JavaScript pt. 1: Syntax and Concepts

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Some content is from Dr. Sadia Sharmin's slides of CSC309 Winter 2021: www.rainsharmin.com

Mahsa Amini

So far

- How web works
  Client/server – request/response - HTTP
- HTML
  Tags: headers, inputs, etc.
- CSS Styles
  Selectors, spacing, layout

This week

- Intro to JavaScript
- Objects and functions
- Scope
- Closures
- Arrow functions

Front-end so far

- HTML: Describes what should be on our page
- CSS: Describes how elements should look like
- But the web age is not interactive!
  We need something that responds to events and user actions
- JavaScript: a language that browsers understand!

Netscape - [Version 2.02]

File Edit View Go Bookmarks Options Directory Window Help

Back Forward Home Reload Images Open Print Find Stop

Location: about:

What's New! What's Cool! Handbook Net Search Net Directory Software

Netscape Navigator (TM)

Version 2.02

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NETSCAPE

JAVA COMPATIBLE

RSA PUBLIC KEY CRYPTOSYSTEM

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Java vs JavaScript

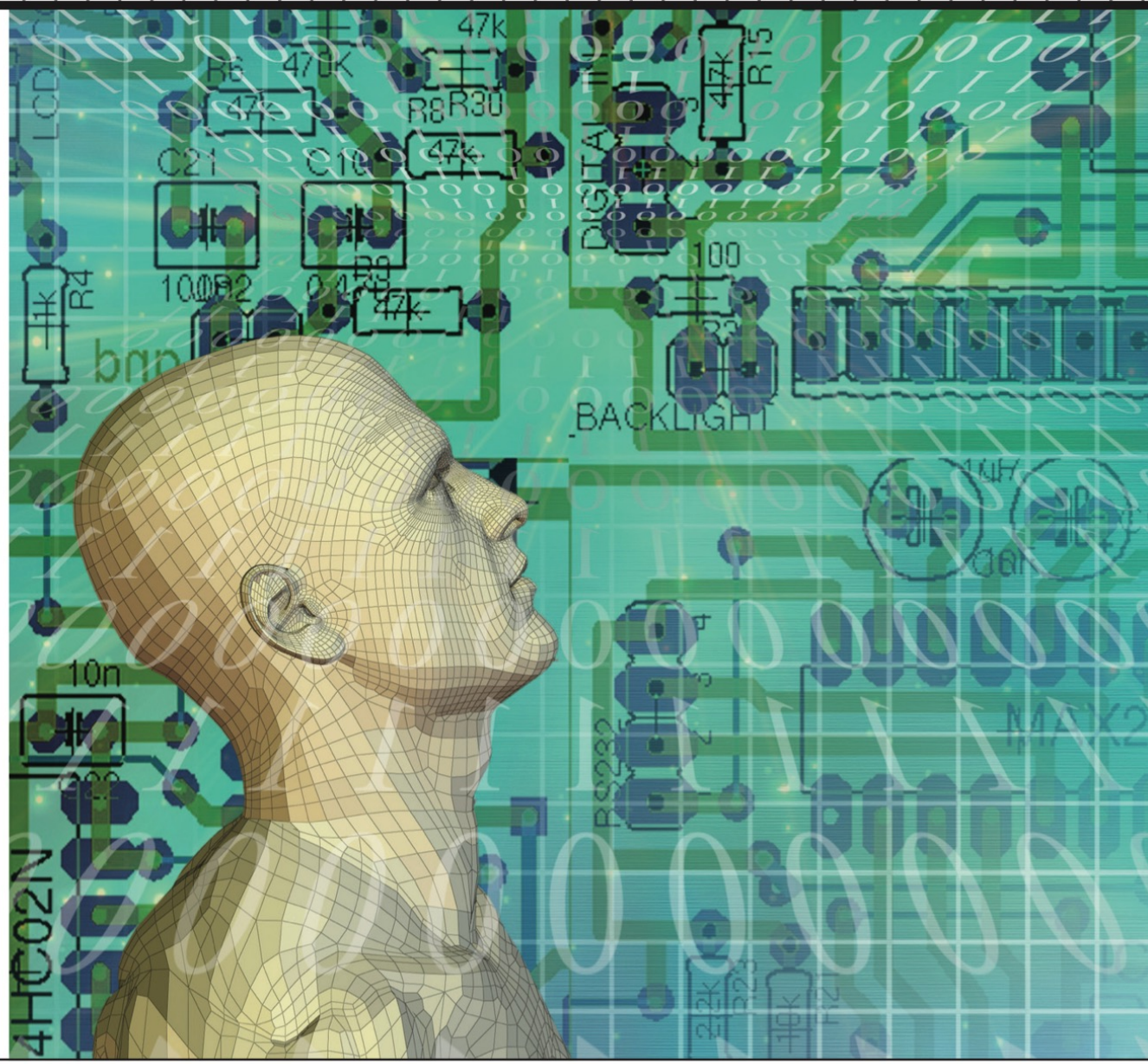
- Eich's script language had a somewhat similar syntax to Java

- Netscape-Sun deal:
  - Netscape browser will support Java apps
  - Eich's language will be called JavaScript!

- No further relevance between Java and JavaScript!

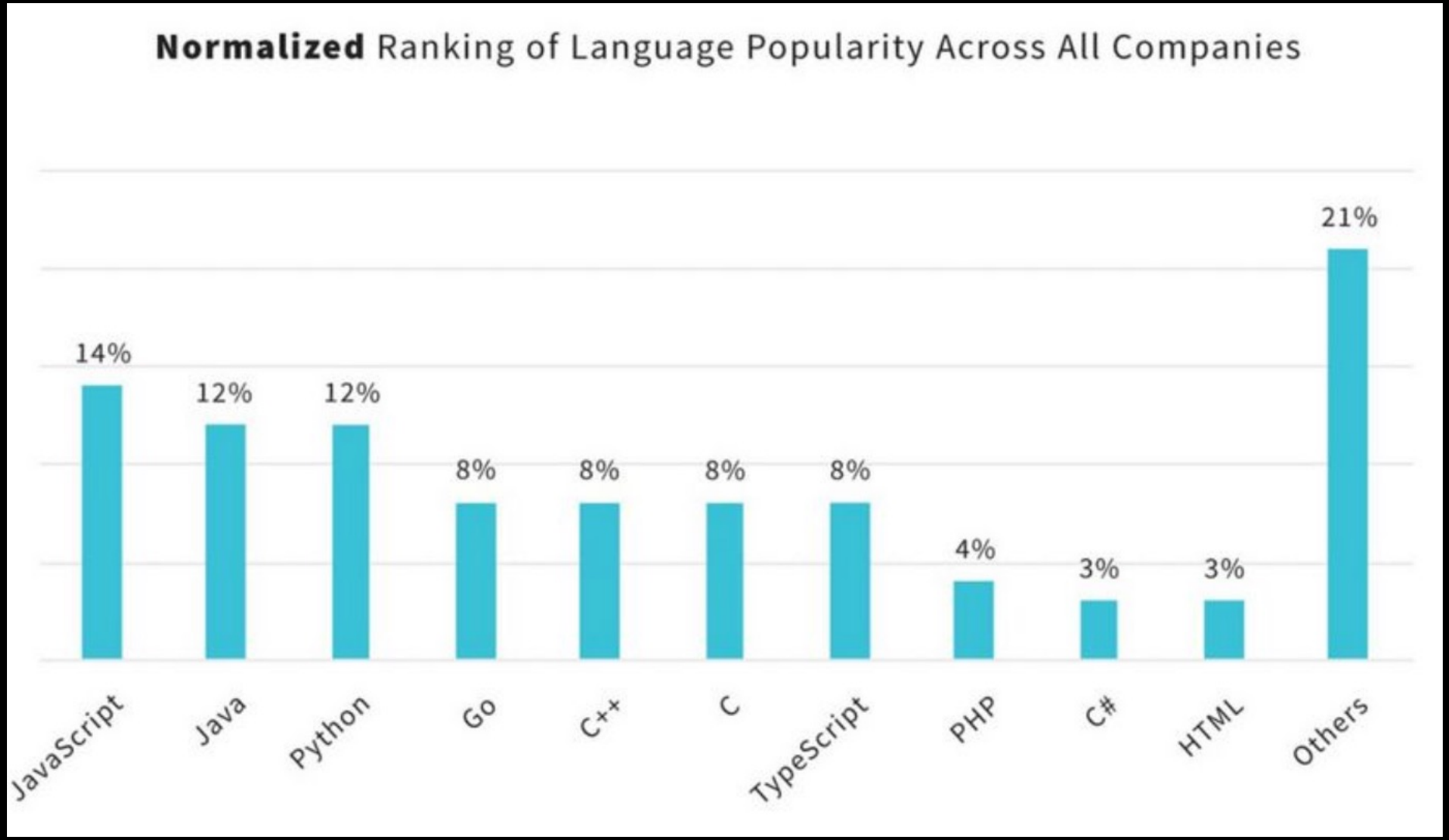
JavaScript: Designing a Language in 10 Days

Charles Severance
University of Michigan



There we go!

Visit: https://madnight.github.io/githut



Source: https://solutionshub.epam.com/blog/post/programming-language-popularity-on-github

- JavaScript is a scripting language
  - Interpreted at runtime
  - No JAR or exe file
- Almost all browsers have a JS interpreter
  - Run JS code accompanying the HTML (i.e., static files)
- Is it exclusive to client-side web applications?
- Answer: NO!
  - Example: NodeJS (more on that later)
  - Moreover, JS is just a language! You sort an array of integers with it

Syntax

- Declaring variables

```
var x = 5;
var y = "hello";
console.log(x + y);
```

- Data types:

  Number, string, boolean, undefined

  Object, function

- JS is dynamically-typed (like Python)

Objects

- Examples:

```
var cars = ["Saab", "Volvo", "BMW"];
var person = {firstName: "John", lastName: "Doe", age: 50,
eyeColor: "blue"};
var ref = null;
```

- Note: null is different from undefined

  `typeof(null)` returns object, while `typeof(undefined)` returns undefined!

Properties

- Examples:

```
person.firstName = "Joe";
person["lastName"] = "Jordan";
cars[0] = 1;
cars.push(2323);
```

- Objects (including arrays) are the only mutable types in JS

Functions

- Syntax:

```
function name(parameter1, parameter2, parameter3) {
  // code to be executed
}
```

- Properties can be functions (methods)

```
var obj = {f: function(x) {
   return x + 2
}}

cars.clear = function(){
    this.length = 0;
}
```

Classes

Visit https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Classes

- A template for creating objects
- Are in fact special functions

  Check `typeof(Rectangle)`
- Classes support inheritance

```
class Rectangle {
  constructor(height, width) {
    this.height = height;
    this.width = width;
  }
  // Getter
  get area() {
    return this.calcArea();
  }
  // Method
  calcArea() {
    return this.height * this.width;
  }
}

const square = new Rectangle(10, 10);

console.log(square.area); // 100
```

Conditions

- If statements:

```
if (typeof(cars[0]) === "number" && cars[0] < 0)
    cars[0] *= -1;
else
    console.log("Bad element");
```

- Important: notice `===`

  Visit https://codeahoy.com/javascript/2019/10/12/==-vs-===-in-javascript/

More statements

- While loops:

```
while (cars.length > 0){
    cars.pop();
}
```

- Switch statement:

```
switch(cars[0]){
    case 1:
        console.log("int");
        break;
    case "name":
        console.log("str");
        break;
    case x:
        console.log("var " + x);
        break;
    default:
        console.log("none");
}
```

For loops

- Classic for loop:

```
for (var i=0; i<10; i++)
    console.log(i * i * i);
```

- Iterable objects:

```
for (name of names)
    console.log("There is a " + name)
```

- Array-specific forEach:

```
names.forEach(function(index, name){
    console.log(name + " at index " + index);
})
```

Scope

Visit: https://www.w3schools.com/js/js_scope.asp

- Three types of scope:
  - Global scope
  - Function scope
  - Block scope

- Global scope
  - Outside any function
  - Variables can be accessed from anywhere in the program

Function scope

- Variables defined anywhere inside a function are local to that function
- Can be used anywhere inside that function
- Cannot be used outside that function

```
// code here can NOT use carName

function myFunction() {
  var carName = "Volvo";
  // code here CAN use carName
}

// code here can NOT use carName
```

Block scope

- To limit a variable to its block inside the function, use let

```
function f(n){
    if (n > 10){
        var tmp = 2;
    }
    // tmp CAN be accessed here
}
```

```
function f(n){
    if (n > 10){
        let tmp = 2;
    }
    // tmp can NOT be accessed here
}
```

Let vs var

- At global and function scopes, let and var work the same
- var supports redeclaration, while let does not
- Both support re-assignment. Use const to disallow it
- let is more like regular variables in other languages
  - Preferred over var

Let vs var

- let does not support redeclaration
- But what happens in a for loop?
  - It is in fact redeclared each time
- Not the case with var

Let vs var

- What is the difference between these two codes?

- The top code print the same value of i

```
for(var i = 1; i <= 5; i++) {
    setTimeout(function() {
        console.log('Value of i : ' + i);
    },100);
}


for(let i = 1; i <= 5; i++) {
    setTimeout(function() {
        console.log('Value of i : ' + i);
    },100);
}
```

Closures

Visit https://medium.com/@prashantramnyc/javascript-closures-simplified-d0d23fa06ba4

- What do variables X and Y store?
- What is the scope of variables a, b, c
- Local variables should be destroyed at the end of function

```
function outer() {

var b = 10;
var c = 100;

   function inner() {

         var a = 20;
         console.log("a= " + a + " b= " + b);


         a++;
         b++;


    }
   return inner;
}

var X = outer();  // outer() invoked the first time
var Y = outer();  // outer() invoked the second time
//end of outer() function executions
```

Closures

- inner captures variable b from outer

- Output:

```
a=20 b=10
a=20 b=11
a=20 b=12
a=20 b=10
```

```
function outer() {

var b = 10;
var c = 100;

   function inner() {

         var a = 20;
         console.log("a= " + a + " b= " + b);

         a++;
         b++;

    }
   return inner;
}

var X = outer();  // outer() invoked the first time
var Y = outer();  // outer() invoked the second time
//end of outer() function executions

X(); // X() invoked the first time
X(); // X() invoked the second time
X(); // X() invoked the third time

Y(); // Y() invoked the first time
```

Arrow functions

- A more convenient way to define functions
- Almost equivalent to regular functions
  - More on that later

```
function regular(a, b){
  return a + b;
}

const arrow = (a, b) => {
    return a + b;
}

const conciseArrow = (a, b) => a + b;
```

Simplify even further

- Today, for loops and if statements are rarely used
- Instead of a for loop, use forEach or map
- Example:

```
var names = ["ali", "hassan"]
names.forEach((item, index) => console.log(item + " at " + index))
upper = names.map(item => item.toUpperCase())
```

Simplify even further

- Take out elements with a specific condition
- Use the filter method instead of for loop and if
- Example:

```
let students = [{name: "John", id: 1}, {name: "Ali", id:2}]
let john = students.filter(item => item.name === "John")
```

Simplify even more further!

- reduce lets you do a lot of cool things with just 1 inline arrow function

- Example:

```
let maxCredit = employee.reduce((acc, cur) =>
Math.max(cur.credit, acc), Number.NEGATIVE_INFINITY)
```

Power of arrow functions!

Regular functions

```
var totalJediScore = personnel
  .filter(function (person) {
    return person.isForceUser;
  })
  .map(function (jedi) {
    return jedi.pilotingScore + jedi.shootingScore;
  })
  .reduce(function (acc, score) {
    return acc + score;
  }, 0);
```

Arrow functions

```
const totalJediScore = personnel
  .filter(person => person.isForceUser)
  .map(jedi => jedi.pilotingScore + jedi.shootingScore)
  .reduce((acc, score) => acc + score, 0);
```

Source: https://medium.com/poka-techblog/simplify-your-javascript-use-map-reduce-and-filter-bd02c593cc2d

Subtlety

- Regular functions have their own this value
- The object that called the function
  - Methods and event listeners: the actual object/element
  - Global function: global object (window)
- Arrow functions do not have their own this

- Do not use arrow functions as event listeners or object methods

  You can use them as class methods though. PERFECTLY WEIRD ISN'T IT?

- However, unlike regular functions, they can bind (capture) this like any other closure value

```
const person = {
    name: 'Kianoosh',
    sayHi() {
        setTimeout(() =>
            console.log(this.name + " says hi!"), 500);
    }
}
```

- For more information, visit https://www.javascripttutorial.net/es6/when-you-should-not-use-arrow-functions/

Destructuring

Visit https://dmitripavlutin.com/javascript-object-destructuring/

```
const hero = {
  name: 'Batman',
  realName: 'Bruce Wayne'
};

const { name, realName } = hero;

name;     // => 'Batman',
realName; // => 'Bruce Wayne'
```

```
const heroes = [
  { name: 'Batman' },
  { name: 'Joker' }
];

const names = heroes.map(
  function({ name }) {
    return name;
  }
);

names; // => ['Batman', 'Joker']
```

```
const hero = {
  name: 'Batman',
  realName: 'Bruce Wayne'
};

const { name, ...realHero } = hero;

realHero; // => { realName: 'Bruce Wayne' }
```

Sessions

- If your project uses session auth, browser already stores and sends the cookies headers

- If it uses token auth, you are responsible for storing and using the token

```
localStorage.setItem('access_token', access_token);
localStorage.getItem('access_token');
```

- Set Authorization header with the appropriate value

This week

- Intro to JavaScript
- Objects and functions
- Scope
- Closures
- Arrow functions

Next week

- DOM
  Getting and manipulating elements
- jQuery
- Asynchronous requests: Ajax
- Event loop
- Fetch API and Promises