.bind(this);
  }
  handleClick() {
    this.setState((state, props) => {
      return {counter: (state.counter + 1)}
    });
  }
  render() {
    const expression = (Math.random() >= 0.5);
    return (
      <div>
        <button onClick={this.handleClick}>Play Again</button>
        <Results fiftyFifty = {expression}/>
        <p>{'Turn: ' + this.state.counter}</p>
      </div>
    );
  }
};
```

You can also render condtionally based on state.

Create a controlled input

Form control elements for text input (`input` and `textarea`) maintain their own state as the user types

You can move this mutable state into a React components state

Initialise the component’s state with an “input” property that holds an empty string (representing the text a user types into the input field)

```
class ControlledInput extends React.Component {
  constructor(props) {
    super(props);
    this.state = {
      input: ''
    };
    this.handleChange = this.handleChange.bind(this);
    // remember to bind any new method to this
  }

  handleChange (event) {
    this.setState({input: event.target.value});
  }
  // don't forget this for event handlers in class components!
  render() {
    return (
      <div>
        <input value = {this.state.input} onChange =
{this.handleChange} />
        <h4>Controlled Input:</h4>
        <p>{this.state.input}</p>
      </div>
    );
```

```
   }
 };
```

The component's state is updated with every change to the input's value (every keystroke)! Very neat!

This can be done with the HTML form element as well. The below renders a form which updates part of the state (the submit property) with the value of the input (in the form) when the submit button (in the form) is pressed (plus the state's input property is updated every time something is typed in the input element). We then pass that to a h1 element:

```
class MyForm extends React.Component {
  constructor(props) {
    super(props);
    this.state = {
      input: '',
      submit: ''
    };
    this.handleChange = this.handleChange.bind(this);
    this.handleSubmit = this.handleSubmit.bind(this);
  }
  handleChange(event) {
    this.setState({
      input: event.target.value
    });
  }
  handleSubmit(event) {
    this.setState(function (state) {
       return {submit: state.input}
    });
  }
  render() {
    return (
      <div>
        <form onSubmit={this.handleSubmit}>
          <input value = {this.state.input} onChange =
{this.handleChange} />
          <button type='submit'>Submit!</button>
        </form>
        <h1>{this.state.submit}</h1>
      </div>
    );
  }
};
```

Splitting into modules

A whole React application can be written on a single file - however this is not very practical. Common practice is declare each component in it's own file as an ES6-module.

Remember we're already using modules when we import react and react-dom modules (from variables "React" and "ReactDOM"):

```
import React from 'react'
import ReactDOM from 'react-dom'
```

In smaller applications, components are usually placed in a directory called "components" within the src directory. Convention, name the file after the component.

create a directory called components for our application and place a file named Note.js inside. The contents of the Note.js file are as follows:

```
import React from 'react'

const Note = ({ note }) => {
return (
    <li>{note.content}</li>
  )
}
```

```
export default Note
```

You still have to import React (not ReactDOM because you’re not rendering to the DOM in this file). Remember you have to export the variable/module you want to import in another file.

Now the file using the component (index.js) can import the module:

```
import React from 'react'
import ReactDOM from 'react-dom'
import Note from './components/Note'

const App = ({ notes }) => {
  // ...
}
```

Location must be given relative to the importing file. The period at the beginning ‘.’ = the current directory.
file extension can be omitted

App (the root component) is also a component → so you should declare it in its own module as well
Because it is the root component → place it in the src directory

```
import React from 'react'
import Note from './components/Note'

const App = ({ notes }) => {
  const rows = () => notes.map(note =>
    <Note
      key={note.id}
      note={note}
    />
  )

  return (
    <div>
      <h1>Notes</h1>
      <ul>
        {rows()}
      </ul>
    </div>
  )
}


export default App
```

What's left in the index.js file is

```
import React from 'react'
import ReactDOM from 'react-dom'

import App from './App'

const notes = [
  // ...
]

ReactDOM.render(
  <App notes={notes} />,
  document.getElementById('root')
)
```

Styling React elements

styling React elements

1. import styles from a stylesheet
    a. not much difference
    b. apply classes to JSX elements using className (rather than class)
2. use inline styles ⇒ very common

Still use style attribute

CANT set the value of the style attribute as a string, rather have to set it as a JavaScript object

```
<div style="color: yellow; font-size: 16px">Mellow Yellow</div>
<div style={{color: "yellow", fontSize: 16}}>Mellow Yellow</div>
```

React cannot accept kebab-case keys (e.g. font-size) ⇒ have to camelCase everything (fontSize)

```
class Colorful extends React.Component {
  render() {
    return (
      <div style = {{color: "red", fontSize: "72px"}}>Big Red</div>
    );
  }
};
```

- convert any hyphenated style attributes to camelCase
- remember “px”, “em”, “vh”, “vw”... values are always actually strings (“100px” not 100px)

Good idea: assign a style object to a constant to keep your code organized:

```
const styles = {
   color: "purple",
   fontSize: 40,
   border: "2px solid purple"
 }

class Colorful extends React.Component {
  render() {
    return (
      <div style={styles}>Style Me!</div>
    );
  }
};
```

Change Inline CSS Conditionally based on Component State

You can render CSS conditionally based on the state of the React component

1. check for a condition

2. if that condition is met, modify the styles object that's assigned to the JSX elements in the render method

IMPORTANT! shift from modifying DOM elements directly

- in that approach you have to keep track of when elements change, manipulate directly
- difficult to keep track of changes

E.g. input with a styled border → turns red if the user types more than 15 characters of text in the input box
(this is actually quite cool)

```
class GateKeeper extends React.Component {
  constructor(props) {
    super(props);
    this.state = {
      input: ''
    };
    this.handleChange = this.handleChange.bind(this);
  }
  handleChange(event) {
    this.setState({ input: event.target.value })
  }
  render() {
    let inputStyle = {
      border: '1px solid black'
    };
    // change code below this line
    this.state.input.split("").length > 15? inputStyle.border
= "3px solid red" : inputStyle.border = "1px solid black"
    // change code above this line
    return (
      <div>
        <h3>Don't Type Too Much:</h3>
        <input
          type="text"
          style={inputStyle}
          value={this.state.input}
          onChange={this.handleChange} />
      </div>
    );
  }
};
```

‘advanced’ JS in Render method

You can write JavaScript directly in your render methods before the return statement *without* needing curly brackets (not yet JSX code)
when you want to use a variable inside the return statement, then it is JSX, then you have to use curly brackets

How to render a data collection

Instead of:

```
import React from 'react'
import ReactDOM from 'react-dom'

const notes = [
  {
    id: 1,
    content: 'HTML is easy',
    date: '2019-05-30T17:30:31.098Z',
    important: true
  },
  {
    id: 2,
    content: 'Browser can execute only Javascript',
    date: '2019-05-30T18:39:34.091Z',
    important: false
  },
  {
    id: 3,
    content: 'GET and POST are the most important methods of HTTP
protocol',
    date: '2019-05-30T19:20:14.298Z',
    important: true
  }
]

const App = (props) => {
  const { notes } = props

  return (
    <div>
      <h1>Notes</h1>
      <ul>
        <li>{notes[0].content}</li>
        <li>{notes[1].content}</li>
        <li>{notes[2].content}</li>
      </ul>
    </div>
  )
}

ReactDOM.render(
  <App notes={notes} />,
  document.getElementById('root')
)
```

You can use Array.map() to generate <li> elements:

```
const App = (props) => {
  const { notes } = props

  return (
    <div>
      <h1>Notes</h1>
     <ul>
       {notes.map(note => <li>{note.content}</li>)}
     </ul>
   </div>
  )
}
```

Or even:

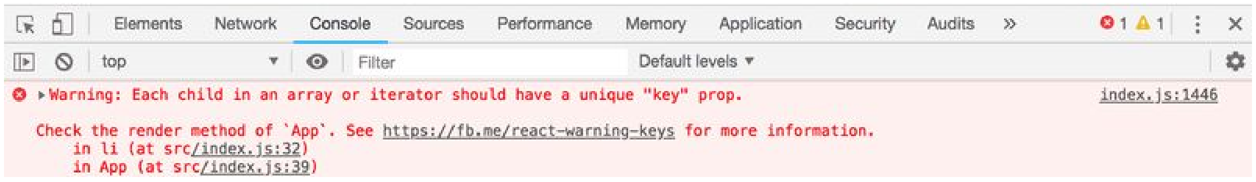
```
const App = (props) => {
  const { notes } = props


 const rows = () =>
   notes.map(note => <li>{note.content}</li>)

  return (
    <div>
      <h1>Notes</h1>
      <ul>

       {rows()}
     </ul>
    </div>
  )
}
```

Remember, they need a key attribute otherwise React will throw a “nasty warning”



```
▸Warning: Each child in an array or iterator should have a unique "key" prop.        index.js:1446

 Check the render method of `App`. See https://fb.me/react-warning-keys for more information.
     in li (at src/index.js:32)
     in App (at src/index.js:39)
```

elements generated by the map method, must each have a unique key value: an attribute called *key*.

Dynamically Render Elements

- Your application often needs to be able to handle an unknown state

THIS IS THE SAME AS “HOW TO RENDER A DATA COLLECTION” FROM FULLSTACK OPEN

e.g. in a to do list, you have no way of knowing how many items a user might have on their list. To set up the component to dynamically render the correct number of list elements:

```
const textAreaStyles = {
  width: 235,
  margin: 5
};

class MyToDoList extends React.Component {
  constructor(props) {
    super(props);
    // change code below this line
    this.state = {
      userInput: '',
      toDoList: []
    }
    // change code above this line
    this.handleSubmit = this.handleSubmit.bind(this);
    this.handleChange = this.handleChange.bind(this);
  }
  handleSubmit() {
    const itemsArray = this.state.userInput.split(',');
    this.setState({
      toDoList: itemsArray
    });
  }
  handleChange(e) {
    this.setState({
      userInput: e.target.value
    });
  }
  render() {
    const items = this.state.toDoList.map((elem) => <li>{elem}</li>)
    return (
      <div>
        <textarea
```

```
          onChange={this.handleChange}
          value={this.state.userInput}
          style={textAreaStyles}
          placeholder="Separate Items With Commas" /><br />
        <button onClick={this.handleSubmit}>Create List</button>
        <h1>My "To Do" List:</h1>
        <ul>
          {items}
        </ul>
      </div>
    );
  }
};
```

Remember: when you create an array of elements, each one needs a key attribute set to a unique value
(eact uses these keys to keep track of which items are added, changed, or removed. This helps make the re-rendering process more efficient when the list is modified in any way.)

Keys only need to be unique between sibling elements, they don't need to be globally unique in your application.

As a last resort you can use array index to uniquely identify the element being rendered.

Dynamically filter an Array

```
class MyComponent extends React.Component {
  constructor(props) {
    super(props);
    this.state = {
      users: [
        {
          username: 'Jeff',
          online: true
        },
        {
          username: 'Alan',
          online: false
        },
        {
          username: 'Mary',
          online: true
        },
        {
          username: 'Jim',
          online: false
        },
        {
          username: 'Sara',
          online: true
        },
        {
          username: 'Laura',
          online: true
        }
      ]
    }
  }
  render() {
    const usersOnline = this.state.users.filter((elem) => elem.online); //
change code here
    const renderOnline = usersOnline.map((elem, index) => <li key =
{index}>{elem.username}</li>); // change code here
    return (
       <div>
         <h1>Current Online Users:</h1>
         <ul>
           {renderOnline}
         </ul>
       </div>
    );
  }
};
```

Render React on a Server

You can run React (a JS view library) on a server with Node.js
use the ReactDOMServer.renderToString(<React Element Name/>) method

REDUX

Redux = state management framework
can be used with any Javascript view library (incl. React)

In Redux

- the entire state of the application is defined by a single state object (housed in the React store)
- any time your app wants to update state → it must do this through the React store
- = unidirectional flow

call the createStore() method on the Redux object, to create the Redux store
requires a reducer argument (a callback function)

Redux store = an object
holds and manages application state

```
const reducer = (state = 5) => {
  return state;
}

let store = Redux.createStore(reducer)
```

OR

```
const store = Redux.createStore(
  (state = 5) => state
);
```

The reducer initialises the Redux store's state. Above, it's state is initialised as an integer, 5.
Here, the Redux store's intialised state is an object with a property 'login' with a 'false' value.

```
const store = Redux.createStore(
  (state = {login: false}) => state
);
```

You can then call methods on the Redux store object you have created

retrieve current state with getState()

```
let currentState = store.getState()
```

Redux Actions

state updates are triggered by dispatching actions

action = JS object that contains information about an action event that has occurred

Redux store object receives action objects, updates its state accordingly

must have type attribute (defines what ‘type’ of action has occurred)

```
let action = {
    type: 'LOGIN'
}
```

Action creator = a function that returns an action

```
let actionCreator = () => action;
//or
function actionCreator () {
    return action
}
```

To dispatch actions to the Redux store (call the dispatch method on the store object)

1. call store.dispatch()
2. pass it the value returned from an action creator
3. (or just the action object itself)

```
store.dispatch(actionCreator());
//or
store.dispatch({ type: 'LOGIN' });
```

Reducer function

Reducer function

- takes state and action as arguments
- always returns a new state
- must return a new copy of state, never modify state directly

Full example:

```
const defaultState = {
  login: false
};

const reducer = (state = defaultState, action) => {
  if (action.type == 'LOGIN') {
    return {login: true};
  } else {
    return state;
  }
};

const store = Redux.createStore(reducer);

const loginAction = () => {
  return {
    type: 'LOGIN'
  }
};
```

Standard practice: to use a switch statement in the reducer function to respond to different action events.

Remember: include a default statement (when you have multiple reducers, they will all run every time an action dispatch is made)

```
const defaultState = {
  authenticated: false
};

const authReducer = (state = defaultState, action) => {
  switch(action.type) {
    case 'LOGIN':
      return {authenticated: true};
    case 'LOGOUT':
      return {authenticated: false};
    default:
      return state;
  }
};

const store = Redux.createStore(authReducer);

const loginUser = () => {
  return {
    type: 'LOGIN'
  }
};

const logoutUser = () => {
  return {
    type: 'LOGOUT'
  }
};
```

Action Types

Common practice:

- assign action types as read-only (const)

```
const LOGIN = 'LOGIN'
const LOGOUT = 'LOGOUT'

const defaultState = {
  authenticated: false
};

const authReducer = (state = defaultState, action) => {

  switch (action.type) {
    case LOGIN:
      return {
        authenticated: true
      }

    case LOGOUT:
      return {
        authenticated: false
      }

    default:
      return state;
  }
};

const store = Redux.createStore(authReducer);

const loginUser = () => {
  return {
    type: LOGIN
  }
};

const logoutUser = () => {
  return {
    type: LOGOUT
  }
};
```

Store Listeners

Calling .subscribe() on the Redux store object
To “subscribe” listener functions to the store, called whenever an action is dispatched to the store.

e.g. to simply log a message every time an action is received and the store updated.

```
const ADD = 'ADD';

const reducer = (state = 0, action) => {
  switch(action.type) {
    case ADD:
      return state + 1;
    default:
      return state;
  }
};

const store = Redux.createStore(reducer);

// global count variable:
let count = 0;

store.subscribe(() => count++)

store.dispatch({type: ADD});
console.log(count); //1
store.dispatch({type: ADD});
console.log(count); //2
store.dispatch({type: ADD});
console.log(count); //3
```

Reducer composition

= combining multiple reducers (when your state becomes more complex)

- define multiple reducers to handle different pieces of your application's state
- then compose these reducers together into one root reducer
- root reducer is then passed into the Redux store object's createStore() method
- combineReducers() method, pass it an object as an argument with keys set to specific reducer functions

```
const INCREMENT = 'INCREMENT';
const DECREMENT = 'DECREMENT';

const counterReducer = (state = 0, action) => {
  switch(action.type) {
    case INCREMENT:
      return state + 1;
    case DECREMENT:
      return state - 1;
    default:
      return state;
  }
};

const LOGIN = 'LOGIN';
const LOGOUT = 'LOGOUT';

const authReducer = (state = {authenticated: false}, action) => {
  switch(action.type) {
    case LOGIN:
      return {
        authenticated: true
      }
    case LOGOUT:
      return {
        authenticated: false
      }
    default:
      return state;
  }
};

const rootReducer = Redux.combineReducers({
    count: counterReducer,
    auth: authReducer
})

const store = Redux.createStore(rootReducer);
```

Adding action data to the store

```
const ADD_NOTE = 'ADD_NOTE';

const notesReducer = (state = 'Initial State', action) => {
  switch(action.type) {
    case ADD_NOTE:
      return action.text
    default:
      return state;
  }
};

const addNoteText = (note) => {
  return {type: ADD_NOTE, text: note}
};

const store = Redux.createStore(notesReducer);

console.log(store.getState());
store.dispatch(addNoteText('Hello!'));
console.log(store.getState());
```

Asynchronous Actions

Synchronous basically means that you can only execute one thing at a time.

Asynchronous means that you can execute multiple things at a time and you don't have to finish executing the current thing in order to move on to next one.

To handle asynchronous actions, you have to use “Redux Thunk middleware”

pass Redux thunk middleware as an argument to:

Redux.applyMiddleware()

the whole thing is passed as a second argument to Redux.createStore()

```
const REQUESTING_DATA = 'REQUESTING_DATA'
const RECEIVED_DATA = 'RECEIVED_DATA'

const requestingData = () => { return {type: REQUESTING_DATA} }
const receivedData = (data) => { return {type: RECEIVED_DATA, users:
data.users} }

const handleAsync = () => {
  return function(dispatch) {
    store.dispatch(requestingData())
    setTimeout(function() {
      let data = {
        users: ['Jeff', 'William', 'Alice']
      }
      store.dispatch(receivedData(data))
    }, 2500);
  }
};

const defaultState = {
  fetching: false,
  users: []
};

const asyncDataReducer = (state = defaultState, action) => {
  switch(action.type) {
    case REQUESTING_DATA:
      return {
        fetching: true,
        users: []
      }
    case RECEIVED_DATA:
      return {
        fetching: false,
        users: action.users
      }
    default:
      return state;
  }
};

const store = Redux.createStore(
  asyncDataReducer,
  Redux.applyMiddleware(ReduxThunk.default)
);
```

State immutability

Never mutate state
never mutate state directly, instead return a new copy of state

strings and numbers = primitive values, immutable by nature

array or object = mutable

```
const ADD_TO_DO = 'ADD_TO_DO';

// A list of strings representing tasks to do:
```

```
const todos = [
  'Go to the store',
  'Clean the house',
  'Cook dinner',
  'Learn to code',
];

const immutableReducer = (state = todos, action) => {
  switch(action.type) {
    case ADD_TO_DO:
      return state.concat(action.todo);
// or [...state, action.todo]
    default:
      return state;
  }
};

// an example todo argument would be 'Learn React',
const addToDo = (todo) => {
  return {
    type: ADD_TO_DO,
    todo
  }
}

const store = Redux.createStore(immutableReducer);
```

You can use the spread operator `...` can be used to copy arrays, maintaining state immutability.

`let newArray = [...myArray];`

To clone an array but add additional values in the new array, you could write `[...myArray, 'new value'].`
Returns a new array composed of the values in myArray and the string 'new value' as the last value.

Only makes a shallow copy of the array → i.e. only for one-dimensional arrays

Object.assign() takes a target object and source objects and maps properties from the source objects to the target object. Any matching properties are overwritten by properties in the source objects.

This behavior is commonly used to make shallow copies of objects by passing an empty object as the first argument followed by the object(s) you want to copy.

`const newObject = Object.assign({}, obj1, obj2);`

creates newObject as a new object, which contains the properties that currently exist in obj1 and obj2.

```
const defaultState = {
  user: 'CamperBot',
  status: 'offline',
  friends: '732,982',
  community: 'freeCodeCamp'
};

const immutableReducer = (state = defaultState, action) => {
  switch(action.type) {
    case 'ONLINE':
      return Object.assign({}, defaultState, {status: 'online'} )
    default:
      return state;
  }
};

const wakeUp = () => {
  return {
    type: 'ONLINE'
  }
};

const store = Redux.createStore(immutableReducer);
```