Introduction to Web Programming

Chap. 4 / Javascript, part I

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Javascript, why ?

- Access the page content
- Modify the page content
- Program instructions followed by the browser
- React to user-triggered events

Examples : slideshow, form validation, filter information on a page for the user, ...

What this chapter is not

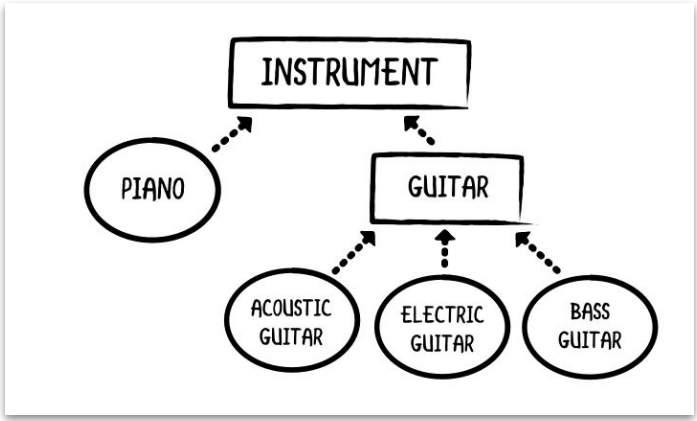
- It is NOT a course about algorithmic (I consider you all know about algorithmics basics, having followed the course Algorithms & Programming 1)
- So if you think you'll learn how to program, this is not the right place
- WE are going to learn about the JS language syntax and how we can use this language to manipulate web pages

Where will we write JS code ?

- In the HTML documents, using the tag `<script></script>` (anywhere in the document)
- In a javascript file, loaded using the tag `<script src="sourceJS.js"></script>`
- We'll see that loading JS scripts at the end of the HTML document is a good practice

JS is object oriented

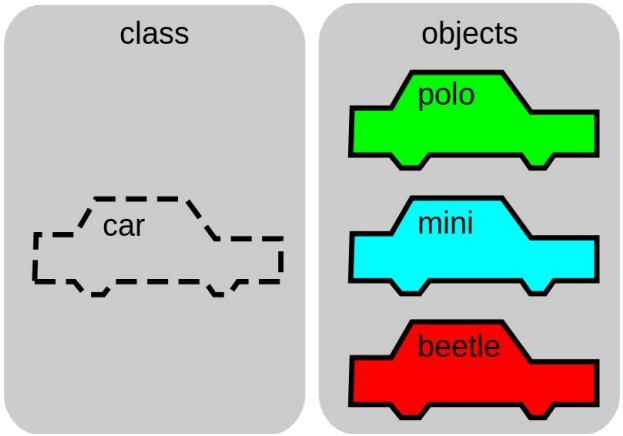
- Program = code + data
- Programs are either built around
  - The code (i.e. what is happening ?) => function-oriented model
  - The data (i.e. what is being affected ?) => object-oriented model
- OOP involves
  - Defining classes (blueprints for objects)
  - Creating objects (specific instances of the classes)
  - Writing applications manipulating those objects

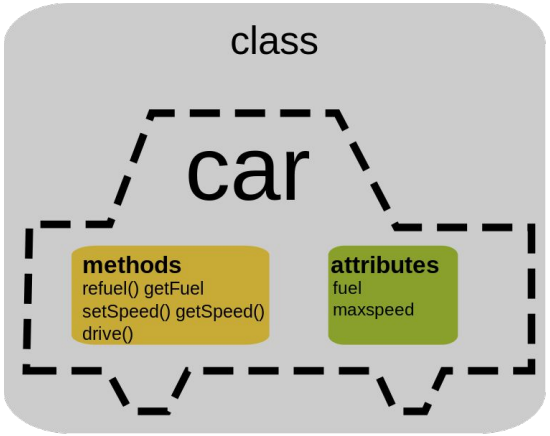


Source: https://www.raywenderlich.com

Some object concepts

- An object is a way to represent things (a car, a person, a building)
- Instances are built with the blueprint
- Each instance of an object has its own properties (name, eye color), its own methods (talk, walk)





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JS objects: window and document

- JS window = window opened in a browser (instance)
- It has some properties (e.g. `document`, `console`, …)
- And some methods (`alert()`, `prompt()`, …)

- JS document = HTML document loaded in a browser
- Root node of the HTML document
- Has some properties (e.g. `doctype`) and methods (e.g. `getElementByID()`)

Calling a method of an object

First things first : outputing stuff

- No equivalent of printf (C) or print (Python) etc.
- We can use alert windows (meh...)
  - `alert("Hello world!");`
- We can write in the (resulting) document
  - `document.write("Hello world!");`
- We can use the browser console
  - `console.log("Hello world!");`

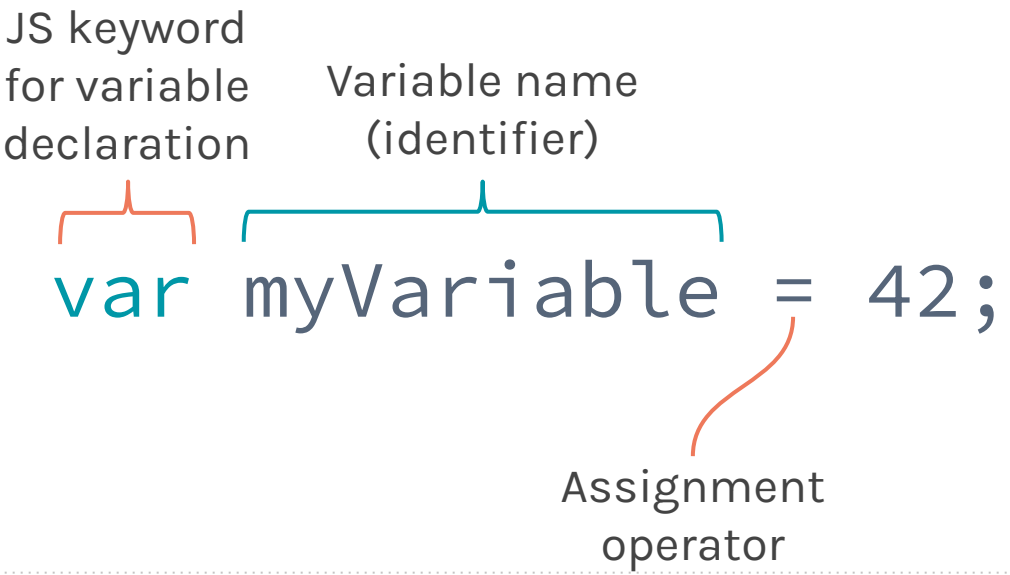
Browser developer tools

Javascript statements

- As in any programming language, JS programs are made of statements
- Statements end with a semicolon `;`
- Statements can be grouped within blocks delimited by curly braces `{}`
- JS is case sensitive
- Comments are just like C comments :
  - `// single line comment`
  - `/* multiple lines comment */`

Javascript variables

- Used to store data ; stored values can change over time
- Variable must be declared before we can use them



Declaring variables : var or let ?

- To declare a variable, one can use either `var` or `let`
- Outside functions, variables declared with either keyword are global
- In functions and block, the scope is different...
  - var is function scoped
  - let is block scoped
- `var` allows variable redeclaration

Variable scope

```
// Global scope
var v1;
let v2;

function doStuff() {
  var mint = 13; // function scope
  for(let i = 0; i < 10; i++){
    // mint is visible here
    // i is visible here
  }
  // mint is still visible here
  // i is no longer visible
}
```

Data types

- Main types are numbers, strings and booleans (true / false)
- Number examples : `42  13.37`
- String examples : `“Hello world”  ‘Hello world’`
- There are also objects, undefined and null
- No need to specify the type of data a variable will hold when you declare them !

```
var v; // undefined
v = 42;
v = “Hello”;
var foo = ‘I\’m ok’; // escape character
var bar = “Hello\nworld”; // newline
```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Operators and expressions

Operator	Example	Description
+	`5 + 5`	Adds the two numeric values; the result is 10.
+	`"Java" + "Script"`	Combines the two string values; the result is JavaScript.
-	`10 - 5`	Subtracts the second value from the first; the result is 5.
*	`5 * 5`	Multiplies the two values; the result is 25.
/	`25 / 5`	Divides the value on the left by the value on the right; the result is 5.
%	`26 % 5`	Obtains the modulus of 26 when it's divided by 5. (Note: A *modulus* is a function that returns the remainder.) The result is 1.

Source: Lemay et al., HTML, CSS & JavaScript web publishing in one hour a day

A little fun with variables

What will be the data type and the value holded
in the following variable :

```
var foo = 40+2+"Hello"+1+3+3+7;
```

Arrays

- Arrays store sets of values
- Items in an array have an index
- The first index is `0` !
- Arrays have methods (arrays are objects)

Arrays

```
// Using a constructor:
var a1 = new Array(10); // 10 slots
a1[0] = 42;

var a2 = ['blue', 'orange', 'gray'];
var a3 = [42, a2, true, "hello"];

var l = a3.length;
a3.pop(); // remove last element
a3.push("world"); // append element
a3.shift(); // remove first element
and shift the rest to the left
a3.unshift(10); // insert in the
beginning of the array
/* Final array:
10 a2 true "world" */
```

Comparison operators

Operator	Operator Description	Notes
==	Equal to	a == b tests to see whether a equals b.
!=	Not equal to	a != b tests to see whether a does not equal b.
<	Less than	a < b tests to see whether a is less than b.
<=	Less than or equal to	-a <= b tests to see whether a is less than or equal to b.
>=	Greater than or equal to	-a >= b tests to see whether a is greater than or equal to b.
>	Greater than	a > b tests to see whether a is greater than b.

=== equal to tests both values & type

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Control structure: conditional

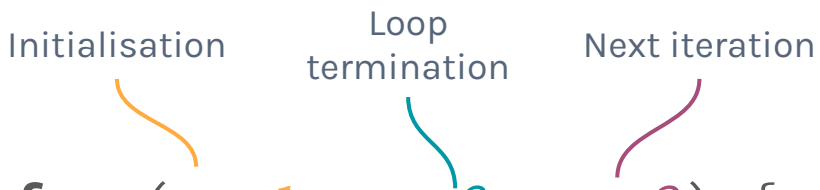
```
if (condition) {
    instructions
} else {
    instructions
}
```

Conditional

```
var color = "blue";

if (color == "red"){
  console.log("Red color");
} else if (color == "green"){
  console.log("Green color");
} else {
  console.log("Another color");
}
```

Control structure: loops




```
for (exp1; exp2; exp3) {
    instructions
}

while (exp){
    instructions;
}
```

Loops

```
for (let i = 0; i < 10; i++){
  console.log(i);
}

var i = 0;
while (i < 10) {
  console.log(i);
  i = i + 1;
}
```

Control in loops

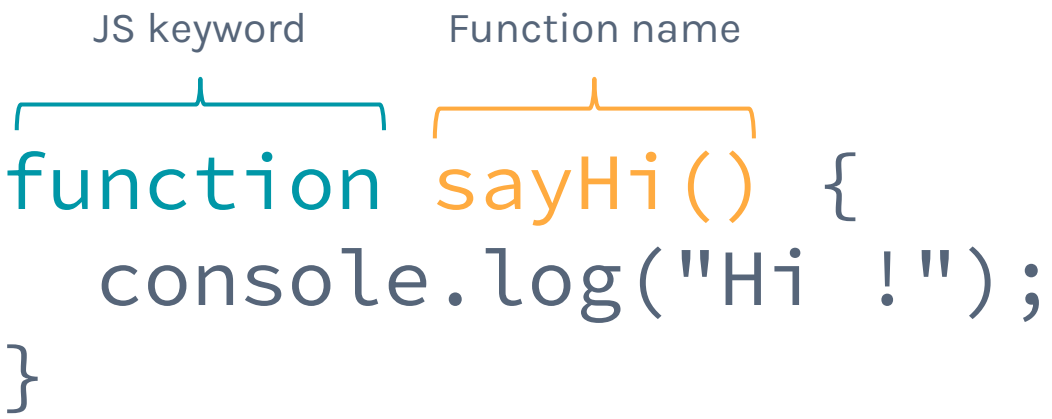
- `break` : interrupt the loop
- `continue` : skip current loop iteration

Loops

```
for (let i = 0; i < 10; i++){
  if (i == 4) break;
  console.log(i);
}
// 0 1 2 3

for (let i = 0; i < 10; i++){
  if (i == 4) continue;
  console.log(i);
}
// 0 1 2 3 5 6 7 8 9
```

Functions



Calling a function

- Functions are useful for “storing” instructions for a specific task
- Once defined, it can be called as many times as needed
- Functions can have parameters
- Functions can return a value

Functions

```
function sayHi(){
  console.log("Hi!");
}

function area(width, height){
  return width*height;
}

sayHi();
var w = 13.37;
var h = 2;
var s = area(w,h);
```

Prelude to HTML/JS interactions

HTML

```html
<form>
  <input type="text"   id="fieldContent"/>
  <input type="button" id="ajoutItem" value="Ajouter"/>
</form>
<span id="output"/><span/>
```

Javascript

```javascript
var bouton = document.getElementById("ajoutItem");
bouton.addEventListener("click", ecrireItem);

function ecrireItem(){
  var outputElt   = document.getElementById("output");
  var content     = document.getElementById("fieldContent").value;
  outputElt.innerHTML += content + "<br>";
}
```

Chapter recap

- Notion of object-oriented programs
- Variables, data types
- Arrays
- Control structure
- Functions