Part IV: JavaScript

JS - Introduction

- JavaScript (ECMA-262) 3rd Irreplaceable Web Language
- A web programming language, the most popular, distinct from Java
- Used to provide behavior (dynamic) to web pages
- Interaction, changing: tags, attributes, and CSS style
- Use <script> to insert JS code internally (HTML)
- Use <script src="path_file.js"> to place JS code in an external file

JS - Why ? How ?

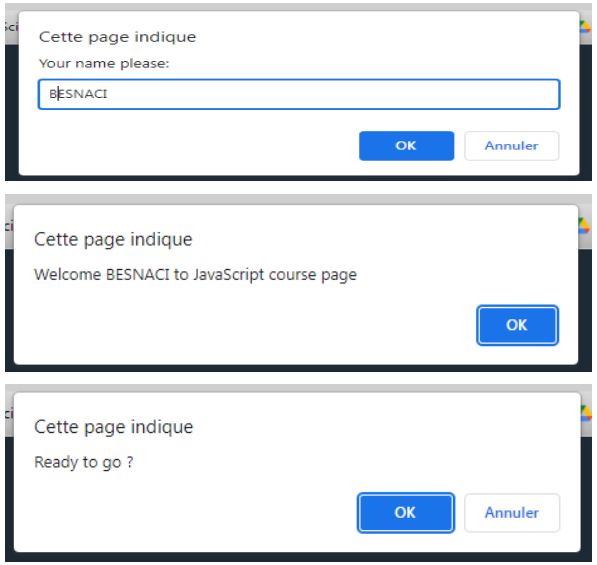
Internal/External

```
<!DOCTYPE html>                                    //HTML file
<html>
<body>
<h1>JavaScript</h1>
<p id="demo"></p>
<script>
var price1 = 5;
const price2 = 6;
let total = price1 + price2;
document.getElementById("demo").innerHTML =
"The total is: " + total;
</script>
</body>
</html>
```

```
var price1 = 5;                                    //JS file
const price2 = 6;
let total = price1 + price2;
document.getElementById("demo").innerHTML =
"The total is: " + total;
```

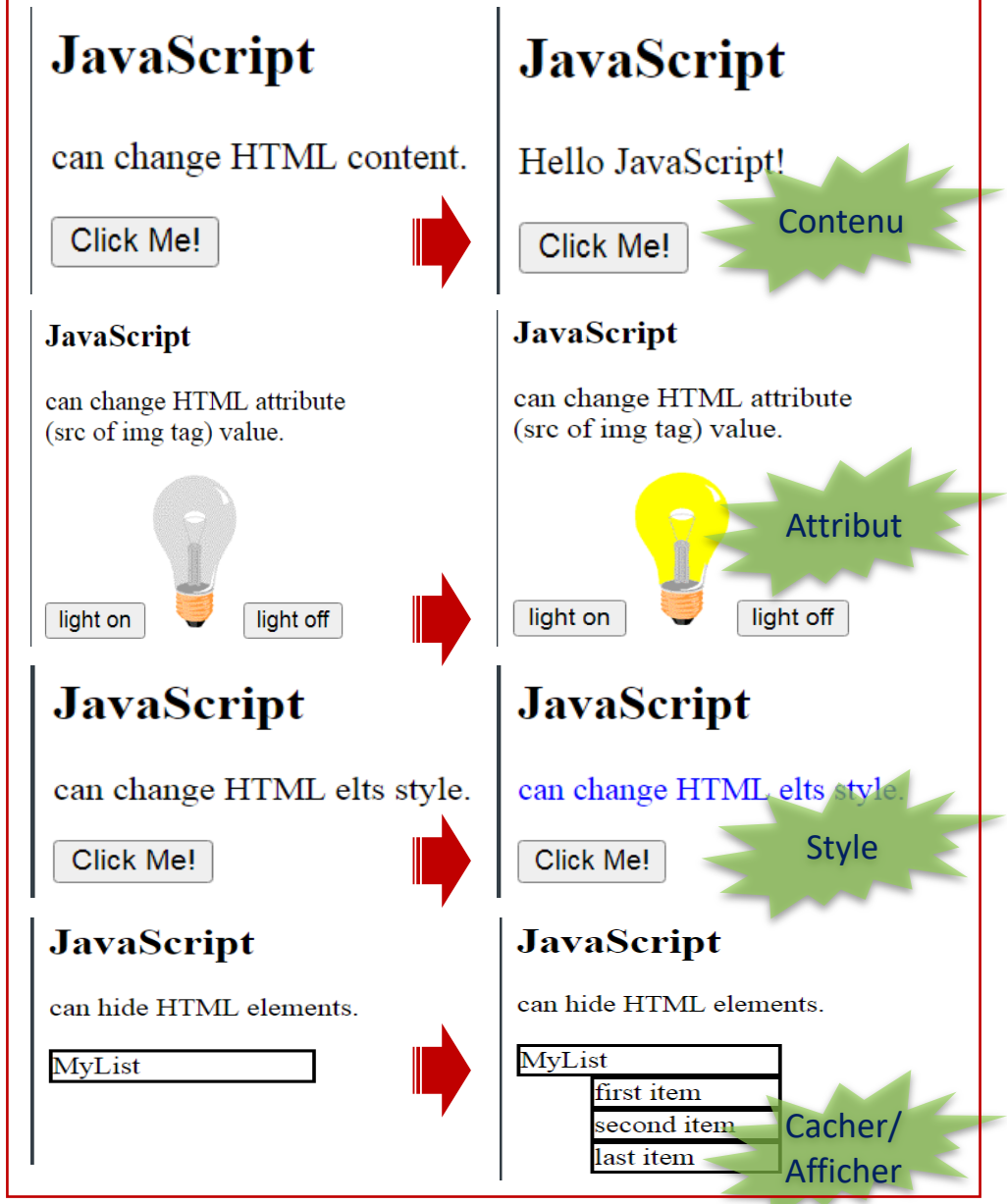
```
<script src="myScript.js"></script> //HTML file
```

Interaction



Control

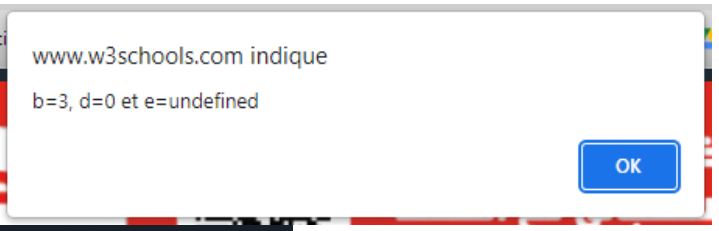
Modification



JS – Variables & types

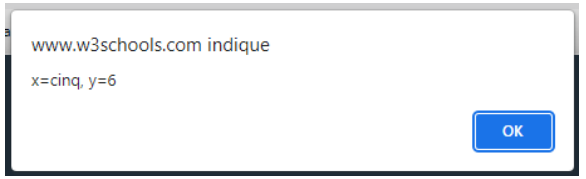
- Variable Declaration: var, let, and const
  - After declaration, the value = undefined
  - Explicit declaration not mandatory
  - const: defines a fixed value, initialization mandatory
  - let: declare before use, block scope
  - var: declare even after use, global scope
- Variable types: number, string, boolean, array, object, function, ...
  - Implicit and dynamic
  - Use the typeof operator to determine the type of a value
  - NaN indicating a non-numeric quantity
  - isNaN() returns true if NaN and false otherwise

```
let x = 5/"three";
```

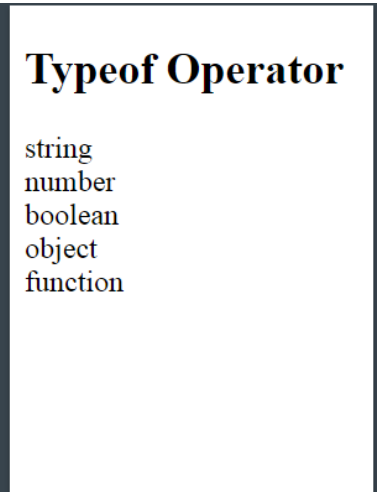



```
<script>
let b = 3, c;
a = b;
const PI = 3.14;
var a;
d = 2*PI;
{let b = 0; d = 0;}
let e;
alert("b="+b+", d="+d+" et e="+e);
</script>
```

```
let x = 5;
y = x + 1;
x = "cinq";
alert("x="+x+", y="+y);
```




```
<!DOCTYPE html>
<html>
<body>
<h2>Typeof Operator</h2>
<script>
x = typeof "john" + "<br>" +
    typeof 3.14 + "<br>" +
    typeof false + "<br>" +
    typeof [1,2,3,4] + "<br>" +
    typeof function () {};
document.write(x);
</script>
</body>
</html>
```



JS – basic instructions

- Expressions: combination of operators (+, -, &&, !, ==, ===, !=, >=, ?, **typeof**, ...) and operands (literals, variables, functions) - classic syntax
- Assignment: =, +=, *=, %=, ...
- I/O: dialog boxes, outputs on the HTML document, on the browser console
  - Dialog boxes: **alert**(), **confirm**(), **prompt**()
  - On HTML: **document.write**(), **innerHTML** attribute (DOM functions)
  - On console: **console.log**()
- Comments: // single line, /* multiline */
- JavaScript is case-sensitive (identifiers)

```
3   <body>
4   <p id="i1"></p>
5   <script>
6   /* Exemples
7   d'instructions
8   de base */
9   let x = prompt("Enter x:");
10  let y = prompt("Enter y:");
11  x /= (y+3)%2;
12  alert("x="+x);
13  console.log("x est de type" + typeof x);
14  y = x;
15  x +="";
16  alert("x est de type:"+typeof x);
17  document.getElementById("i1").innerHTML =
18  "Le type de x n'a pas changé:" + x===y;
19  //document.write("...") est utilisé pour tester
20  </script>
21  </body>
```

JS – control instructions

- Conditionnel
  - **if** (Cond) Inst / **if** (Cond) Inst **else** Inst → classic
  - **switch** (Exp) {**case** Val: Inst break; … **default**: Inst} → comparison with ===
- Repeatition
  - **for** (Init; Cond; Incr) Inst → classic
  - **for** (Var **in** Obj) Inst → iterate over an object's properties
  - **for** (Var **of** Itér) Inst → iterate over the values of an iterable
  - **while** (Cond) Inst → classic
  - **do** Inst **while** (Cond) → classic

```
<script>
if (hour < 18) { alert("Good day");}
else { alert("Good evening");}

switch (new Date().getDay()) {
  case 0: alert("Sunday"); break;
  case 1: alert("Monday");break;
  case 2: alert("Tuesday");break;
  default: alert("a day");}

let text = "";
const cars = ["BMW", "Volvo", "Saab", "Ford", "Fiat", "Audi"];
for (let i = 0; i < cars.length; i++) {
  text += cars[i] + "<br>";}

const person = {fname:"John", lname:"Doe", age:25};
text = "";
for (let x in person) {
  text += person[x];}

  const cars = ["BMW", "Volvo", "Mini"];

text = "";
for (let x of cars) {
  text += x;}
</script>
```

JS – functions, events, errors

- Functions
  - **function** Name(P1, ...) {code}
  - Function with **return** to send back values
  - Call **without parentheses** to return the code
  - **Typeof** returns **function** for functions
- Events
  - Controlling events triggered by the **browser** or the **user**
    - E.g., Page loading/closing, ...
    - E.g., Data filling, triggering actions, ...
  - HTML provides attributes to manage them
    - E.g., onload, onchange, onclick, onmouseover, onkeypress, ...
- Errors
  - **try** {code} **catch**(err) {code}
  - Handling code that may cause an error (try)
  - Handling the error by executing certain code (catch)

```
1   <p id="usr">User name here !</p>
2   <input type="button" onclick="insertName()">
3   <script>
4   function insertName(){
5   try {
6       const n = prompt("Name:");
7       document.getElementById("user").innerHTML = n;
8   } catch (error) {
9       alert(error.message);
10  }
11  }
12  </script>
```

JS – objects & classes

- Objects
  - **const** obj = {prop1:val1, …propi: **function**(…){…}, … }
    - Ex: const car = {type:"Fiat", model:"500", color:"white"};
  - obj.prop = val / obj["prop"] = val / obj.propi(…)
    - Ex: alert(car.type); car["model"] = "100"; car.move();
- Classes
  - **class** name { constructor(param) { Init } m1(…) { … } … }
  - **constructor**: object creation and property initialization
  - **const** obj = **new** name(…); class object creation
  - **Implicit** properties in the constructor
  - obj **instanceof** type: true if obj is an instance of type

```
<script>
const person = {
    firstName: "dev",
    lastName : "Web",
    id       : 5566,
    fullName : function() {
      return this.firstName + " " + this.lastName;
    }
};
person.id++;
person["firstName"] = "Dev";
person.age = 20;

class Car {
  constructor(name, year) {
    this.name = name;
    this.year = year;
  }
  age() {
    let date = new Date();
    return date.getFullYear() - this.year;
  }
}
let myCar = new Car("Ford", 2014);
alert("My car is " + myCar.age() + " years old.");
</script>
```

JS – String object

- Strings: used to store and manipulate text (' ' / " ")
- Special characters: \", \', \\, \n, \t, ...
- Regular expressions (regex): string representing a search pattern
  - **Syntax**: /pattern/modifiers → e.g., /algeria(-|_)\d*/i e.g., /[0-5]+\s-\s(da|dt)/g
- Length: str.length
- Methods:
  - **charAt**(index): character at index "index"
  - **indexOf**(str): index of the first occurrence of a string "str"
  - **match**(rex): array of occurrences of a string/regex "rex" (or null)
  - **replace**(rex,str): replaces occurrences of a string/regex "rex" with another string "str"
  - **search**(rex): index of the first occurrence (or -1) of a string/regex "rex"
  - **slice**(index,length): part of the string starting from index "index" of length "length"
  - **split**(sep): array of substrings according to the separator "sep"
  - **trim**(): string without space characters, tab, ... at the ends

JS – String object

```
<!DOCTYPE html>
<html>
<body>
<script>
    var text = " Ceci, est un exemple de \'texte\'. \n";
    alert(text[1]+text.charAt(2)); //Ce
    alert(text.indexOf("ex"));//14
    alert(text.slice(7,10));//est
    alert(text.trim());//Ceci, est un exemple de 'texte'.
    let tm = text.match(/[a-z]*e(x|s)[a-z]*/ig);
    alert(tm);//est,exemple,texte
    let rt = text.replace(/[a-z]+ /g,"-");
    alert(rt);//Ceci, ----'texte'.
    let st = text.search(/\sex/);
    alert("Indice du 1er ' ex': "+  st);//13
</script>
</body>
</html>
```

JS – Array object

- Creation: const t=[1, 'two', 3.0] / const t=[]; t[0]=1;t[1]='two';t[2]=3.0; / const t=new Array(1,'two',3.0)
- Size (number of elements): t.length
- Adding elements: t[t.length]=val / t.push(val)
- Verification: Array.isArray(t)
- Methods:
  - **t.push(elt)/t.pop(), t.unshift(elt)/t.shift()**: push/pop at beginning/end
  - **t.join**(sep): list of elements separated by sep
  - **t1.concat**(t2, …): concatenation of multiple arrays
  - **t.slice**(i,n): portion starting from index i with n-1 elements
  - **t.splice**(i,n,e1,…): replace n elements from index i with elements ei (returns replaced elements and changes t)
  - **t.sort()/t.reverse()**: ascending/descending alphanumeric sort
  - **t.indexOf**(e): index of the first occurrence of element e
  - **t.forEach**(f): call function f for each element

JS – Array object

```
4   <script>
5       const a = [1, "deux", 3.0];
6       const b = []; b[0]=1; b[1]="deux"; b[2]=3.0;
7       const c = new Array(1,"deux",3.0);
8       alert(a); alert(b); alert(c); //1,deux,3
9       let size = a.length;
10      a[size] = 4.1; a.push(5);
11      alert(a); //1,deux,3,4.1,5
12      a.unshift("zero"); a.pop();
13      alert(a.join(" "));//zero 1 deux 3 4.1
14      let bc = b.concat(c);
15      alert("slice: "+bc.slice(1,4));//deux,3,1
16      bc.splice(1,4,"x","y","z");
17      alert("splice: "+bc);//splice: 1,x,y,z,3
18      alert(bc.sort());//1,3,x,y,z
19      let d = bc.sort(); d.push(3);
20      alert(bc.indexOf(3));//1
21      var elts=""; a.forEach(parenth);
22      function parenth(item){elts += item+" / ";}
23      alert(elts);//zero / 1 / deux / 3 / 4.1 /
24  </script>
```

JS – Date object

- Creation: const d=new Date(); / const d=new Date(y,m,d,h,mt,s,ms); / const d=new Date(str); / const d=new Date(ms_1970)
- Formats (strings):
  - **ISO**: YYYY-MM-DD (2022-03-31), YYYY-MM (2022-03), YYYY (2022), YYYY-MM-DDTHH:MM:SSZ (2022-03-31T21:05:23Z)
  - **Short**: MM/DD/YYYY (06/15/2002)
  - **Long**: MMM DD YYYY (Apr 15 2000), MMM… DD YYYY (April 10 2015)
- Display: use d.toDateString() for a nicer display
- Methods:
  - **Date.parse**(str): milliseconds of a valid date e.g., Date.parse("March 21, 2012") → 1332284400000
  - **d.getFullYear(), d.getMonth(), d.getDate(), d.getHours(), …, d.getTime(), d.getDay(), Date.now()**: respectively give the year, month, day, hour, …, time in milliseconds, day of the week, and current time
  - **d.setFullYear()**, …: respectively set the year, …

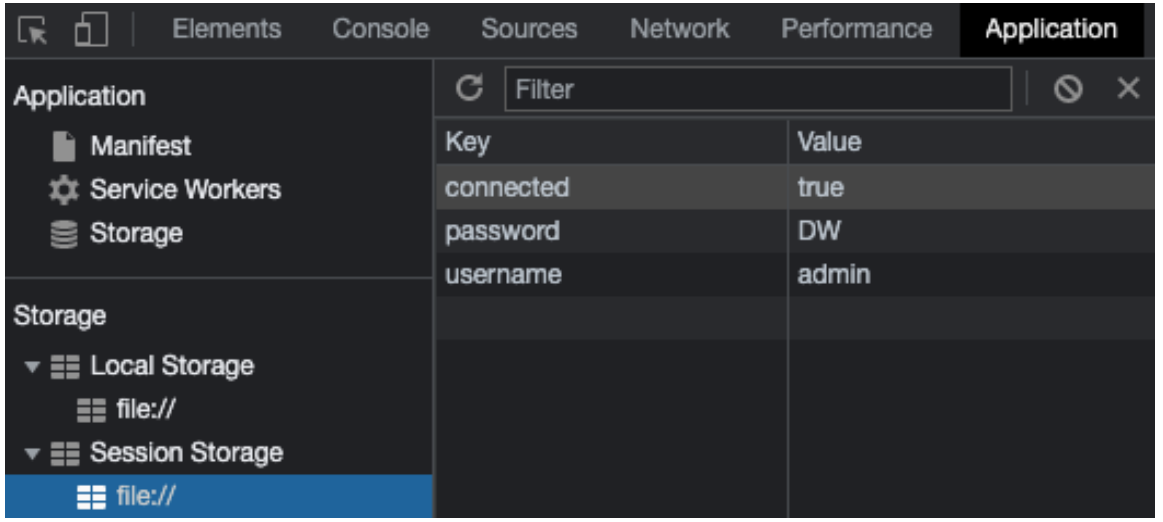
JS – Math object

- Math is a static object, **Math.PI, Math.E, Math.LN2**, … are constants
- Methods
  - **Math.round**(x): x rounded to its nearest integer
  - **Math.trunc**(x): integer part of x
  - **Math.sign**(x): returns 1 if x is positive, -1 if negative, or 0 if zero
  - **Math.power**(x,y): x raised to the power y
  - **Math.sqrt**(x): square root of x
  - **Math.abs**(x): absolute value of x
  - **Math.sin**/**cos**(x): sine/cosine of x
  - **Math.min**/**max**(x1,x2, …): minimum/maximum of a list of arguments
  - **Math.random**(): random number between 0 and 1
  - **Math.log**(x): natural logarithm of x

JS – Data Storage objects

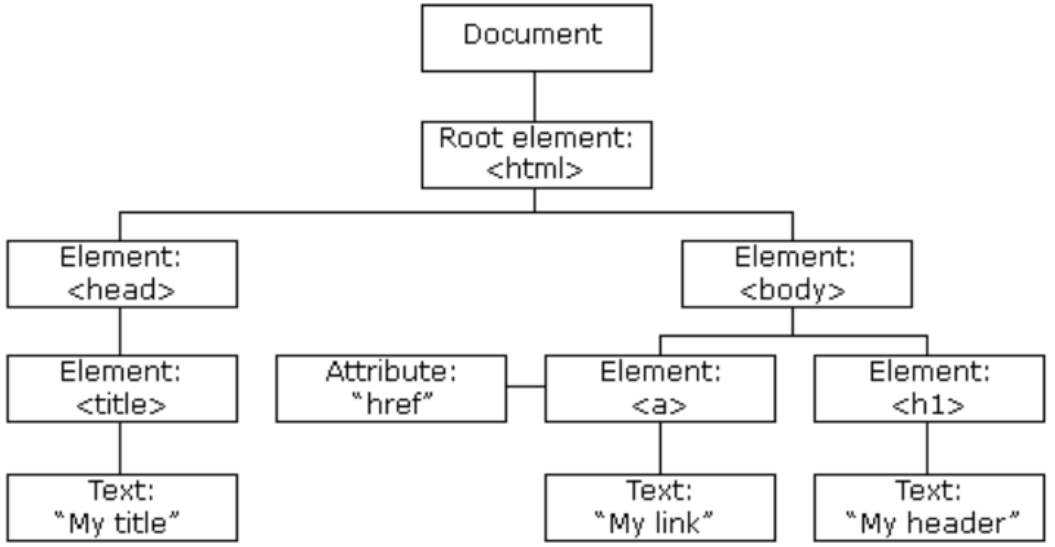
- To create and manipulate data locally in the browser for a specific website
- Data format: ”key-value” pairs
- Duration: **permanent** (localStorage object) or **temporary** (sessionStorage object)
  - setItem("key","value") → insertion
  - getItem("key") → retrieval
  - removeItem("key") → deletion
  - clear() → deletion of all data

```
function login(){
    let un = document.getElementById("un").value;
    let pw = document.getElementById("pw").value;
    if ((un == "admin")&&(pw == "DW")){
        sessionStorage.setItem("connected","true");
        sessionStorage.setItem("username", un);
        sessionStorage.setItem("password", pw);
    }
}
function logout(){
    sessionStorage.removeItem("connected");
}
```



JS – HTML DOM

- DOM (Document Object Model): a **standard** object model for HTML documents, defining:
  - HTML elements as objects
  - Properties of all HTML elements
  - Methods for accessing all HTML elements
  - Events for all HTML elements
- HTML DOM is a **standard** for how to get, modify, add, or remove HTML elements.




```
1  <!DOCTYPE html>
2  <html>
3      <head>
4          <title>My title</title>
5      </head>
6      <body>
7          <h1>teMy header</h1>
8          <a href="adress">My link</a>
9      </body>
10 </html>
```

JS – DOM HTML

- **Manipulating HTML elements** involves manipulating DOM objects through their **properties** (e.g., innerHTML) and **methods** (e.g., getElementById).
- Search for elements
  - ducument.getElementById(id)
  - ducument.getElementsByTagName(tag)
  - ducument.getElementsByClassName(class)
  - document.querySelector(selector)
  - document.querySelectorAll(selector)
- Update elements
  - e.innerHTML = val
  - e.attribute_name = val
  - e.style.property_name = val
  - e.setAttribute(attribute_name, val)

```
<!DOCTYPE html>
<html>
<body>
<h2>JavaScript HTML DOM</h2>
<div>
    <p>Text1</p>
    <p class="intro" id="2nd">Text2</p>
</div>
<p class="intro">Text3</p>
<input type="checkbox" checked>
<script>
    const a = document.getElementsByClassName("intro");
    const b = document.getElementById("2nd");
    const c = document.getElementsByTagName("p")
    const d = document.querySelectorAll("div>p")
    a[1].innerHTML = c[0].innerHTML + " + " + b.innerHTML;
    b.style.background = "lightblue";
    document.getElementsByTagName("input")[0].checked = false;
</script>
</body>
</html>
```

JS – DOM HTML

- Adding/removing elements
  - document.createElement(e)
  - document.removeChild(e)
  - document.appendChild(e)
  - document.replaceChild(new,old)
- Add event handler
  - e.onclick = function(){code}
  - *e*.addEventListener(*event, function*)

```
<!DOCTYPE html>
<html>
<body>
<h2>JavaScript HTML DOM</h2>
<div>
    <p>Text1</p>
</div>
<p>Text2</p>
<input type="button" value="ok">
<script>
    const divn = document.getElementsByTagName("div")[0];
    const pn = document.createElement("h4");
    pn.innerHTML = "Example";
    divn.appendChild(pn);
    const im = document.createElement("img");
    im.setAttribute("src", "logo.png");
    divn.replaceChild(im,divn.firstElementChild);
    const lastp = document.body.children[2];
    document.body.removeChild(lastp);
    const btn = document.getElementsByTagName("input")[0];
    btn.onclick = function(){btn.value = "clicked ...";}
    btn.addEventListener("mouseover", change());
    function change(mess){btn.value = "Mouse overed ...";}
</script>
</body>
</html>
```

JS – DOM HTML

- Specific HTML elements
  - document.documentElement, document.body, document.head, document.title
  - document.forms, document.images
  - document.URL, document.domain
- Navigate between elements
  - e.parentNode, e.childNodes[n°], e.firstChild, e.lastChild, e.nextSibling, e.previousSibling
  - e.nodeName, e.nodeValue, e.nodeType

```
<!DOCTYPE html>
<html>
    <head>
        <title>Old title</title>
    </head>
<body>
<h2>JavaScript HTML DOM</h2>
<form action="" name="myForm">
    Name: <input type="text" name="nom"> <br>
    Email: <input type="text" name="courriel">
</form>
<script>
    document.title = "New title";
    document.body.style.background = "lightblue";
    document.forms.myForm.nom.placeholder = "Name";
    document.forms.myForm.courriel.placeholder = "email";
    alert("Domain: "+document.domain+"URL: "+document.URL)
    const mf = document.forms.myForm;
    document.forms.myForm.innerHTML +=
    "<br> first label is: "+
    mf.childNodes[0].nodeValue+", next tag is: "+
    mf.childNodes[0].nextSibling.nodeName+
    "<br> parent tag is:"+
    mf.children[0].parentNode.nodeName;
</script>
</body>
</html>
```