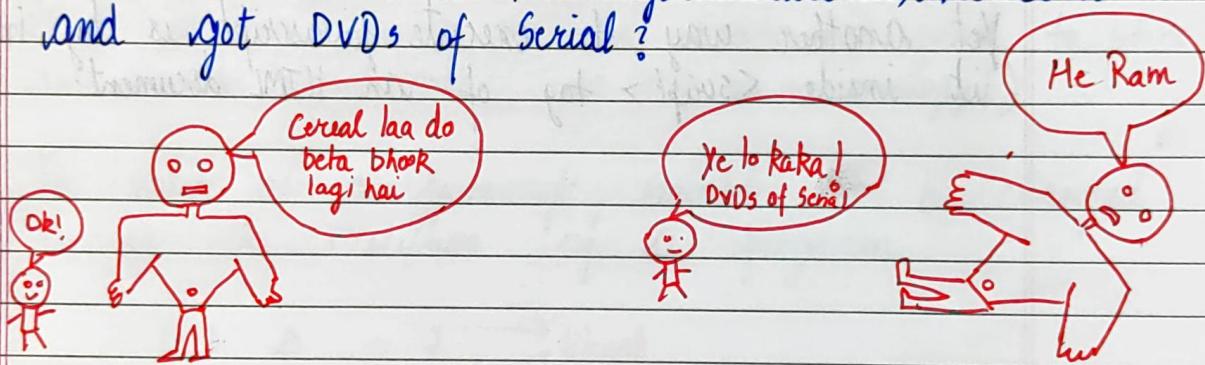


Introduction to programming

Programming is a way to talk to computers. A language like Hindi, English or Bengali can be used to talk to a human but for computers we need straightforward instructions.

Computer is Dumb!

When was the last time you ordered some cereal and got DVDs of Serial?



Programming is the act of constructing a program, a set of precise instructions telling a computer what to do.

What is EcmaScript?

ECMA Script is a standard on which Javascript is based! It was created to ensure that different documents on javascript are actually talking about the same language.

JavaScript & ECMA Script can almost always be used interchangably. JavaScript is very liberal in what it allows.

How to execute JavaScript?

JavaScript can be executed right inside one's browser. You can open the javascript console and start writing javascript there.

Another way to execute javascript is a runtime like Node.js which can be installed and used to run javascript code.

Yet another way to execute javascript is by inserting it inside <script> tag of an HTML document.

Chapter 1 - Variables & Data

Just like we follow some rules while speaking English (the grammar), we have some rules to follow while writing a JavaScript program. The set of these rules is called syntax in JavaScript.

What is a Variable?

A variable is a container that stores a value. This is very similar to the containers used to store rice, water and oats (Treat this as an analogy!)

The value of a JavaScript variable can be changed during the execution of a program.

`var a = 7;` \Rightarrow literal
`let Identifiera = 7;` \Rightarrow Declaring Variables
 \downarrow assignment operator

Rules for choosing variable names

- Letters, digits, underscores & \$ sign allowed.
- Must begin with a \$, - or a letter.
- JavaScript reserved words cannot be used as a variable name.
- Harry & harry are different variables (case sensitive)

Var vs let in JavaScript

- 1> Var is globally scoped while let & const are block scoped
- 2> Var can be updated & re-declared within its scope
- 3> let can be updated but not re-declared
- 4> const can neither be updated nor be re-declared.

5. var variables are initialized with undefined whereas let and const variables are not initialized.
6. const must be initialized during declaration unlike let and var

Primitive Data Types & Objects

Primitive data types are a set of basic data types in javascript

Object is a non primitive datatype in javascript

These are the 7 primitive datatypes in javascript

- Null
- Number
- String
- Symbol
- Undefined
- Boolean
- BigInt

Object

An object in JavaScript can be created as follows.

const item = {

 key ← name : "Led Bulb", value
 key ← price : "150" → value
 }

Quick Quiz: Write a JavaScript program to store name, phone number and marks of a student using objects.

Chapter 2 - Expressions & Conditionals

A fragment of code that produces a value is called an expression. Every value written literally is an expression. For ex: 77 or "Harry"

Operators in JavaScript

1. Arithmetic Operators

+	Addition
-	Subtraction
*	Multiplication
**	Exponentiation
/	Division
%	Modulus
++	Increment
--	Decrement

2. Assignment Operators

=	$x = y$
+=	$x = x + y$
-=	$x = x - y$
*=	$x = x * y$
/=	$x = x / y$
%=	$x = x \% y$
**=	$x = x ** y$

3. Comparison Operators

$= =$	equal to
\neq	not equal
$= = =$	equal value and type
$\neq = =$	not equal value or not equal type
$>$	greater than
$<$	less than
\geq	greater than or equal to
\leq	less than or equal to
$?$	ternary operator

4. Logical Operators

$\&\&$	logical and
$\ \ $	logical or
$!$	logical not

Apart from these, we also have type and bitwise operators. Bitwise operators perform bit by bit operations on numbers.

$$\begin{array}{c} \curvearrowleft \text{operands} \\ 7 + 8 = 15 \rightarrow \text{Result} \\ \curvearrowleft \text{operator} \end{array}$$

Comments in JavaScript

Sometimes we want our programs to contain a text which is not executed by the JS Engine

Such a text is called comment in Javascript

A comment in Javascript can be written as follows :

let a = 2; // this is a single line comment

/*
 I am a
 multiline comment
 */

} Multiline comment

→ Single line comment

Sometimes comments are used to prevent the execution of some lines of code

let switch = true;
// switch = false → commented line won't execute

Conditional Statements

Sometimes we might have to execute a block of code based off some condition.

For example a prompt might ask for the age of the user and if its greater than 18, display a special message.

In JavaScript we have three forms of if else statement.

1. if statement
2. if ... else statement
3. if ... else if ... else statement

If statement

The if statement in JavaScript looks like this:

```
if (condition) {  
    // execute this code  
}
```

The if statement evaluates the condition inside the ()
If the condition is evaluated to true, the code inside
the body of if is executed else the code is
not executed.

if - else statement

The if statement can have an optional else clause.
The syntax looks something like this

```
if (condition) {  
    // block of code if condition true  
}  
else {  
    // block of code if condition false  
}
```

If the condition is true, code inside if is
executed else code inside else block is executed

if - else if statement

Sometimes we might want to keep rechecking a set
of conditions one by one until one matches.
We use if else if for achieving this.

Syntax of if...else if looks like this

```
if (age > 0) {  
    console.log("A valid age");  
}  
else if (age > 10 && age < 15) {  
    console.log("but you are a kid");  
}  
else if (age > 18) {  
    console.log("not a kid");  
}  
else {  
    console.log("Invalid Age")  
}
```

JavaScript ternary Operator

Evaluates a condition and executes a block of code based on the condition

Condition ? exp1 : exp2

Example syntax of ternary operator looks like this:

(marks > 10) ? 'Yes' : 'No'

↳ if marks are greater than 10, you are passed
else not

Chapter 3 - Loops & functions

We use loops to perform repeated actions. For example - If you are assigned a task of printing numbers from 1 to 100, it will be very hectic to do it manually. Loops help us automate such tasks.

Types of loops in JavaScript

- for loop → loops a block of code no of times
- for in loop → loops through the keys of an object
- for of loop → loops through the values of an object
- while loop → loops a block based on a specific condition
- do-while loop → while loop variant which runs atleast once

The for loop

The syntax of a for loop looks something like this

```
for (statement 1 ; statement 2 ; statement 3) {  
    // code to be executed  
}
```

- Statement 1 is executed one time
- Statement 2 is the condition base on which the loop runs (loop body is executed)
- Statement 3 is executed everytime the loop body is executed

Quick Quiz : Write a sample for loop of your choice.

The `for-in` loop
 The syntax of `for-in` loop looks like this

```
for (key in object) {  
    // Code to be executed  
}
```

Quick Quiz : Write a sample program demonstrating `for-in` loop

Note - `for-in` loops also work with arrays which will be discussed in the later videos.

The `for-of` loop

The syntax of `for-of` loop looks like this

```
for (variable of iterable) {  
    // Code  
}  
→ For every iteration  
↳ Iterable data structure like Arrays, Strings etc.
```

Quick Quiz : Write a sample program demonstrating `for-of` loops

The `while` loop

The syntax of `while` loop looks like this :

```
while (condition) {  
    // Code to be executed  
}
```

Note : If the condition never becomes false, the loop will never end and this might crash the runtime!

Quick Quiz : Write a sample program demonstrating while loop.

The do - while loop

The do while loop's syntax looks like this :

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

Quick Quiz : Write a sample program demonstrating do while loop

Functions in Java Script

A JavaScript function is a block of code designed to perform a particular task.

Syntax of a function looks something like this :

```
function myFunc () {  
    // code  
}
```

```
function binodFunc (parameter 1, parameter 2) {  
    // code  
}
```

Function with parameters

Here the parameters behave as local variables

bind Func (7, 8) \Rightarrow Function Invocation

Function invocation is a way to use the code inside the function

A function can also return a value. The value is "returned" back to the caller

Const sum = (a, b) $\Rightarrow \{$

Another way to create &
use the function
 \uparrow

let c = a + b;

return c;

}

\Rightarrow Returns the sum

let y = sum (1, 3)

console.log(y)

\rightarrow Prints 4

Chapter 4 - Strings

Strings are used to store and manipulate text.
String can be created using the following syntax:

Let name = "Harry" → Creates a string

name · length

↳ This property prints length of the string

Strings can also be created using single quotes

```
let name = 'Harry'
```

Template Literals

Template literals use backticks instead of quotes to define a string

```
let name = 'Harry'
```

With template literals, it is possible to use both single as well as double quotes inside a string

Let sentence = ` The name "is" Harry's`
 backtic double quote

We can insert variables directly in template literal. This is called string interpolation.

let a = 'This is \${name}' → Prints 'This is a Harry'
name is a variable

Escape Sequence Characters

If you try to print the following string, JavaScript will misunderstand it

```
let name = 'Adam D'Angelo'
```

We can use single quote escape sequence to solve the problem

```
let name = 'Adam D\''Angelo'
```

Similarly we can use \" inside a string with double quotes

Other escape sequence characters are as follows

\n → Newline

\t → Tab

\r → Carriage Return

String properties and Methods

1, let name = "Harry"
name.length → prints 5

2, let name = "Harry"
name.toUpperCase() → prints HARRY

3, let name = "Harry"
name.toLowerCase() → prints harry

4, let name = "Harry"
^{0 1 2 3 4}
 name.slice(2, 4) → prints rr
 (from 2 to 4, 4 not included)

5, let name = "Harry"
 name.slice(2) → prints rry
 (from 2 to end)

6, let name = "Harry Bhai"
 let newName = name.replace("Bhai", "Bhai")

7, let name1 = "Harry"
 let name2 = "Namam"
 let name3 = name1.concat(name2, "Yes")
 ↳ We can even use + operator

8, let name = " Harry "
 let newName = name.trim()
 ↳ Removes whitespaces

Strings are immutable. In order to access the character at an index we use the following syntax

let name = "Harry"
 name[0] → Prints H
 name[1] → Prints a

Chapter 5 - Arrays

Arrays are variables which can hold more than one value.

`const fruits = ["banana", "apple", "grapes"]`

`const a1 = [7, "Harry", false]`

↳ Can be different types

Accessing Values

`let numbers = [1, 2, 7, 9]`

`numbers[0] → 1`

`numbers[1] → 2`

Finding the length

`let numbers = [1, 7, 9, 21]`

`numbers[0] → 1`
`numbers.length → 4`

Changing the values

`let numbers = [7, 2, 40, 9]`

`numbers[2] = 8`

↳ "numbers" now becomes [7, 2, 8, 9]

Arrays are mutable

Arrays can be changed



In JavaScript, arrays are objects. The typeof operator on arrays returns object

const n = [1, 7, 9]

typeof n → returns "object"

Arrays can hold many values under a single name

Array methods

There are some important array methods in JavaScript. Some of them are as follows:

1. `toString()` → converts an array to a string of comma separated values

let n = [1, 7, 9]
n.toString() → 1, 7, 9

2. `join()` → joins all the array elements using a separator

let n = [7, 9, 13]
n.join("-") → 7-9-13

3. `pop()` → removes last element from the array

let n = [1, 2, 4]
n.pop() → updates the original array
returns the popped value

4. `push()` → Adds a new element at the end of the array

`let a = [7, 1, 2, 8]`

`a.push(9)` → modifies the original array
↳ returns the new array length

5. `shift()` → Removes first element and returns it

6. `unshift()` → Adds element to the beginning.
Returns new array length

7. `delete` → Array elements can be deleted using the delete operator

`let d = [7, 8, 9, 10]`

`delete d[1]` → delete is an operator

8. `Concat()` → Used to join arrays to the given array

`let a1 = [1, 2, 3]`

`let a2 = [4, 5, 6]`

`let a3 = [9, 8, 7]`

`a1.concat(a2, a3)` → Returns [1, 2, 3, 4, 5, 6, 9, 8, 7]

↳ Returns a new array

Does not change existing arrays

9> `Sort()` → `sort()` method is used to sort an array alphabetically.

`let a = [7, 9, 8]`

`a.sort()`

↳ `a` changes to `[7, 8, 9]`
[modifies the original array]

`Sort()` takes an optional compare function. If this function is provided as the first argument, the `Sort()` function will consider these values (the values returned from the compare function) as the basis of sorting.

10> `Splice()` → `Splice` can be used to add new items to an array

`const numbers = [1, 2, 3, 4, 5]`

`numbers.splice(2, 1, 23, 24)`

Returns deleted items. modifies the array

position to add no of elements to remove Elements to be added

11> `Slice()` → slices out a piece from an array.
It creates a new array.

`const num = [1, 2, 3, 4]`

`num.slice(2)` → `[3, 4]`

`num.slice(1, 3)` → `[2, 3]`

12. `reverse()` → Reverses the elements in the source array.

Looping through Arrays

Arrays can be looped through using the classical JavaScript `for` loop or through some other methods discussed below

1. `forEach` loop → calls a function, once for each array element

```
const a = [1, 2, 3]
a.forEach((value, index, array) => {
    // function logic
});
```

2. `map()` → creates a new array by performing some operation on each array element.

```
const a = [1, 2, 3]
a.map((value, index, array) => {
    return value * value;
});
```

3. `filter()` → filters an array with values that passes a test. Creates a new array

```
const a = [1, 2, 3, 4, 5]
a.filter(greater - than - 5)
```

4, reduce method → Reduces an array to a single value

const n = [1, 8, 7, 11]
let sum = numbers.reduce [add)
 $1+8+7+11$ ↳ A function

5, Array.from → Used to create an array from any other object

Array.from("Harry")

6, for...of → For-of loop can be used to get the values from an array

7, for...in → for-in loop can be used to get the keys from an array.

Chapter 5 - Practice Set

- 1 Create an array of numbers and take input from the user to add numbers to this array.
- 2 Keep adding numbers to the array in ① until 0 is added to the array.
- 3 Filter for numbers divisible by 10 from a given array.
- 4 Create an array of square of given numbers.
- 5 Use reduce to calculate factorial of a given number from an array of first n natural numbers. (n being the number whose factorial needs to be calculated)

Chapter 6 - JavaScript in the browser

JavaScript was initially created to make web pages alive. JS can be written right in a web page's HTML to make it interactive.

The browser has an embedded engine called the JavaScript engine or the Javascript runtime.

JavaScript's ability in the browser is very limited to protect the user's safety. For example a webpage on <http://goofy.com> cannot access <http://codeswear.com> and 'steal' information from there.

Developer tools

Every browser has some developer tools which makes a developer's life a lot easier.

F12 on chrome opens Dev tools

All HTML Elements	Elements	Console	Network	All network requests All the errors + logs

We can also write JavaScript commands in the Console

The script tag

The script tag is used to insert JavaScript into an HTML page

The script tag can be used to insert external or internal scripts

```
<Script>  
alert ("Hello")  
</Script>  
// or ...  
<Script src = " /js/thisone.js " > </Script>
```

The benefit of a separate javascript file is that the browser will download it and store it in its cache

Console object methods

The console object has several methods, log being one of them. Some of them are as follows:

- assert() → Used to assert a condition
- clear() → Clears the console
- log() → Outputs a message to the console
- table() → Displays a tabular data
- warn() → Used for warnings
- error() → Used for errors
- info() → Used for special information

You will naturally remember some or all of these with time
Comprehensive list can be looked up on MDN

Interaction : alert, prompt and confirm

alert : Used to invoke a mini window with a msg.

`alert ("hello")`

prompt : Used to take user input as string

`inp = prompt ("Hi", "No")`

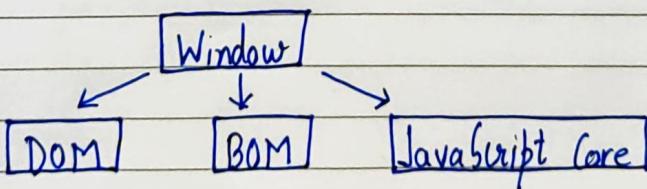
↳ optional default value

Confirm : Shows a message and waits for the user to press ok or cancel. Returns true for ok and false for cancel.

The exact location & look is determined by the browser which is a limitation

Window object, BOM & DOM

We have the following when JavaScript runs in a browser



Window object represents browser window and provides methods to control it. It is a global object

Document Object Model (DOM)

Dom represents the page content as HTML

`document.body` → Page body as JS object

`document.body.style.background = "green"`
↳ Changes page background to green

Browser Object Model (BOM)

The Browser Object Model (BOM) represents additional objects provided by the browser (host environment) for working with everything except the document.

The functions `alert` / `confirm` / `prompt` are also a part of the BOM

`location.href = "https://codewithharry.com"`

↳ Redirected to another URL

Chapter 7 - Walking the DOM

DOM tree refers to the HTML page where all the nodes are objects. There can be 3 main types of nodes in the DOM tree:

1. text nodes
2. element nodes
3. comment nodes

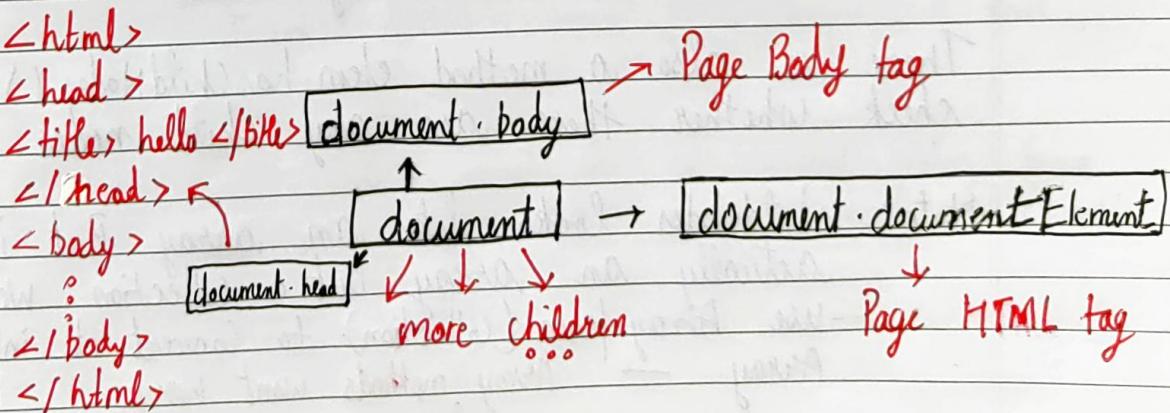
In an HTML page, `<html>` is at the root and `<head>` and `<body>` are its children, etc.

A text node is always a leaf of the tree

Auto Correction

If an erroneous HTML is encountered by the browser, it tends to correct it for example, if we put something after the body, it is automatically moved inside the body. Another example is `<table>` tag which must contain `<tbody>`

Walking the DOM



Note : document.body can sometimes be null if the javascript is written before the body tag.

Children of an element

Direct as well as deeply nested elements of an element are called its children

Child nodes → Elements that are direct children
For example head & body are children of <html>

Descendant nodes → All nested elements, children, their children and so on ...

firstChild, lastChild & childNodes

element.firstChild → first child element

element.lastChild → last child element

element.childNodes → All child nodes

Following is always true :

elem.childNodes[0] == elem.firstChild

elem.childNodes[elem.childNodes.length - 1] == elem.lastChild

There is also a method elem.hasChildNodes() to check whether there are any child nodes.

Note: childNodes looks like an array. But it's not actually an array but a collection. We can use Array.from(Collection) to convert it into an Array. → Array methods won't work

Notes on DOM collections

- They are read-only
- They are live. elem.childNodes variable (reference) will automatically update if childNodes of elem is changed.
- They are iterable using for...of loop

Siblings and the parent

Siblings are nodes that are children of the same parent.

- For example: <head> and <body> are siblings.
Siblings have same parent. In the above example its html
- <body> is said to be the "next" or "right" sibling of <head>, <head> is said to be the "previous" or "left" sibling of <body>
- The next sibling is in nextSibling property, and the previous one in previousSibling.
The parent is available as parentNode.

```
< alert ( document . documentElement . parentNode ) ; //document  
alert ( document . documentElement . parentElement ) ; // null
```

Element only Navigation

Sometimes, we don't want text or comment nodes. Some links only take Element nodes into account. For example

document.previousElementSibling → Previous sibling which is an Element

document.nextElementSibling → next sibling (Element)

document.firstElementChild → first Element child

document.lastElementChild → last Element child

Table links

Certain DOM elements may provide additional properties specific to their type for convenience.

Table element supports the following properties:

table.rows → collection of tr elements

table.caption → reference to <caption>

table.tHead → reference to <thead>

table.tFoot → reference to <tfoot>

table.tBodies → collection of <tbody> elements

tbody.rows → collection of <tr> inside

tr.cells → collection of td and th

tr.sectionRowIndex → index of tr inside enclosing element

tr.rowIndex → Row number starting from 0

td.cellIndex → no of cells inside enclosing <tr>

Quick Quiz: Print typeof document and typeof window in the console & see what it prints

Searching the DOM

DOM navigation properties are helpful when the elements are close to each other. If they are not close to each other, we have some more methods to search the DOM.

→ `document.getElementById`

This method is used to get the element with a given "id" attribute

```
let span = document.getElementById('span')
span.style.color = "red"
```

→ `document.querySelectorAll`

Returns all elements inside an element matching the given CSS selector

→ `document.querySelector`

Returns the first element for the given CSS selector.
A efficient version of `elem.querySelectorAll(css)[0]`

→ `document.getElementsByTagName`

Returns elements with the given tag name

→ `document.getElementsByClassName`

Returns elements that have the given CSS class

→ Dont forget the "s" letter

→ `document.getElementsByName`

Searches elements by the name attribute.

matches, closest & contains methods

There are three important methods to search the DOM

- 1> elem.matches(css) → To check if element matches the given CSS selector
- 2> elem.closest(css) → To look for the nearest ancestor that matches the given CSS - selector. The elem itself is also checked
- 3> elemA.contains(elemB) → Returns true if elemB is inside elemA (a descendant of elemA) or when elemA == elemB

Chapter 8 - Events & other DOM properties

Console.dir function

Console.log shows the element DOM tree

Console.dir shows the element as an object with its properties

tagName / nodeName

Used to read tag name of an element

tagName → only exists for Element nodes

nodeName → defined for any node (text, comment etc.)

innerHTML and outerHTML

The innerHTML property allows to get the HTML inside the element as a string.

↳ Valid for element nodes only

The outerHTML property contains the full HTML: innerHTML + the element itself.

innerHTML is valid only for element nodes. For other node types we can use nodeValue or data.

textContent

Provides access to the text inside the element: only text, minus all tags.

The hidden property

The "hidden" attribute and the DOM property specifies whether the element is visible or not.

<div hidden> I am hidden </div>

<div id = "element"> I can be hidden </div>

<script>

element.hidden = true;

</script>

Attribute methods

1. elem.hasAttribute (name) → Method to check for existence of an attribute
2. elem.getAttribute (name) → Method used to get the value of an attribute
3. elem.setAttribute (name, value) → Method used to set the value of an attribute.
4. elem.removeAttribute (name) → Method to remove the attribute from elem.
5. elem.attributes → Method to get the collection of all attributes

data-* attributes

We can always create custom attributes but the ones starting with "data-" are reserved for programmers use. They are available in a property named dataset.

If an element has an attribute named "data-one", it's available as element.dataset.one

Insertion methods

We looked at some ways to insert elements in the DOM. Here is another way:

```
let div = document.createElement('div') // create
```

```
div.className = "alert" // Set class
```

```
div.innerHTML = "<span> hello </span>"
```

```
document.body.append(div)
```

Here are some more insertion methods:

1. node.append(e) → Append at the end of node

2. node.prepend(e) → Insert at the beginning of node

3. node.before(e) → Insert before node

4. node.after(e) → Insert after node

5. node.replaceWith(e) → replaces node with the given node.

Quick Quiz : Try out all these methods with your own webpage.

insertAdjacentHTML / Text / Element

This method is used to insert HTML. The first parameter is a code word, specifying where to insert. Must be one of the following:

- 1, "beforebegin" - Insert HTML immediately before element
- 2, "afterbegin" - Insert HTML into element at the beginning
- 3, "beforeend" - Insert HTML into element at the end.
- 4, "afterend" - Insert HTML immediately after element.

The second parameter is an HTML string

Example :

```
<div id="div"> </div>
<script>
    div.insertAdjacentHTML('beforebegin', '<p> Hello </p>');
    div.insertAdjacentHTML('afterend', '<p> Bye </p>');
</script>
```

The output would be :

```
<p> Hello </p>
<div id="div"> </div>
<p> Bye </p>
```

Node removal

To remove a node, there's a method `node.remove()`

`let id1 = document.getElementById("id1")`

`id1.remove()`

`ClassName` and `classList`

If we assign something to `elem.className`, it replaces the whole string of classes.

Often we want to add/remove/toggle a single class.

1. `elem.classList.add/remove("class")` - Adds/removes a class
2. `elem.classList.toggle("class")` - Adds the class if it doesn't exist, otherwise removes it.
3. `elem.classList.contains("class")` - Checks for the given class, returns true/false

`setTimeout` and `setInterval`

`setTimeout` allows us to run a function once after the interval of time.

Syntax of `setTimeout` is as follows:

`let timerId = setTimeout(function, <delay>, <arg1>, <arg2>)`

`returns a timerId`

`in ms`

clearTimeout is used to cancel the execution (in case we change our mind). For example:

```
let timerId = setTimeout(() => alert("never"), 1000);
```

clearTimeout(timerId)

→ cancel the execution

setInterval method has a similar syntax as setTimeout :

```
let timerId = setInterval(function, <delay>, <args...>);
```

All arguments have the same meaning. But unlike setTimeout, it runs the function not only once, but regularly after the given interval of time.

To stop further calls, we can use clearInterval(timerId).

Browser Events

An event is a signal that something has happened. All the DOM nodes generate such signals!

Some important DOM events are:

Mouse events : click, contextmenu (right click), mouseover/mouseout, mousedown/mouseup, mousemove

Keyboard events : keydown and keyup

form element events : submit, focus etc.

Document events : DOMContentLoaded

Handling Events

Events can be handled through HTML attributes

```
<input value = "Hey" onclick = "alert('hey')" type = "button">
```

↳ Can be another JS function

Events can also be handled through the onclick property

```
elem.onclick = function() {  
    alert("yes")  
};
```

Note: Adding a handler with JavaScript overwrites the existing handler

addEventListener and removeEventListener

addEventListener is used to assign multiple handlers to an event.

```
element.addEventListener(event, handler)
```

```
element.removeEventListener(event, handler)
```

↳ handler must be the same function object for this to work

The Event Object

When an event happens, the browser creates an event object, puts details into it and passes it as an argument to the handler

```
elem.onclick = function(event) {  
    ...  
}
```

event.type : Event type

event.currentTarget : Element that handled the event

event.clientX / event.clientY : Coordinates of the cursor