JavaScript

Create Your Code Masterpiece for Web Development Success

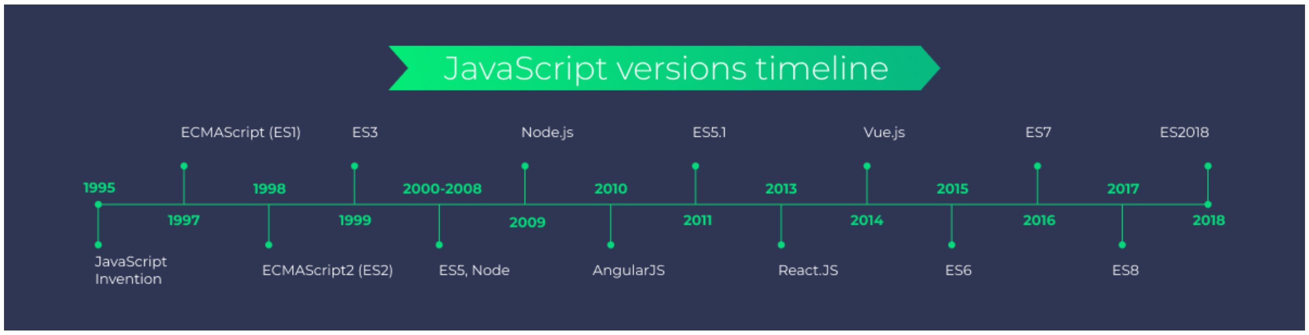
WHAT IS JAVASCRIPT ?

JavaScript is a programming language for making websites interactive. It works alongside HTML and CSS, adding dynamic features like form validation and updating content. It's versatile and widely used for web development.

JavaScript History :

JavaScript was invented by Brendan Eich in 1995. a Netscape programmer developed a new scripting language in just 10 days. It was originally named Mocha, but quickly became known as LiveScript and, later, JavaScript.

Timeline of JavaScript :



WHY WE NEED JAVASCRIPT ?

JavaScript is crucial for making websites interactive and dynamic. It adds features like form validation and content updates, enhancing the overall user experience. Without JavaScript, websites would be static and less engaging.

HOW TO USE THE JAVASCRIPT ?

We can use the JavaScript in three different ways along with our html.

1. Inline JavaScript

2. Internal JavaScript

3. External JavaScript

1.Inline JavaScript :

Inline JavaScript is used in the same line similar to inline CSS though, we have to use the functions at which point we need to activate the JavaScript. We will in detail when we are discussing about it.

Syntax :

```
< tagName  function = " javaScript code" > </tagName>
```

Example :

```
<button onclick = " function count() { counter++;
console.log(counter);}">

Increase

</button>
```

2. Internal JavaScript :

Internal JavaScript is used in the same file, we separate it by using the " script " tag.

Syntax :

```
<script>

//javascript code

</script>
```

Example :

```
<script>
function count(){
counter++;
console.log(counter);
}
```

3.External JavaScript :

External javascript is mainly used for it's reusablility nature. In external javascript we write the javascript code in a seperate file and will include to the necessary html document

Syntax :

```
<script src = "path"> </script>
```

Example :

```
<script src = "../javascript/filename.js"></script>
```

NOTE : To link the CSS file we use the link tag though, for Javascript we use the script

Basic structure for javascript:

Unlike C, java we will not have any structure to the javascript. But we have to write the code in a systematic way.

Output in javascript :

1. console

When we are using the console we will display the output inside the browser console.

There are different styles to use the console to display output :

1. log

2. info

3. error

4. warn

Syntax :

console.type("content");

2. alert :

When we are using the alert then it will show us a alert box on the browser.

Syntax :

alert("content"); or windows.alert("content");

Comments :

In javascript we are having comments. Comments are non-executable code which will help us to write some info which are not belong to the code to make others understand.

There are two types of comments in javascript:

1. single line comments

2. multi line comments

1. single line comments :

We can only write one line of comments in single line comments.

Syntax:

// single line comments

2. Multi-line comments :

We can write multiple lines of comments in multi line comments.

Syntax :

/*

multiple lines of comments

*/

Variables in Javascript:

Variables are containers which will store values inside them temporily. To name a variable we need to follow some rules.

Rules :

1. Declare the variable :

We have the declare a variable 1st inorder to access it.

We are having the 3 types of declarations.

a. let - can change based on value/ data

b. const - can't change value in the entire the program

c. Var - Var is similar to let but it is functional level variable.

NOTE : We use the let instead of var as it is more flexiable and will not allow any leakages that will happen with var.

Syntax :

declarationTyle varName;

Note : VarName should be unique, We cannot declare the same variable twice.

Datatypes in javascript :

Datatypes represents the type of data we are storing inside the variable. JavaScript has several built-in data types that are used to represent different kinds of values. Here are the main data types in JavaScript:

1. **Primitive Data Types:**

- *****Undefined:***** Represents an uninitialized or undefined value.

Syntax :

let undefinedVar;

console.log(undefinedVar); // Output: undefined

- *****Null:***** Represents the absence of any object value.

Syntax :

let nullVar = null;

console.log(nullVar); // Output: null

- **Boolean:** Represents a logical entity and can have two values: `true` or `false`.

Syntax :

```
let isTrue = true;
console.log(isTrue);  // Output: true
```

- **Number:** Represents numeric values, including integers and floating-point numbers.

Syntax :

```
let integerNumber = 42;
let floatingPointNumber = 3.14;
```

- **String:** Represents sequences of characters, enclosed within single or double quotes.

Syntax :

```
let stringVar = "Hello";
console.log(stringVar);  // Output: Hello
```

- **Symbol:** Introduced in ECMAScript 6, symbols are unique and immutable primitive.

values, often used as property keys in objects.

Syntax :

```
let symbol1 = Symbol('uniqueSymbol');
        let symbol2 = Symbol('uniqueSymbol');
        console.log(symbol1 === symbol2);  // Output: false (symbols are
        always unique)
```

2. **Object:**

- **Object:** A compound data type that allows you to group related data and functions together.

Example :

```
let person = {
    firstName: 'John',
    lastName: 'Doe',
    age: 30,
    isStudent: false,
};
```

3. **Special Objects:**

- **Function:** A subtype of objects that is callable as a function.

Example :

```
function add(a, b) {
   return a + b;
}
```

- **Array:** A subtype of objects that represents an ordered collection of values.

Example :

```
let numbers = [1, 2, 3, 4, 5];
let fruits = ['apple', 'orange', 'banana'];
```

- **Date:** Represents a specific point in time, with associated methods for working with dates and times.

Example :

```
let currentDate = new Date();
```

- **RegExp (Regular Expression):** Represents a regular expression for pattern matching.

Example :

let pattern = /abc/;

- *****Map:***** A collection of key-value pairs where keys can be of any data type.

  Example :

  let myMap = new Map();

  myMap.set('key1', 'value1');

  myMap.set('key2', 'value2');

- *****Set:***** A collection of unique values.

  Example :

  let mySet = new Set([1, 2, 3, 4, 5]);

4. **Primitive Wrapper Objects (Non-primitive data types):**

- *****String Object:***** A wrapper object for primitive string values.

let stringObject = new String('This is a string object');

- *****Number Object:***** A wrapper object for primitive number values.

let numberObject = new Number(42);

- *****Boolean Object:***** A wrapper object for primitive boolean values.

let booleanObject = new Boolean(true);

Note : It's important to note that JavaScript is a dynamically typed language, meaning the data type of a variable is not explicitly declared but is inferred at runtime. Additionally, JavaScript is loosely typed, allowing values to be coerced from one type to another in certain situations.

Operators in javascript :

We use the operators in javascript to perform specific operations with the help of operators. In javascript we are having 7 operators.

Here are some of the key types of operators in JavaScript:

1. **Arithmetic Operators:**

- `+` (Addition)

- `-` (Subtraction)
- `*` (Multiplication)
- `/` (Division)
- `%` (Modulus - remainder of division)

Example :

```
let a = 5;
let b = 2;
console.log(a + b);  // Output: 7
```

2. **Assignment Operators:**

- `=` (Assignment)
- `+=`, `-=`, `*=`, `/=` (Compound assignment)

Example :

```
let x = 10;
x += 5; // Equivalent to x = x + 5;
```

3. **Comparison Operators:**

- `==` (Equality, loose equality)
- `===` (Strict equality)
- `!=` (Inequality, loose inequality)
- `!==` (Strict inequality)
- `>`, `<`, `>=`, `<=` (Greater than, Less than, Greater than or equal, Less than or equal)

Example :

```
let num1 = 5;
let num2 = '5';
console.log(num1 == num2);   // Output: true (loose equality)
console.log(num1 === num2);  // Output: false (strict equality)
```

4. **Logical Operators:**

- `&&` (Logical AND)
- `||` (Logical OR)
- `!` (Logical NOT)

Example :

```
let isTrue = true;
let isFalse = false;
console.log(isTrue && isFalse);  // Output: false (logical AND)
console.log(isTrue || isFalse);  // Output: true (logical OR)
console.log(!isTrue);            // Output: false (logical NOT)
```

5. **Increment/Decrement Operators:**

- `++` (Increment)
- `--` (Decrement)

Example :

```
let count = 10;
 count++;
```

6. **Concatenation Operator:**

- `+` (String concatenation)

Example :

```
let str1 = 'Hello';
let str2 = 'World';
let greeting = str1 + ' ' + str2;  // Output: 'Hello World'
```

7. **Conditional (Ternary) Operator:**

- `condition ? expr1 : expr2`;

Example :

```
let age = 20;
let message = (age >= 18) ? 'Adult' : 'Minor';
```

Accept user Input :

To accept user input we follow two ways.

1. To use the prompt

2. To use the text box to submit the data.

1. Prompt :

prompt belongs to windows. hence we use the below syntax to accept the user input from the browser itself. It accepts the strings by default.

Syntax :

```
variableName = window.prompt(" message  ");
```

2. Using textbox :

For that we need to add the onclick method inorder to accept the data.

Example :

```
document.getElementById("IdName-button").onclick = function(){
variable = document.getElementById("idName-input").value;
}
```

Note : If we need to change the datatype of variable we will use the type converstion.

Type Converstion :

Type converstion is used to convert a value from one datatype to another.

- To type convert we need to use the datatype before the value inorder to change it's datatype. We use the below function inorder to change the datatype

Number( ) - to convert into number

String( ) - to convert into String

Boolean( ) - to convert into Boolean

Syntax :

varName = dataType(varName/ value);

Example :

let a = '2'; // String

a = Number(a); // converting from String to Number

NOTE : if we are trying to convert any variable which is not initialized then it will convert them using the default values.

1. NaN - not a number > for nuber

2. undefined - > for values which are not defined

3. false - > for Boolean

Math Lib in javascript :

We can use the mathematical operations using the math lib. In JavaScript, the Math object provides a set of built-in mathematical functions and constants. Here are some commonly used functions and constants available in the Math object:

### Mathematical Constants:

1. **`Math.PI`**: Represents the mathematical constant Pi (approximately 3.14159).

2. **`Math.E`**: Represents the mathematical constant Euler's number (approximately 2.71828).

### Basic Mathematical Functions:

1. **`Math.abs(x)`**: Returns the absolute value of a number.

2. **`Math.ceil(x)`**: Rounds a number up to the nearest integer.

3. **`Math.floor(x)`**: Rounds a number down to the nearest integer.

4. **`Math.round(x)`**: Rounds a number to the nearest integer.

5. **`Math.max(x, y, ...)`**: Returns the highest value among the given arguments.

6. **`Math.min(x, y, ...)`**: Returns the lowest value among the given arguments.

### Exponential and Logarithmic Functions:

1. **`Math.exp(x)`**: Returns the value of Euler's number raised to the power of x.

2. **`Math.log(x)`**: Returns the natural logarithm (base e) of a number.

3. **`Math.log10(x)`**: Returns the base 10 logarithm of a number.

### Trigonometric Functions:

1. **`Math.sin(x)`**: Returns the sine of an angle (in radians).

2. **`Math.cos(x)`**: Returns the cosine of an angle (in radians).

3. **`Math.tan(x)`**: Returns the tangent of an angle (in radians).

4. **`Math.asin(x)`**: Returns the arcsine of a number, returning values in the range of -π/2 to π/2 radians.

5. **`Math.acos(x)`**: Returns the arccosine of a number, returning values in the range of 0 to π radians.

6. **`Math.atan(x)`**: Returns the arctangent of a number, returning values in the range of -π/2 to π/2 radians.

### Random Number Functions:

1. **`Math.random()`**: Returns a pseudo-random number between 0 (inclusive) and 1 (exclusive).

2. **`Math.floor(Math.random() * (max - min + 1)) + min`**: Generates a random integer between min (inclusive) and max (inclusive).

Conditional Statments :

Conditional statements in JavaScript are used to make decisions in your code based on certain conditions. The most common conditional statements in JavaScript are:

1. **if statement:**

The `if` statement is used to execute a block of code if a specified condition evaluates to true.

Syntax :

```
if (condition) {
   // code to be executed if the condition is true
}
```

2. **if-else statement:**

The `if-else` statement allows you to execute one block of code if the condition is true and another block if the condition is false.

Syntax :

```
if (condition) {
   // code to be executed if the condition is true
} else {
   // code to be executed if the condition is false
}
```

3. **if-else if-else statement:**

You can use multiple conditions with the `if-else if-else` statement to check for different cases.

Syntax :

```
if (condition1) {
   // code to be executed if condition1 is true
} else if (condition2) {
   // code to be executed if condition2 is true
} else {
   // code to be executed if none of the conditions are true
}
```

4. **switch statement:**

The `switch` statement is useful when you have multiple possible conditions to check. It's an alternative to using multiple `if-else if` statements.

Syntax :

```
switch (expression) {
   case value1:
      // code to be executed if expression matches value1
```

```
            break;
        case value2:
            // code to be executed if expression matches value2
            break;
        // ... more cases
        default:
            // code to be executed if expression doesn't match any case
    }
```

Strings in javaScript :

In JavaScript, strings are sequences of characters, such as text, and they are used to represent and manipulate textual data. Strings can be created using single or double quotes, and there are various methods available to perform operations on strings. Here are some basics about strings in JavaScript:

### Creating Strings:

You can create strings using single or double quotes:

Example :

```
let singleQuotedString = 'This is a single-quoted string.';
let doubleQuotedString = "This is a double-quoted string.";
```

Both single and double quotes are acceptable, and you can use them interchangeably. This flexibility can be useful in certain situations.

### String Concatenation:

You can concatenate (combine) strings using the `+` operator:

Example :

```
let firstName = "John";
let lastName = "Doe";
let fullName = firstName + " " + lastName;
console.log(fullName);  // Output: John Doe
```

### String Length:

You can find the length of a string using the `length` property:

Example :

```
let message = "Hello, World!";
let messageLength  = message.length;
console.log(messageLength);   // Output: 13
```

### Accessing Characters:

Individual characters in a string can be accessed using square brackets and the character's index (zero-based):

Example :

```
let str = "JavaScript";
let firstChar = str[0];  // J
let thirdChar = str[2];  // v
```

### String Methods:

JavaScript provides various methods for working with strings. Some common ones include:

- `toUpperCase()` and `toLowerCase()`:

Convert a string to uppercase or lowercase.

Example :

```
    let text = "Hello, World!";
    let uppercased = text.toUpperCase();   // HELLO,  WORLD!
let lowercased = text.toLowerCase();   // hello, world!
```

- `indexOf()`:

Find the index of a substring within a string.

-lastIndexof() - used to return the last index o f the value/ character.

Example :

```
let sentence = "JavaScript is awesome!";
let index = sentence.indexOf("awesome");   // 15
```

- `slice(start, end)`:

Extract a portion of a string.

Example :

```
let phrase = "To be or not to be";
let sliced = phrase.slice(6, 13);  // "or not"
```

- `replace(oldString, newString)`:

Replace occurrences of a substring with another.

Example :

```
let original = "I like cats.";
let modified = original.replace("cats",  "dogs");  // "I like dogs."
```

-trim() :

trim() method is used to remove whitespace (spaces, tabs, and newlines) from both ends of a string.

Example :

```
let stringWithWhitespace = "   Hello, World!   ";
// Using trim() to remove leading and trailing whitespace
let trimmedString = stringWithWhitespace.trim();
console.log(trimmedString);  // Output: "Hello, World!"
```

-repeat() :

Used to repeat the String n- number of times.

Example :

```
let a = "Hello";
console.log(a.repeat(5));  // "HelloHelloHelloHelloHello"
```

- startsWith() and endsWith() :

Used to check where the string starts/end with the give info or not.

Example :

```
let varname = "String";
varname.startsWith('D'); // false
varname.endsWith('h'); //true
```

-includes():

The includes() method is a built-in method of the JavaScript String and Array objects. It is used to check whether a particular value (substring for strings or element for arrays) is present in the given string or array.

Example :

```
let text = "Hello, World!";
    // Check if the string includes a specific substring
    let containsHello = text.includes("Hello");
    console.log(containsHello);  // Output: true
    let containsFoo = text.includes("Foo");
    console.log(containsFoo);  // Output: false
```

-replaceAll() :

It is used to replace all occurrences of a specified substring or regular expression with another string. This method is an improvement over the older replace() method, which only replaced the first occurrence by default.

Example :

```
let originalString = "Hello, World! Hello, Universe!";
    let newString = originalString.replaceAll("Hello",  "Hola");
    console.log(newString);// Output: "Hola, World! Hola, Universe!"
```

-replace() :

It is used to replace the first occurrence only.

Example :

```
// Using replace() to replace only the first occurrence
    let firstReplacement  = originalString.replace("Hello",  "Hola");
```

```
console.log(firstReplacement);  / Output: "Hola, World! Hello,
Universe!"
```

-padStart() :

The padStart() method is a string method in JavaScript that allows you to pad the beginning of a string with a specified number of characters until the desired length is reached. This method is useful for aligning strings, especially in cases where you want to ensure a minimum length for a string.

Example :

```
let originalString = "42";

let paddedString = originalString.padStart(5, "0");

console.log(paddedString);// Output: "00042"
```

-padEnd() :

The padEnd() method is a string method in JavaScript that allows you to pad the ending of a string with a specified number of characters until the desired length is reached. This method is useful for aligning strings, especially in cases where you want to ensure a minimum length for a string.

Example :

```
let originalString = "42";

let paddedString = originalString.padEnd(5, "0");

console.log(paddedString);// Output: "42000"
```

-slice() :

Slicing method is used to create a sub string from the original string. String slicing follows the below syntax :

Syntax :

```
stringVar.slice(IndexStart,  IndexEnd);
```

Example :

```
let originalString = "I like JavaScript";

console.log(originalString.slice(2,  8); // like J
```

Loops in javaScript :

In JavaScript, loops are used to execute a block of code repeatedly until a specified condition is met. There are several types of loops in JavaScript, each serving different purposes. Here are the main types of loops:

### 1. `for` Loop:

The `for` loop is commonly used when the number of iterations is known in advance.

Syntax :

```
for (initialization; condition; increment/decrement) {
   // code to be executed in each iteration
}
```

Example:

```
for (let i = 0; i < 5; i++) {
   console.log(i); // Output: 0, 1, 2, 3, 4
}
```

### 2. `while` Loop:

The `while` loop is used when you want to execute a block of code as long as a specified condition is true.

Syntax :

```
while (condition) {
   // code to be executed as long as the condition is true
}
```

Example:

```
let i = 0;
while (i < 5) {
   console.log(i); // Output: 0, 1, 2, 3, 4
   i++;
}
```

### 3. `do-while` Loop:

The `do-while` loop is similar to the `while` loop, but it ensures that the block of code is executed at least once before checking the condition.

Syntax :

```
do {
   // code to be executed
} while (condition);
```

Example:

```
let i = 0;
do {
   console.log(i); // Output: 0 (even though the condition is false)
   i++;
} while (i < 0);
```

### Loop Control Statements:

JavaScript also provides loop control statements such as `break` and `continue`:

- *The `break` statement is used to exit a loop prematurely.*

- *The `continue` statement is used to skip the rest of the code inside a loop for the current iteration and move to the next iteration.*

Example using `break`:

```
for (let i = 0; i < 5; i++) {
   if (i === 3) {
      break; // exit the loop when i is 3
   }
   console.log(i); // Output: 0, 1, 2
}
```

Example using `continue`:

```
for (let i = 0; i < 5; i++) {
   if (i === 2) {
      continue; // skip the rest of the code for i = 2
   }
   console.log(i); // Output: 0, 1, 3, 4
}
```

Function :

Functions in JavaScript are blocks of reusable code that can be defined and called to perform a specific task. Functions help organize code, promote reusability, and make it easier to maintain and debug programs. Here's an overview of how functions work in JavaScript:

### 1. Function Declaration:

You can declare a function using the `function` keyword, followed by the function name, a list of parameters (if any), and the code block.

Example :

```
function greet(name) {
   console.log("Hello, " + name + "!");
}
// Call the function
greet("John"); // Output: Hello, John!
```

### 2. Function Expression:

You can also define a function using a function expression, where the function is assigned to a variable.

Example :

```
let greet = function(name) {
   console.log("Hello, " + name + "!");
};
```

```
// Call the function
greet("Jane"); // Output: Hello, Jane!
```

### 3. Arrow Functions (ES6+):

Arrow functions provide a concise syntax for defining functions, especially for short functions with a single statement.

Example :

```
let greet = (name) => {
    console.log("Hello, " + name + "!");
};
// Call the function
greet("Alice"); // Output: Hello, Alice!
```

### 4. Function Parameters and Return Values:

Functions can take parameters, which are values passed to the function, and they can return a value using the `return` keyword.

Example :

```
function add(a, b) {
    return a + b;
}
let result = add(3, 4);
console.log(result); // Output: 7
```

### 5. Default Parameters (ES6+):

ES6 introduced default parameter values, allowing you to provide default values for function parameters.

Example :

```
function greet(name = "Guest") {
    console.log("Hello, " + name + "!");
}
greet();          // Output: Hello, Guest!
greet("Bob");    // Output: Hello, Bob!
```

### 6. Function Scope:

Variables declared inside a function are local to that function, creating a function scope. They are not accessible outside the function.

Example :

```
function example() {
   let localVar = "I am a local variable";
   console.log(localVar);
}
example(); // Output: I am a local variable
// console.log(localVar); // This would result in an error
```

### 7. Function Invocation:

Functions can be invoked (called) in various ways, including as standalone functions, as methods of objects, or using the `call()` and `apply()` methods.

Example :

```
// Standalone function
function sayHello() {
   console.log("Hello!");
}
sayHello(); // Output: Hello!
// Function as a method
let obj = {
   greet: function() {
      console.log("Greetings!");
   }
```

```
        };
        obj.greet(); // Output: Greetings!
```

Arrays :

In JavaScript, an array is a data structure that allows you to store and organize multiple values in a single variable. Arrays can hold elements of any data type, including numbers, strings, objects, and other arrays. The elements in an array are indexed starting from 0, and you can access them using square brackets.

### Creating Arrays:

Arrays can be created using the `Array` constructor or using array literals.

#### Using Array Literals:

Example :

```
        // Array of numbers
        let numbers = [1, 2, 3, 4, 5];
        // Array of strings
        let fruits = ["Apple", "Banana", "Orange"];
        // Array of mixed data types
        let mixedArray = [1, "two", true, { key: "value" }];
```

### Accessing Elements:

You can access elements in an array using their index. Remember that array indices start from 0.

Example :

```
        let fruits = ["Apple", "Banana", "Orange"];
        console.log(fruits[0]); // Output: Apple
        console.log(fruits[1]); // Output: Banana
```

### Modifying Elements:

You can modify elements in an array by assigning new values to specific indices.

Example :

```
let numbers = [1, 2, 3, 4, 5];
numbers[2] = 10;
console.log(numbers); // Output: [1, 2, 10, 4, 5]
```

### Array Methods:

JavaScript provides a variety of built-in methods for working with arrays. Here are a few examples:

#### a. `push()` and `pop()`:

Example :

```
let numbers = [1, 2, 3];
numbers.push(4); // Add an element to the end
console.log(numbers); // Output: [1, 2, 3, 4]
let poppedElement = numbers.pop(); // Remove and return the last element
console.log(numbers); // Output: [1, 2, 3]
console.log(poppedElement); // Output: 4
```

#### b. `shift()` and `unshift()`:

Example :

```
let fruits = ["Banana", "Orange", "Apple"];
fruits.shift(); // Remove the first element
console.log(fruits); // Output: ["Orange", "Apple"]
fruits.unshift("Mango"); // Add an element to the beginning
console.log(fruits); // Output: ["Mango", "Orange", "Apple"]
```

#### c. `slice()`:

Example :

```
let numbers = [1, 2, 3, 4, 5];
let slicedArray = numbers.slice(1, 4); // Extract elements from index 1 to 3 (not including 4)
```

```
console.log(slicedArray); // Output: [2, 3, 4]
```

#### d. `splice()`:

Example :

```
let numbers = [1, 2, 3, 4, 5];

numbers.splice(2, 2, 10, 11); // Remove 2 elements starting from index 2 and insert 10 and 11

console.log(numbers); // Output: [1, 2, 10, 11, 5]
```

For each method :

If you are looking to use a callback function with an array iteration, the `forEach` method in JavaScript is a commonly used approach.

For each method will uses the following arguments :

1. ***currentValue:*** The current element being processed in the array.
2. ***index (optional):*** The index of the current element being processed.
3. ***array (optional):*** The array that forEach is being applied to.

Syntax :

```
array.forEach(function(currentValue, index, array) {
      // Code to be executed for each element
    });
```

Example :

```
let fruits = ['apple', 'banana', 'orange'];
    fruits.forEach(function(fruit, index, array) {
      console.log(`Index ${index}: ${fruit}`);
    });
```

Map() :

The `map()` method in JavaScript is used to create a new array by applying a provided function to each element of the original array.

Syntax :

```
const newArray = array.map(function(currentValue, index, array) {
  // Code to be executed for each element
  // Return the new element to be included in the new array
  return newElement;
});
```

- *`currentValue`: The current element being processed in the array.*
- *`index` (optional): The index of the current element being processed.*
- *`array` (optional): The array that `map` is being applied to.*

Example :

```
let numbers = [1, 2, 3, 4, 5];
let squaredNumbers = numbers.map(function(number) {
  return number * number;
});
console.log(squaredNumbers);  // Output: [1, 4, 9, 16, 25]
```

In this example, the `map` method creates a new array `squaredNumbers` by squaring each element of the original `numbers` array.

You can also use arrow functions for a more concise syntax:

Example :

```
let numbers = [1, 2, 3, 4, 5];
let squaredNumbers = numbers.map(number => number * number);
console.log(squaredNumbers);  // Output: [1, 4, 9, 16, 25]
```

NOTE : The `map()` method is useful when you want to transform each element of an array and create a new array based on those transformations.

.filter() :

In JavaScript, you can use the `filter` method to create a new array with elements that pass a certain condition. The `filter` method is available for arrays and takes a callback function as its argument. This callback function is applied to each element of the array, and if the function returns `true`, the element is included in the new array; otherwise, it is excluded.

Syntax :

```
const newArray = originalArray.filter(function(element, index, array) {
    // Your filtering condition goes here
    // Return true if the element should be included in the new array, false
  otherwise
});
// or using arrow function for a more concise syntax:
const newArray = originalArray.filter((element, index, array) => {
    // Your filtering condition goes here
    // Return true if the element should be included in the new array, false
  otherwise
});
```

Explanation:

- `originalArray`: The array you want to filter.
- `element`: The current element being processed in the array.
- `index`: The index of the current element in the array.
- `array`: The array being processed.

Inside the callback function, you provide the condition that determines whether an element should be included in the new array. If the condition is met (returns `true`), the element is included; otherwise, it is excluded. The resulting filtered array is stored in `newArray`.

Example :

```
const numbers = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10];
// Filtering even numbers
```

```
const evenNumbers = numbers.filter(function(number) {
  return number % 2 === 0;
});
console.log(evenNumbers); // Output: [2, 4, 6, 8, 10]
```

You can also use arrow functions for a more concise syntax:

Example :

```
// Using arrow function for filtering odd numbers
const oddNumbers = numbers.filter(number => number % 2 !== 0);
console.log(oddNumbers); // Output: [1, 3, 5, 7, 9]
```

In these examples, the `filter` method is applied to an array of numbers, and it creates a new array containing only even numbers or odd numbers, depending on the condition specified in the callback function.

Reduce() :

In JavaScript, the `reduce` method is used to reduce an array to a single value. It takes a callback function as its argument, which is applied to each element of the array in sequence to accumulate a result.

Syntax :

```
const result = array.reduce(function(accumulator, currentValue, currentIndex, array) {
  // Your reduction logic goes here
  return updatedAccumulator; // This value will be used as the accumulator in the next iteration
}, initialValue);
```

- `accumulator`: *The accumulated result of the reduction.*
- `currentValue`: *The current element being processed in the array.*
- `currentIndex`: *The index of the current element in the array.*
- `array`: *The array being processed.*

- `initialValue` (optional): An initial value for the accumulator. If not provided, the first element of the array is used as the initial accumulator value.

Example :

```
const numbers = [1, 2, 3, 4, 5];
const sum = numbers.reduce(function(accumulator, currentValue) {
  return accumulator + currentValue;
}, 0);
console.log(sum); // Output: 15
```

In this example, the `reduce` method is used to add up all the numbers in the array. The initial value of the accumulator is set to `0`, and the callback function simply adds the current element to the accumulator in each iteration.

Spread Operator :

It is used to unpack the arrays. The spread operator is represented by '...' infront of variable, the spread operator (...) is a versatile syntax that allows you to expand elements of an array or properties of an object. It is commonly used for creating shallow copies of arrays and objects, merging arrays, and passing function arguments.

Syntax :

```
...arrayName;
```

Example :

```
let originalArray = [1, 2, 3];
let copyArray = [...originalArray];
console.log(copyArray); // Output: [1, 2, 3]
```

Rest Parameters :

In JavaScript, the rest parameter, denoted by the ellipsis (`...`) followed by a parameter name, allows a function to accept any number of arguments as an array.