# JavaScript

**How can use JavaScript in code?**

1. JavaScript code use between **<script> ….. </script>** tag.

<script>

document.getElementById ("main").innerHTML = "JavaScript";

</script>

**\*\* Old JavaScript examples may use a type attribute: <script type="text/javascript">.**

**\*\* The type attribute is not required now. JavaScript is the default scripting language in HTML.**

1. You can place any number of scripts in an HTML document.
2. Scripts can be placed in the **<body>** or in the **<head>** section of an HTML page, or in both.
3. Placing scripts at the bottom of the <body> element improves the display speed, because script interpretation slows down the display.
4. For using external script file, file name use in **src** (source) attribute of a **<script>** tag:

<script src="myScript.js"> </scrip>

\*\* External script files cannot contain <script> tags.

**JavaScript Output:**

1. Writing into an HTML element, using innerHTML.
2. Writing into the HTML output using document.write().

\*\* Using document.write() after an HTML document is loaded, will delete all existing HTML:

1. Writing into an alert box, using window.alert().
2. Writing into the browser console, using console.log().

**JavaScript Statements:**

1. JavaScript statements are composed of:

Values, Operators, Expressions, Keywords, and Comments.

1. Semicolons separate JavaScript statements.
2. JavaScript statements can be grouped together in code blocks, inside curly brackets {...}.

# JavaScript Syntax

JavaScript syntax is the set of rules, how JavaScript programs are constructed:

1. **JavaScript Values Syntex:** The JavaScript syntax defines two types of values:
2. Fixed values (Literal)

\*\*Numbers are written with or without decimals: ---------- 10, 10.58

\*\*Strings are text, written within double or single quotes. ---------- “shuvo”

1. Variable values (Variables)

\*\*variables are used to store data values.

\*\*JavaScript uses the keywords var, let and const to declare variables.

\*\*An equal sign is used to assign values to variables

\*\* All JavaScript identifiers are case sensitive.

\*\* Hyphens are not allowed in JavaScript. They are reserved for subtractions.

1. **JavaScript Operators:** JavaScript uses arithmetic operators ( + - \* / ) to compute values:
2. **JavaScript Expressions:** An expression is a combination of values, variables, and operators, which computes to a value.
3. **JavaScript Keywords:** JavaScript keywords are used to identify actions to be performed
4. **JavaScript Comments:** Code after double slashes // or between /\* and \*/ is treated as a comment.
5. **JavaScript Character Set**: JavaScript uses the Unicode character set.

# JavaScript Variables

1. Variables are containers for storing data (storing data values).
2. All JavaScript variables must be identified with unique names.
3. These unique names are called identifiers.
4. JavaScript identifiers are case-sensitive.
5. It's a good programming practice to declare all variables at the beginning of a script.
6. var
7. let
8. const
9. nothing

### Let:

1. If you think the value of the variable can change, use let.
2. Variables defined with let cannot be Redeclared in same block.
3. Variables defined with let must be Declared before use.
4. Variables defined with let have Block Scope.

### Const:

1. If you want a general rule: always declare variables with const
2. Variables defined with const cannot be Redeclared.
3. Variables defined with const cannot be Reassigned.
4. Variables defined with const have Block Scope.
5. JavaScript const variables must be assigned a value when they are declared:

Use const when you declare:

1. A new Array
2. A new Object
3. A new Function
4. A new RegExp

The keyword const is a little misleading. It does not define a constant value. It defines a constant reference to a value. its means identifier

You can NOT:

1. Reassign a constant value
2. Reassign a constant array
3. Reassign a constant object

You CAN:

1. Change the elements of constant array
2. Change the properties of constant object

### Value = undefined:

variables are often declared without a value. The value can be something that has to be calculated, or something that will be provided later, like user input. A variable declared without a value will have the value undefined.

# JavaScript Operators

1. Arithmetic Operators
2. Assignment Operators
3. Comparison Operators
4. Logical Operators
5. Conditional Operators
6. Type Operators

# Data Types

1. JavaScript variables can hold different data types: numbers, strings, objects.
2. JavaScript evaluates expressions from left to right. Different sequences can produce different results:
3. JavaScript has dynamic types. This means that the same variable can be used to hold different data types:
4. Number
5. String
6. Boolean
7. Object
8. Undefined

\*\* JavaScript has dynamic types. This means that the same variable can be used to hold different data

# JavaScript Events

1. HTML events are "things" that happen to HTML elements.
2. When JavaScript is used in HTML pages, JavaScript can "react" on these events.
3. An HTML event can be something the browser does, or something a user does.

**Here are some examples of HTML events:**

1. An HTML web page has finished loading
2. An HTML input field was changed
3. An HTML button was clicked

**Common HTML Events**

1. **Onchange**: An HTML element has been changed
2. **Onclick**: The user clicks an HTML element
3. **Onmouseover**: The user moves the mouse over an HTML element
4. **Onmouseout**: The user moves the mouse away from an HTML element
5. **Onkeydown**: The user pushes a keyboard key
6. **Onload**: The browser has finished loading the page

**JavaScript Event Handlers**

1. Event handlers can be used to handle and verify user input, user actions, and browser actions:
2. Things that should be done every time a page loads
3. Things that should be done when the page is closed
4. Action that should be performed when a user clicks a button
5. Content that should be verified when a user inputs data

**Many different methods can be used to let JavaScript work with events:**

1. HTML event attributes can execute JavaScript code directly
2. HTML event attributes can call JavaScript functions
3. You can assign your own event handler functions to HTML elements
4. You can prevent events from being sent or being handled

# Strings

1. You can use single or double quotes
2. You can use quotes inside a string, if they don't match the quotes surrounding the string
3. Comparing two JavaScript objects always returns false.

### String Search

1. String indexOf()
2. String lastIndexOf()
3. String search ()
4. String match ()
5. String matchAll()
6. String includes ()
7. String startsWith()
8. String endsWith()

### Escape Character

1. \’ ------ ' ------ Single quote
2. \" " Double quote
3. \\ \ Backslash
4. \b Backspace
5. \f Form Feed
6. \n New Line
7. \r Carriage Return
8. \t Horizontal Tabulator
9. \v Vertical Tabulator

\*\* Do not create Strings objects.

### String Methods

* All string methods return a new string. They don't modify the original string.
* Strings are immutable: Strings cannot be changed, only replaced.

1. **Length**: The length property returns the length of a string:

let text = "ABCDEFGHIJKLMNOPQRSTUVWXYZ";

let length = text.length;

1. **slice (start, end):**

* extracts a part of a string and returns the extracted part in a new string.
* The method takes 2 parameters: start position, and end position (end not included).
* JavaScript counts positions from zero. First position is 0. Second position is 1.
* If a parameter is negative, the position is counted from the end of the string.
* slices out a portion of a string from position -12 to position -6.

let text = "Apple, Banana, Kiwi";

let part = text.slice(7, 13);

Ans: Banana

1. **substring (start, end):**

* substring () is like slice ().
* The difference is that start and end values less than 0 are treated as 0 in substring ()
* If you omit the second parameter, substring () will slice out the rest of the string.

1. **substr (start, length):**

* second parameter specifies the length of the extracted part.
* If you omit the second parameter, substr () will slice out the rest of the string.
* If the first parameter is negative, the position counts from the end of the string.

1. **replace ():**

* The replace () method replaces a specified value with another value in a string.
* The replace () method does not change the string it is called on.
* The replace () method returns a new string.
* The replace () method replaces only the first match.
* the replace () method is case sensitive

1. **toUpperCase** (): A string is converted to upper case with toUpperCase ().
2. **toLowerCase** (): A string is converted to lower case with toLowerCase ()
3. **concat**():

* joins two or more strings.
* can be used instead of the plus operator. These two lines do the same.

1. **trim** (): The trim() method removes whitespace from both sides of a string:
2. **trimStart**(): removes whitespace only from the start of a string.
3. **trimEnd**() : removes whitespace only from the end of a string.
4. **padEnd**(): pads a string with another string:
5. **charAt**()
6. **split()**

\*\*All string methods return a new string. They don't modify the original string.

### Template Literals

1. **Back-Tics Syntax**

Template Literals use back-ticks (``) rather than the quotes ("") to define a string:

let text = `He's often called "Johnny"`;

let text =`The quick

brown fox

jumps over

the lazy dog`;

1. **Interpolation**

Template literals provide an easy way to interpolate variables and expressions into strings.

The syntax is:  **${...}**

let firstName = "John";

let lastName = "Doe";

let text = `Welcome ${firstName}, ${lastName}!` ;

1. **tagged template literals ----------------- (ES6)**
2. Tags allow you to parse template literals with a function.
3. The first argument of a tag function contains an array of string values.
4. The remaining arguments are related to the expressions.

**Syntax:**

TYPICAL FUNCTION

function greet (string, …values) {

// do something

};

TAG FUNCTION

greet `I'm ${name}. I'm ${age} years old. `

**Example:**

function useless(strings, ...values) {

return 'I render everything useless.';

}

let name = 'Benedict';

let occupation = 'being awesome';

let sentence = useless `Hi! I'm ${ name } and I'm busy at ${ occupation }.` ;

console.log(sentence);

# JavaScript Numbers

## JavaScript Numbers are Always 64-bit Floating Point

Integers (numbers without a period or exponent notation) are accurate up to 15 digits.

### Number Methods

1. **toString() :** Returns a number as a string

let x = 123;  
x.toString();  
(123).toString();  
(100 + 23).toString()

1. **toExponetial():** Returns a number written in exponential notation

let x = 9.656;  
x.toExponential(2);  
x.toExponential(4);  
x.toExponential(6);

1. **toFixed():** Returns a number written with a number of decimals

let x = 9.656;  
x.toFixed(0);  
x.toFixed(2);  
x.toFixed(4);  
x.toFixed(6);

1. **toPrecision():** Returns a number written with a specified length

let x = 9.656;  
x.toPrecision();  
x.toPrecision(2);  
x.toPrecision(4);  
x.toPrecision(6);

1. **ValueOf():** Returns a number as a number

let x = 123;  
x.valueOf();  
(123).valueOf();  
(100 + 23).valueOf();

1. **Number ():** 
   1. Returns a number converted from its argument.
   2. If the number cannot be converted, NaN (Not a Number) is returned.
   3. Number () can also convert a date to a number.

Number(true);

Number(false);

Number("10");

Number("  10");

Number("10  ");

Number(new Date("1970-01-01"))

1. **parseFloat():** Parses its argument and returns a floating point number

parseFloat("10");  
parseFloat("10.33");  
parseFloat("10 20 30");

1. **parseInt():** Parses its argument and returns a whole number

parseInt("-10");  
parseInt("-10.33");  
parseInt("10");

# Array

An array is a special variable, which can hold more than one value:

1. JavaScript, arrays use numbered indexes.
2. Last array index is [ array.length - 1];
3. Arrays are a special type of objects.
4. Array indexes start with 0.

### Create array:

Method-1:

const array\_name = [item1, item2, ...., ….];

Method-2:

const cars = [];

cars[0]= "Saab";

cars[1]= "Volvo";

Method-3:

Const car = new Array(“shuvo”,26); // no need to use new array method

**Accessing Array Elements:**

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

let car = cars [0]; // first element

console.log(cars) // full array

let car = cars[cars.length - 1]; // last index

### Array method & property:

1. **Length:** The length property of an array returns the length of an array.

const p = cars.length;

1. **Array.isArray():** to know the variable is array or object use Array.isArray() methods.

Array.isArray(cars);

1. **Instanceof ():** The instanceof operator returns true if an object is created by a given constructor

cars instanceof Array;

1. **toString() :** method  converts an array to a string of (comma separated) array values.

const fruits = ["Banana", "Orange", "Apple", "Mango"];

console.log(fruits.toString());

1. **join()** : method also joins all array elements into a string. But we can specify the separator;

const fruits = ["Banana", "Orange", "Apple", "Mango"];

fruits.join(" \* ");

1. **pop() :** removes the last element from an array.

const fruits = ["Banana", "Orange", "Apple", "Mango"];  
fruits.pop();

1. **push()** : adds a new element to an array at the end:

const fruits = ["Banana", "Orange", "Apple", "Mango"];  
fruits.push("Kiwi");

1. **shift ():** removes the first array element and "shifts" all other elements to a lower index.
   * 1. const fruits = ["Banana", "Orange", "Apple", "Mango"];  
        fruits.shift();
2. **unshift ():** adds a new element to an array at the beginning , and "unshifts" older elements:

const fruits = ["Banana", "Orange", "Apple", "Mango"];  
fruits.unshift("Lemon");

1. **delete():** 
   1. Array elements can be deleted using the JavaScript operator delete.
   2. Using delete leaves undefined holes in the array.

const fruits = ["Banana", "Orange", "Apple", "Mango"];  
delete fruits[0];

1. **includes () :** 
   1. The includes() method returns true if an array contains a specified value.
   2. The includes() method returns false if the value is not found.
   3. The includes() method is case sensitive.

Syntax:

array.includes (element, start);

const fruits = ["Banana", "Orange", "Apple", "Mango"];  
fruits.includes("Banana", 3);

1. **concat():** creates a new array by merging (concatenating) existing arrays. The concat() method can also take strings as arguments.

const G = ["Cecilie", "Lone"];  
const B = ["Emil", "Tobias", "Linus"];  
const C = G.concat(B);

const D = G.concat(B, C); // three array concat

1. **splice (added, removed, elements1, elements2):**
   1. adds new items to an array.
   2. Splice() method work in original array.
   3. The 1st defines the position where new elements should be added (spliced in).
   4. The 2nd parameter defines how many elements should be removed.
   5. The rest of the parameters ("Lemon”, "Kiwi") define the new elements to be added.

const fruits = ["Banana", "Orange", "Apple", "Mango"];  
 fruits.splice(2, 0, "Lemon", "Kiwi");

1. **slice(removed):**
   1. The slice() method slices out a piece of an array into a new array.
   2. The slice() method creates a new array.
   3. The slice() method does not remove any elements from the source array.
   4. The method then selects elements from the start argument, and up to (but not including) the end argument.
2. s**ort ():**
   1. **String Sort:** methos sort the array alphabetically.
      * 1. const fruits = ["Banana", "Orange", "Apple", "Mango"];  
           fruits.sort();
   2. **Nemuric Sort:** By default, the sort() function sorts values as strings. Because of this, the sort() method will produce incorrect result when sorting numbers.
      * 1. const points = [40, 100, 1, 5, 25, 10];  
           points.sort(function(a, b){return a - b});
3. **Random Order:**
   * 1. const points = [40, 100, 1, 5, 25, 10];  
        points.sort(function(){return 0.5 - Math.random()});
4. **reverse() :** reverses the elements in an array.
5. **Math.max()**
6. **Math.min()**

# Iteration

1. **ForEach():** method calls a function (a callback function) once for each array element.

const numbers = [45, 4, 9, 16, 25];  
 let txt = "";  
 numbers.forEach(myFunction);  
 function myFunction(value, index, array) {  
  txt += value + "<br>";  
 }

myFunction(value, index, array) takes 3 arguments:

1. The item value
2. The item index
3. The array itself
4. **map():**
5. The map() method creates a new array by performing a function on each array element.
6. The map() method does not execute the function for array elements without values.
7. The map() method does not change the original array.

const numbers1 = [45, 4, 9, 16, 25];

const numbers2 = numbers1.map(myFunction);

function myFunction(value, index, array) {

  return value \* 2;

}

1. **filter():**

The arr.filter() method is used to create a new array from a given array consisting of only those elements from the given array which satisfy a condition set by the argument method.

const numbers = [45, 4, 9, 16, 25];  
const over18 = numbers.filter(myFunction);

function myFunction(value, index, array) {  
  return value > 18;  
}

**syntax:**

array.filter( callback(element, index, arr ) , thisValue )

1. callback: This parameter holds the function to be called for each element of the array.
2. element: The parameter holds the value of the elements being processed currently.
3. index:  is optional, it holds the index of the current Value element in the array starting from 0.
4. arr: This parameter is optional; it holds the complete array on which Array.
5. thisValue: This parameter is optional, it holds the context to be passed as this to be used while executing the callback function. If the context is passed, it will be used like this for each invocation of the callback function, otherwise undefined is used as default.

the callback function does not use the index and array parameters, so they can be omitted:

const numbers = [45, 4, 9, 16, 25];  
const over18 = numbers.filter(myFunction);  
  
function myFunction(value) {  
  return value > 18;  
}

1. **reduce()**
2. The reduce() method runs a function on each array element to produce (reduce it to) a single value.
3. The reduce() method works from left-to-right in the array.
4. The reduce() method does not reduce the original array.

const numbers = [45, 4, 9, 16, 25];  
let sum = numbers.reduce(myFunction, 100);  
function myFunction(total, value) {  
   return total + value;  
}

**reduce() Syntax:**

array.reduce( function(total, currentValue, currentIndex, arr),

1. function(total, currentValue, index, arr): It is the required parameter and used to run for each element of array. It contains four parameter which are listed below:
2. total: It is required parameter and used to specify the initialValue, or the previously returned value of the function.
3. currentValue: It is required parameter and used to specify the value of the current element.
4. currentIndex: It is optional parameter and used to specify the array index of the current element.
5. arr: It is optional parameter and used to specify the array object the current element belongs to.
6. initialValue: It is optional parameter and used to specify the value to be passed to the function as the initial value.
7. **reduceRight()**

The reduceRight() works from right-to-left in the array.

const numbers = [45, 4, 9, 16, 25];  
let sum = numbers.reduceRight(myFunction);  
  
function myFunction(total, value, index, array) {  
   return total + value;  
}

1. **every()**
2. **some()**
3. **indexOf()**
4. **lastIndexOf()**
5. **find()**
6. **findIndex()**
7. **Array.from()**
8. **Keys()**
9. **entries()**
10. **includes()**

# Date Objects

1. new Date() creates a new date object with the current date and time:
2. 6 numbers specify year, month, day, hour, minute, second:
3. 5 numbers specify year, month, day, hour, and minute:
4. 3 numbers specify year, month, and day:

# Math Object

1. Math.E         returns Euler's number
2. Math.PI        returns PI
3. Math.SQRT2     returns the square root of 2
4. Math.SQRT1\_2   returns the square root of ½
5. Math.LN2      // returns the natural logarithm of 2
6. Math.LN10     // returns the natural logarithm of 10
7. Math.LOG2E    // returns base 2 logarithm of E
8. Math.LOG10E
9. Math.round(x) Returns x rounded to its nearest integer
10. Math.ceil(x) Returns x rounded up to its nearest integer
11. Math.floor(x) Returns x rounded down to its nearest integer
12. Math.trunc(x) Returns the integer part of x ([new in ES6](https://www.w3schools.com/js/js_es6.asp))
13. Math.random()

# Destructuring ---- ES6

when we pass those to a function, it may need not be an object/array as a whole. It may need individual pieces. Destructuring assignment is a special syntax that allows us to “unpack” arrays or objects into a bunch of variables, as sometimes that’s more convenient.

1. **Destructing Arrays:**

const arrValue = ['one', 'two', 'three'];

// destructuring assignment in arrays

const [x, y, z] = arrValue;

console.log(x); // one

console.log(y); // two

console.log(z); // three

1. **Object destructuring**

const hero = {

name: 'Batman',

realName: 'Bruce Wayne'

};

const { name, realName } = hero;

console.log(name);

console.log(realName);

# Spread Operator --------ES6

The JavaScript spread operator **( ... )** allows us to quickly copy all or part of an existing array or object into another array or object.

const numbersOne = [1, 2, 3];

const numbersTwo = [4, 5, 6];

const numbersCombined = [...numbersOne, ...numbersTwo];

**Assign the first and second items from numbers to variables and put the rest in an array.**

Const numbers = [1, 2, 3, 4, 5, 6];

const [one, two, ...rest] = numbers;

**We can use the spread operator with objects too:**

const myVehicle = {

brand: 'Ford',

model: 'Mustang',

color: 'red'

}

const updateMyVehicle = {

type: 'car',

year: 2021,

color: 'yellow'

}

const myUpdatedVehicle = {...myVehicle, ...updateMyVehicle }

# Rest parameter ----- ES6

1. ES6 provides a new kind of parameter so-called rest parameter that has a prefix of three dots (...)
2. The rest parameter syntax allows a function to accept an indefinite number of arguments as an array
3. The rest parameters must be at the end

**Syntax:**

function fn (a, b, ...args) {

//......................................

}

**Example:**

function myFun(a, b, ...manyMoreArgs) {

console.log("a", a);

console.log("b", b);

console.log("manyMoreArgs", manyMoreArgs);

}

myFun ("one", "two", "three", "four", "five", "six");

# Conditional statements

1. **If statement:**
   * Use if to specify a block of code to be executed, if a specified condition is true
   * Use else to specify a block of code to be executed, if the same condition is false
   * Use else if to specify a new condition to test, if the first condition is false
   * Use switch to specify many alternative blocks of code to be executed
2. **for:**
3. **for/ in loop:**

const numbers = [45, 4, 9, 16, 25];  
let txt = "";  
for (let x in numbers) {  
  txt += numbers[x];  
}

\*\*\* Do not use for in over an Array if the index order is important.

1. **forEach():**

The forEach() method calls a function (a callback function) once for each array element.

const numbers = [45, 4, 9, 16, 25];  
let txt = "";  
numbers.forEach(myFunction);  
function myFunction(value, index, array) {  
  txt += value;  
}

Note that the function takes 3 arguments:

1. The item value
2. The item index
3. The array itself
4. **for/of:**

JavaScript for of statement loops through the values of an iterable object.

const cars = ["BMW", "Volvo", "Mini"];  
let text = "";  
for (let x of cars) {  
  text += x;  
}

1. **while:**
2. **do/while:**
3. **Switch statement:**

The continue statement (with or without a label reference) can only be used to skip one loop iteration. the break statement "jumps out" of a loop.

switch(expression) {

case x:

// code block

break;

case y:

// code block

break;

default:

// code block

}

# Maps

1. A Map holds key-value pairs where the keys can be any datatype.
2. A Map remembers the original insertion order of the keys.
3. **new Map() Method:**

Creating a Map by passing an Array to the new Map() constructor:

const fruits = new Map ([

  ["apples", 500],

  ["bananas", 300],

  ["oranges", 200]

]);

1. **Map.set() method:**

Adding elements to a Map with the set () method:

const fruits = new Map ();

fruits.set("apples", 500);

fruits.set("bananas", 300);

fruits.set("oranges", 200);

1. **get() Method:**

The get() method gets the value of a key in a Map:

fruits.get("apples");

1. **size Property**: fruits.size;
2. **delete () Method:** fruits.delete("apples");
3. **has() Method :** fruits.has("apples");
4. **forEach() Method:**

The forEach() method calls a function for each key/value pair in a Map:

let text = "";

fruits.forEach (function(value, key) {

  text += key + ' = ' + value;

})

1. **entries() Method:**

The entries() method returns an iterator object with the [key, values] in a Map:

let text = "";

for (const x of fruits.entries()) {

  text += x;

}

# Modules ------ES6

JavaScript modules rely on the import and export statements.

1. **Export:**

You can export a function or variable from any file. You can create named exports two ways

1. In-line individually:

export const name = "Jesse";  
export const age = 40;

1. All at once at the bottom:

const name = "Jesse"

const age = 40

export { name, age }

1. Default Exports

const message = () => {

const name = "Jesse";

const age = 40;

return name + ' is ' + age + 'years old.';

};

export default message;

1. **Import:**

You can import modules into a file in two ways, based on if they are named exports or default exports.

1. Import from named exports

import { name, age } from "./person.js";

1. Import from default exports

import message from "./message.js";

# Errors

1. **try and catch:**
2. The **try** statement allows you to define a block of code to be tested for errors while it is being executed.
3. The**catch** statement allows you to define a block of code to be executed, if an error occurs in the try block.

try {

Block of code to try  
}  
catch(err) {

  Block of code to handle errors  
}

1. **throw Statement:**

When an error occurs, JavaScript will normally stop and generate an error message. The throw

Statement allows you to create a custom error. The technical term for this is: JavaScript will throw an exception (throw an error).

try {

If (x == "") {

throw "empty";

}

If (isNaN(x)) throw "not a number";

}

  catch(err) {

    message.innerHTML = "Input is " + err;

  }

1. **finally, Statement:**

The finally statement defines a code block to run regardless of the result.

try {

  Block of code to try

}

catch(err) {

Block of code to handle errors

}

finally {

  Block of code to be executed regardless of the try / catch result

}

# Scope

1. Block scope
2. Function scope
3. Global scope

# Hoisting

# Use Strict

**"use strict"** Defines that JavaScript code should be executed in "strict mode". Strict mode is declared by adding "use strict"; to the beginning of a script or a function.

1. Using a variable, without declaring it, is not allowed:
2. Using an object, without declaring it, is not allowed:
3. Deleting a variable (or object) is not allowed.
4. Deleting a function is not allowed.
5. Duplicating a parameter name is not allowed:
6. Octal numeric literals are not allowed:
7. Octal escape characters are not allowed:
8. Writing to a read-only property is not allowed:
9. Writing to a get-only property is not allowed:
10. Deleting an undeletable property is not allowed:
11. The word eval cannot be used as a variable:
12. The with statement is not allowed
13. **“This”** keyword in functions behaves differently in strict mode

# Object

1. Objects are variables too. But objects can contain many values.
2. Object values are written as name: value pairs (name and value separated by a colon).
3. Dates are always objects
4. Math are always objects
5. Regular expressions are always objects
6. Arrays are always objects
7. Functions are always objects
8. Objects are always objects

const person = {

firstName:"John",

lastName:"Doe",

age:50,

eyeColor:"blue"

};

### There are different ways to create new objects:

1. **Create a single object, using an object literal.**

Example 1:

const person = {

firstName:"John",

lastName:"Doe",

Age: 50,

eyeColor:"blue"

};

Example 2:

const person = {};  
person.firstName = "John";  
person.lastName = "Doe";  
person.age = 50;  
person.eyeColor = "blue";

1. **Create a single object, with the keyword new.**

const person = new Object ();  
person.firstName = "John";  
person.lastName = "Doe";  
person.age = 50;  
person.eyeColor = "blue";

1. **Define an object constructor, and then create objects of the constructed type.**
2. **Create an object using Object.create().**

\*\*\*\*\* Objects are mutable: They are addressed by reference, not by value.

### JavaScript Object Properties and method

1. Properties are the values associated with a JavaScript object.
2. A JavaScript object is a collection of **unordered** properties.
3. Properties can usually be changed, added, and deleted, but some are read only.

**Syntax for accessing the property of an object -----**

1. objectName.property
2. objectName["property"]
3. objectName[expression]
4. **Property in loop:**

for (let x in person) {

txt += person[x];

}

1. **Add property:**

person.nationality = "English";

1. **Deleting Property:**

delete person.age;

1. **Nested Object:**

myObj = {

  name: "John",

  age:30,

  cars: {

    car1:"Ford",

    car2:"BMW",

    car3:"Fiat"

  }

}

1. **Object called:**

myObj.cars.car2;

myObj.cars["car2"];

myObj["cars"]["car2"];

myObj[p1][p2];

1. **Nested Arrays and Objects:**
2. Values in objects can be arrays
3. values in arrays can be objects

const myObj = {

  name: "John",

  age: 30,

  cars: [

    { name: "Ford", models:["Fiesta", "Focus", "Mustang"] },

    { name: "BMW", models:["320", "X3", "X5"] },

    { name: "Fiat", models:["500", "Panda"] }

 ]

}

for (let i in myObj.cars) {

  x += "<h1>" + myObj.cars[i].name + "</h1>";

  for (let j in myObj.cars[i].models) {

    x += myObj.cars[i].models[j];

  }

}

**This:**

1. In an **object** method, **this** refers to the object.
2. **Alone**, this refers to the global object.
3. In a **function**, this refers to the **global** object.
4. In a **function**, in strict mode, this is **undefined**.
5. In an **event**, this refers to the element that received the **event**.
6. Methods like **call**(), **apply**(), and **bind**() can refer **this** to any **object**

**Accessing Object Methods:**

1. You will typically describe fullName() as a method of the person object, and fullName as a property.
2. The fullName property will execute (as a function) when it is invoked with ().
3. If you access the fullName **property**, without (), it will return the **function definition**:

objectName.methodName()

### Display Objects

1. **Displaying the Object Properties by name:**

const person = {

  name: "John",

  age: 30,

  city: "New York"

};

document.getElementById("demo").innerHTML = person.name;

1. Displaying the Object Properties in a Loop

for (let x in person) {

txt += person[x] + " ";

};

**\*\*\* person.x** will not work (Because **x** is a variable).

1. Displaying the Object using Object.values():

Any JavaScript object can be converted to an array using

const myArray = Object.values(person);

1. Displaying the Object using JSON.stringify()

Any JavaScript object can be stringified (converted to a string) with the JavaScript function.

const person = {

  name: "John",

  age: 30,

  city: "New York"

};  
  
let myString = JSON.stringify(person);

### Object Constructors function:

1. A constructor is a special function that creates and initializes an object instance of a class.
2. In JavaScript, a constructor gets called when an object is created using the new keyword.
3. The purpose of a constructor is to create a new object and set values for any existing object properties.

**Without parameter:**

function User () {

this.name = 'Bob';

}

var user = new User ();

**With parameter:**

function Person (first, last, age, eye) {

this.firstName = first;

this.lastName = last;

this.age = age;

this.eyeColor = eye;

}

const m2 = new Person ("John", "Doe", 50, "blue");  
const m2 = new Person ("Sally", "Rally", 48, "green");

\*\* It is considered good practice to name constructor functions with an upper-case first letter.

**Constructor Function Vs Object Literal**

Object Literal is generally used to create a single object. The constructor function is useful if you want to create multiple objects.

\*\*using object literal

let person = {

name: 'Sam'

}

\*\* using constructor function

function Person () {

this.name = 'Sam'

}

let person1 = new Person ();

**Adding property and method in construction function:**

function Person (first, last, age, eyecolor) {

this.firstName = first;

   this.lastName = last;

   this.age = age;

   this.eyeColor = eyecolor;

   this.nationality = "English";

}

const ob1 = new Person ("John", "Doe", 50, "blue");  
const ob2 = new Person ("Sally", "Rally", 48, "green");

**Adding property:**

1. Adding a new property to an existing object

Ob1.nationality = "English";

You cannot add a new property to an object constructor the same way you add a new property to an existing object:

Person.nationality = "English";

1. To add a new property to a constructor, you must add it to the constructor function

function Person(first, last, age, eyecolor) {

this.firstName = first;

this.lastName = last;

this.age = age;

this.eyeColor = eyecolor;

this.nationality = "English";

}

**Adding method:**

1. Adding a new method to an existing object :

myFather.name = function () {

return this.firstName + " " + this.lastName;

};

1. Your constructor function can also define methods:

function Person(first, last, age, eyecolor) {

this.firstName = first;

this.lastName = last;

this.age = age;

this.eyeColor = eyecolor;

this.name = function() {

return this.firstName + " " + this.lastName;

};

}

Use of construction function :

Property call:

Obj.lastname;

Method call :

Obj.name();

**Object Prototypes**

1. All JavaScript objects inherit properties and methods from a prototype.
2. We cannot add a new property and method to an existing object constructor:
3. But with prototype we can add property and method in object.

Proparty add:

function Person(first, last, age, eyecolor) {

  this.firstName = first;

  this.lastName = last;

  this.age = age;

  this.eyeColor = eyecolor;

}  
  
Person.prototype.nationality = "English";

method add:

function Person(first, last, age, eyecolor) {  
  this.firstName = first;  
  this.lastName = last;  
  this.age = age;  
  this.eyeColor = eyecolor;  
}  
  
Person.prototype.name = function() {  
  return this.firstName + " " + this.lastName;  
};

# Function

1. JavaScript functions are defined with the function keyword.

2. You can use a function declaration or a function expression.

1. **Function Declarations:**

function functionName(parameters) {

   // code to be executed

}

Declared functions are not executed immediately. They are "saved for later use", and will be executed later, when they are invoked (called upon).

function myFunction(a, b) {

return a \* b;

}

myFunction();

1. **Function Expressions**:

const x = function (a, b) {return a \* b};

let z = x(4, 3);

* Function can be store in variable .
* After a function expression has been stored in a variable, the variable can be used as a function:
* **the function above is actually an anonymous function (a function without a name).**
* Functions stored in variables do not need function names. They are always invoked (called) using the variable name.
* The function above ends with a semicolon because it is a part of an executable statement.

1. **Function () Constructor**

Functions can also be defined with a built-in JavaScript function constructor called Function ().You actually don't have to use the function constructor

const myFunction = new Function ("a", "b", "return a \* b");  
let x = myFunction (4, 3);

1. **Self-Invoking Functions**
2. A self-invoking expression is invoked (started) automatically, without being called.
3. Function expressions will execute automatically if the expression is followed by **().**
4. Function not necessary any name;

(Function () {  
  let x = "Hello!!”; // I will invoke myself  
}) ();

1. **JavaScript functions can be used as values:**

function myFunction(a, b) {  
  return a \* b;  
}  
let x = myFunction(4, 3);

1. **JavaScript functions can be used in expressions:**

function myFunction(a, b) {  
  return a \* b;  
}  
let x = myFunction(4, 3) \* 2;

**JavaScript functions have both properties and methods.**

1. arguments.length
2. toString()
3. **Arrow Functions: ES-6**
4. Arrow functions allows a short syntax for writing function expressions.
5. You don't need the function keyword, the return keyword, and the curly brackets.
6. Arrow functions are not hoisted. They must be defined before they are used.
7. Arrow functions do not have their own this. They are not well suited for defining object methods.
8. Arrow functions aren't suitable for call, [apply](https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global_Objects/Function/apply) and [bind](https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global_Objects/Function/bind) methods,
9. Arrow functions cannot be used as constructors.

// ES5

var x = function(x, y) {  
  return x \* y;  
}

// ES6

const x = (x, y) => x \* y;

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

[Advanced syntax](https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Functions/Arrow_functions#advanced_syntax):

1. To return an object literal expression requires parentheses around expression:

(params) => ({ foo: "a" }) // returning the object { foo: "a" }

1. [Rest parameters](https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Functions/rest_parameters) are supported, and always require parentheses:

(a, b, ...r) => expression

1. [Default parameters](https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Functions/Default_parameters) are supported, and always require parentheses:

(a=400, b=20, c) => expression

1. [Destructuring](https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Operators/Destructuring_assignment) within params is supported, and always requires parentheses:

([a, b] = [10, 20]) => a + b ; // result is 30

({ a, b } = { a: 10, b: 20 }) => a + b; // result is 30

1. [Arrow functions used as methods](https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Functions/Arrow_functions#arrow_functions_used_as_methods)

'use strict';

const obj = { // does not create a new scope

i: 10,

b: () => console.log(this.i, this),

c() {

console.log(this.i, this);

},

}

obj.b(); // prints undefined, Window { /\* … \*/ } (or the global object)

obj.c(); // prints 10, Object { /\* … \*/ }

1. **Function Parameters:**

parameters are the names listed in the function definition.

1. JavaScript function definitions do not specify data types for parameters.
2. JavaScript functions do not perform type checking on the passed arguments.
3. JavaScript functions do not check the number of arguments received.

function functionName(parameter1, parameter2, parameter3) {

  // code to be execute

}

1. **Default Parameters**:

If a function is called with missing arguments (less than declared), the missing values are set to undefined.

function myFunction(x, y) {

  if (y === undefined) {

y = 2;

}

}

function myFunction (x, y = 2) {

// function code

}

1. **The Arguments:**
2. JavaScript functions have a built-in object called the arguments object.
3. Arguments are the real values passed to (and received by) the function.
4. **arguments** name array receives all the argument passed in function.

x = findMax(1, 123, 500, 115, 44, 88); // argument value……

function findMax() {

  let max = -Infinity;

  for (let i = 0; i < arguments.length; i++) {

     if (arguments[i] > max) {

       max = arguments[i];

     }

  }

  return max;

}

1. JavaScript arguments are passed by value: The function only gets to know the values, not the argument's locations.
2. If a function changes an argument's value, it does not change the parameter's original value.
3. Changes to arguments are not visible (reflected) outside the function

# Function Methods

1. call (),
2. apply (),
3. bind ()
4. **call () method :**
5. In JavaScript all functions are object methods.
6. With the call() method, you can write a method that can be used on different objects.

const person = {

fullName: function() {

return this.firstName + " " + this.lastName;

}

}

const person1 = {

firstName:"John",

lastName: "Doe"

}

const person2 = {

firstName:"Mary",

lastName: "Doe"

}

person.fullName.call(person1);

**The call() Method with Arguments:**

const person = {

fullName: function(city, country) {

return this.firstName + " " + this.lastName + "," + city + "," + country;

}

}

const person1 = {

firstName:"John",

lastName: "Doe"

}  
person.fullName.call(person1, "Oslo", "Norway");

1. **apply() Method:**
2. The apply() method is similar to the call()
3. With the apply() method, you can write a method that can be used on different objects.
4. The call() method takes arguments separately.
5. The apply() method takes arguments as an array.
6. The apply() method is very handy if you want to use an array instead of an argument list

const person = {

fullName: function(city, country) {

return this.firstName + " " + this.lastName + "," + city + "," + country;

}

}  
const person1 = {

firstName:"John",

lastName: "Doe"

}  
  
person.fullName.apply(person1, ["Oslo", "Norway"]); // array in apply()

person.fullName.call(person1, "Oslo", "Norway"); // call method

1. **bind() method :**

With the bind() method, an object can borrow a method from another object.

const person = {

firstName:"John",

lastName: "Doe",

fullName: function () {

return this.firstName + " " + this.lastName;

}

}  
  
const member = {

firstName:"Hege",

lastName: "Nilsen",

}  
  
let fullName = person.fullName.bind(member);

1. Closures

Global variables can be made local (private) with closures.

# Asynchronous

1. JavaScript functions are executed in the sequence they are called.
2. Not in the sequence they are defined.

function myFirst() {

  myDisplayer("Hello");

}

function mySecond() {

   myDisplayer("Goodbye");

}  
myFirst();

mySecond();

mySecond();

myFirst();

Sometimes you would like to have better control over when to execute a function.

Suppose you want to do a calculation, and then display the result.

**We can do it as below:**

function myDisplayer(some) {

  document.getElementById("demo").innerHTML = some;

}

function myCalculator(num1, num2) {

  let sum = num1 + num2;

  return sum;

}

let result = myCalculator(5, 5);

myDisplayer(result);

**Other Way:**

function myDisplayer(some) {

  document.getElementById("demo").innerHTML = some;

}

function myCalculator(num1, num2) {

  let sum = num1 + num2;

  myDisplayer(sum);

}

myCalculator(5, 5);

The problem with the first example above, is that you have to call two functions to display the result. The problem with the second example, is that you cannot prevent the calculator function from displaying the result.

### How JavaScript Asynchronous Works:

1. when JavaScript code run in browser, all code convert into machine language. Then browser interpret all the code.
2. Browser have two things.
   * + 1. runtime
       2. engine
3. **Runtime:**

Runtime is the environment in which a programming language executes. JavaScript’s runtime majorly constitutes three things namely JavaScript Engine, Web API, Call stack. JavaScript can work with asynchronous code as well as synchronous code.

The unique feature of JavaScript’s runtime is that even though JavaScript’s interpreter is single-threaded, it can execute multiple codes at a time using concurrent fashion in a non-blocking way. This enables asynchronous behavior. As the interpreter is not multithreaded, it rules out parallelism.

1. **JavaScript Engine:**

JavaScript engine can be considered as the heart of the runtime. It is the place where each code is executed. JavaScript engine constitutes of Heap storage and call stack. Let’s understand each of those.  JavaScript is a single-threaded language. This means it has only one call stack and one memory heap. Hence, it can only execute one code at a time. In other words, the code is executed in an orderly fashion. It must execute one code in the call stack before moving to the next code to be executed. There are two types of code tasks in JavaScript, asynchronous code which runs and gets executed after certain loading, synchronous, which gets executed instantaneously.

**Heap :**

It is the place where all the objects and data are stored. This is similar to the heap storage we see on various other languages like C++, Java, etc. It contains the store of the data related to all the objects, arrays, etc. that we create in the code.

**Call Stack:**

It is the place where the code is stacked before the execution. It has the properties of a basic stack( first in last out ). Once a coding task is stacked into the call stack, it will be executed. There is an event loop that takes place and this is the one that makes the JavaScript interpreter smart. It is responsible for concurrent behavior.

**Web API:**

JavaScript has the access to different web API’s and it adds a lot of functionality. For example, JavaScript has the access to the DOM API, which gives access to the DOM tree to JavaScript. Using this, we can make changes to the HTML elements present on the browser. Also, you can think of the timer, which gives it access to the time-related functions, etc. Also, the geolocation API which gives it access to the location of the browser. Like this, JavaScript has the access to various other APIs.

**Callback Queue:**

This is the place where asynchronous code is queued before passing to the call stack. The passing of the code task from the callback queue to the call stack is taken care of by the event loop. In addition to this, there is also a micro tasks queue.

### JavaScript Callbacks

A function passed as an argument to another function is called callbacks .

function myDisplayer(some) {

document.getElementById("demo").innerHTML = some;

}  
  
function myCalculator(num1, num2, myCallback) {

let sum = num1 + num2;

myCallback(sum);

}  
  
myCalculator(5, 5, myDisplayer);

\*\*\*\* When you pass a function as an argument, remember not to use parenthesis.

Right: myCalculator(5, 5, myDisplayer);

Wrong ~~: myCalculator(5,5, MyDisplayer);~~

### Asynchronous

1. Functions running in parallel with other functions are called asynchronous
2. In the real world, callbacks are most often used with asynchronous functions.

Asynchronous function :

1. setTImeout()
2. setInterval()

**setTimeout() function :**

setTimeout(myFunction, 3000);

function myFunction () {

document.getElementById("demo").innerHTML = "I love You !!";

}

**setInterval() function :**

console.log(“dlkj”)

setInterval(myFunction, 1000);  
  
function myFunction() {

console.log(“function”);

}

Console.log(“finish”)

### Promises

# JSON

1. JSON is a format for storing and transporting data.
2. JSON is often used when data is sent from a server to a web page.
3. JSON stands for JavaScript Object Notation
4. JSON is a lightweight data interchange format
5. JSON is language independent \*
6. JSON is "self-describing" and easy to understand

**JSON Example:**

{

"employees": [

 {"firstName":"John", "lastName":"Doe"},

{"firstName":"Anna", "lastName":"Smith"},

{"firstName":"Peter", "lastName":"Jones"}

]

}

**JSON Syntax Rules**

1. Data is in name/value pairs
2. Data is separated by commas
3. Curly braces hold objects
4. Square brackets hold arrays

**JSON strings into JavaScript objects:**

Use the JavaScript built-in function JSON.parse() to convert the string into a JavaScript object:

let text = '{ "employees" : [' +

'{ "firstName":"John" , "lastName":"Doe" },' +

'{ "firstName":"Anna" , "lastName":"Smith" },' +

'{ "firstName":"Peter" , "lastName":"Jones" }

]

}';

const obj = JSON.parse(text);

**converting an object into a JSON string:**

Use the JavaScript built-in function JSON.stringify() to convert object into a JSON string

# Class

1. Use the keyword class to create a class.
2. Always add a method named constructor():
3. Then add any number of methods.

class ClassName {

  constructor() { ... }

  method\_1() { ... }

  method\_2() { ... }

  method\_3() { ... }

}

class Car {

  constructor(name, year) {

    this.name = name;

    this.year = year;

  }

  age() {

    let date = new Date();

    return date.getFullYear() - this.year;

  }

}

let myCar1 = new Car("Ford", 2014);  
let myCar2 = new Car("Audi", 2019);

**Class Inheritance:**

To create a class inheritance, use the extends keyword.

class Car {

constructor(brand) {

    this.carname = brand;

  }

  present() {

    return 'I have a ' + this.carname;

  }

}  
class Model extends Car {

  constructor(brand, mod) {

    super(brand);

    this.model = mod;

  }

  show() {

    return this.present() + ', it is a ' + this.model;

  }

}

The super () method refers to the parent class.

By calling the super() method in the constructor method, we call the parent's constructor method and gets access to the parent's properties and methods.

**Getters and Setters:**

It can be smart to use getters and setters for your properties, especially if you want to do something special with the value before returning them, or before you set them.

To add getters and setters in the class, use the get and set keywords.

class Car {

  constructor(brand) {

    this.carname = brand;

  }

  get cnam() {

    return this.carname;

  }

  set cnam(x) {

    this.carname = x;

  }

}

even if the getter is a method, you do not use parentheses when you want to get the property value.

AJAX