JavaScript

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JavaScript overview

- JavaScript is a programming language that can be used to add, remove, change, or modify HTML elements and CSS settings on a web page.
- JavaScript can also be used as a standalone language, but most often is it used for creating *dynamic* web pages
- JavaScript syntax has many similarities with C++ and Java, though it is not related to either
- These notes and examples highlight some of the key concepts and differences between JavaScript and other programming languages.

First JavaScript example

```
// example for loop
let sum = 0;
for (let i = 1; i <= 10; i++) {
        sum += i;
}
document.write('<p>The sum of 1-10 is: ' + sum + '</p>');

// example if..else statement
sum = 0;
if (sum > 5) {
        document.write('<p>The sum is greater than 5</p>');
} else {
        document.write('<p>The sum is NOT greater than 5</p>');
}
```

JavaScript variable declaration and scope

- JavaScript **best practices** for declaring variables:
  - Use *var* only for global variables (though only use global variables if necessary)
  - Use *const* for constant variables (elements of arrays can still be changed) (introduced 2015)
  - Use *let* for all other variables (introduced 2015)

Declaration	Example	Scope	Allows redeclaration?	Allows reassignment?
const	const x = 4;	Block	No	No
var	var x = 4;	Global or Function	Yes	Yes
let	let x = 4;	Block	No	Yes
*(none)**	x = 4;	Global	Yes	Yes

*When using *strict* mode, referencing an undeclared variable will cause an error. You should always use *strict* mode! (https://www.w3schools.com/js/js_strict.asp)

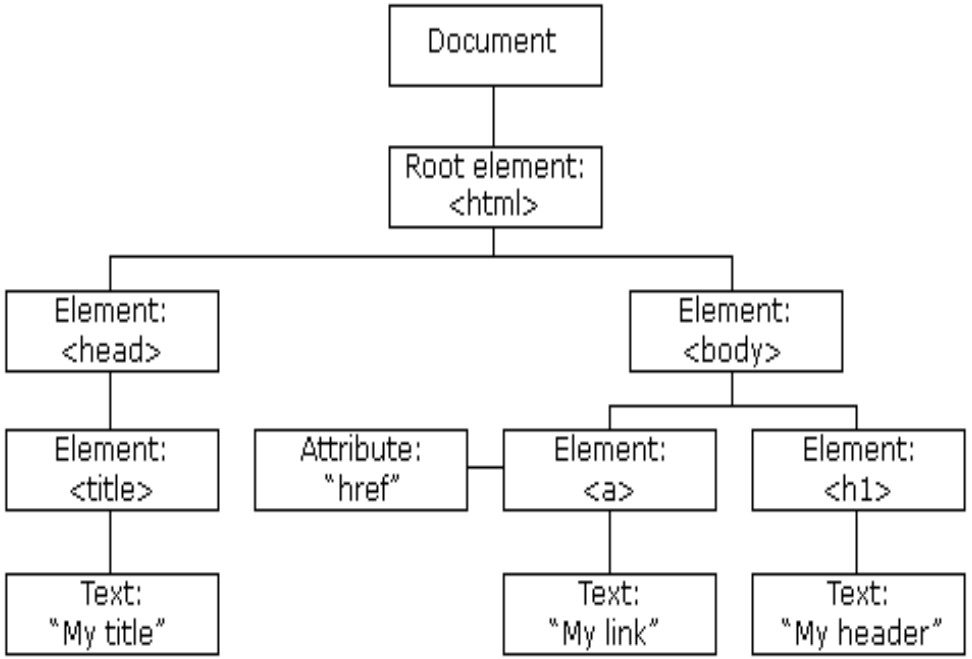
Variable declaration and scope (con't)

- A variable that is not initialized will have the value *undefined*
- JavaScript has a bizarre behavior known as “hoisting” where variable declarations but not assignments are moved to the top of the current scope
  - This also allows you to call functions before they are defined, if a *function declaration* is used
  - Variables declared using *let* and *const* are technically hoisted but cannot be accessed until they are initialized
- More details and examples:
  - https://www.w3schools.com/js/js_scope.asp
  - https://www.w3schools.com/js/js_let.asp

HTML Document Object Model (DOM)

- The HTML DOM provides standards for programmatically accessing, changing, adding, or deleting HTML elements

- Key observation:
  - The DOM defines a tree where HTML elements have *children* and *parents*
  - Each HTML element has attributes and styles and includes its children



source: https://www.w3schools.com/js/js_htmldom.asp

Finding and changing HTML elements

These work for any element (not just the document)

Method For Finding HTML elements	Description
document.getElementById(id)	Find an element by its unique id (returns a **single** element)
document.getElementsByTagName(name)	Find elements by tag name (returns a **HTMLCollection**)
document.getElementsByClassName(name)	Find elements by class name (returns a **HTMLCollection**)

Syntax for accessing and/or changing* an element	Description
element.innerHTML	The inner HTML of an element (may contain HTML tags)
element.innerText	The inner text of an element (HTML tags are ignored)
element.attribute	The attribute value of an HTML element
element.style.*property*	The style of an HTML element (properties are in camelCase, e.g., 'background-color' is 'backgroundColor')

*Assignment is used to change the corresponding value; for example to change the HTML of an element use, e.g., element.innerHTML = “<h2> Changed </h2>”

Modified from: https://www.w3schools.com/js/js_htmldom_document.asp

Functions in JavaScript

- Functions can be created using a *function declaration*:

  - function add(x,y) {
    return x + y;
    }

- Functions can be created using a *function expression*:

  - myfunction = function(x,y,…) {
    return x + y;
    }

- *Arrow functions* are a short-hand way of defining function expressions, by omitting the *function* and *return* keywords, and the braces:

  - myfunction = (x,y) => x + y;

Functions in JavaScript (con't)

- The *this* keyword refers to the object the code belongs to.
  - By itself, *this* refers to the [Global Window]
  - In a function declaration or expression, *this* refers to the element that called the function
    - If the function was called from the window and you are in strict mode, then *this* is undefined; otherwise, *this* is [object Window]
  - For arrow functions, *this* refers to the *owner* of the function
    - Don't use arrow functions to respond to events if you need to know what triggered the event
- Function declarations are *hoisted* while function expressions and arrow functions are not.
- For more information, see:
  - https://www.w3schools.com/js/js_function_definition.asp
  - https://www.w3schools.com/js/js_this.asp

Events in JavaScript

- JavaScript is used to respond to events, such as a button click.

Event	Description
onchange	An HTML element has been changed
onclick	The user clicks an HTML element
onmouseover	The user moves the mouse over an HTML element
onmouseout	The user moves the mouse away from an HTML element
onkeydown	The user pushes a keyboard key
onload	The browser has finished loading the page

Table from: https://www.w3schools.com/js/js_events.asp

Complete list: https://www.w3schools.com/jsref/dom_obj_event.asp

Events in JavaScript

- You can set the event attribute of the element:
  - `<button onclick = "alert('hi');">Click </button>`
    - The value of an attribute is a string that specifies JavaScript to be executed
- You can use an event listener to attach or remove an event handler to an element:
  - `element.addEventListener("click", myfunction);`
  - `element.removeEventListener("click", myfunction);`
  - the second argument of each must be a *function*, which can be anonymous, though anonymous functions can't be removed:
    - element.addEventListener("click", function() {alert('hi');});
- Using the event listener gives you more control and is preferred as it separates the web page structure from its logic, and allows the event to trigger multiple function calls
- More information
  - https://www.w3schools.com/js/js_events.asp
  - https://www.w3schools.com/js/js_htmldom_eventlistener.asp

Additional notes

- Most of the time for web development, we use JavaScript in order to:
  - get one or more HTML elements (by id, class name, tag name, etc) in order to change the HTML or the attributes of an element
  - respond to events (clicking, mousing over an element, etc)
- We will use JavaScript arrays and objects (see the examples)
- Tips for troubleshooting code:
  - Look at the console (which is where errors will be displayed)
    - Generally, there will not be errors on the web page.
  - Use *console.log* and *alerts* to test your code. These can be especially useful to test whether a function is being called.