INFO2180 LECTURE 4

JAVASCRIPT

JAVASCRIPT IS A PROGRAMMING LANGUAGE THAT ADDS INTERACTIVITY TO YOUR WEBSITE

https://developer.mozilla.org/en-US/docs/Learn/Getting_started_with_the_web/JavaScript_basics

JAVASCRIPT (JS) IS A LIGHTWEIGHT, INTERPRETED, PROGRAMMING LANGUAGE WITH FIRST-CLASS FUNCTIONS.

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

OVERVIEW

OVERVIEW

- Introduced 1995 in Netscape Navigator Web Browser
- JavaScript has nothing to do with Java.
- It was called that as a marketing ploy since Java was popular.
- Primarily runs in your browser
- It can now run on the server-side using Node.js

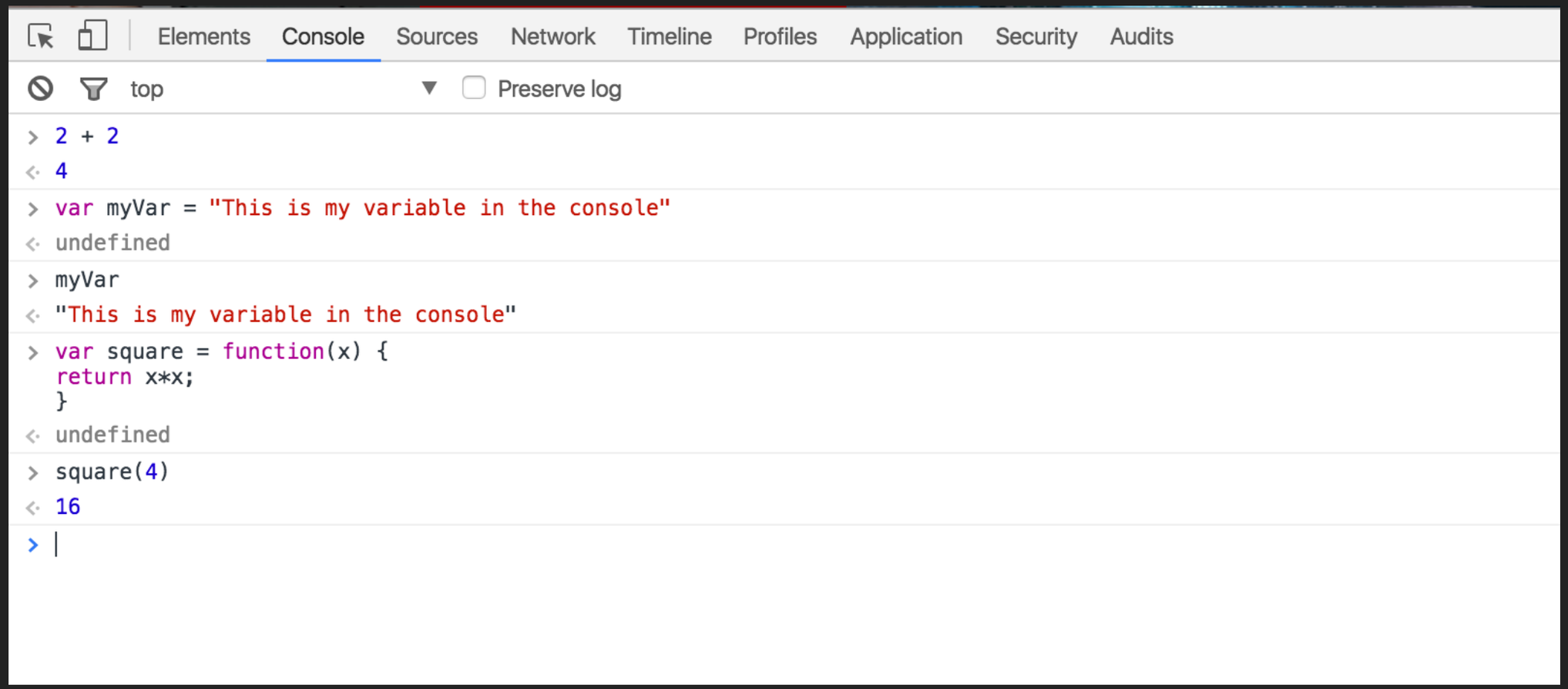
OVERVIEW

- ECMAScript is the standard. Current version is ECMAScript 2023 or ECMAScript 14 (ES14) as at June 2023.
- While not all browsers currently support all the new features, you can take advantage of them through a transpiler (e.g. BabelJS)

THE CONSOLE

THE CONSOLE LETS YOU USE STANDARD JAVASCRIPT STATEMENTS AND CONSOLE-SPECIFIC COMMANDS WHILE A PAGE IS LIVE IN THE BROWSER TO HELP YOU DEBUG THE PAGE.

https://developers.google.com/web/tools/chrome-devtools/debug/console/


Elements
Console
Sources
Network
Timeline
Profiles
Application
Security
Audits
top
Preserve log
> 2 + 2
< 4
> var myVar = "This is my variable in the console"
< undefined
> myVar
< "This is my variable in the console"
> var square = function(x) {
return x*x;
}
< undefined
> square(4)
< 16
>

CONSOLE.LOG

You can use `console.log()` instead of `alert()` to help you with debugging your code.

VALUES, TYPES AND OPERATORS

THERE ARE 6 BASIC TYPES OF VALUES

- Numbers
- Strings
- Booleans
- Objects
- Functions
- Undefined values

OPERATORS

- Unary Operator (e.g. `typeof`)
- Binary Operators (e.g. `+`, `-`, `*`, `/`, and `%`)
- Ternary Operator (e.g `?:` used as short hand if/else)
- Logical Operators (e.g. `&&`, `||`)
- Comparison Operators (e.g. `==`, `!=`, `===`, `!==`, `<`, `>`, `<=`, `>=`)

EXAMPLES OF NUMBERS

```
14
```
(Integer)

```
9.81
```
(Fractional Number)

```
2.998e8
```
(Scientific Notation)

EXAMPLES OF ARITHMETIC

```
100 + 4 * 11
```

```
10 / 2
```

```
314 % 100
```

EXAMPLES OF NUMBERS

What is NaN?

EXAMPLES OF NUMBERS

`NaN` stands for “not a number”, even though it is a value of the number type. You’ll get this result when you, for example, try to calculate **`0 / 0`** (zero divided by zero), **`Infinity - Infinity`**, or any number of other numeric operations that don’t yield a precise, meaningful result.

EXAMPLES OF STRINGS

```
"The Quick brown fox jumps over
the lazy dog."
```

```
"This is one line\nAnd this is
another"
```

EXAMPLES OF STRING CONCATENATION

```
"Hello" + " " + "World!"
```

EXAMPLES OF TEMPLATE LITERALS

```
`Hello my name is ${variablename}
and I am cool.`
```

Note: The use of backticks (``` `` ```) instead of quotes. These strings are good for multi-line strings. You can also have variables interpolated within the string. e.g. ${variableName}

EXAMPLES OF BOOLEAN VALUES

`true` and `false`

EXAMPLES OF COMPARISONS

```
10 < 12
// -> true

15 > 18
// -> false

"Aardvark" < "Zoroaster"
// -> true
```

EXAMPLES OF LOGICAL OPERATORS

```
false || true
// -> true

false && true
// -> false
```

EXAMPLES OF TERNARY OPERATOR

```
(3 < 4) ? "It's less than 4" :
        "It's greater than 4";
```

UNDEFINED VALUES

`null` and `undefined`

UNDEFINED VALUES

A variable that has not been assigned a value is of type undefined. A method or statement also returns undefined if the variable that is being evaluated does not have an assigned value. A function returns undefined if a value was not returned.

EXPRESSIONS AND STATEMENTS

EXPRESSIONS

AN EXPRESSION IS A COMBINATION OF VALUES, VARIABLES, AND OPERATORS, WHICH COMPUTES TO A VALUE.

http://www.w3schools.com/js/js_syntax.asp

SIMPLE EXAMPLE OF AN EXPRESSION

```
10

"my string"

5 - 2

x * 10
```

STATEMENTS

STATEMENTS ARE INSTRUCTIONS TO BE EXECUTED AND ARE USUALLY SEPARATED BY SEMICOLONS.

http://www.w3schools.com/js/js_syntax.asp

VARIABLES

EXAMPLES

```
let x = 3;
let myvar = "my value";
var someVar = "some val";
const SOME_NUM = 7;
```

KEYWORDS AND RESERVED WORDS

```
break case catch class const continue debugger
default delete do else enum export extends
false finally for function if implements
import in instanceof interface let new null
package private protected public return static
super switch this throw true try typeof var
void while with yield
```

These cannot be used as variable or function names.

FUNCTIONS

FUNCTIONS ARE THE BREAD AND BUTTER OF JAVASCRIPT PROGRAMMING.

http://eloquentjavascript.net/03_functions.html

IT IS A TOOL TO STRUCTURE LARGER PROGRAMS, TO REDUCE REPETITION, TO ASSOCIATE NAMES WITH SUBPROGRAMS, AND TO ISOLATE THESE SUBPROGRAMS FROM EACH OTHER.

http://eloquentjavascript.net/03_functions.html

EXAMPLE OF A FUNCTION DEFINITION

```
let makeNoise = function() {
  console.log("Pling!");
};

makeNoise();
// → Pling!
```

ANOTHER EXAMPLE

```
let power = function(base, exponent) {
  let result = 1;
  for (let count = 0; count < exponent; count++)
    result *= base;
  return result;
};

console.log(power(2, 10));
// → 1024
```

SHORTHAND EXAMPLE

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

ARROW FUNCTIONS EXAMPLE

```
(x, y) => {
  return x * y;
}
```

ARROW FUNCTIONS EXAMPLE

```
let square = (x) => { x * x;}
```

```
let square = (x) => x * x;
```

CONTROL STRUCTURES

IF/ELSE

```
let num = Number(prompt("Pick a number", "0"));
if (num < 10) {
  alert("Small");
} else if (num < 100) {
  alert("Medium");
} else {
  alert("Large");
}
```

WHILE LOOP

```
let number = 0;
while (number <= 12) {
  console.log(number);
  number = number + 2;
}
```

FOR LOOP

```
for (var number = 0; number <= 12; number++) {
  console.log(number);
}
// → 0
// → 1
//   … etcetera
```

FOR...IN LOOP

```
const fruits = ["Banana", "Orange", "Pineapple"];

for(const key in fruits) {
  console.log(key);
});

// → 0
// → 1
// → 2
```

FOR..OF LOOP

```
const fruits = ["Banana", "Orange", "Pineapple"];

for(const item of fruits) {
  console.log(item);
});

// → "Banana"
// → "Orange"
// → "Pineapple"
```

FOREACH LOOP

```
const fruits = ["Banana", "Orange", "Pineapple"];

fruits.forEach((elem, index) => {
  console.log(elem, index);
});

// → "Banana", 0

// → "Orange", 1

// → "Pineapple", 2
```

SWITCH

```
switch (prompt("What is the weather like?")) {
  case "rainy":
    console.log("Remember to bring an umbrella.");
    break;
  case "sunny":
    console.log("Dress lightly.”);
    break;
  default:
    console.log("Unknown weather type!");
    break;
}
```

COMMENTS

EXAMPLE OF JAVASCRIPT COMMENTS

```
// This is a single line comment
```

```
/*
This is a multi-line
comment
*/
```

ARRAYS AND OBJECTS

ARRAYS

Arrays allow you to store a list/collection of values.

```
let fruits = [“Apple”, “Banana”];
console.log(fruits[0]);
// → Apple
```

ARRAY OPERATIONS - PUSH

```
let newList = fruits.push("Orange");
// -> ["Apple", "Banana", "Orange"]
```

Add to the end of an Array

ARRAY OPERATIONS - POP

```
let newList = fruits.pop();
// -> ["Apple", "Banana"]
```

Remove from the end of an Array.

ARRAY OPERATIONS - LENGTH

```
let fruits = ["Apple", "Banana"]

fruits.length;
// -> 2
```

Returns the number of items in an Array.

ARRAY OPERATIONS - MAP

```
let 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 OPERATIONS – FILTER

```
let 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 OPERATIONS - REDUCE

```
const numbers = [1, 2, 3, 4];

const reducer = (accumulator,
currentValue) => accumulator +
currentValue;


// 1 + 2 + 3 + 4
console.log(numbers.reduce(reducer));
// expected output: 10
```

ARRAY OPERATIONS – REDUCE

```
const numbers = [1, 2, 3, 4];

const sum = numbers.reduce((result, item) =>
result + item, 0);

console.log(sum); // result: 10
```

OBJECTS

Objects allow you to store a list/collection of values too but with named keys (instead of numbers). It's like an associative array or hash in other languages.

EXAMPLE OF AN OBJECT

```
let myCar = {
   wheels: 4,
   "brand name": "Toyota",
   model: "Corolla",
   features: ["air condition", "radio"]
};
```

EXAMPLE OF RETRIEVING A VALUE FROM AN OBJECT

```
myCar.wheels

// -> 4
```

```
myCar['wheels']

// -> 4
```

EXAMPLE OF SETTING A VALUE OF AN OBJECT

```
myCar.year = "2005";
```

```
myCar['year'] = "2005";
```

There is a lot more to Objects and you can mimic OOP principles with them. For more information read http://eloquentjavascript.net/06_object.html.

CLASSES

SIMPLE EXAMPLE OF USING THE CLASS SYNTAX

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

  // Method
  calcArea() {
    return this.height * this.width;
  }
}
```

SIMPLE EXAMPLE OF USING THE CLASS SYNTAX

```
let rect = new Rectangle(20, 40);
rect.calcArea(); // 800
```

SPREAD AND REST OPERATORS

SPREAD

The spread syntax allows us to expand array, string or object expressions in places where key-value pairs are expected.

SPREAD SYNTAX (...)

```
function sum(x, y, z) {
  return x + y + z;
}

const numbers = [1, 2, 3];
console.log(sum(...numbers));
// expected output: 6
```

SPREAD SYNTAX (...)

Another command example:

```
let numberStore = [0, 1, 2];
let newNumber = 12;
numberStore = [...numberStore, newNumber];
```

REST

The rest operator is similar to the spread operator but is used to put the "rest" of some specific user-supplied values into a JavaScript array, object or function.

REST

```
// Define a function with two regular parameters and one
rest parameter:
function myBio(firstName, lastName, ...otherInfo) {
  return otherInfo;
}

// Invoke myBio function while passing five arguments to
its parameters:
myBio("Lauren", "Amelie", "Awesome Coder", "Web
Developer", "Female");

// The invocation above will return:
["Awesome Coder", "Web Developer", "Female"]
```

DESTRUCTURING

DESTRUCTURING

The destructuring assignment syntax makes it possible to unpack values from arrays, or properties from objects, into distinct variables.

DESTRUCTURING

So instead of doing this:

```
const someArray = [10, 20, 30, 40, 50];
let a = someArray[0];
let b = someArray[1];

console.log(a); // 10
console.log(b); // 20
```

DESTRUCTURING

We could shorten it and do this:

```
let [a, b, ...rest] = [10, 20, 30, 40, 50];

console.log(a); // 10
console.log(b); // 20
console.log(rest); // [30, 40, 50]
```

DESTRUCTURING

You can also do this with Objects

```
let {make, model, ...rest} = { make:
"Toyota", model: "Corolla", wheels: 4};

console.log(make); // Toyota
console.log(model); // Corolla
console.log(rest); // { wheels: 4 }
```

STRICT MODE

STRICT MODE

- JavaScript can be made a little more “strict” by enabling strict mode.
- To do this you would place `"use strict";` at the top of your JS file or the top of a function body.
- Strict mode for instance will require you to use `var`. (e.g. `var myVariable = "foo";` as opposed to just saying `myVariable = "foo"`).
- It also disallows giving a function multiple parameters with the same name. (e.g. `function getAnswer(x, x) { //some code }`)
- Strict mode does a few more things that might be helpful in spotting problems in your code.

ADDING JAVASCRIPT TO YOUR WEBPAGES

EXTERNAL FILES

```
<script src="../myscript.js"></script>
```

Usually this is put in the <head></head> tags.

INTERNAL/EMBEDDED FILES

```
<script type="text/javascript">
// My code here
</script>
```

EXAMPLE USING ATTRIBUTES

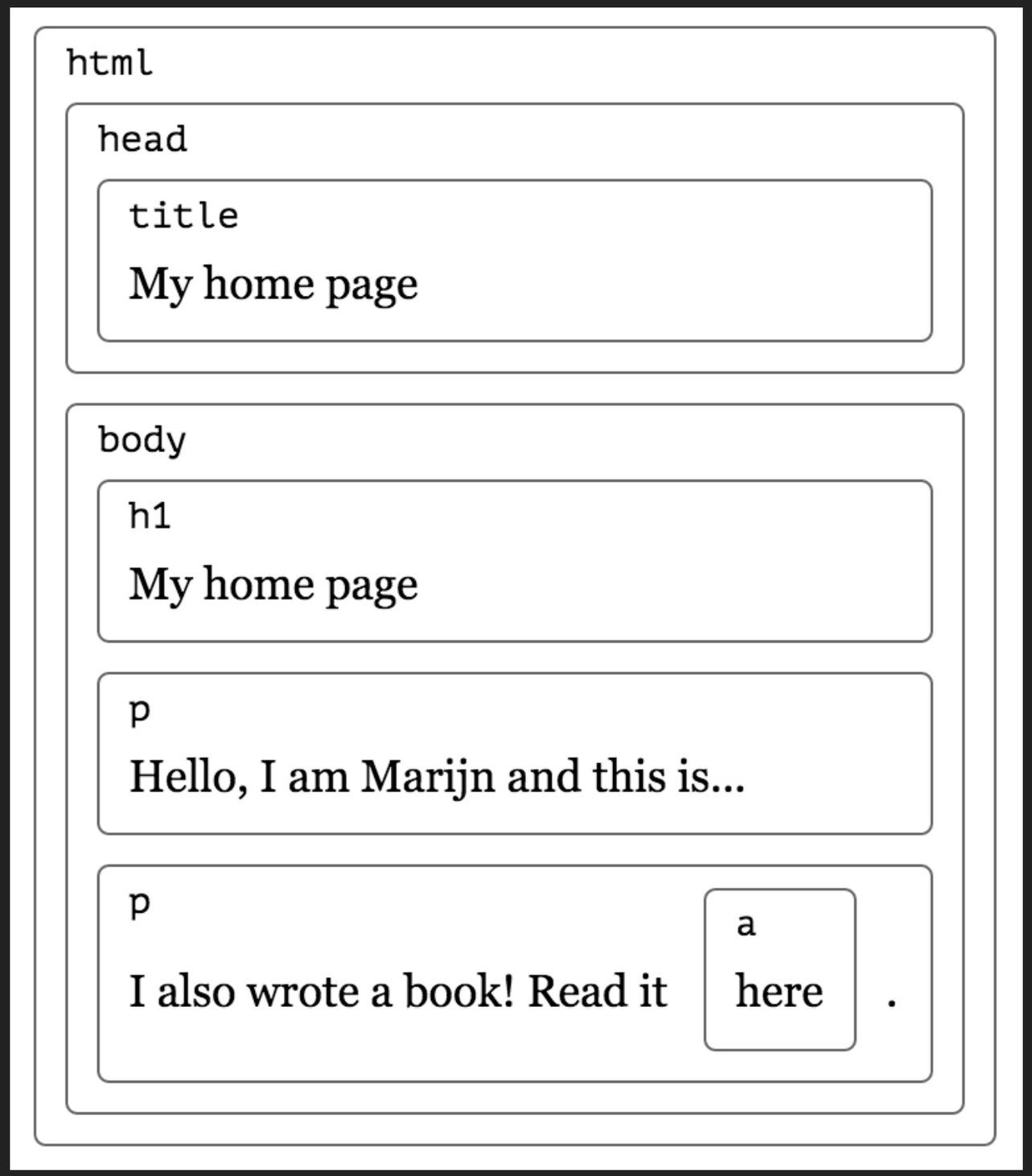
```
<button
onclick="alert('Boom!');">DO NOT
PRESS</button>
```

THE DOCUMENT OBJECT MODEL (DOM)

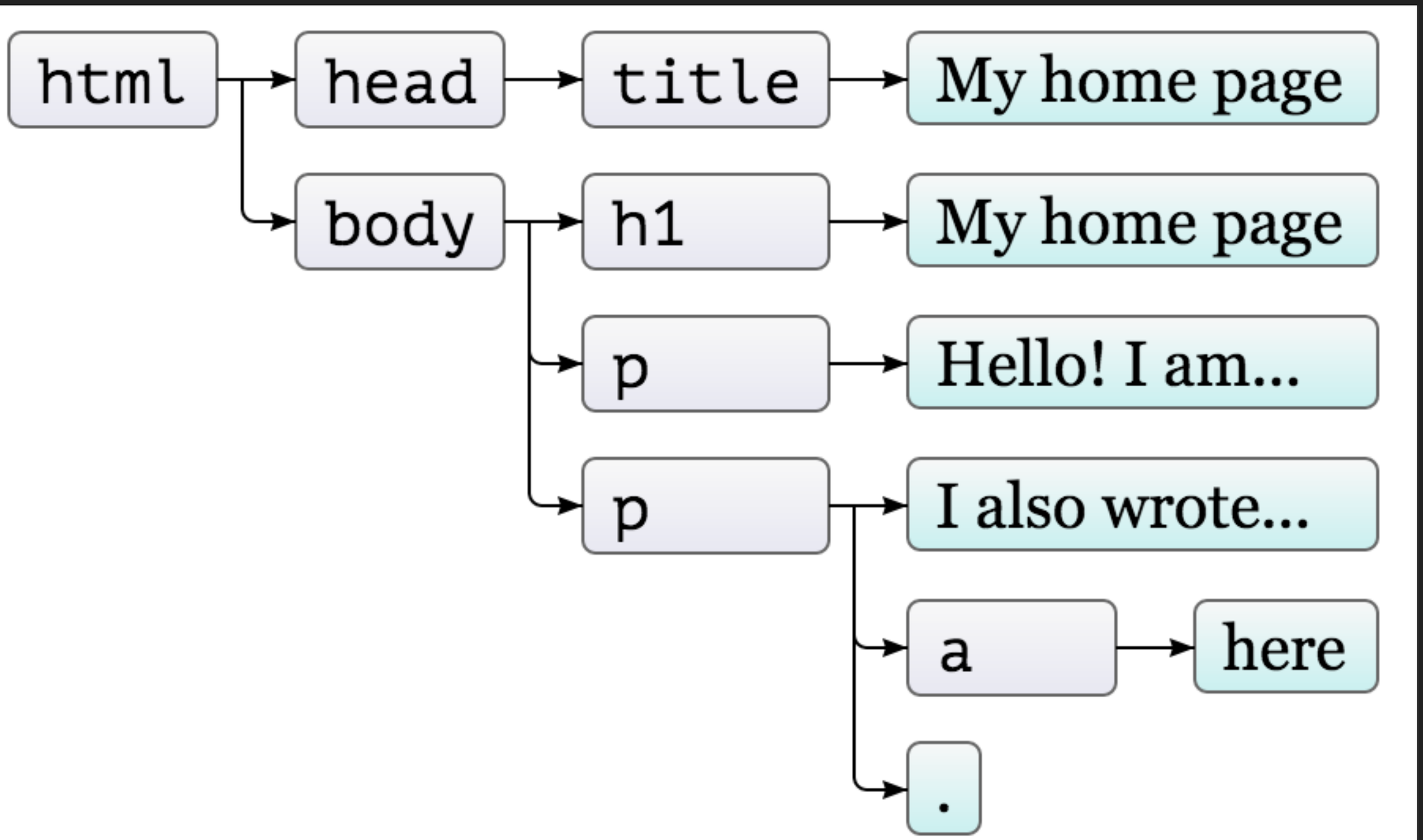
IT IS A PROGRAMMING INTERFACE FOR HTML, XML AND SVG DOCUMENTS. IT PROVIDES A STRUCTURED REPRESENTATION OF THE DOCUMENT AS A TREE.

https://developer.mozilla.org/en-US/docs/Web/API/Document_Object_Model

```
<!doctype html>
<html>
  <head>
    <title>My home page</title>
  </head>
  <body>
    <h1>My home page</h1>
    <p>Hello, I am Marijn and this is my home
page.</p>
    <p>I also wrote a book! Read it
      <a href="http://
eloquentjavascript.net">here</a>.</p>
  </body>
</html>
```



http://eloquentjavascript.net/13_dom.html

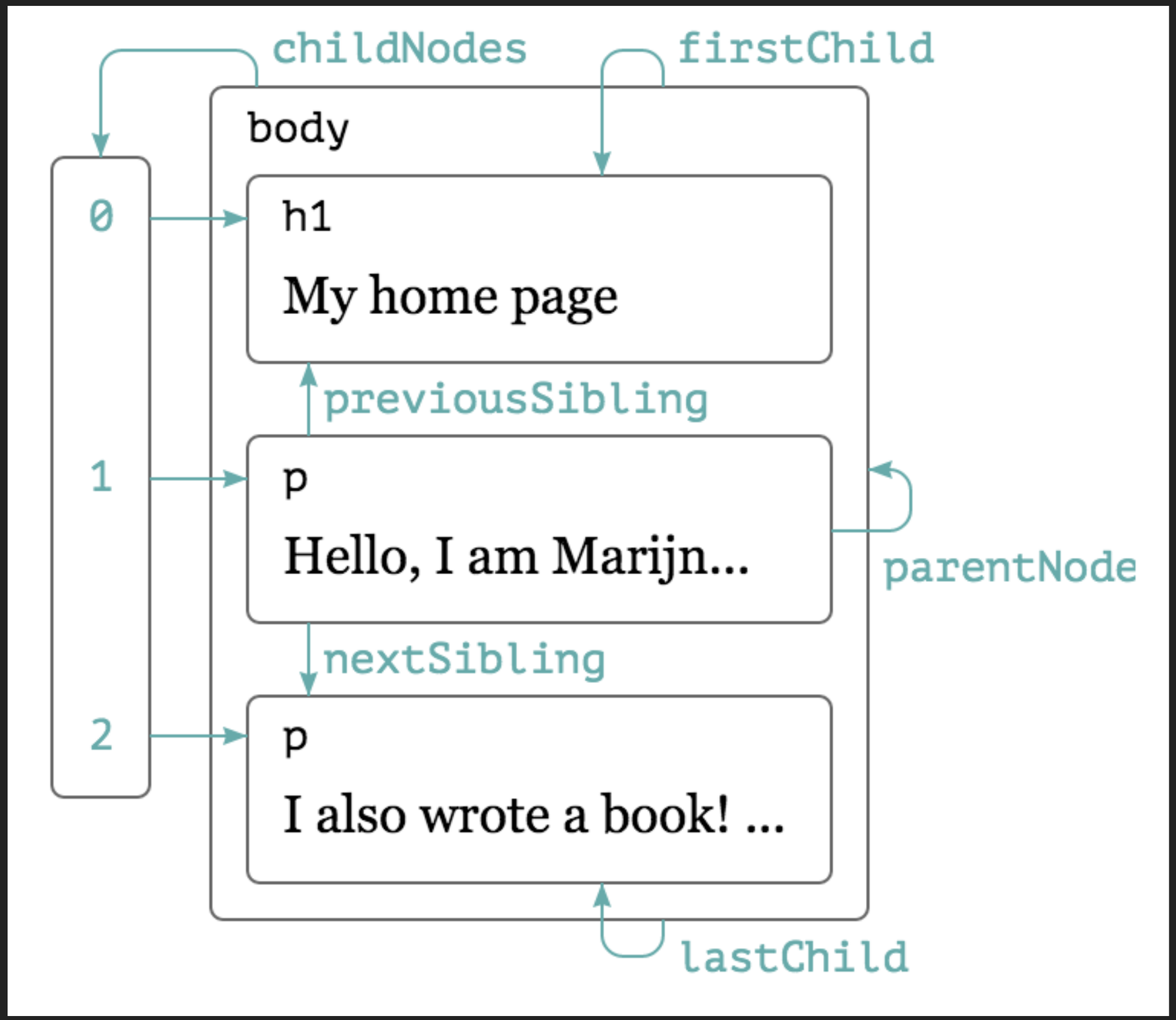


http://eloquentjavascript.net/13_dom.html

`document` is the global variable that gives us access to all the elements in our HTML document.

How can we traverse the DOM?

The DOM has various properties and methods for traversing the tree. We can use these properties and methods in JavaScript to find elements and manipulate the DOM.



http://eloquentjavascript.net/13_dom.html

Each node in the tree has a **`parentNode`** and **`childNodes`** property.

In addition to those you also have `firstChild`, `lastChild`, `previousSibling` and `nextSibling` properties.

While that is good, sometimes you want to access elements by their tag names, class names or id attributes. How could we do that?

`getElementsByTagName()`

`getElementById()`

`getElementsByClassName()`

EXAMPLES

```
let link =
document.body.getElementsByTagName("a")[0];
console.log(link.href);
// -> http://eloquentjavascript.net
```

EXAMPLES

```
<p>My profile photo:</p>
<p><img id="profile-image" src="img/
me.png"></p>
```

```
<script>
  const photo =
document.getElementById("profile-image");
  console.log(photo.src);
</script>
```

What if you want to change the DOM?

EXAMPLES OF CHANGING THE DOM

```
let target =
document.getElementById("one");
```

```
target.removeChild(node)

target.appendChild(newNode)

document.body.insertBefore(newNode,
target)
```

EXAMPLES OF CHANGING THE DOM

```
let someNode = document.getElementById("one");
let newNode = document.createElement("div");
```

```
someNode.append(newNode);
someNode.prepend(newNode)
someNode.before(newNode);
someNode.after(newNode);
newNode.remove();
```

You can also create nodes.

`createTextNode()`

`createElement()`

EXAMPLES OF CREATING NODES

```
let myDiv = document.createElement("div");
let myText = document.createTextNode("my
text");
myDiv.append(myText);
document.body.append(myDiv);
```

We could then change the text in a node by using **`innerHTML`** or **`textContent`** properties.

EXAMPLES OF CHANGING THE TEXT IN AN ELEMENT

```
let myDiv =
document.getElementById("myDiv");
myDiv.innerHTML = "<strong>Hello!</strong>";
// or
myDiv.textContent = "Hello!";
```

What about attributes?

EXAMPLE OF GETTING THE VALUE OF AN ATTRIBUTE

```
<a href="page.html">Link</a>

<script>
document.getElementsByTagName("a")
[0].href
</script>

// -> page.html
```

`getAttribute()`

`setAttribute()`

EXAMPLE OF GETTING THE VALUE OF AN ATTRIBUTE

```
<a href="page.html">Link</a>

<script>
document.getElementsByTagName(“a")
[0].getAttribute("href");
</script>

// -> page.html
```

What if we want to *add* or *remove* a **`class`** on an element?

We could use the `setAttribute()` method or we can use the `className` property.

EXAMPLE OF ADDING A CLASS TO AN ELEMENT

```
<div class="">Some text</div>
<script>
document.querySelector("div").classNa
me = "bar";
</script>
```

We can also use the **`classList`** property and it's associated **`add()`** and **`remove()`** methods.

EXAMPLE OF ADDING A CLASS TO AN ELEMENT

```
<div class="foo">Some text</div>
<script>
document.querySelector("div").classLi
st.add("bar");
</script>
```

What if we want to change the style of an element?

EXAMPLES OF CHANGING A STYLE

```
let elem = document.getElementById("my-id");
```

```
elem.style.fontSize = "12px";
```

CSS properties that contain a dash (**-**) have their dashes removed and the letter that follows capitalized. So **font-family** would be **fontFamily**.

Can I access elements like I do in CSS using selectors?

querySelectorAll()

querySelector()

EXAMPLES OF QUERY SELECTORS

```
document.querySelectorAll(".class-
name");
document.querySelectorAll("div > p");
document.querySelector("ul li");
```

`querySelector()` will return only the first matching element.

EVENT HANDLING

EVENT HANDLERS MAKE IT POSSIBLE TO DETECT AND REACT TO EVENTS WE HAVE NO DIRECT CONTROL OVER.

THERE ARE MANY DIFFERENT EVENT TYPES

- mouse events (e.g. **`click`**, **`mouseover`**, **`mousedown`**, **`mouseup`**, **`mousemove`**, **`mouseout`**)
- key events (e.g. **`keypress`**, **`keyup`**, **`keydown`**)
- load events (e.g. **`load`**, **`unload`**, **`beforeunload`**, **`DOMContentLoaded`**)
- focus events (e.g. **`focus`**, **`blur`**)
- etc...

ATTACHING EVENTS

- You can attach events directly in HTML (inline) as an attribute

```
<a href="#" onclick="myFunction();">Link</a>
```

- Or using the DOM property with JavaScript

```
document.getElementById("my-id").onclick =
myFunction();
```

- Or using an event listener

```
target.addEventListener("click", function() { //
some code here});
```

EXAMPLE

```
<button>Click me</button>

<p>No handler here.</p>

<script>
  let button = document.querySelector("button");
  button.addEventListener("click", function() {
    console.log("Button clicked.");
  });
</script>
```

Mouse events also allow access to properties that tell you the mouse position.

clientX/clientY
(in relation to the viewport)

pageX/pageY
(in relation to the top left of document)

offsetX/offsetY
(in relation to an element)

screenX/screenY
(in relation to the screen)

Many events have default actions associated with them.

How do we prevent the default action from occurring?

A link for example when clicked will go to the URL specified in the href attribute. Or a Submit button when clicked will submit a form.

To prevent the default action we can use the `preventDefault()` method.

EXAMPLE

```
<button type="submit">Submit</button>
<script>
  const btn = document.querySelector("button");
  btn.addEventListener("click", function(event) {
    event.preventDefault();
    console.log("Nope.");
  });
</script>
```

RESOURCES

- Eloquent JavaScript - http://eloquentjavascript.net/
- Mozilla Developer Network - https://developer.mozilla.org/en-US/docs/Web/JavaScript/Guide
- W3Schools - http://www.w3schools.com/js/
- The Modern JavaScript Tutorial - http://javascript.info/
- JSLint - http://jslint.com/
- Learn ES2015 - https://babeljs.io/docs/learn-es2015/