Lecture 9

ES6

Topics

- **Evolution of JavaScript**
- **Main goals of JavaScript & ES6**
- **ES6 Features**

Definitions

https://www.ecma-international.org/

- JavaScript (JS) - a high level, dynamic, untyped and interpreted programming language created original for web browsers
- ECMA International - an international non-profit standards organization *(European Computer Manufacturers Association)*
- ECMAScript (ES) - scripting-language specification standardized by ECMA International. (*Implemented well known languages such as JavaScript, JScript and ActionScript)*
- ES2015 (ES6) - the newest version of ECMAScript

JavaScript Evolution

1990’s

- 1995: Netscape creates Mocha
- 1995: Mocha > LiveScript > JavaScript
- 1996: ECMA adopts JavaScript
- 1997: ECMA-262 (ES1)
- 1998: ES2
- 1999: ES3 (regex, try/catch)

* 1990's browser wars IE vs Netscape

2000-2004

- Browser wars - IE wins and becomes the dominant web browser

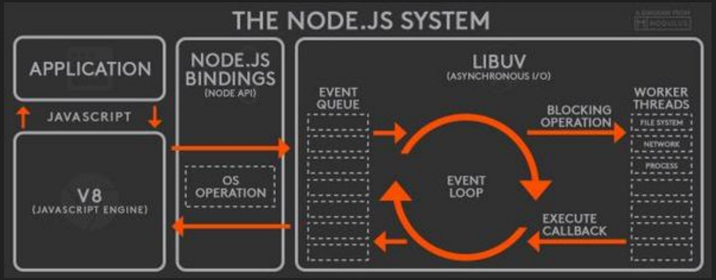
- Not a lot of innovation happening the JS world at this time.

- GMail was launched in 2004. It was the first popular web application that really showed off what was possible with client-side JavaScript

2005: AJAX

- Broadband Internet becomes popular
- Asynchronous server requests (AJAX) become popular
- Renaissance of JavaScript
- Countless JavaScript libraries emerge (mainly helping with AJAX requests and DOM operations)

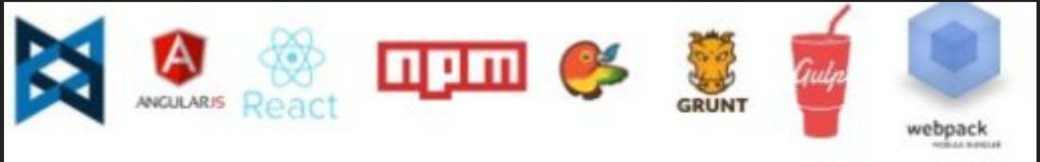
2006-2009



- 2008: ECMAScript4 *(abandoned)*
- 2009: ECMAScript ~~3.1~~ 5 (strict, JSON, Reflect)
- 2009: Emergence of Server Side JavaScript environment => Node.js

2010-2015

- frameworks continue to evolve, no longer just DOM & AJAX helpers
- JS Packet Manager ie. npm, bower
- solutions for keeping code in modules (node.js, CommonJs, AMD, Browserify)
- JavaScript preprocessors (Grunt, Gulp, Webpack..)



JavaScript Pros/Cons

Pros

- easy syntax
- functions are objects
- the only native web browser language
- independently driven

Cons

- not many clean code practices
- each framework = new practices, enforcing bad practices overall
- very rapid development often makes tools and frameworks obsolete fast

Why should you learn vanilla JavaScript before frameworks?

- If you master JavaScript fundamentals, your only challenge when learning new JS frameworks will be scoped to their specific syntax.

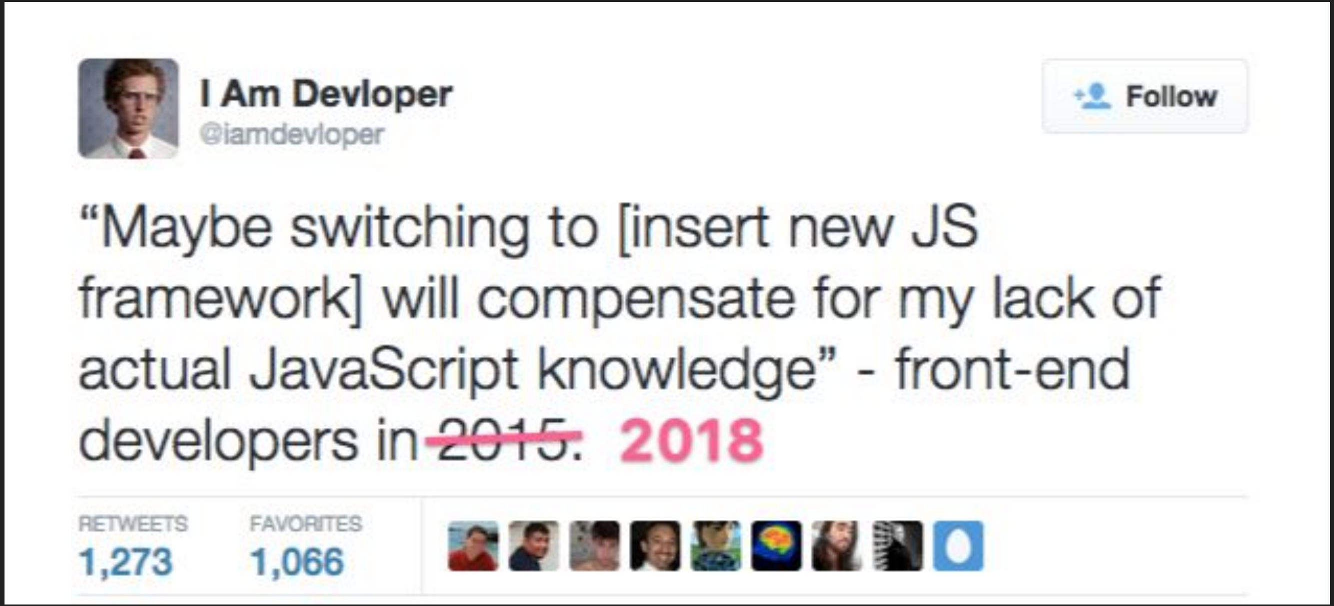
- Understanding JavaScript’s core engineering principles is paramount, if you want to build yourself a decent web career.

- In the past 5 years, more than 10 frontend JS frameworks made the news. Guess how many will do the same in the next 5-10 years?

- "JQuery developers" are trying to catch up on Angular. Tomorrow, they'll be trying to catch up on React/Vue, and the loop will continue as technology advances..

Vanilla JS..

- *VanillaJS is a name to refer to using plain JavaScript without any additional libraries like jQuery.*

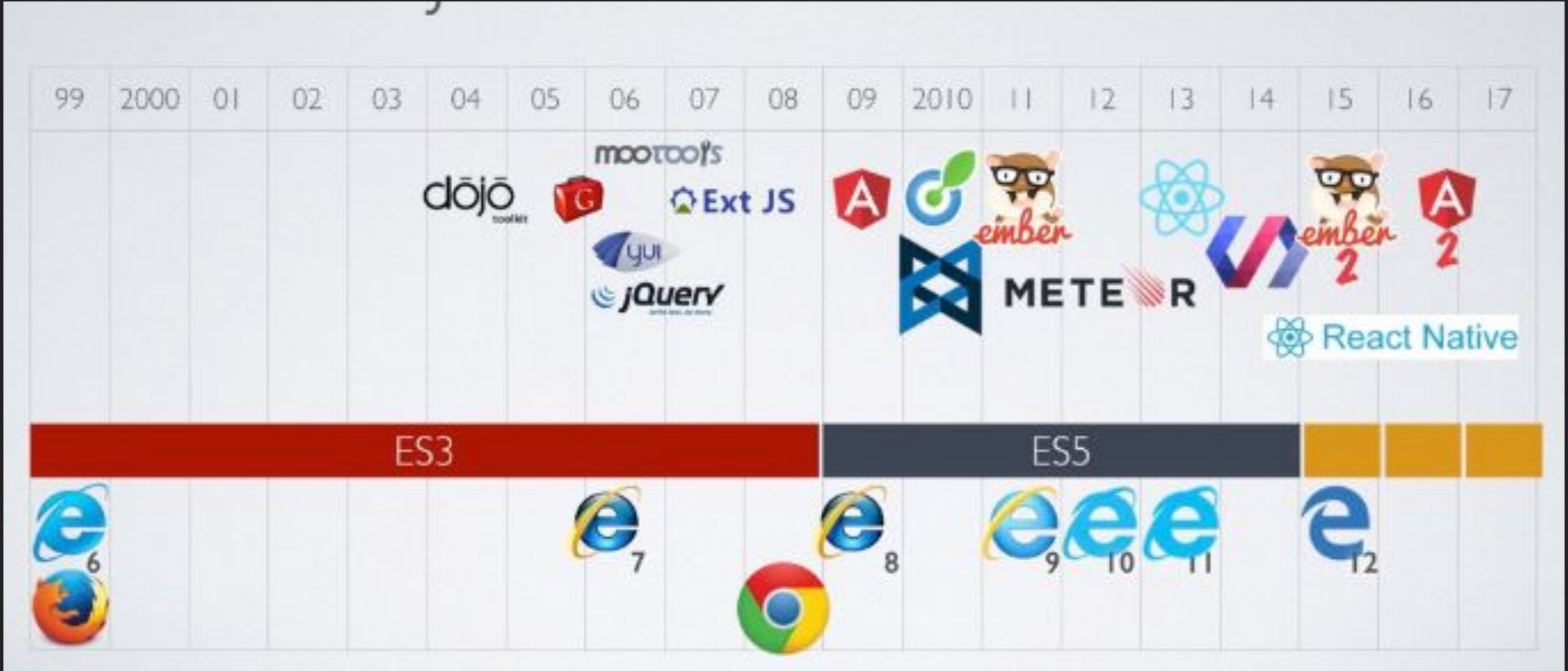


I Am Devloper
@iamdevloper

“Maybe switching to [insert new JS framework] will compensate for my lack of actual JavaScript knowledge” - front-end developers in ~~2015.~~ 2018

JavaScript UI Frameworks Timeline

http://www.evolutionoftheweb.com/



ES6

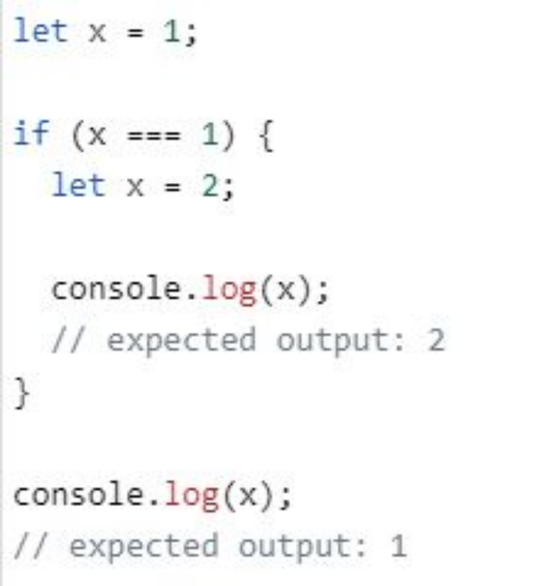
ES6 Main Goals

- Fix (some of) ES5 problems
- backwards compatibility (Babel is a compiler to translate ES6 code to make valid ES5)
- modern syntax
- better suited for bigger complex application (ie. native modules)
- new features in the standard library (ie. native class support, arrow functions, modules)

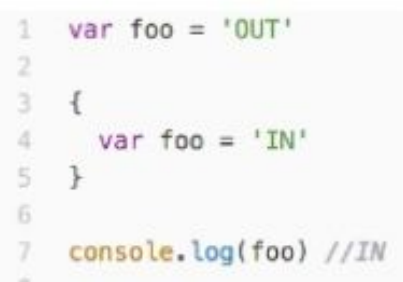
ES6 new syntax

let statement

- The **let** statement declares a block scope local variable, optionally initializing it to a value.



```
let x = 1;

if (x === 1) {
  let x = 2;

  console.log(x);
  // expected output: 2
}

console.log(x);
// expected output: 1
```

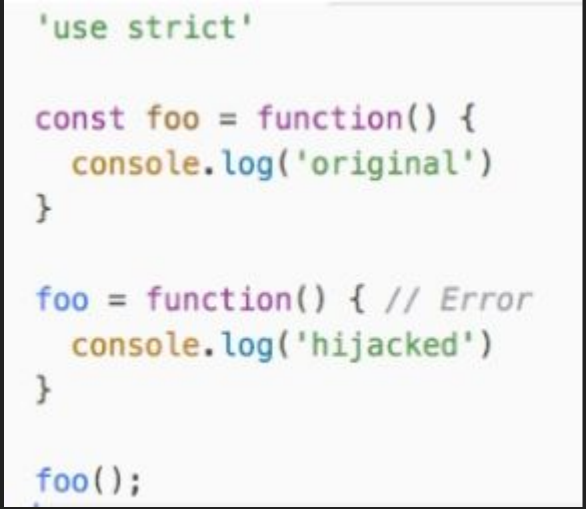


```
var foo = 'OUT'

{
  var foo = 'IN'
}

console.log(foo) //IN
```

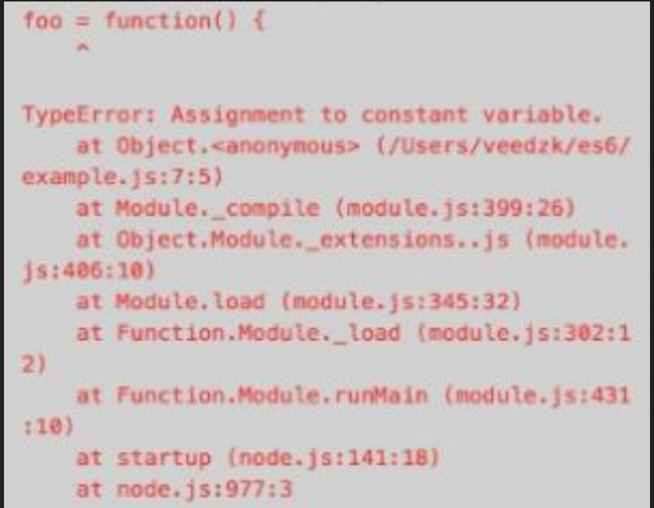
ES5 var statement

const statement

Constants are block-scoped, much like variables defined using the let statement. The value of a constant cannot change through reassignment, and it can't be redeclared.



```
'use strict'

const foo = function() {
  console.log('original')
}

foo = function() { // Error
  console.log('hijacked')
}

foo();
```

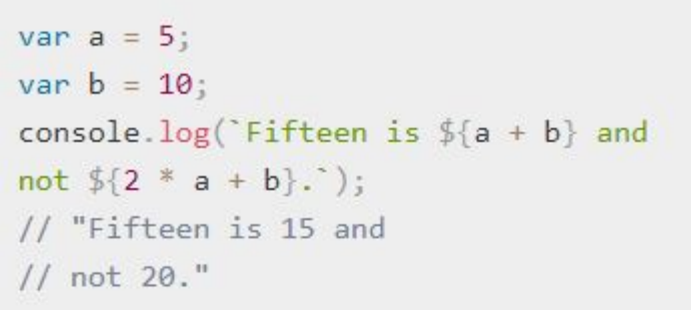


```
foo = function() {
    ^

TypeError: Assignment to constant variable.
    at Object.<anonymous> (/Users/veedzk/es6/
example.js:7:5)
    at Module._compile (module.js:399:26)
    at Object.Module._extensions..js (module.
js:406:10)
    at Module.load (module.js:345:32)
    at Function.Module._load (module.js:302:1
2)
    at Function.Module.runMain (module.js:431
:10)
    at startup (node.js:141:18)
    at node.js:977:3
```

Video - let & const

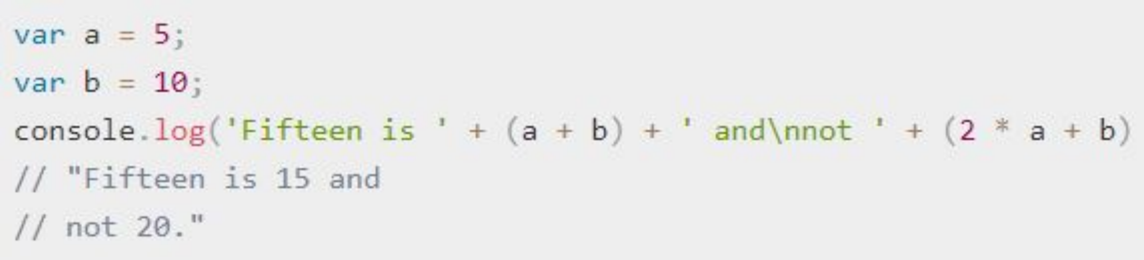
template literals

Template literals are string literals allowing embedded expressions. You can use multi-line strings and string interpolation features with them. *(ES5 => template strings)*



```
var a = 5;
var b = 10;
console.log(`Fifteen is ${a + b} and
not ${2 * a + b}.`);
// "Fifteen is 15 and
// not 20."
```

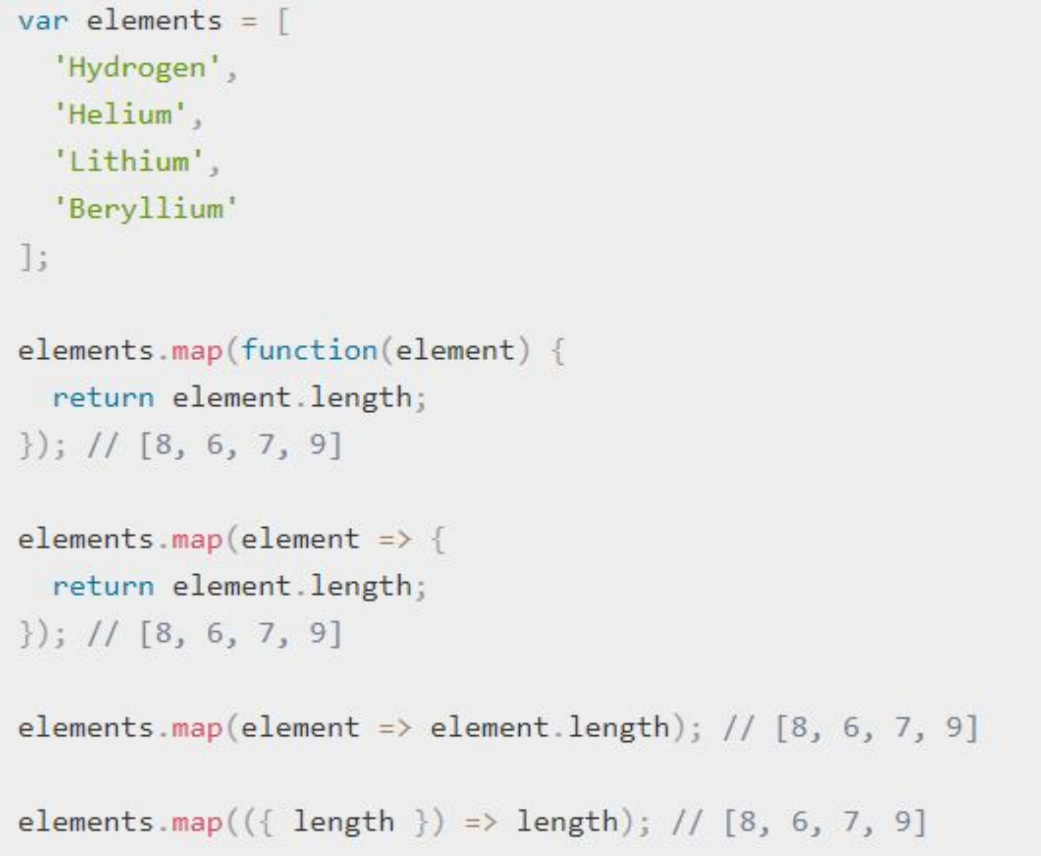
ES6: Template Literals



```
var a = 5;
var b = 10;
console.log('Fifteen is ' + (a + b) + ' and\nnot ' + (2 * a + b)
// "Fifteen is 15 and
// not 20."
```

ES5: Embedded Expressions with normal strings

Arrow functions



```
var elements = [
  'Hydrogen',
  'Helium',
  'Lithium',
  'Beryllium'
];

elements.map(function(element) {
  return element.length;
}); // [8, 6, 7, 9]

elements.map(element => {
  return element.length;
}); // [8, 6, 7, 9]

elements.map(element => element.length); // [8, 6, 7, 9]

elements.map(({ length }) => length); // [8, 6, 7, 9]
```

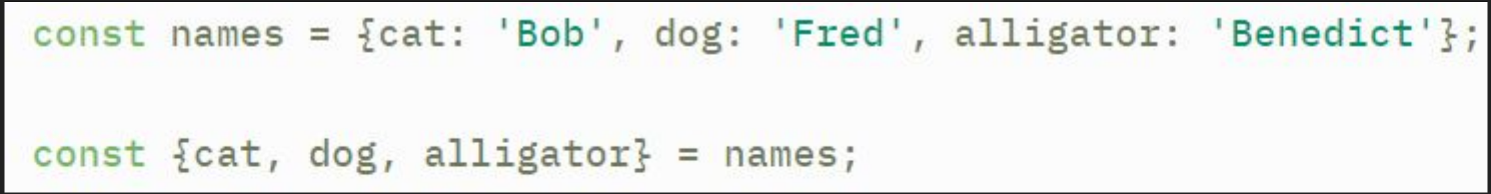
- An arrow function expression has a shorter syntax than a function expression and does not have its own this, arguments, super, or new.target.

- These function expressions are best suited for non-method functions, and they cannot be used as constructors.

Destructuring.

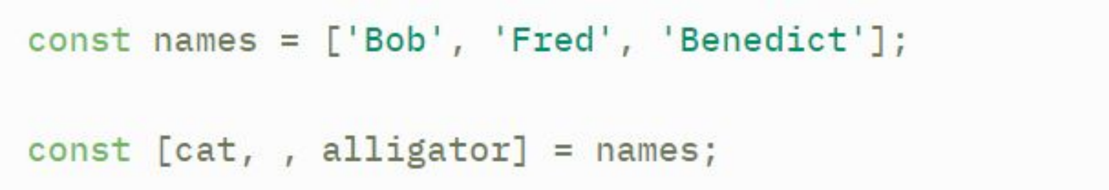
- Destructuring syntax allows you to extract data from arrays and objects with more ease and less syntactic clutter.
- We can extract properties from the object and assign them to new const variables

Object Destructuring



```
const names = {cat: 'Bob', dog: 'Fred', alligator: 'Benedict'};

const {cat, dog, alligator} = names;
```

Array Destructuring *(use comma to skip items)*

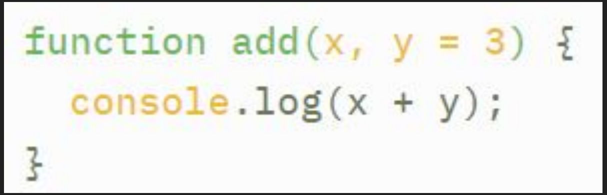


```
const names = ['Bob', 'Fred', 'Benedict'];

const [cat, , alligator] = names;
```

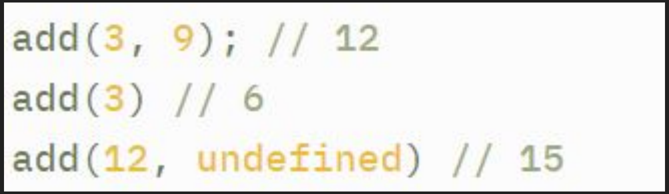
Default Parameters

- Default values can be defined for your function parameters in JavaScript. The default value will be used when an argument is missing or it evaluates to undefined.

Value 3 is used when y is not provided or when undefined is provided

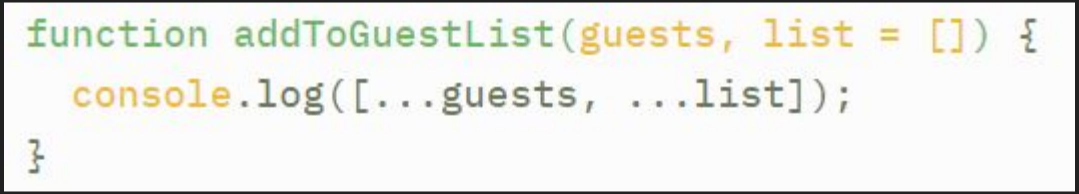


```
function add(x, y = 3) {
  console.log(x + y);
}
```



```
add(3, 9); // 12
add(3) // 6
add(12, undefined) // 15
```

Default params can ensure you have an empty array or object literal

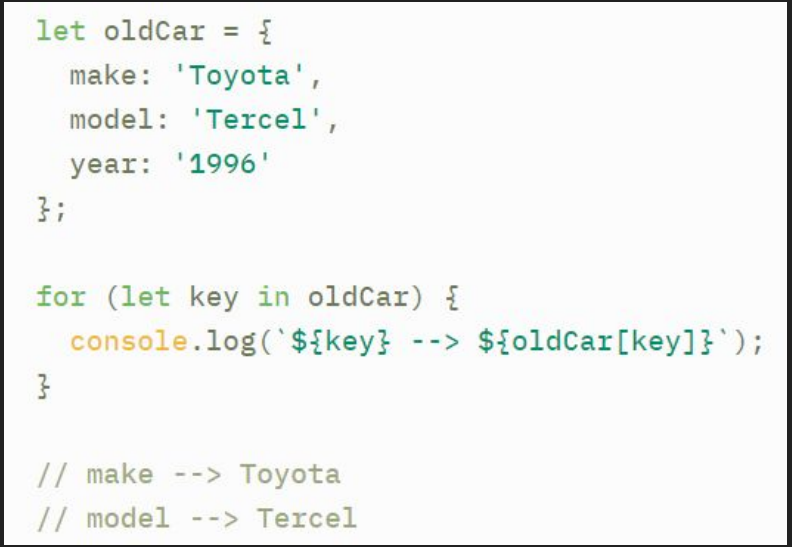


```
function addToGuestList(guests, list = []) {
  console.log([...guests, ...list]);
}
```

Iteration - for loops

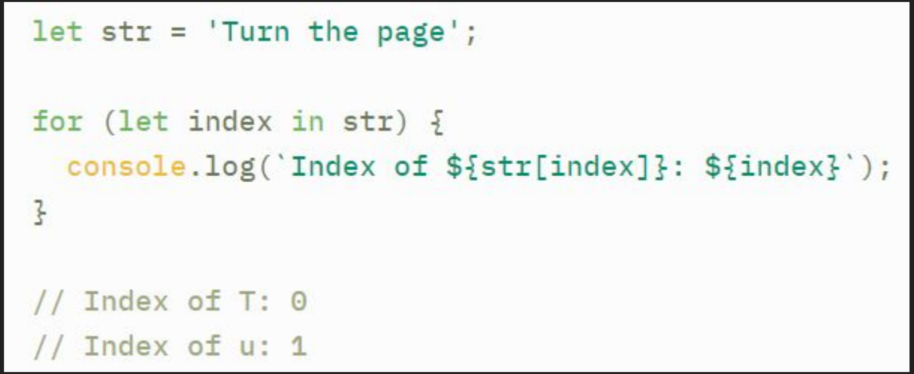
for in... statement

- Use for...in to iterate over the properties of an object (the object keys)
- Also use for...in to iterate over the index values of an iterable like an array or a string



```
let oldCar = {
  make: 'Toyota',
  model: 'Tercel',
  year: '1996'
};

for (let key in oldCar) {
  console.log(`${key} --> ${oldCar[key]}`);
}

// make --> Toyota
// model --> Tercel
```

Iterating over object

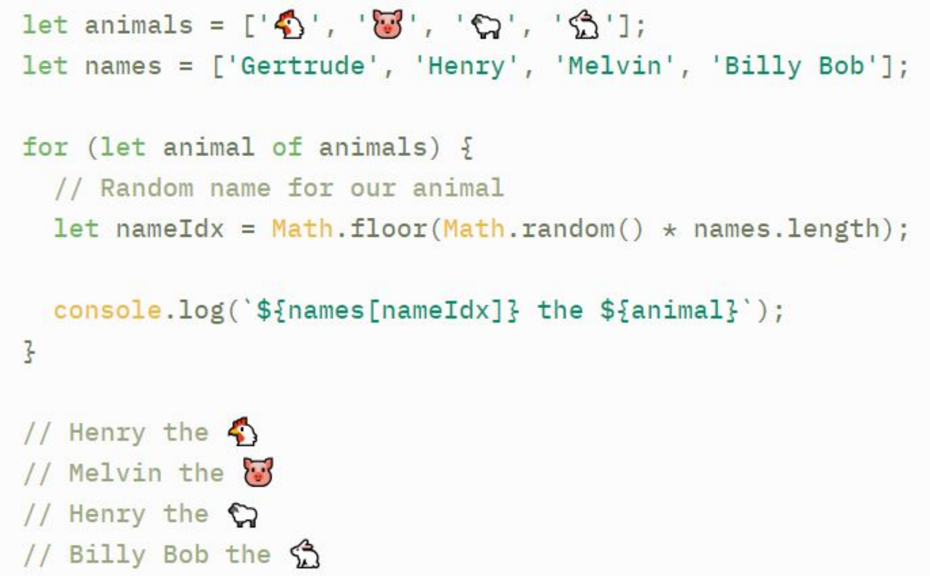


```
let str = 'Turn the page';

for (let index in str) {
  console.log(`Index of ${str[index]}: ${index}`);
}

// Index of T: 0
// Index of u: 1
```

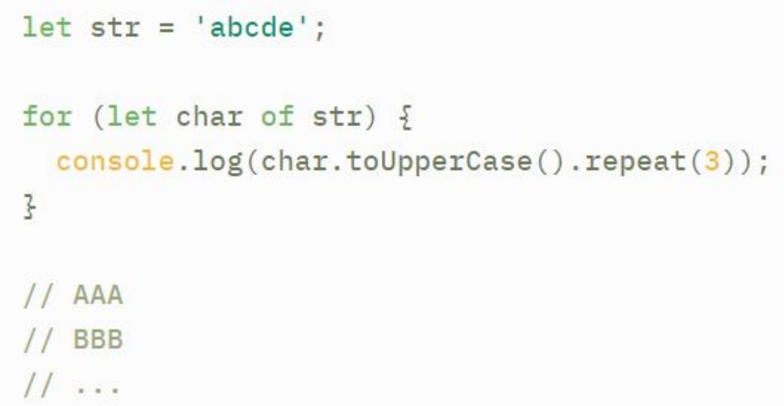
Iterating over string

for of... statement

- Use for...of to iterate over the values in an iterable ie. array, string
- Also can iterate over maps, sets, generators, DOM node collections and the arguments object available inside a functions.



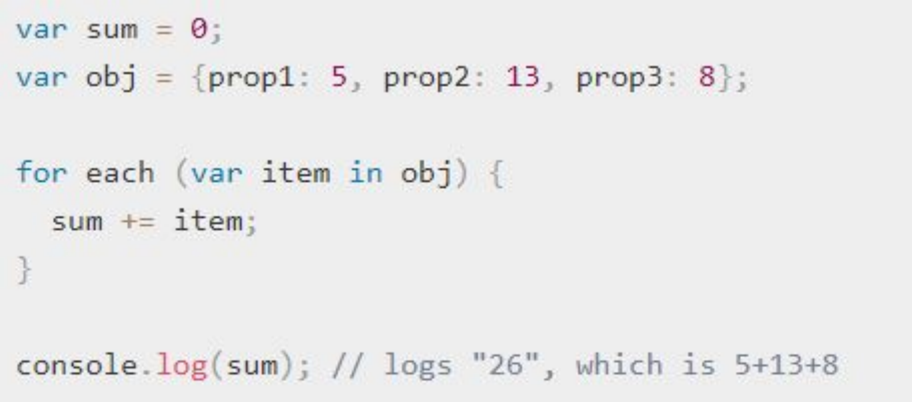
```
let animals = ['🐓', '🐷', '🐑', '🐇'];
let names = ['Gertrude', 'Henry', 'Melvin', 'Billy Bob'];

for (let animal of animals) {
  // Random name for our animal
  let nameIdx = Math.floor(Math.random() * names.length);

  console.log(`${names[nameIdx]} the ${animal}`);
}

// Henry the 🐓
// Melvin the 🐷
// Henry the 🐑
// Billy Bob the 🐇
```



```
let str = 'abcde';

for (let char of str) {
  console.log(char.toUpperCase().repeat(3));
}

// AAA
// BBB
// ...
```

for each in..statement

- The for each...in statement is deprecated, best practice do not use it.
- Firefox now warns about the usage of for each...in and it no longer works starting with Firefox 57.



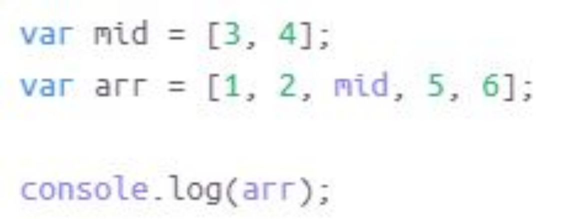
```
var sum = 0;
var obj = {prop1: 5, prop2: 13, prop3: 8};

for each (var item in obj) {
  sum += item;
}

console.log(sum); // logs "26", which is 5+13+8
```

Object & Arrays

Spread (...) operator

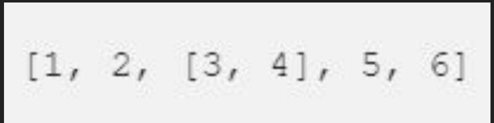
- It lets you use the spread (...) operator to copy enumerable properties from one object to another

When we don't use spread operator



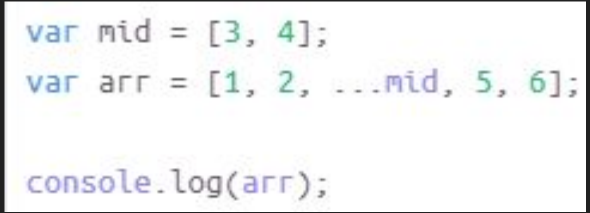
```
var mid = [3, 4];
var arr = [1, 2, mid, 5, 6];

console.log(arr);
```

Outputs



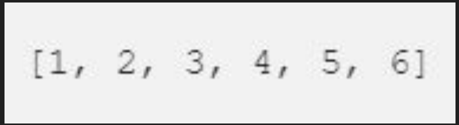
```
[1, 2, [3, 4], 5, 6]
```

When we use spread operator



```
var mid = [3, 4];
var arr = [1, 2, ...mid, 5, 6];

console.log(arr);
```

Outputs



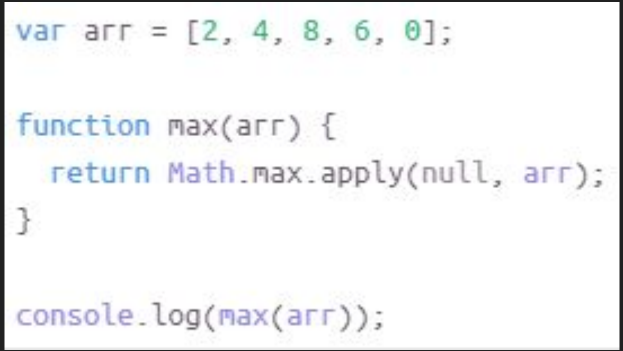
```
[1, 2, 3, 4, 5, 6]
```

Spread (...) operator cont.

- Math operator wants to find maximum value of multiple numbers, you can't use array as input.

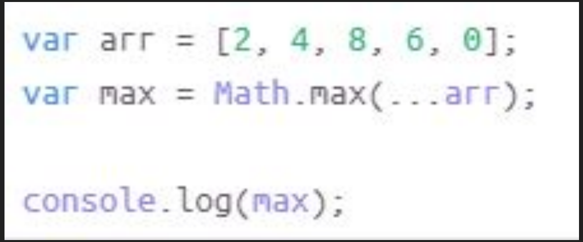
- Instead of using apply, we can use the spread syntax to expand our array elements and inputs each element into the Math.max() method

When we use apply method



```
var arr = [2, 4, 8, 6, 0];

function max(arr) {
  return Math.max.apply(null, arr);
}


console.log(max(arr));
```

When we use spread method



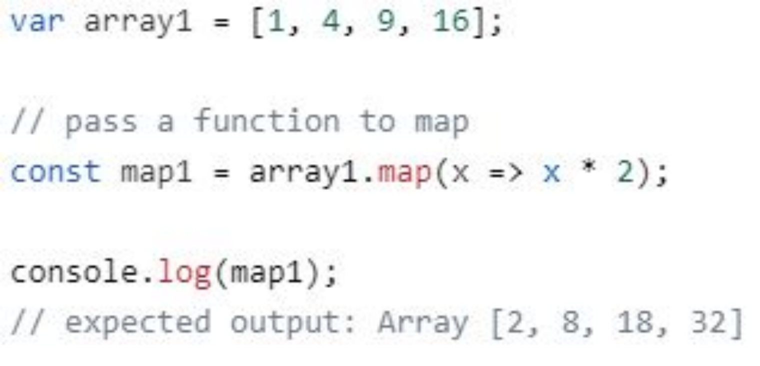
```
var arr = [2, 4, 8, 6, 0];
var max = Math.max(...arr);


console.log(max);
```

Video - spread operator

ES5 recap: map

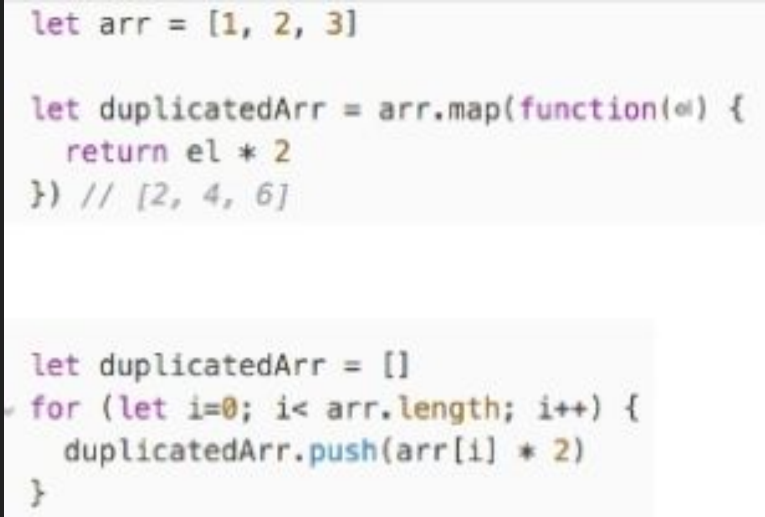
- The array.proto.map() method creates a new array with the results of calling a provided function on every element in the calling array.

Array.map()



```
var array1 = [1, 4, 9, 16];

// pass a function to map
const map1 = array1.map(x => x * 2);

console.log(map1);
// expected output: Array [2, 8, 18, 32]
```

Array.map() vs for loop

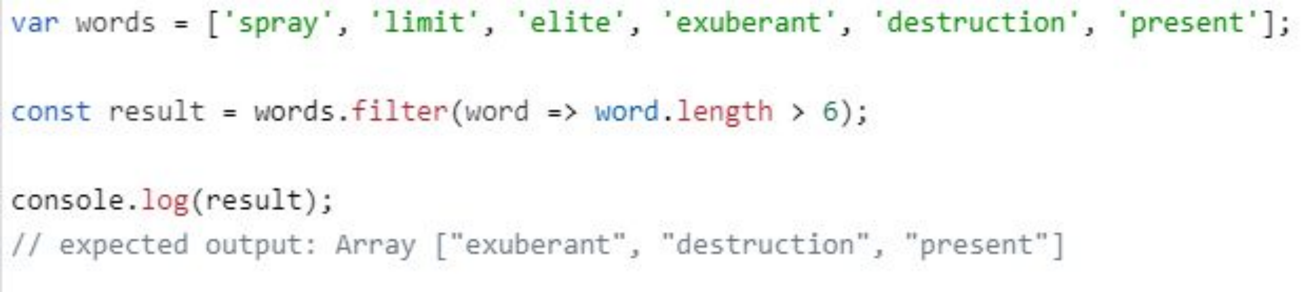


```
let arr = [1, 2, 3]

let duplicatedArr = arr.map(function(el) {
  return el * 2
}) // [2, 4, 6]



let duplicatedArr = []
for (let i=0; i< arr.length; i++) {
  duplicatedArr.push(arr[i] * 2)
}
```

ES5 recap: Filter

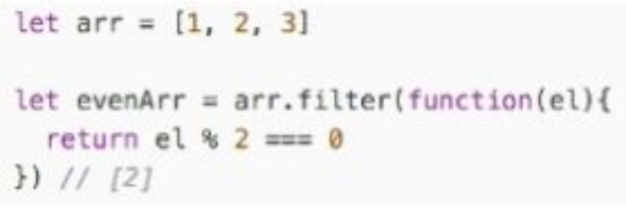
- The array.proto.filter() method creates a new array with all elements that pass the test implemented by the provided function.

Array.filter()

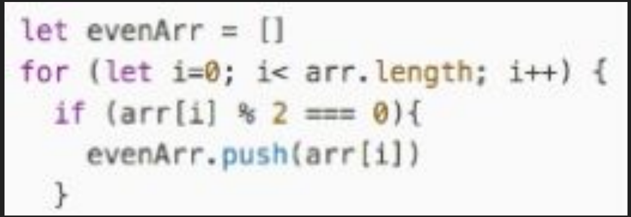


```
var words = ['spray', 'limit', 'elite', 'exuberant', 'destruction', 'present'];

const result = words.filter(word => word.length > 6);

console.log(result);
// expected output: Array ["exuberant", "destruction", "present"]
```

Array.filter() vs for loop



```
let arr = [1, 2, 3]

let evenArr = arr.filter(function(el){
  return el % 2 === 0
}) // [2]
```

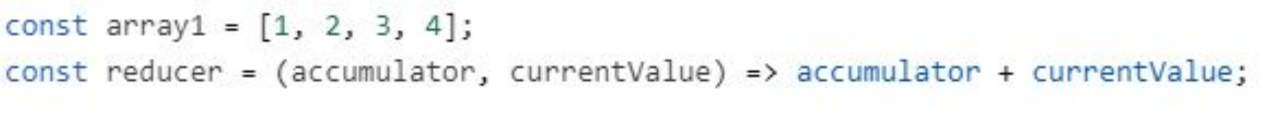


```
let evenArr = []
for (let i=0; i< arr.length; i++) {
  if (arr[i] % 2 === 0){
    evenArr.push(arr[i])
  }
```

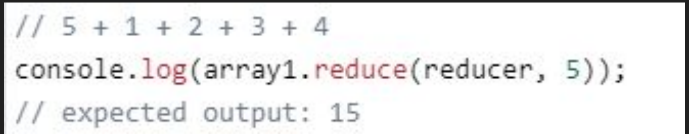
ES5 recap: Reduce

- The array.proto.reduce() method executes a reducer function (that you provide) on each member of the array resulting in a single output value.

Array.reduce()

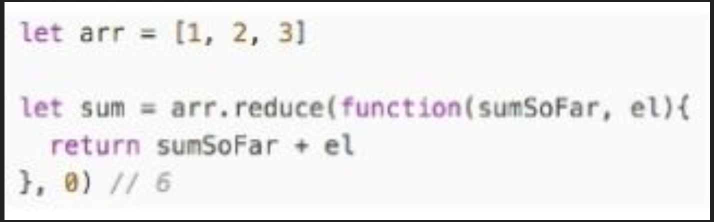


```
const array1 = [1, 2, 3, 4];
const reducer = (accumulator, currentValue) => accumulator + currentValue;
```

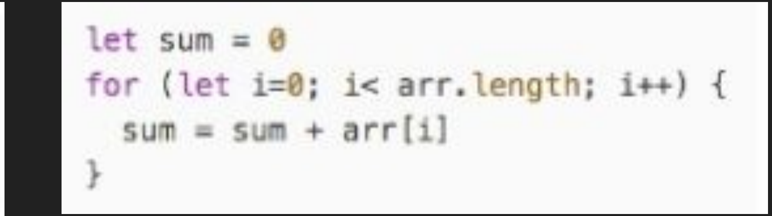


```
// 5 + 1 + 2 + 3 + 4
console.log(array1.reduce(reducer, 5));
// expected output: 15
```

Array.reduce() vs for loop



```
let arr = [1, 2, 3]

let sum = arr.reduce(function(sumSoFar, el){
  return sumSoFar + el
}, 0) // 6
```



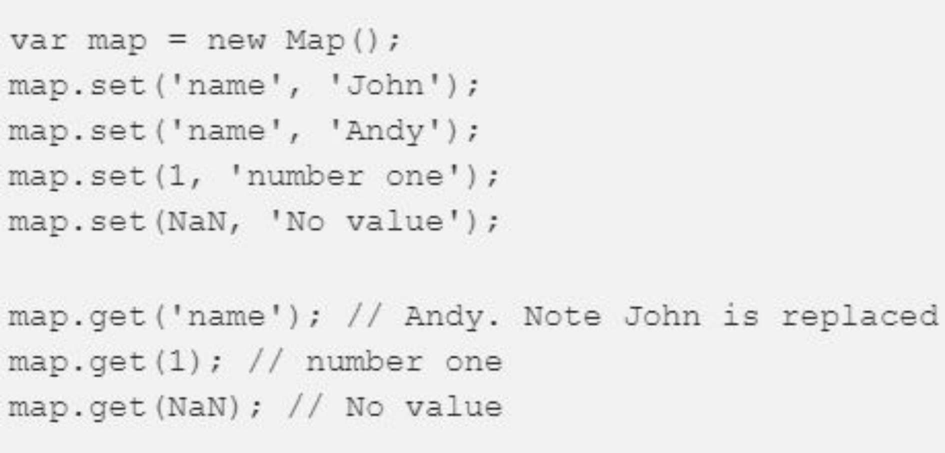
```
let sum = 0
for (let i=0; i< arr.length; i++) {
  sum = sum + arr[i]
}
```

Video - array filter

Map

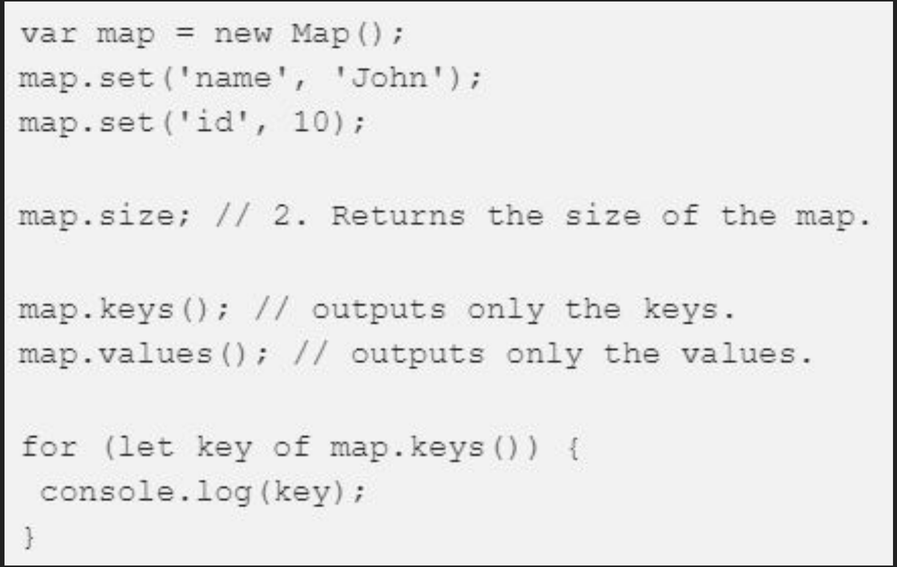
- Map holds key-value pairs. It’s similar to an array but we can define our own index.
- All indexes are unique and we can use any value as key or value.

Map keys can be any value



```
var map = new Map();
map.set('name', 'John');
map.set('name', 'Andy');
map.set(1, 'number one');
map.set(NaN, 'No value');

map.get('name'); // Andy. Note John is replaced
map.get(1); // number one
map.get(NaN); // No value
```

Other useful methods used in Map

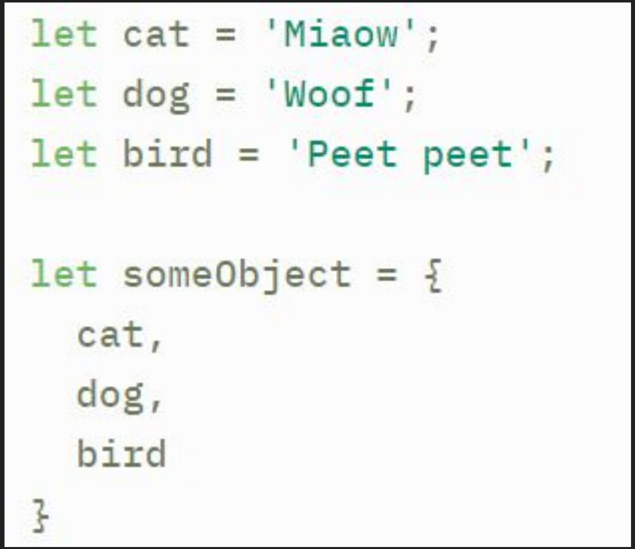


```
var map = new Map();
map.set('name', 'John');
map.set('id', 10);

map.size; // 2. Returns the size of the map.

map.keys(); // outputs only the keys.
map.values(); // outputs only the values.

for (let key of map.keys()) {
 console.log(key);
}
```

Object property declaration

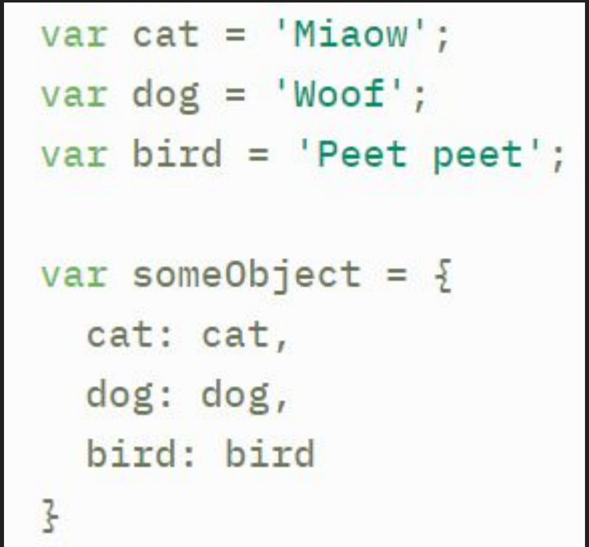
- Shorthand key names can now be used to define an object, when key's have same name as variables passed in as properties.

ES6 Syntax



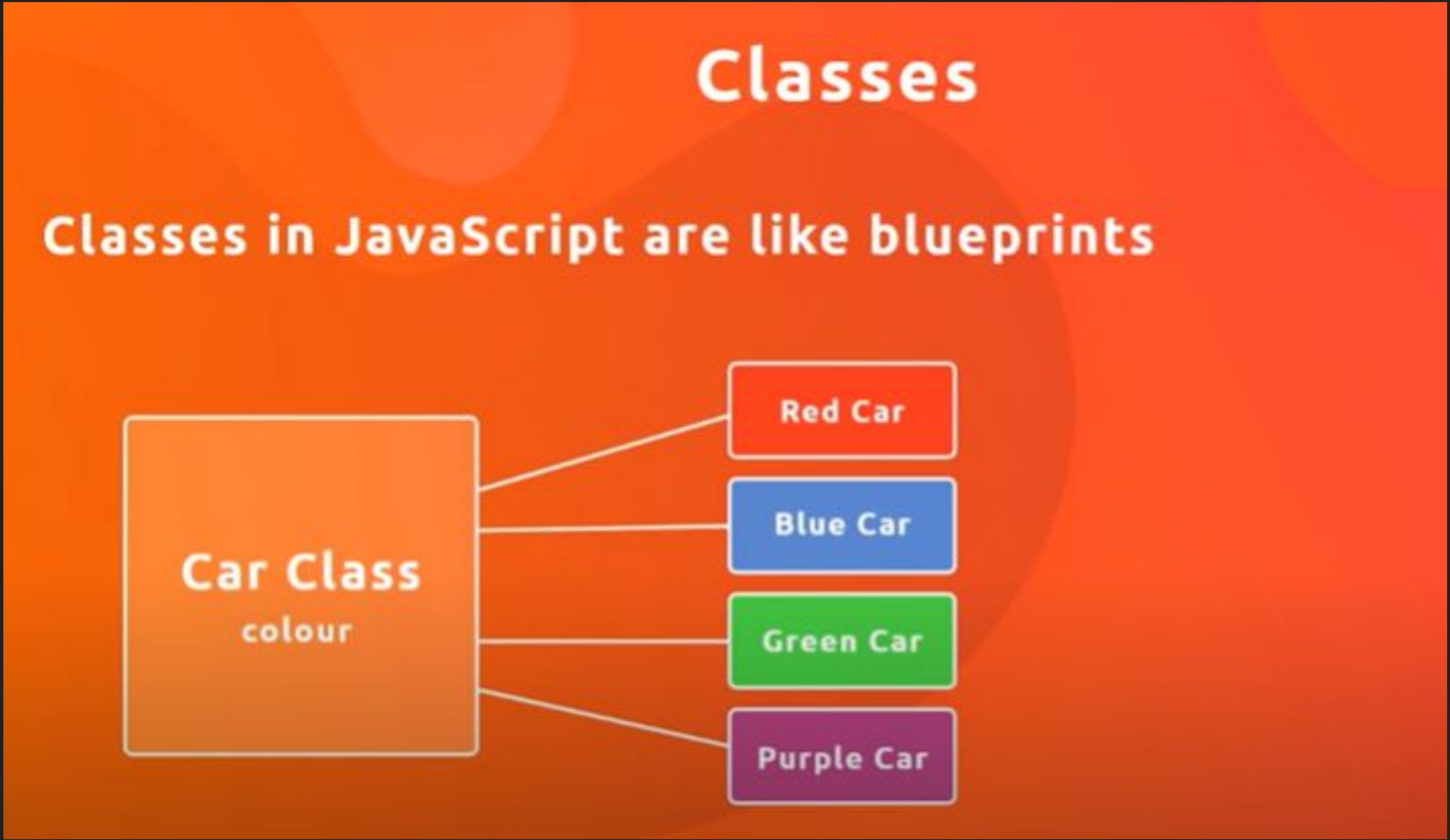
```
let cat = 'Miaow';
let dog = 'Woof';
let bird = 'Peet peet';

let someObject = {
  cat,
  dog,
  bird
}
```

ES5 Syntax



```
var cat = 'Miaow';
var dog = 'Woof';
var bird = 'Peet peet';

var someObject = {
  cat: cat,
  dog: dog,
  bird: bird
}
```

Classes



Classes

Classes in JavaScript are like blueprints

Car Class

colour

Red Car

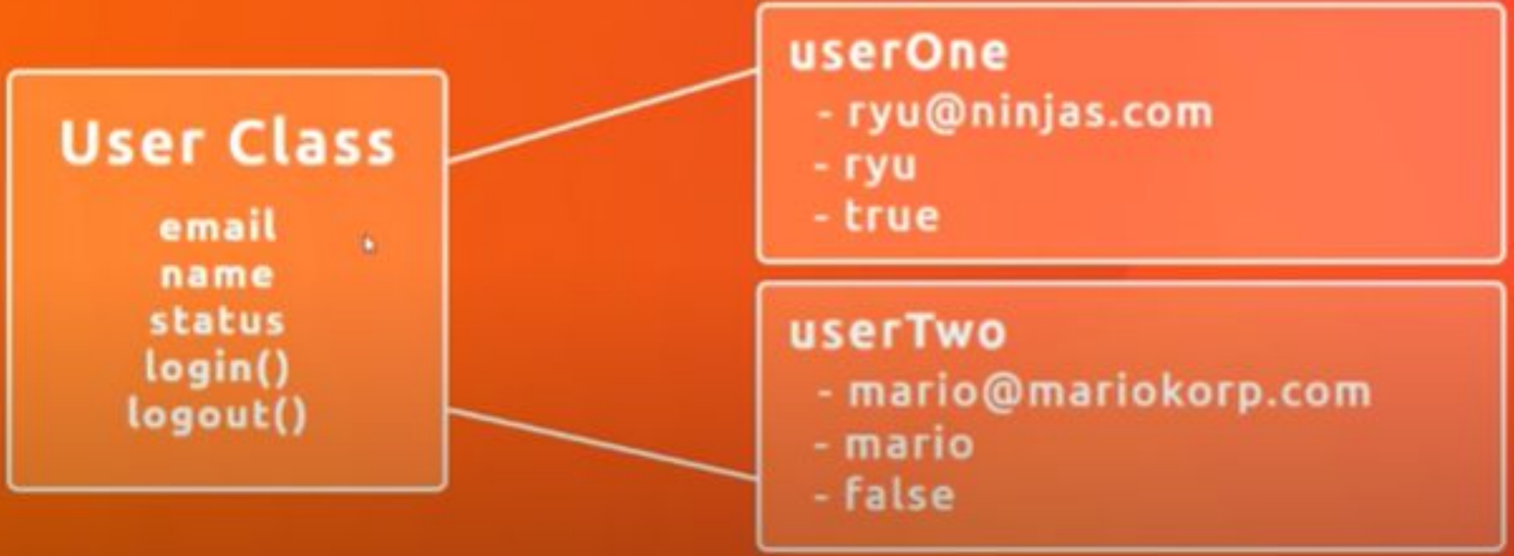
Blue Car

Green Car

Purple Car

Classes

Classes in JavaScript are like blueprints



User Class

email
name
status
login()
logout()

userOne

- ryu@ninjas.com
- ryu
- true

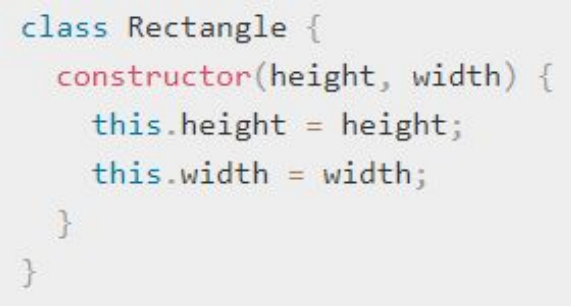
userTwo

- mario@mariokorp.com
- mario
- false

Classes

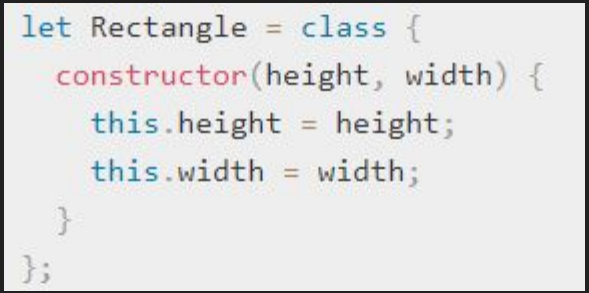
- JavaScript classes, introduced in ECMAScript 2015, are primarily syntactical sugar over JavaScript's existing prototype-based inheritance.
- The class syntax does not introduce a new object-oriented inheritance model to JavaScript.
- * Function declaration are hoisted, class declaration are not.

Class declaration



```
class Rectangle {
  constructor(height, width) {
    this.height = height;
    this.width = width;
  }
}
```

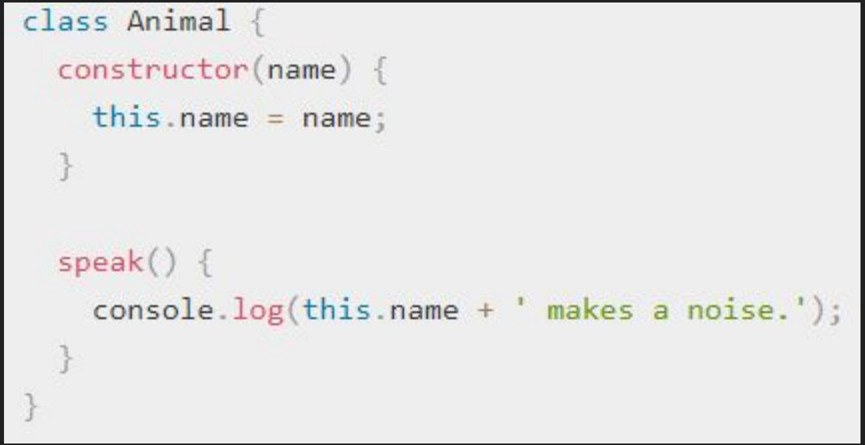
Class Expression



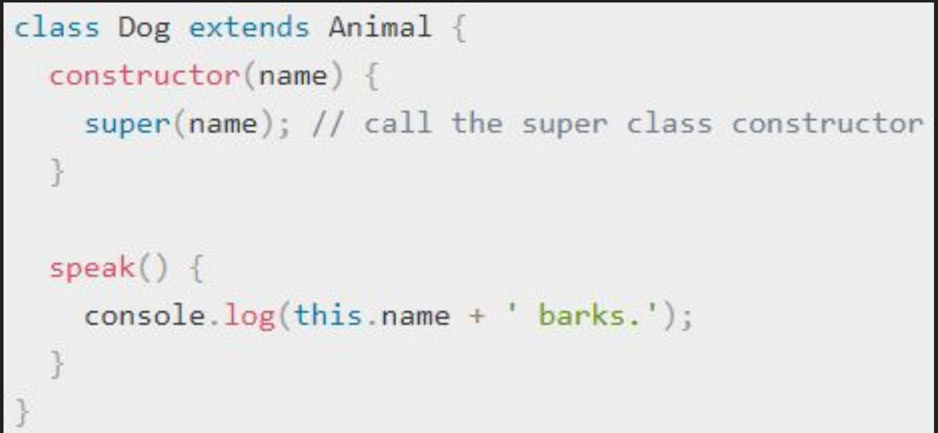
```
let Rectangle = class {
  constructor(height, width) {
    this.height = height;
    this.width = width;
  }
};
```

Subclassing with extends

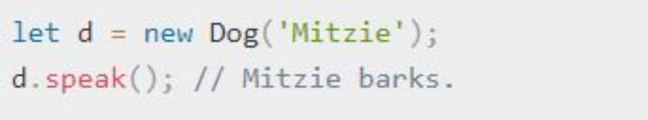
- The extends keyword is used in class declarations or class expressions to create a class as a child (sub class) of another class.



```
class Animal {
  constructor(name) {
    this.name = name;
  }

  speak() {
    console.log(this.name + ' makes a noise.');
  }
}
```



```
class Dog extends Animal {
  constructor(name) {
    super(name); // call the super class constructor
  }

  speak() {
    console.log(this.name + ' barks.');
  }
}
```

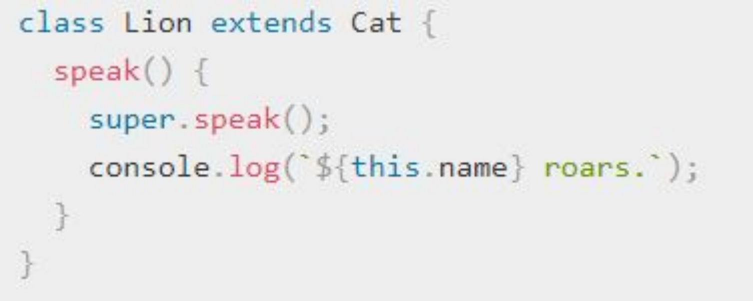


```
let d = new Dog('Mitzie');
d.speak(); // Mitzie barks.
```

Super class calls with super

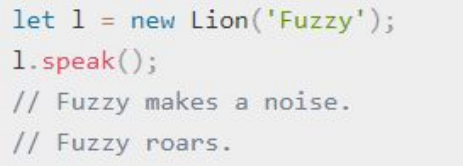
- The super keyword is used to call corresponding methods of super class. This is one advantage over prototype-based inheritance.

sub class



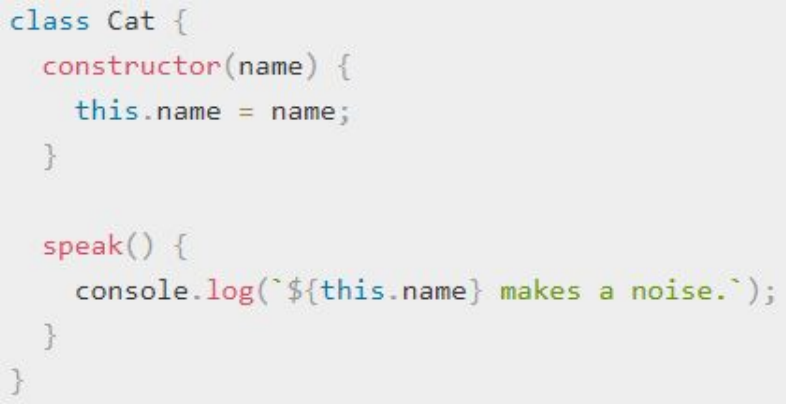
```
class Lion extends Cat {
  speak() {
    super.speak();
    console.log(`${this.name} roars.`);
  }
}
```

output



```
let l = new Lion('Fuzzy');
l.speak();
// Fuzzy makes a noise.
// Fuzzy roars.
```

super class

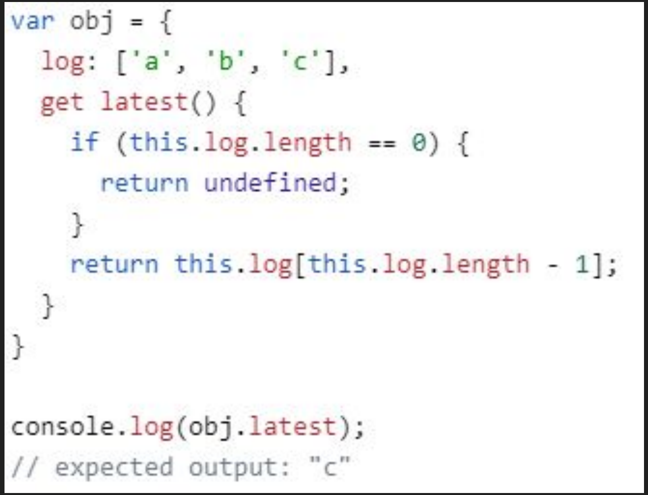


```
class Cat {
  constructor(name) {
    this.name = name;
  }

  speak() {
    console.log(`${this.name} makes a noise.`);
  }
}
```

Setters & Getters

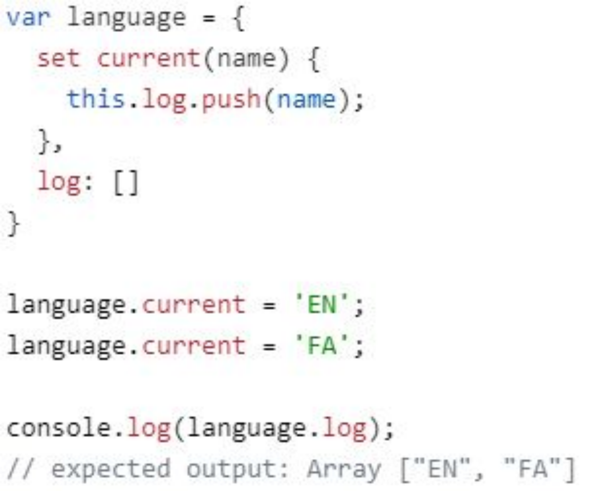
- The get syntax binds an object property to a function that will be called when that property is looked up.
- The set syntax binds an object property to a function to be called when there is an attempt to set that property.

getter



```
var obj = {
  log: ['a', 'b', 'c'],
  get latest() {
    if (this.log.length == 0) {
      return undefined;
    }
    return this.log[this.log.length - 1];
  }
}

console.log(obj.latest);
// expected output: "c"
```

setter



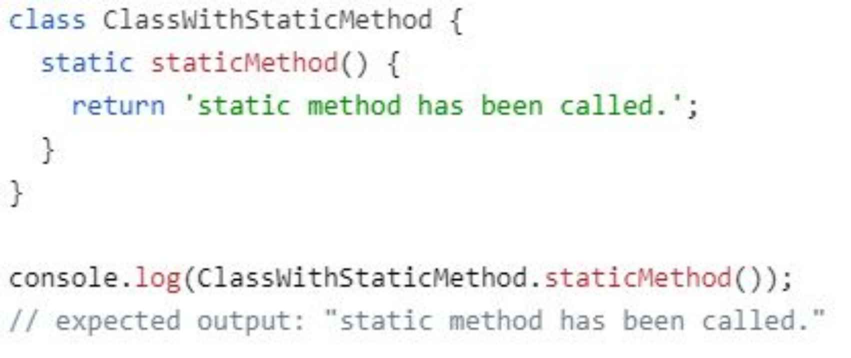
```
var language = {
  set current(name) {
    this.log.push(name);
  },
  log: []
}

language.current = 'EN';
language.current = 'FA';

console.log(language.log);
// expected output: Array ["EN", "FA"]
```

Video - setters/getters

Static methods

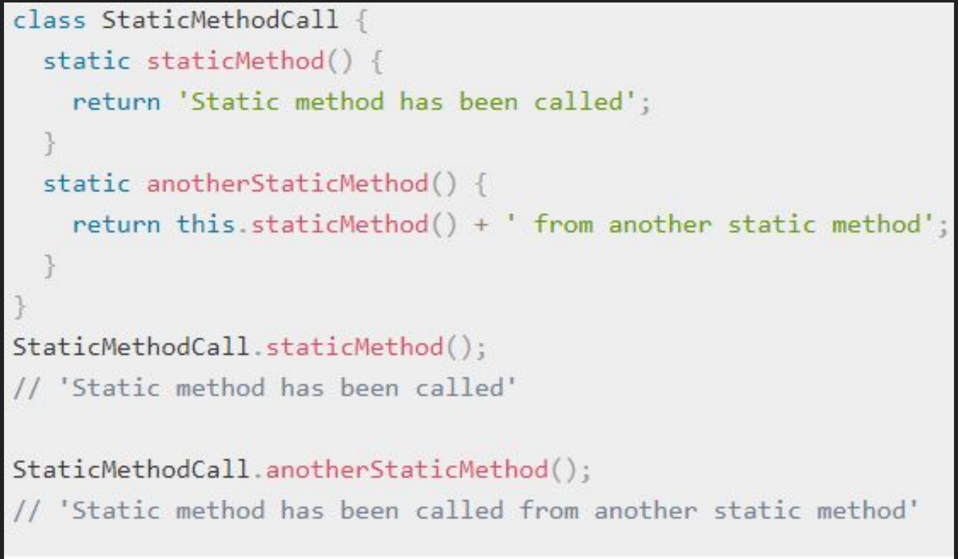
- The static keyword defines a static method for a class.
- Static methods aren't called on instances of the class. Instead, they're called on the class itself.
- These are often utility functions, such as functions to create or clone objects.

Static method



```
class ClassWithStaticMethod {
  static staticMethod() {
    return 'static method has been called.';
  }
}

console.log(ClassWithStaticMethod.staticMethod());
// expected output: "static method has been called."
```

Calling static method…from another static method



```
class StaticMethodCall {
  static staticMethod() {
    return 'Static method has been called';
  }
  static anotherStaticMethod() {
    return this.staticMethod() + ' from another static method';
  }
}
StaticMethodCall.staticMethod();
// 'Static method has been called'

StaticMethodCall.anotherStaticMethod();
// 'Static method has been called from another static method'
```