JavaScript

Q. What is JavaScript?

* JavaScript is a light weight / text-based programming language.
* It is most well known as scripting language for Web pages.

* What can we do with JS?
  * Web development
  * Mobile application development
  * Game development

Firefox uses SpiderMonkey JS engine.
Chrome uses V8 JS engine.

Adding JS in Code

- You can add JS code in HTML document by using the HTML <script> tag that wraps around JavaScript code.

The <script> tag can be used in the <head> or <body> section in the HTML.

Example

```
<html>
  <head>
    ____________
    ____________
  </head>
  <body>
      <script scr = "index.js"> </script>
  </body>
</html>
```

You will have to create a javascript file with .js extension.

Variables

A variable is a container for storing data (storing data values).

4 ways to declare a Javascript Variable:

* Using var
* using let
* Using const
* we can also declare a variable without using any keyword.

Ex

```
var x = 5;
let y = 6;
Z = 10;
```

When to use "const" ?

When we declare any value with "const" keyword then it means those value are constant and cannot be changed.

```
const price = 5;
```

```
let a = 5;          // number literal
let name = 'Rishabh';   // string literal
let status = true;      // boolean literal
```

Variable Naming Rules

⇒ Cannot be a reserved keyword.
⇒ Cannot start with a number.
⇒ Cannot contain space or '-'.
⇒ Should be meaningful.
⇒ Use camelcase. Ex- let arrName;

Primitive Types

In JavaScript there are 7 primitive data types:

* string — `let s = 'Rishabh';`
* number — `let n = 15;`
* bigint — It is a integer with arbitary precision.
* boolean — `let y = true;`
* undefined — `let a;`
* symbol — a data type whose instance are unique and immutable.
* null — `let z = null;`

Dynamic Typing

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

Ex
```
let n;      // undefind
let n = 5;  // a number
n = 'Rishabh'; // a string
```

Reference Types

* Objects
* Arrays
* Functions

Objects

A Javascript object is a collection of named values.

Object values are written as key : value pair.

Objects are variables too, but it contains multiple values.

Ex

```
let person = {
    fName : 'Rishabh',
    lName : 'Kushwaha',
    age : 20
};
```

Access in Objects

⇒ person.age

⇒ person['age']

Arrays

An array is a special variable, which can hold multiple values of multiple data types or of same type.

Ex

```
let name = ['Rishabh', 'Babbar', 'Lakshay'];

let person = ['Rishabh', 20, 'BCA'];
```

Operators

* Arithmetic
* Assignment
* Comparison
* Bitwise
* Logical

Arithmetic

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

Assignment

=	/=
+=	%=
-=	**=
*=	

Comparison

>	greater than	===	equal value & type
<	less than	!==	not equal value & type
>=	greater than equal to	!=	not equal
<=	less than equal to	==	equal to
?	ternary operator		

Logical

AND	&&
OR	||
NOT	!

Bitwise

Bitwise AND

Bitwise OR

Control Statements

* if-else
* switch

if -else

```
if (condition) {
    ======
}
```
} single

```
else if (condition) {
    ======
}
```
} multiple

```
else {
    ======
}
```
} single

Switch case

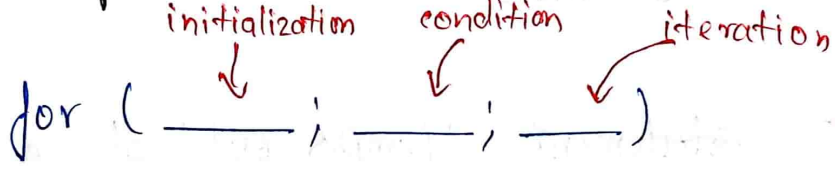
```
switch (expression) {
    case 0: [ ] ;
        break ;
    case : [ ] ;
        break ;
    default : [ ] ;
}
```

Loops

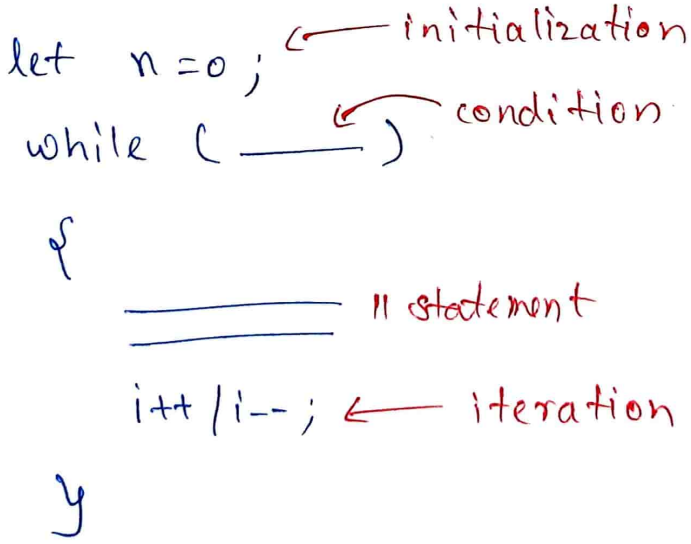
It is used when we want repeatition of task.

* for loop
* while loop
* do-while loop
* for-in loop
* for-of loop

For loop



While loop



Do-while loop

```
let i = 0;        <-- initialization
do
{
    ========      // statement
    ========
    ========
    i++;          <-- iteration
} while (___);    <-- condition
```

Break and Continue

The break statement "jumps out" of a loop.

The continue statement "jumps over" or "skip" one iteration in the loop.

* Creating An Object

```
const rectangle = {

    length : 1,
    breadth : 2,

    // a function that is created inside an object
    // is known as a method.
    draw : function() {
        console.log('lets draw');
    }
};
```

* Object Creation by —
    * Factory Function
    * Constructor Function

* Factory Function

```
function createRectangle (len, bre) {

    return rectangle = {
        length : len,
        breadth : bre,
        draw() {
```

```
        console.log('lets draw');
    };
};

// factory function calling
const rectangle0bj = createRectangle(5,4);
console.log(createRectangle(5,4));
```

Constructor Function

In this function we will us pascal notation.

Pascal Notation --> NumberOfStudents

Constructor function --> properties | methods -->

it initialize | define and doesn't return

```
function Rectangle() {
    // 'this' keyword represents the current
    // object we are working with.
    this.length = 1;
    this.breadth = 5;

    this.draw = function() {
        console.log('Drawing');
    };
}
```

Object creation using constructor

// 'new' keyword returns an empty object.

```
let rectangleObj = new Rectangle();
```

* Dynamic Nature of Objects

Addition / removal of any property in the object is possible.

```
// creation
retangleObj.color = 'yellow';
// deletion
delete rectangleObj.color;
```

* Constructor Properties

⇒ Functions are objects

In JS functions are also known as objects.

⇒ We can us '.' operator in any function and we will see many properties of it.

Types in JS

→ Primitive or value types
  —→ here copy is created

→ Reference or object types
  —→ here address is passed

* Primitive
  → Number
  → String
  → Boolean
  → Null
  → Symbol

* Reference
  → Functions
  → Objects
  → Arrays

* Iteration through Objects
  * For-of
  * For-in

* For-of

It is only used in iterables i.e. arrays and maps, etc.

Syntax

```
for (variable of iterable) {
    // statement
}
```

* For-in

→ It is only used in objects.

→ It is used to check whether any property is present or not in the object.

Syntax

```
for (key in object) {
    // statement
}
```

* Object Cloning

It is used to create a copy of original object with same properties included in it.

⟹ Using assign

Ex // original

```
const employee = {
    name : 'Rishabh',
    age : 20,
    height : 5.8
}
```

// cloning

```
const copyEmp = employee; Object.assign
                ({}, employee);

console.log(copyEmp);
```

=> Using iteration

```
const object = {a:1, b:2, c:3};
// using for-in loop
for (const property in object) {
    console.log(`${property}; ${object[property]}`);
}
```

// `` = backtick character

=> Using spread operator (...)

↓ It is created above

```
let copyEmp = {... employee};

console.log(copyEmp);
```

* Garbage Collector

→ It is used to deallocate the memory.

→ It runs ~~at~~ automatically in background.

→ We have no contol over it, mean we cannot contol the ~~start~~ / end of it.

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* Math Object

Math is a built-in object that has properties and methods for mathematical constants and function.

* Math Properties

The syntax is :

```
Math.property
```

Ex- Math.E // returns Eulers number

Math.PI // returns PI

Math.SQRT2 // returns square root of 2

* Math Methods

The syntax is:

Math.method(number)

Ex.

Math.round(x)	Returns x rounded to its nearest integer
Math.ceil(x)	Returns x rounded up to its nearest integer.
Math.floor(x)	Returns x rounded down to its nearest integer
Math.trunc(x)	Returns integer part of x
Math.pox(x,y)	Returns the value of x to the power of y.
Math.sqrt(x)	returns the square root of x.
Math.abs(x)	Returns the absolute (+ve) value of x.
Math.min()	Returns the lowest value in a list of arguements
Math.max()	Returns the highest value in a list of arguements.

* String

The string object is used to represent and manipulate a sequence of characters.

Creating Strings

It can be created as primitive, from string literals or as objects, using String() constructor.

Ex // primitive

```
const str1 = 'A string primitive';
const str2 = "A string primitive";
const str3 = `A string primitive`;
                // here ` are backtick characters

// using objects
const str4 = new String("A string object");
```

=> We can convert primitive string into object by using . character.

=> A string object can also be converted to its primitive counterpart with the valueOf() method.

* String Methods

=> length — It returns the length of a string

=> slice() — Extracts a part of string and returns the extracted part in a new string

=> substring(start, end) — Same as slice but start & end values are less than 0

=> substr(start, end) — Same as slice but second parameter specifies the length of the extracted part

=> replace() — It replaces a specified value with another value in a string.

=> toUpperCase() — A string is converted into upper case.

=> toLowerCase() — A string is converted into lower case.

=> concat() — It joins two or more strings

=> trim() — It removes whitespace from both ends of a string.

=> trimStart() and trimEnd()

* Template Literals

It uses back-ticks (` `) rather than the quotes ("") to define a string.

Ex

```
let text = `Hello World`;
```

⇒ You can use both single and double qoutes inside a string.

Ex

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

⇒ Template literals allows multiline strings:

Ex

```
let text =
`This is
the best
news ever`;
```

* Interpolation

Template literals provide an easy way to interpolate variables and expression into string.

This method is called string interpolation.

Syntax

```
${...}
```

* Variable Substitution

Template literals allows variables in strings.

Ex

```
let fname = "Rishabh";
let lname = "Kushwaha";

let text = `Welcome ${fname}, ${lname} !`;
```

Output

Welcome Rishabh Kushwaha!

* Escape Sequence

Special characters can be encoded using escape sequence.

code	Result	Description
\0		null character
\'	'	single quote
\"	"	double quote
\\	\	backslash
\n		newline
\t		tab space

* Date Objects

Date objects are created with the new Date() constructor.

There are 9 ways to create a new date object.

new Date()

new Date(date string)

// const d = new Date("October 13, 2014 11:13:00");

new Date(year, month)

new Date(year, month, day)

new Date(year, month, day, hours)

new Date(year, month, day, hours, minutes)

new Date(year, month, day, hours, minutes, seconds)

new Date(year, month, day, hours, minutes, seconds, ms)

new Date(milliseconds)

* Getter & Setter

⇒ get

It is a function without arguements. The Javascript getter methods are used to access the properties of an object.

=> set

A function with one arguement. The Javascript setter methods are used to change the values of an object.

* Array Object

An array object is used to store multiple values in a single variable.

Ex

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

* Array Operations
  * Adding new elements
  * Finding elements
  * Removing elements
  * Spilitting elements
  * Combining elements

* Array Creation

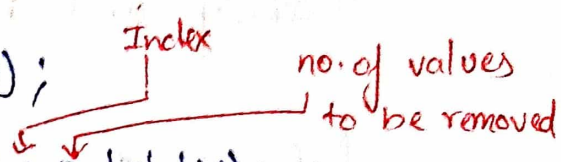
```
let arr1 = [1,2,3,4,5];
```

* Insertion

→ at start -- arr.push(0);

→ at middle -- arr.splice(1,0,'a','b');

→ at end -- arr.unshift(6);



* Searching

We can use;

indexOf() - Searches an array for an element and returns its position.

includes() - checks if an array contains the specified element.

NOTE - Predicate Functions

Predicate functions are functions that return a single TRUE or FALSE.

* Removing

→ at start -- arr.shift()

→ at middle -- arr.splice(index, no. of elements you want to delete)

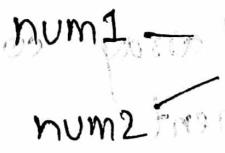
→ end — arr.pop()

* Emptying An Array

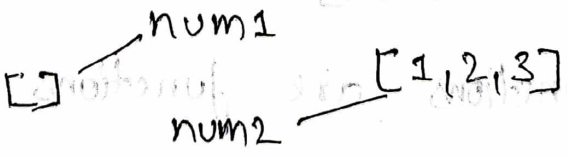
```
arr1 = [];
// array will be empty because of garbage collector

let num1 = [1,2,3];
let num2 = num1;

num1 = [];
// but it's not a good way delete an array
// because it's an object so address will be
// copied, not the copy is created.
```



So when we assign num1 = []



Here num1 will point to an empty array.

⇒ The best way to delete an array is using the below code.

```
arr.length = 0;
```

⇒ There is another way to delete an array using the splice().

```
num1.splice(0, num1.length);
```

* Combining And Slicing An Array

⇒ Combine

```
let arr1 = [1,2,3];
let arr2 = [3,4,5];
let combine = arr1.concat(arr2);
```

⇒ Slice

```
combine.slice(starting index, ending index);
// ending index means it will take value
// to index ending -1.
```

Combining an array using Spread operator(...)

```
let combine = [...arr1, ...arr2];
```

Creating a copy using spread operator (...)

```
let another = [...combine];
```

* Iterating / Traversing an Array

We will use **for of** loop because it works on iterables only.

```
for(let value of arr1) {
        console.log(value);
}
```

=> forEach()

The forEach() method calls a function for each element in an array.

```
arr1.forEach(function (number) {
        console.log(number);
});
```

Converting forEach() into arrow (=>) function

```
arr1.forEach(number => console.log(number));
```

* Joining Arrays

```
const joined = arr1.join(',');
```

* Splitting an Array

```
let mes = 'This is my name';
let parts = mes.split(' ');
```

* Sorting an Array

```
let numb = [3,7,0,9,6];
numb.sort()
```

We can also sort any array in reverse order after sorting in an unsorted array.

```
[numb.reverse()]
```

reverse() is used to reverse an array, it overwrites the original array.

⇒ Above functions cannot sort an object, it can be done using predicate function.

* Filtering an Array

⇒ The filter() method creates a new array filled with elements that pass a test provided by a function.

⇒ It doesn't change the original array.

Syntax

```
array.filter(function(currentValue, index, arr),
thisValue)
```

→ // Here → refers to optional values

Ex

```
let num = [5,7,-6,-3,0];
let filtered = num.filter(function(value){
    return value >= 0;
});
```

Using ⇒ function

```
let filtered = num.filter(value => value >=0);
```

* Mapping in Array

→ map() creates a new array from calling a function for each array element.

→ It calls a function once for each element in an array.

→ It does not change the original array.

Ex

```
let num = [7, 8, 9, 1];
let items = num.map(function(value) {
    return 'student_no ' + value;
});
```

Using => function

```
let items = num.map(value => 'student_no ' + value);
```

* Mapping With Objects

```
let num = [7, 8, -7, -10];
let filtered = num.filter(value => value >= 0);
let items = filtered.map(function(number) {
    return {value: number};
});
```

Using => function

```
let items = filtered.map(number => {value: number});
```

* Chaining

In chaining we replace a variable with its original code.

Ex

```
let items = num
    .filter(value => value >= 0)
    .map(number => {value: number});
// In the above code we replaced filtered
// variable with its original code.
```

Ex

```
let items = num
    .filter(value => value >= 0)
    .map(number => {value: number});
// In the above code we replaced filtered
// variable with its original code.
```

* Functions

A block of code that fulfills a specific task is called a function.

Creation Syntax

```
function funName() {
    statement
}
```

Why we need functions?

→ Better readability
→ code reuse
→ To avoid bulky code
→ To reduce bugs

* Function Declaration

```
function run(parameters) {
        console.log('running');
}
```

* Function calling / invoking

```
run();
```

* Hoisting Concept

Q. If we call the function before the actual function is written, will it run properly?

⇒ Yes, because in JavaScript all the functions are sent at the top of the file and this process is known as Hoisting and its done autometically by js engine.

* Types of function assignment

i) Name function assignment

ii) Anonymous function assignment

Named function Assignment

```
let stand = function walk() {
        console.log ('walk');
};
```

Anonymous function Assignment

```
let stand2 = function() {
        console.log ('walk');
};
```

Calling the function

```
stand()
// If we call the walk() after the assignment
it will not be called, we can only
call it using stand().
```

Can we call the function before its declaration?

No, because hoisting only works with function initialization not with function assignment.

JS is Dynamic Language

```
let x = 1;
x = 'a';
```

No error will come in the above code.

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

```
console.log(sum(1,2)) --> 3
```

console.log(sum(1)) ==> If we pass only one value the the output will be NaN (Not a Number) because by default value 2 will be not defined.

console.log(sum()) --> NaN

console.log(sum(1,2,3,4,5)) --> 3 because 1 -> a and 2 -> b and rest of the numbers will go to arguements.

Arguements are special ~~of~~ objects.

* REST operator (...)

It is also known as spread operator, it is used to concatinate & copy the arrays.

If in a function we have multiple parameters the we can handle all the parameters with the help of the rest operator.

```
function sum (num, value, ...args) {
        console.log (args)
}
sum (1,2,3,4,5,6,7,8)
```

⇒ By using the rest parameter we can ~~et~~ only assign the values before args not after it.

⇒ We can store the varying parameters / data in the array form using the rest operator.

* Default Parameters

When a user does not pass any value to the function then the function takes the value by itself.

⇒ Below r=5 is default parameter

So, if you pass a value to 'r' in the function calling then it will take the passed value otherwise it will take the default value.

```
function interest (p, r=5, y=10) {
        return p*r*y/100;
}

console.log(interest(1000));
```

⇒ If 'r' is a default parameter then all the parameter to the right side of it must be also default. (It's a rule)

* Getter Setter

getter → to access the properties

setter → to change or mutate properties

```
let person = {
    fName : 'Rishabh',
    lName : 'Kushwaha',
    get fullName() {
        return `${person.fName} ${person.lName}`
    },
    set fullName(value) {
        let parts = value.split(' ');
        this.fName = parts[0];
        this.lName = parts[1];
    }
};

console.log(person.fullName);
```

→ Rishabh Kushwaha

```
person.fullName = 'Love Babbar';
console.log(person.fullName);
```

→ Love Babbar

* Try and Catch Block

=> The try statement defines a code block to run (to try).

=> The catch statement defines a code block to handle any error.

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

=> The throw statement defines a custom error.

```
try {
    Block of code to try
}
catch(err) {
    Block of code to handle errors
}
finally {
    Block of code to run regardless of the try/
    catch result
}
```

* Scope

Scope determines the accessibility (visibility) of variable.

JavaScript has 3 types of scopes:

-> Block scope
-> Function scope
-> Global scope

Ex

```
{
    var x = 2;
    let y = 2;
}
// x can be used here
// y cannot be used here
```

Variable declared with var keyword cannot have block scope.

* Reducing an Array

=> The reduce() method executes a reducer function for an array.

⇒ The reduce() method returns a single value: the function's accumulated result.

⇒ The reduce() method does not change the original array.

```
let arr = [1,2,3,4,5];
let sum = 0;

for (let value of arr) {
        sum = sum + value;
}
console.log(sum);
```

-> 15

Now by using reduce() method with ⇒ function

```
let sum1 = arr.reduce((accumulator, currenValue) =>
accumulator + currentValue, 0);
```

/*-> accumulator is like the sum variable that stores the value.

-> currentValue is like the loop

-> 0 is initialization of the value (if 0 is not set then the accumulator will start from the first value i.e. 1)

```
console.log(sum1);
```

-> 15