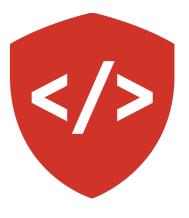
CODE 301

Intermediate Software Development



AGENDA

- ➤ Assignment review
- ➤ Functional Programming

FUNCTIONAL PROGRAMMING

SIMPLE!= EASY

- Rich Hickey

"SOMETIMES, THE ELEGANT IMPLEMENTATION IS JUST A FUNCTION. NOT A METHOD. NOT A CLASS. NOT A FRAMEWORK. JUST A FUNCTION."

- John Carmack

FUNCTIONAL PROGRAMMING

- ➤ Why?
 - ➤ Long tradition going back to Lisp (vs Fortran)
 - ➤ Has been primarily in academia but strongly resurgent in industry
 - ➤ For many hiring managers, a signal that you know what you're doing
 - ➤ Cleaner code easier to reason about
 - ➤ Scalable and Performant on multi-core systems, large volumes of data

HOW FUNCTIONAL PROGRAMMING RELATES TO JS

- ➤ JavaScript was almost Scheme, a Functional language based on LISP
- ➤ In 1994 Brendan Eich wanted a functional language for the browser but under competitive pressure from Java introduced OO features into the language
- ➤ But at its core, JS is still a Functional Language. Why?

VARIABLES ARE SCOPED TO FUNCTIONS IN JS

➤ The only place to "attach" a variable in JavaScript is to a function, with the **var** keyword

```
var window_scope_var = 'you can find me at window.window_scope_var'
function doSomething() {
  var function_scope = 'you can only use me in the scope of
function'
  console.log(window_scope_var);
  function innerFunction() {
    var inner_scope = 'I am only in this function!'
    console.log(function_scope);
    console.log(inner_scope);
```

WHAT IS FUNCTIONAL PROGRAMMING

- ➤ What is it? No one "standard" for functional but includes:
 - ➤ Immutability
 - ➤ Declarative vs. Imperative code
 - Stateless (pure) functions
 - ➤ First-class Functions and Currying

FUNCTIONAL PROGRAMMING

- ➤ Functional features built in to JavaScript (ECMA 5 standard)
 - ➤ Array
 - ➤ .forEach
 - .some and .every
 - > .concat
 - ➤ .filter
 - ➤ .map
 - > .reduce

MUTABILITY AND IMMUTABILITY

- ➤ A fancy way of saying "changeable"
- ➤ For example, Array Methods:

- ➤ Don't Mutate the data
 - ➤ forEach
 - > Slice
 - ➤ Map
 - > Reduce
 - > Filter

- ➤ Mutate the data
 - > Sort
 - > Reverse
 - ➤ Splice

IMMUTABILITY

- ➤ Why?
 - ➤ Limiting the amount of things that change gives focus
 - ➤ Take away opportunities for things to be unintentionally modified
- ➤ Cons
 - ➤ Harder, (but simpler). Memory usage (maybe)
- ➤ "Shared mutable state is the root of all evil." Pete hunt
- There are libraries for immutability in JS, but not required
 - ➤ ImmutableJS, Mori, Deep-freeze
- ➤ Object.freeze()

THE TAKEAWAY?

Look for opportunities in your code to remove changing a variable's value - mutable state.

DECLARATIVE VS IMPERATIVE

➤ Describe **WHAT** you want

VS

➤ **HOW**: The steps to get it done

IMPERATIVE EXAMPLE

```
s = \sum_{x=1}^{N} x^2 = 1^2 + 2^2 + 3^3 + \dots + N^2
```

```
function sumOfSquares(nums) {
 var i, sum = 0, squares = [];
  for (i = 0; i < nums.length; i++) {
    squares.push(nums[i]*nums[i]);
  for (i = 0; i < squares.length; i++) {
    sum += squares[i];
 return sum;
console.log(sumOfSquares([1, 2, 3, 4, 5]));
```

DECLARATIVE EXAMPLE

```
s = \sum_{x=1}^{N} x^2 = 1^2 + 2^2 + 3^3 + \dots + N^2
```

```
function sumOfSquares2(nums) {
   return nums
      .map(function(num) { return num * num; })
      .reduce(function(start, num) { return start + num; }, 0)
   ;
}
console.log(sumOfSquares2([1, 2, 3, 4, 5]));
```

PURE (STATELESS) FUNCTIONS

```
// pure (stateless)
function square(x) {
  return x * x;
function squareAll(items) {
  return items.map(square);
// impure (stateful)
function square(x) {
  updateXinDatabase(x);
  return x * x;
function squareAll(items) {
 var i;
  for (i = 0; i < items.length; i++) {</pre>
    items[i] = square( items[i] );
```

FIRST CLASS FUNCTIONS

- \triangleright Also called higher-order functions or λ
- ➤ In JS, all functions are objects
- ➤ You've already been using these in callbacks, etc.
- ➤ Enable Abstraction and Composability

```
// pure (stateless)

function square(x) {
  return x * x;
}

function squareAll(items) {
  return items.map(square);
}
```

FUNCTIONAL BLOG DEMO

IN-CLASS EXERCISE

Scrape the TIOBE Index HTML

FUNCTIONAL PROGRAMMING

- ➤ There's much more to discover!
 - https://lodash.com
 - https://drboolean.gitbooks.io/ mostly-adequate-guide/
 - http://reactivex.io/learnrx/
 - http://www.infoq.com/ presentations/Simple-Made-Easy



Predicates, Optionals, Functors, oh my!

RECAP

RECAP

- ➤ Functional programming will make your programs more understandable, maintainable, reliable, and performant.
- ➤ Speaking from experience, it can make a difference in an interview, too.