70 Javascript Interview Questions

1. What is the difference between undefined and null?

Before understanding the differences between undefined and null we must understand the similarities between them.

- They belong to Javascript's 7 primitive types (string, number, null, undefined, boolean, symbol, bigint).
- They are **falsy** values. Values that evaluated to false when converting to boolean using Boolean(value) or !!value.

```
console.log(!!null); //logs false
console.log(!!undefined); //logs false

console.log(Boolean(null)); //logs false
console.log(Boolean(undefined)); //logs false
```

The differences:

- undefined is the default value of a variable that has not been assigned a specific value. Or a function that has no explicit return value ex. console.log(1). Or a property that does not exist in an object. The Javascript engine does this for us the **assigning** of undefined value.

```
let _thisIsUndefined;
const doNothing = () => {};
const someObj = {
  a : "ay",
  b : "bee",
  c : "si"
};

console.log(_thisIsUndefined); //logs undefined
console.log(doNothing()); //logs undefined
console.log(someObj["d"]); //logs undefined
```

- null is "**a value that represents no value**". null is value that has been explicitly defined to a variable. In this example we get a value of null when the fs.readFile method does not throw an error.

```
fs.readFile('path/to/file', (e,data) => {
   console.log(e); //it logs null when no error occurred
   if(e){
     console.log(e);
   }
   console.log(data);
 });
```

- When comparing null and undefined we get true when using == and false when using ===.

```
console.log(null == undefined); // logs true
console.log(null === undefined); // logs false
```

2. What does the && operator do?

The && or **Logical AND** operator finds the first *falsy* expression in its operands and returns it and if it does not find any falsy expression it returns the last expression. It employs short-circuiting to prevent unnecessary work.

```
console.log(false && 1 && []); //logs false
console.log(" " && true && 5); //logs 5
```

Using **if** statements.

```
  const router: Router = Router();

  router.get('/endpoint', (req: Request, res: Response) => {
     let conMobile: PoolConnection;
     try {
        //do some db operations
     } catch (e) {
     if (conMobile) {
      conMobile.release();
     }
  }
});
```

Using **&&** operator.

```
const router: Router = Router();

router.get('/endpoint', (req: Request, res: Response) => {
  let conMobile: PoolConnection;
  try {
     //do some db operations
  } catch (e) {
    conMobile && conMobile.release()
  }
});
```

3. What does the `||` operator do?

The `||` operator or **Logical OR** operator finds the first truthy expression in its operands and returns it. This too employs short-circuiting to prevent unnecessary work. It was used before to initialize default parameter values IN functions before **ES6 Default function parameters** was supported.

```
console.log(null || 1 || undefined); //logs 1

function logName(name) {
  var n = name || "Mark";
  console.log(n);
}

logName(); //logs "Mark"
```

4. Is using the `+` or `unary plus` operator the fastest way in converting a string to a number?

According to MDN Documentation the `+` is the fastest way of converting a string to a number because it does not perform any operations on the value if it is already a number.

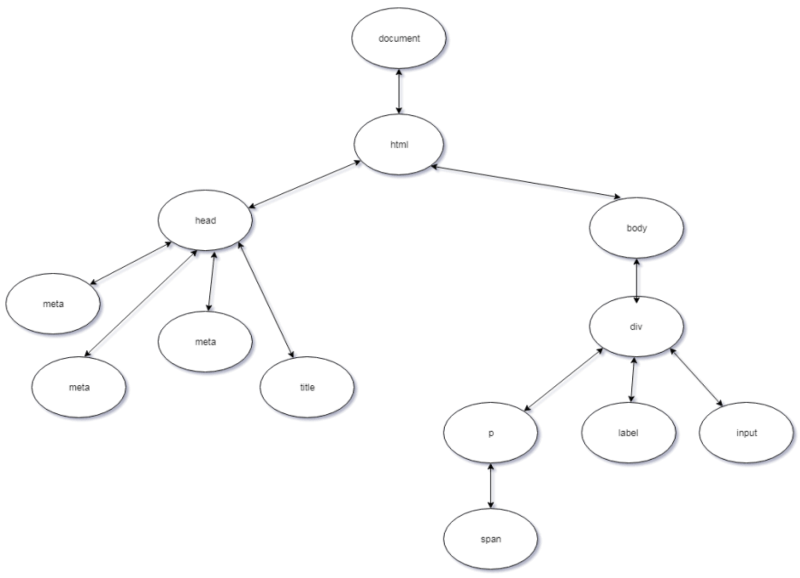
5. What is the `DOM`?

DOM stands for **Document Object Model** is an interface (**API**) for HTML and XML documents. When the browser first reads (parses) our HTML document it created a big object, a really big object based on the HTML document this is the **DOM**. It is a tree-like structure that is modeled from the HTML document. The **DOM** is used for interacting and modifying the **DOM structure** or specific Elements or Nodes.

Imagine if we have an HTML structure like this.

```
<!DOCTYPE html>
<html lang="en">

<head>
   <meta charset="UTF-8">
   <meta name="viewport" content="width=device-width, initial-scale=1.0">
   <meta http-equiv="X-UA-Compatible" content="ie=edge">
   <title>Document Object Model</title>
</head>

<body>
   <div>
      <p>
         <span></span>
      </p>
      <label></label>
      <input>
   </div>
</body>

</html>
```

The **DOM** equivalent would be like this.



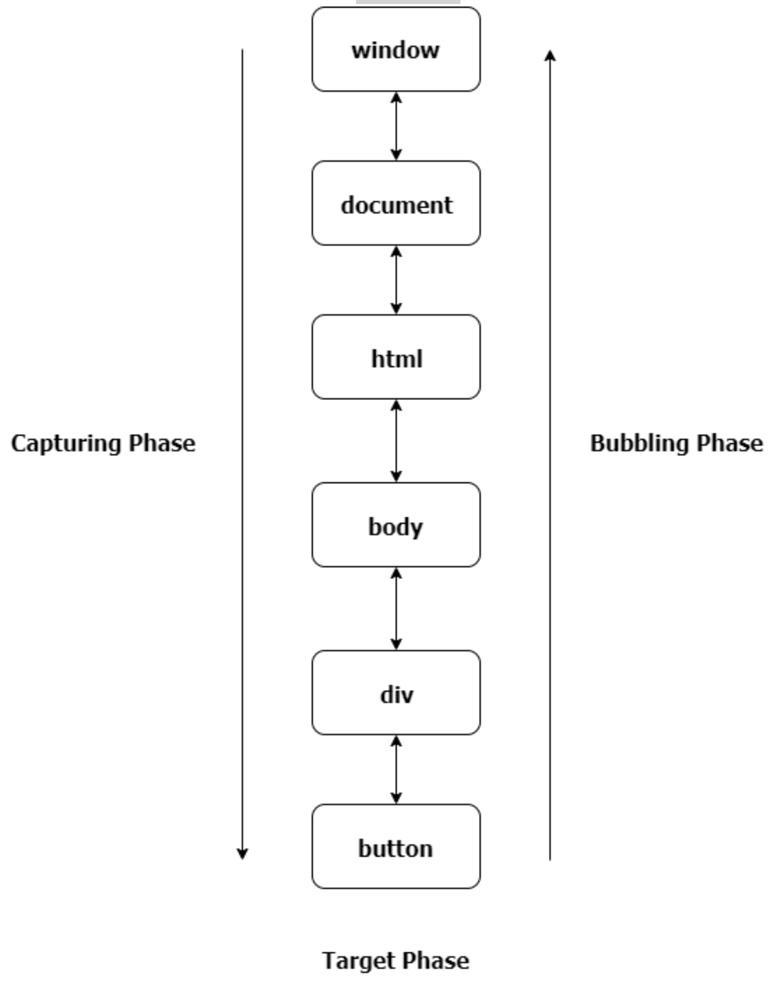
The document object in **Javascript** represents the **DOM**. It provides us many methods that we can use to selecting elements to update element contents and many more.

6. What is Event Propagation?

When an **event** occurs on a **DOM** element, that **event** does not entirely occur on that just one element. In the **Bubbling Phase**, the **event** bubbles up or it goes to its parent, to its grandparents, to its grandparent's parent until it reaches all the way to the window while in the **Capturing Phase** the event starts from the window down to the element that triggered the event ot the event.target.

Event Propagation has **three** phases.

1. Capturing Phase – the event starts from window then goes down to every element until it reaches the target element.
2. Target Phase – the event has reached the target element.
3. Bubbling Phase – the event bubbles up from the target element then goes up every element until it reaches the window.



7. What is Event Bubbling?

When an **event** occurs on a **DOM** element, that **event** does not entirely occur on that just one element. In the **Bubbling Phase**, the **event** bubbles up or it goes to its parent, to its grandparents, to its grandparent's parent until it reaches all the way to the window.

If we have an example markup like this.

```html
<div class="grandparent">
   <div class="parent">
     <div class="child">1</div>
   </div>
 </div>
```

And our js code.

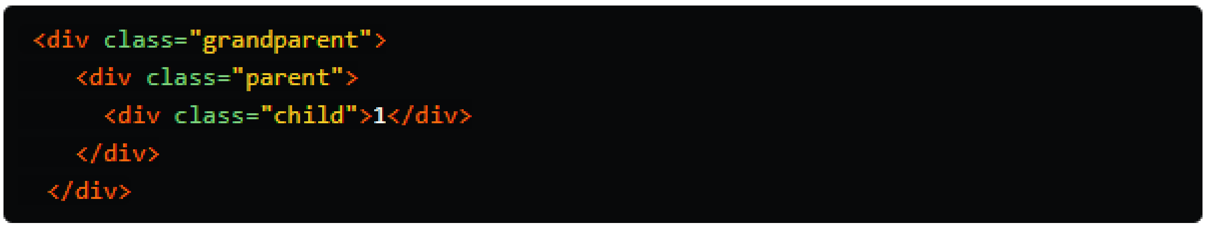
```javascript
function addEvent(el, event, callback, isCapture = false) {
  if (!el || !event || !callback || typeof callback !== 'function') return;
  if (typeof el === 'string') {
    el = document.querySelector(el);
  };
  el.addEventListener(event, callback, isCapture);
}

addEvent(document, 'DOMContentLoaded', () => {
  const child = document.querySelector('.child');
  const parent = document.querySelector('.parent');
  const grandparent = document.querySelector('.grandparent');

  addEvent(child, 'click', function (e) {
    console.log('child');
  });

  addEvent(parent, 'click', function (e) {
    console.log('parent');
  });

  addEvent(grandparent, 'click', function (e) {
    console.log('grandparent');
  });

  addEvent(document, 'click', function (e) {
    console.log('document');
  });

  addEvent('html', 'click', function (e) {
    console.log('html');
  })

  addEvent(window, 'click', function (e) {
    console.log('window');
  })

});
```

The addEventListener method has a third optional parameter **useCapture** with a default value of false the event will occur in the **Bubbling phase** if true the event will occur in the **Capturing Phase**. If we click on the child element it logs child, parent, grandparent, html, document and window respectively on the console. This is **Event Bubbling**.

8. What is Event Capturing?

When an event occurs on a DOM element, that event does not entirely occur on that just one element. In Capturing Phase, the event starts from the window all the way down on the element that triggered the event.

If we have an example markup like this.



```
<div class="grandparent">
   <div class="parent">
     <div class="child">1</div>
   </div>
 </div>
```

And our js code.

```
function addEvent(el, event, callback, isCapture = false) {
  if (!el || !event || !callback || typeof callback !== 'function') return;
  if (typeof el === 'string') {
    el = document.querySelector(el);
  };
  el.addEventListener(event, callback, isCapture);
}

addEvent(document, 'DOMContentLoaded', () => {
  const child = document.querySelector('.child');
  const parent = document.querySelector('.parent');
  const grandparent = document.querySelector('.grandparent');

  addEvent(child, 'click', function (e) {
    console.log('child');
  }, true);

  addEvent(parent, 'click', function (e) {
    console.log('parent');
  }, true);

  addEvent(grandparent, 'click', function (e) {
    console.log('grandparent');
  }, true);

  addEvent(document, 'click', function (e) {
    console.log('document');
  }, true);

  addEvent('html', 'click', function (e) {
    console.log('html');
  }, true)

  addEvent(window, 'click', function (e) {
    console.log('window');
  }, true)

});
```

The addEventListener method has a third optional parameter **useCapture** with a default value of false the event will occur in the **Bubbling Phase** if true the event will occur in the **Capturing Phase**. If we click on the child element it logs window, document, html, grandparent, parent and child respectively on the **console**. This is **Event Capturing**.

9. What is the difference between event.preventDefault() and event.stopPropagation() methods?

The event.preventDefault() method **prevents** the default behavior of an element. If used in a form element it **prevents** it from submitting. If used in an anchor element it **prevents** it from navigating. If used in a contextmenu it **prevents** it from showing or displaying. While the event.stopPropagation() method stops the propagation of an event or it stops the event from occuring in the bubbling or capturing phase.

10. How to know if the event.preventDefault() method was used in an element?

We can use the event.defaultPrevented property in the event object. It returns a boolean indicating if the event.preventDefault() was called in a particular element.

11. Why does this code obj.someprop.x throw an error?

Obviously, this throws an error due to the reason we are trying to access an x property in the someprop property which have an undefined value. Remember **properties** in an object which does not exist in itself and its **prototype** has a default value of undefined and undefined has no property x.

12. What is event.target?

In simplest terms, the **event.target** is the elment on which the event **occured** or the element that **triggered** the event.

Sample HTML Markup.

```html
<div onclick="clickFunc(event)" style="text-align: center;margin:15px;
border:1px solid red;border-radius:3px;">
    <div style="margin: 25px; border:1px solid royalblue;border-radius:3px;">
        <div style="margin:25px;border:1px solid skyblue;border-radius:3px;">
          <button style="margin:10px">
             Button
          </button>
        </div>
    </div>
  </div>
```

Sample Javascript.

```javascript
 function clickFunc(event) {
  console.log(event.target);
}
```

If you click the button it will log the **button** markup even though we attach the event on the outermost `div` it will always log the **button** so we can conclude that the event.target is the element that triggered the event.

13. What is `event.currentTarget`?

The **event.currentTarget** is the element on which we attact the event handler **explicitly**. Considering the same markup in Question 12, if you click the button it will log the outermost **div** markup even though we click the button. In this example, we can conclude that the **event.currentTarget** is the element on which we attach the event handler.

14. What is the difference between `==` and `===` ?

The difference between `==` (**abstract equality**) and `===` (**strict equality**) is that the `==` compares by **value** after *coercion* and `===` compares by **value** and **type** without *coercion*.

Let's dig deeper on the `==`. So first let's talk about *coercion*.

Coercion is the process of converting a value to another type. As in this case, the `==` does implicit coercion. The `==` has some condition to perform before comparing the two values.

Suppose we have to compare `x == y` values.

1. If `x` and `y` have same type. Then compare them with the `===` operator.
2. If `x` is `null` and `y` is `undefined` then return `true`.
3. If `x` is `undefined` and `y` is `null` then return `true`.
4. If `x` is type `number` and `y` is type `string` then return `x == toNumber(y)`.
5. If `x` is type `string` and y is type `number` then return `toNumber(x) == y`.
6. If `x` is type `boolean` then return `toNumber(x) == y`.
7. If `y` is type boolean then return `x == toNumber(y)`.
8. If `x` is either `string`, `symbol` or `number` and `y` is type `object` then return `x == toPrimitive(y)`.
9. If `x` is either `object` and `x` is either `string`, `symbol` then return `toPrimitive(x) == y`.
10. Return `false`.

Note: `toPrimitive` uses first the `valueOf` method then the `toString` method in objects to get the primitive value of that object.

Let's have examples.

x	y	x == y
5	5	true
1	'1'	true
null	undefined	true
0	false	true
'1,2'	[1,2]	true
'[object Object]'	{}	true

These examples all return true.

The **first example** goes to **condition one** because x and y have the same type and value.

The **second example** goes to **condition four** y is converted to a number before comparing.

The **third example** goes to **condition two**.

The **fourth example** goes to **condition seven** because y is boolean.

The **fifth example** goes to **condition eight**. The array is converted to a string using the toString() method which returns 1,2.

The **last example** goes to **condition ten**. The object is converted to a string using the toString() method which returns [object Object].

x	y	x === y
5	5	true
1	'1'	false
null	undefined	false
0	false	false
'1,2'	[1,2]	false
'[object Object]'	{}	false

If we use the === operator all the comparisons except for the first example will return false because they don't have the same type while the first example will return true because the two have the same type and value.

15. Why does it return false when comparing two similar objects in Javascript?

Suppose we have an example below.

```
let a = { a: 1 };
let b = { a: 1 };
let c = a;

console.log(a === b); // logs false even though they have the same property
console.log(a === c); // logs true hmm
```

Javascript compares *objects* and *primitives* differently. In *primitives* it compares them by **value** while in *objects* it compares them by **reference** or the **address in memory where the variable is stored**. That's why the first `console.log` statement returns `false` and the second `console.log` statement returns `true`. `a` and `c` have the same reference and `a` and `b` are not.

16. What does the `!!` operator do?

The Double NOT operator or !! coerces the value on the right side into a boolean. Basically it's a fancy way of converting a value into a boolean.

```
console.log(!!null); //logs false
console.log(!!undefined); //logs false
console.log(!!''); //logs false
console.log(!!0); //logs false
console.log(!!NaN); //logs false
console.log(!!' '); //logs true
console.log(!!{}); //logs true
console.log(!![]); //logs true
console.log(!!1); //logs true
console.log(!![].length); //logs false
```

17. How to evaluate multiple expressions in one line?

We can use the `,` or comma operator to evaluate multiple expressions in one line. It evaluates from left-to-right and returns the value of the last item on the right or the last operand.

```
let x = 5;

x = (x++ , x = addFive(x), x *= 2, x -= 5, x += 10);

function addFive(num) {
  return num + 5;
}
```

If you log the value of x it would be **27**. First, we **increment** the value of x it would be **6**, then we invoke the function addFive(6) and pass the 6 as a parameter and assign the result to x the new value of x would be **11**. After that, we multiply the current value of x to **2** and assign it to x the updated value of x would be **22**. Then, we subtract the current value of x to 5 and assign the result to x the updated value would be **17**. And lastly, we increment the value of **x** by 10 and assign the updated value to x now the value of x would be **27**.

18. What is Hoisting?

Hoisting is the term used to describe the moving of *variables* and *functions* to the top of their (*global or function*) scope on where we define that variable or function.

To understand **Hoisting**, let's talk about *execution context*.

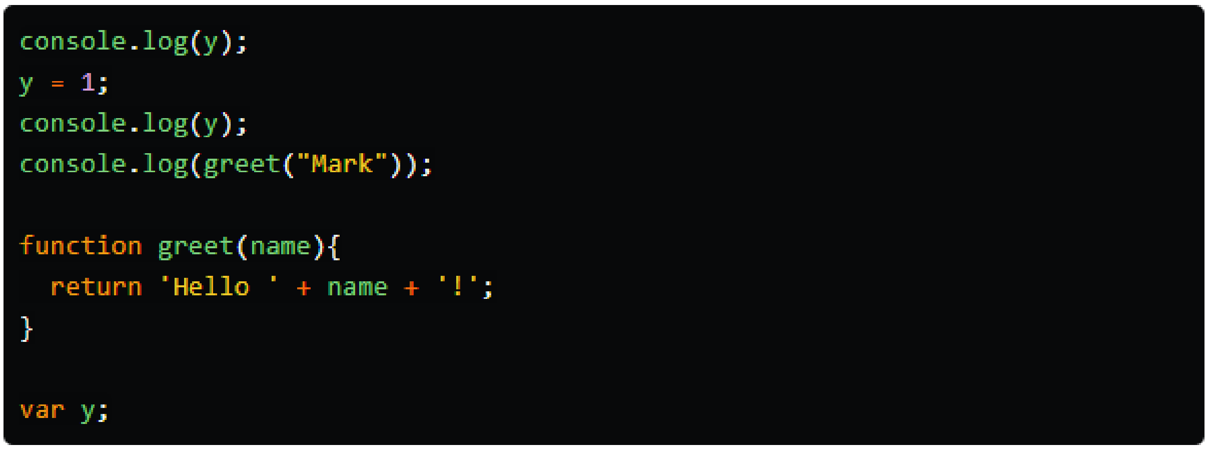
The **Execution Context** is the "environment of code" that is currently executing. The **Execution Context** has two phases *compilation* and *execution*.

Compilation – in this phase, it gets all the *function declarations* and *hoists* them up to the top of their scope so we can reference them later. Gets all *variables declaration* (**declare with the var keyword**) and also *hoists* them up and give them a default value of undefined.

Execution – in this phase, it assigns values to the variables *hoisted* earlier and it *executes* or *invokes* functions (**methods in objects**).

Note: Only **function declarations** and variables declared with the *var* keyword are *hoisted*. Not **function expressions** or **arrow functions**, let and const keywords.

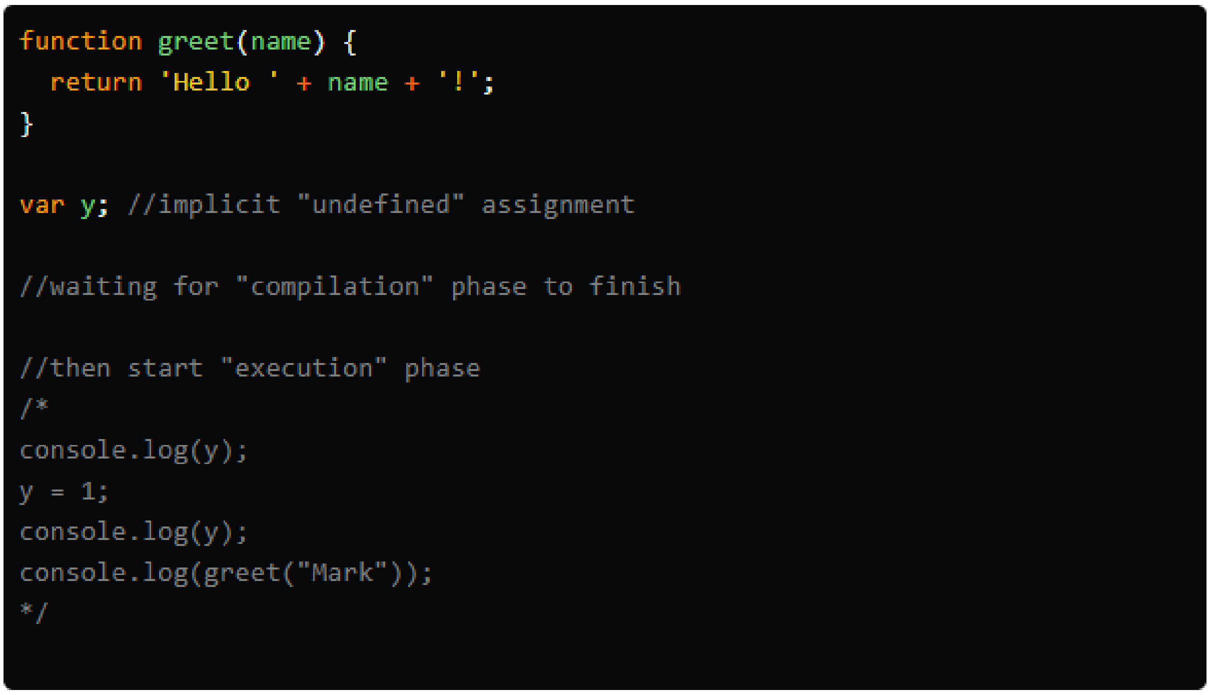
Suppose we have an example code in the global scope below.



```
console.log(y);
y = 1;
console.log(y);
console.log(greet("Mark"));

function greet(name){
  return 'Hello ' + name + '!';
}

var y;
```

This code logs undefined, 1, Hello Mark! respectively.

So the *compilation* phase would look like this.



```
function greet(name) {
  return 'Hello ' + name + '!';
}

var y; //implicit "undefined" assignment

//waiting for "compilation" phase to finish

//then start "execution" phase
/*
console.log(y);
y = 1;
console.log(y);
console.log(greet("Mark"));
*/
```

For example purposes, I commented on the *assignment* of variable and *function call*.

After the *compilation* phase finishes, it start the *execution* phase invoking methods and assigns values to variables.

```
function greet(name) {
  return 'Hello ' + name + '!';
}

var y;

//start "execution" phase

console.log(y);
y = 1;
console.log(y);
console.log(greet("Mark"));
```

19. What is Scope?

Scope in Javascript is the **area** where we have valid access to variables or functions. Javascript has three types of Scopes. **Global Scope**, **Function Scope** and **Block Scope(ES6)**.

- **Global Scope** - variables or functions declared in the global namespace are in the global scope and therefore is accessible everywhere in our code.

```
    //global namespace
    var g = "global";

    function globalFunc(){
      function innerFunc(){
           console.log(g); // can access "g" because "g" is a global variable
      }
      innerFunc();
    }
```

- **Function Scope** – variables, functions and parameters declared within a function are accessible inside that function but not outside of it.

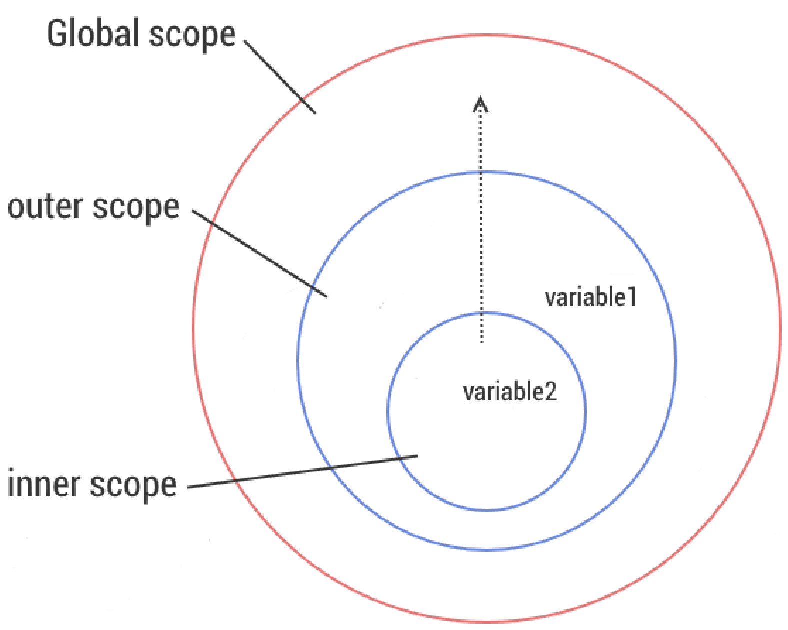
```
     function myFavoriteFunc(a) {
        if (true) {
           var b = "Hello " + a;
        }
        return b;
    }
    myFavoriteFunc("World");

    console.log(a); // Throws a ReferenceError "a" is not defined
    console.log(b); // does not continue here
```

- **Block Scope** – variables (let, const) declared within a block { } can only be accessed within it.

```
function testBlock(){
  if(true){
    let z = 5;
  }
  return z;
}

testBlock(); // Throws a ReferenceError "z" is not defined
```

Scope is also a set of rules for finding variables. If a variable does not exist in the **current scope** it **looks up** and searches for a variable in the **outer scope**. If it doesn't exist again it **looks up** until it reaches the **global scope**. If the variable exists then we can use it, if not it throws an error. It searches for the **nearest** variable and it stops **searching** or **looking up** once it finds it. This is called **Scope Chain**.

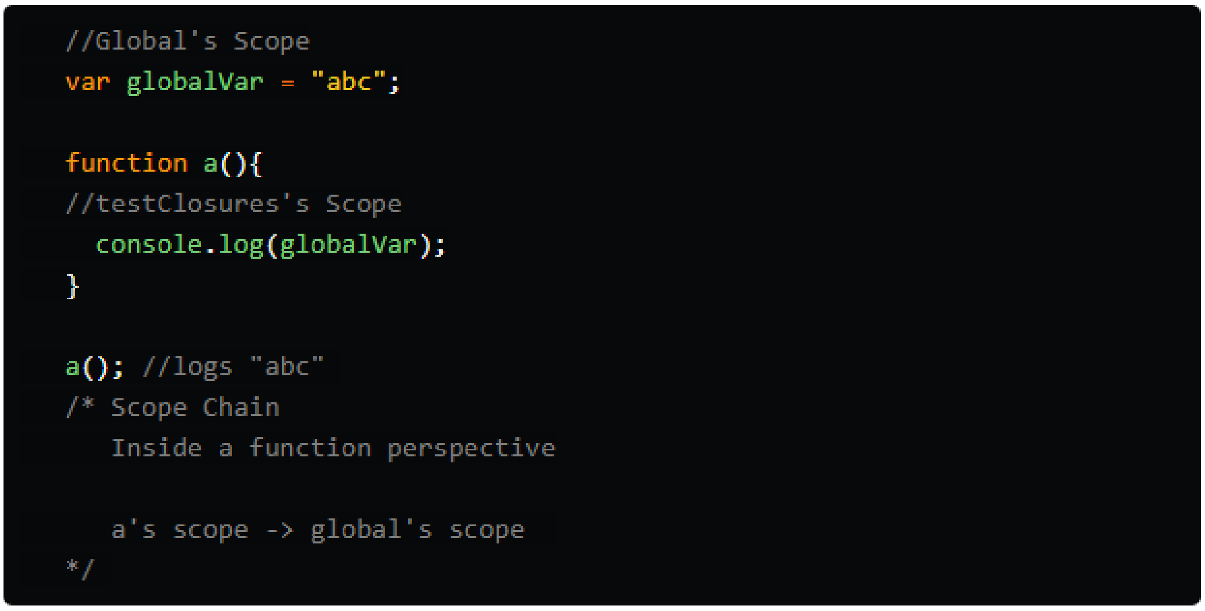
```
   /* Scope Chain
   Inside inner function perspective

   inner's scope -> outer's scope -> global's scope
  */



  //Global Scope
  var variable1 = "Comrades";
  var variable2 = "Sayonara";

  function outer(){
  //outer's scope
    var variable1 = "World";
    function inner(){
    //inner's scope
      var variable2 = "Hello";
      console.log(variable2 + " " + variable1);
    }
    inner();
  }
  outer();
// logs Hello World
// because (variable2 = "Hello") and (variable1 = "World") are the nearest
// variables inside inner's scope.
```



20. What are Closures?

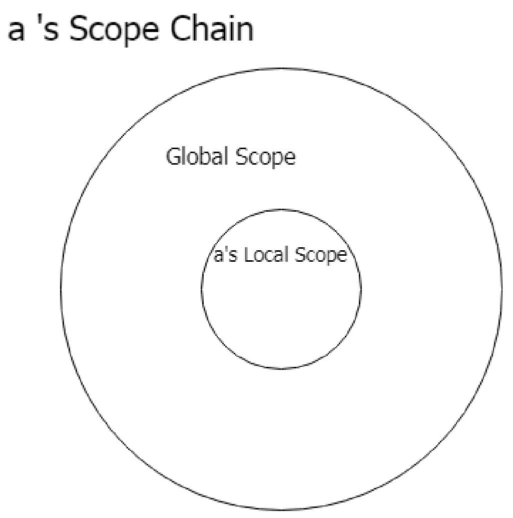
This is probably the hardest question of all these questions because **Closures** is a controversial topic.

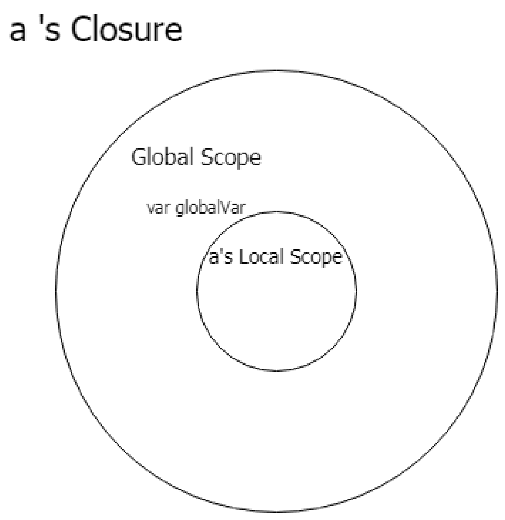
Closures is simply the ability of a function at the time of declaration to remember the references of variables and parameters on its current scope, on its parent function scope, on its parent's parent function scope until it reaches the global scope with the help of **Scope Chain**. Basically it is the **Scope** created when the function was declared.



```
//Global's Scope
var globalVar = "abc";

function a(){
//testClosures's Scope
  console.log(globalVar);
}

a(); //logs "abc"
/* Scope Chain
   Inside a function perspective

   a's scope -> global's scope
*/
```

In this example, when we declare the a function the **Global Scope** is part of a's closure.



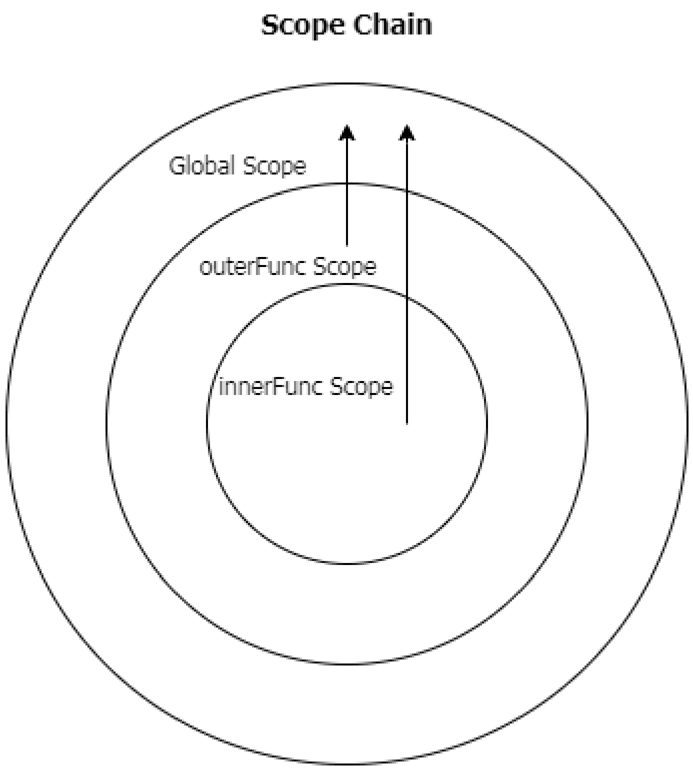


The reason for the variable globalVar which does not have a value in the image because of the reason that the value of that variable can change based on **where** and **when** we invoke the a function.

But in our example above the globalVar variable will have the value of **abc**.

Let’s have a complex example.

```
var globalVar = "global";
var outerVar = "outer"

function outerFunc(outerParam) {
  function innerFunc(innerParam) {
    console.log(globalVar, outerParam, innerParam);
  }
  return innerFunc;
}

const x = outerFunc(outerVar);
outerVar = "outer-2";
globalVar = "guess"
x("inner");
```



This will print "guess outer inner". The explanation for this is that when we invoke the outerFunc function and assigned the returned value the innerFunc function to the variable x, the outerParam will have a value of **outer** even though we assign a new value **outer-2** to the outerVar variable, because the reassignment happened after the invocation of the outer function and in that time when we invoke the outerFunc function it looks up the value of outerVar in the **Scope Chain**, the outerVar will have a value of "**outer**". Now, when we invoke the x variable which have a reference to the innerFunc, the innerParam will have a value of **inner** because that's the value we pass in the invocation and the globalVar variable will have a value of **guess** because before the invocation of the x variable we assign a new value to the globalVar and at the same time of invocation x the value of globalVar in the Scope Chain is **guess**.

We have an example that demonstrates a problem of not understanding closure correctly.

```
const arrFuncs = [];
for(var i = 0; i < 5; i++){
  arrFuncs.push(function (){
    return i;
  });
}
console.log(i); // i is 5

for (let i = 0; i < arrFuncs.length; i++) {
  console.log(arrFuncs[i]()); // all logs "5"
}
```

This code is not working as we expected because of **Closures**. The var keyword makes a global variable and when we push a function we return the global variable i. So when we call one of those functions in that array after the loop it logs 5 because we get the current value of i which is 5 and we can access it because it's a global variable. Because **Closures** keeps the **references** of that variable not its values at the time of its creation. We can solve this using **IIFES** or changing the var keyword to let for block-scoping.

21. What are the falsy values in Javascript?

Falsy values are values that when we converted to boolean becomes false. These are "", 0, null, undefined, NaN, false.

22. How to check if a value is falsy?

Use the **Boolean** function or the Double NOT operator **!!**.

23. What does "use strict" do?

"use strict" is a ES5 feature in **Javascript** that makes our code in **Strict Mode** in *functions* or *entire scripts*. **Strict Mode** helps us avoid **bugs** early on in our code and adds restrictions to it.

Restrictions that Strict mode gives us:

- Assigning or Accessing a variable that is not declared.

```
function returnY(){
   "use strict";
   y = 123;
   return y;
}
```

- Assigning a value to a read-only or non-writable global variable.

```
  "use strict";
  var NaN = NaN;
  var undefined = undefined;
  var Infinity = "and beyond";
```

- Deleting an undeletable property.

```
"use strict";
const obj = {};

Object.defineProperty(obj, 'x', {
   value : '1'
});

delete obj.x;
```

- Duplicate parameter names.

```
"use strict";

function someFunc(a, b, b, c){

}
```

- Creating variables with the use of the **eval** function.

```
"use strict";

eval("var x = 1;");

console.log(x); //Throws a Reference Error x is not defined
```

- The default value of **this** will be undefined.

```
"use strict";

function showMeThis(){
  return this;
}

showMeThis(); //returns undefined
```

There are many more restrictions in Strict mode than these.

24. What's the value of this in Javascript?

Basically, this refers to the value of the object that is currently executing or invoking the function. **Currently** due to the reason that the value of **this** changes depending on the context on which we use it and where we use it.

```
const carDetails = {
  name: "Ford Mustang",
  yearBought: 2005,
  getName(){
     return this.name;
  },
  isRegistered: true
};

console.log(carDetails.getName()); // logs Ford Mustang
```

This is what we would normally expect because in the **getName** method we return this.name, this in this context refers to the object which is the carDetails object that is currently the “owner” object of the function executing.

Let’s add some code to make it weird. Below the console.log statement add this three lines of code.

```
var name = "Ford Ranger";
var getCarName = carDetails.getName;

console.log(getCarName()); // logs Ford Ranger
```

The second console.log statement prints the word **Ford Ranger** which is weird because in our first console.log statement it printed **Ford Mustang**. The reason to this is that the getCarName method has a different “owner” object that is the window object. Declaring variables with the var keyword in the global scope attaches properties in the window object with the same name as the variables. Remember this in the global scope refers to the window object when “use strict” is not used.

```
console.log(getCarName === window.getCarName); //logs true
console.log(getCarName === this.getCarName); // logs true
```

this and window in this example refer to the same object.

One way of solving this problem is by using the apply and call methods in functions.

```
console.log(getCarName.apply(carDetails)); //logs Ford Mustang
console.log(getCarName.call(carDetails));  //logs Ford Mustang
```

The apply and call methods expects the first parameter to be an object which would be value of this inside that function.

IIFE, Functions that are declared in the global scope, **Anonymous Functions** and Inner functions in methods inside an object has a default of **this** which points to the **window** object.

```
(function (){
  console.log(this);
})(); //logs the "window" object

function iHateThis(){
   console.log(this);
}

iHateThis(); //logs the "window" object

const myFavoriteObj = {
  guessThis(){
     function getThis(){
       console.log(this);
     }
     getThis();
  },
  name: 'Marko Polo',
  thisIsAnnoying(callback){
    callback();
  }
};


myFavoriteObj.guessThis(); //logs the "window" object
myFavoriteObj.thisIsAnnoying(function (){
  console.log(this); //logs the "window" object
});
```

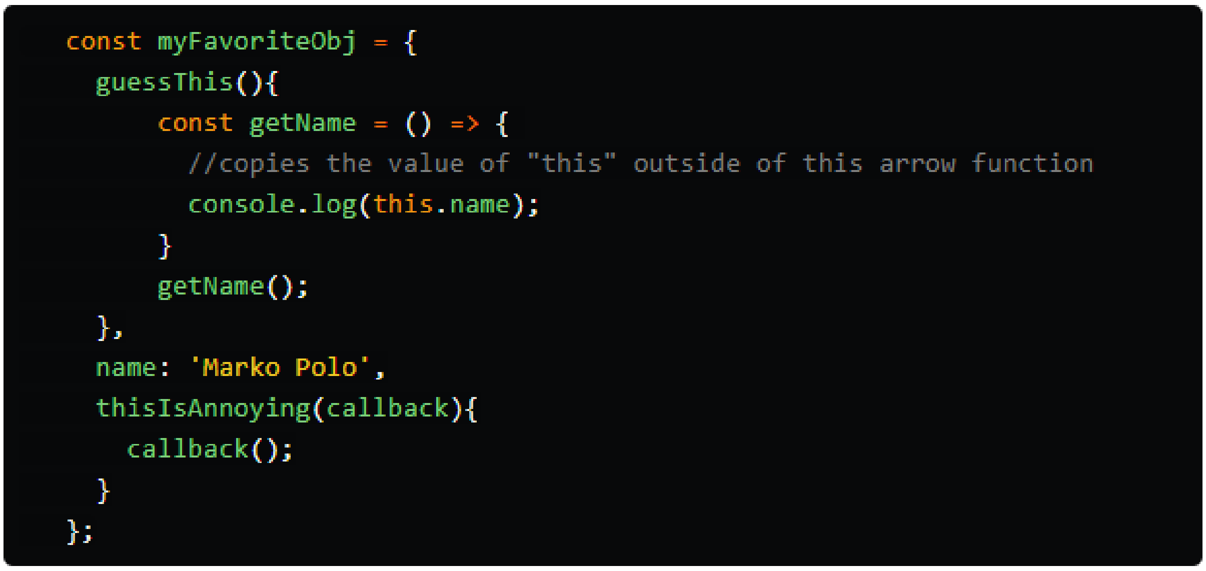
If we want to get the vlue of the name property which is Marko Polo in the myFavoriteObj object there are two ways to solve this.

First, we save the value of this in a variable.

```
const myFavoriteObj = {
  guessThis(){
      const self = this; //saves the this value to the "self" variable
      function getName(){
        console.log(self.name);
      }
      getName();
  },
  name: 'Marko Polo',
  thisIsAnnoying(callback){
    callback();
  }
};
```

In this image we save the value of `this` which would be the `myFavoriteObj` object. So we can access it inside the `getName` inner function.

Second, we use **ES6 Arrow Functions**.

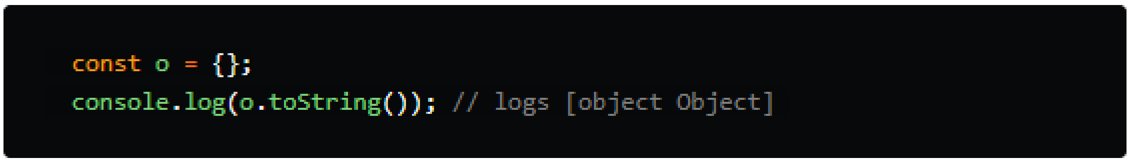


```
const myFavoriteObj = {
  guessThis(){
     const getName = () => {
       //copies the value of "this" outside of this arrow function
       console.log(this.name);
     }
     getName();
  },
  name: 'Marko Polo',
  thisIsAnnoying(callback){
    callback();
  }
};
```

Arrow Functions does not have its own `this`. It copies the value of `this` of the eclosing lexical scope or in this example the value of `this` outside the `getName` inner function which would be the myFavoriteObj object. We can also determine the value of `this` on **how the function is invoked**.

25. What is the `prototype` of an object?

A `prototype` in simplest terms is a *blueprint* of an object. It is used as a fallback for **properties** and **methods** if it does not exist in the current object. It's the way to share properties and functionality between objects. It's the core concept around Javascript's **Prototypal Inheritance**.



```
const o = {};
console.log(o.toString()); // logs [object Object]
```

Even though the `o.toString` method does not exist in the `o` object, it does not throw an error instead returns a string `[object Object]`. When a property does not exist in the object it looks into its **prototype** and if it still does not exist it looks into the **prototype's prototype** and so on until it finds a property with the same in the **Prototype Chain**. The end of the **Prototype Chain** is the **Object.prototype**.

```
console.log(o.toString === Object.prototype.toString); // logs true
// which means we we're looking up the Prototype Chain and it reached
// the Object.prototype and used the "toString" method.
```

26. What is an IIFE, what is the use of it?

An **IIFE** or **Immediately Invoked Function Expression** is a function that is gonna get invoked or executed after its creation or declaration. The syntax for creating **IIFE** is that we wrap the `function( ) { }` inside a parantheses `( )` or the **Grouping Operator** to treat the function as an expression and after that we invoke it with another parantheses `( )`. So an **IIFE** looks like this `( function( ) { } )( )`.

```
(function () {

}());

(function () {

})();

(function named(params) {

})();

(() => {

})();

(function (global) {

})(window);

const utility = (function () {
   return {
      //utilities
   };
})();
```

These examples are all valid **IIFE**. The second to the last example shows we can pass arguements to an **IIFE** function. The last example shows that we can save the result of the **IIFE** to a variable so we can reference it later.

The best use of **IIFE** is making initialization setup functionalities and to avoid **naming collisions** with other variables in the global scope or polluting the global namespace. Let's have an example.

```
<script src="https://cdnurl.com/somelibrary.js"></script>
```

Suppose we have a link to a library `somelibrary.js` that exposes some global functions that we can use in our code but this library has two methods that we don't use `createGraph` and `drawGraph` because these methods have bugs in them. And we want to implement our own `createGraph` and `drawGraph` methods.

- One way of solving this is by changing the structure of our scripts.

```
<script src="https://cdnurl.com/somelibrary.js"></script>
<script>
   function createGraph() {
      // createGraph logic here
   }
   function drawGraph() {
      // drawGraph logic here
   }
</script>
```

When we use this solution we are overriding those two methods that the library gives us.

- Another way of solving this is by changing the name of our own helper functions.

```
<script src="https://cdnurl.com/somelibrary.js"></script>
<script>
   function myCreateGraph() {
      // createGraph logic here
   }
   function myDrawGraph() {
      // drawGraph logic here
   }
</script>
```

When we use this solution we will also change those function calls to the new function names.

- Another way is using an **IIFE**.

```
<script src="https://cdnurl.com/somelibrary.js"></script>
<script>
   const graphUtility = (function () {
      function createGraph() {
         // createGraph logic here
      }
      function drawGraph() {
         // drawGraph logic here
      }
      return {
         createGraph,
         drawGraph
      }
   })();
</script>
```

In this solution, we are making a utility variable that is the result of **IIFE** which returns an object that contains two methods createGraph and drawGraph.

Another problem that **IIFE** solves is in this example.

```
var li = document.querySelectorAll('.list-group > li');
for (var i = 0, len = li.length; i < len; i++) {
   li[i].addEventListener('click', function (e) {
      console.log(i);
   })
}
```

Suppose we have a ul element with a class of **list-group** and it has 5 li child elements. And we want to console.log the value of i when we **click** an individual li element.

But the behavior we want in this code does not work. Instead, it logs 5 in any **click** on an li element. The problem we're having is due to how **Closures** work. **Closures** are simply the ability of functions to remember the references of variables on its current scope, on its parent function scope and in the global scope. When we devlare variables using the var keyword in the global scope, obviously we are making a global variable i. So when we click an li element it logs **5** because that is the value of i when we reference it later in the callback function.

- One solution to this is an **IIFE**.

```
var li = document.querySelectorAll('.list-group > li');
for (var i = 0, len = li.length; i < len; i++) {
   (function (currentIndex) {
      li[currentIndex].addEventListener('click', function (e) {
         console.log(currentIndex);
      })
   })(i);
}
```

This solution works because of the reason that the **IIFE** creates a new scope for every iteration and we capture the value of i and pass it into the currentIndex parameter so the value of currentIndex is different for every iteration when we invoke the **IIFE**.

27. What is the use Function.prototype.apply method?

The apply invokes a function specifying the this or the owner object of that function on that time of invocation.

```
const details = {
  message: 'Hello World!'
};

function getMessage(){
  return this.message;
}

getMessage.apply(details); // returns 'Hello World!'
```

This method works like Function.prototype.call. The only difference is how we pass arguements. In apply we pass arguements as an array.

```
const person = {
  name: "Marko Polo"
};

function greeting(greetingMessage) {
  return `${greetingMessage} ${this.name}`;
}

greeting.apply(person, ['Hello']); // returns "Hello Marko Polo!"
```

28. What is the use Function.prototype.call method?

The `call` invokes a function specifying the `this` or the “owner” object of that function on that time of invocation.

```
const details = {
  message: 'Hello World!'
};

function getMessage(){
  return this.message;
}

getMessage.call(details); // returns 'Hello World!'
```

This method works like `Function.prototype.apply` the only difference is how we pass arguements. In `call` we pass directly the arguements separating them with a comma `,` for every arguement.

```
const person = {
  name: "Marko Polo"
};

function greeting(greetingMessage) {
  return `${greetingMessage} ${this.name}`;
}

greeting.call(person, 'Hello'); // returns "Hello Marko Polo!"
```

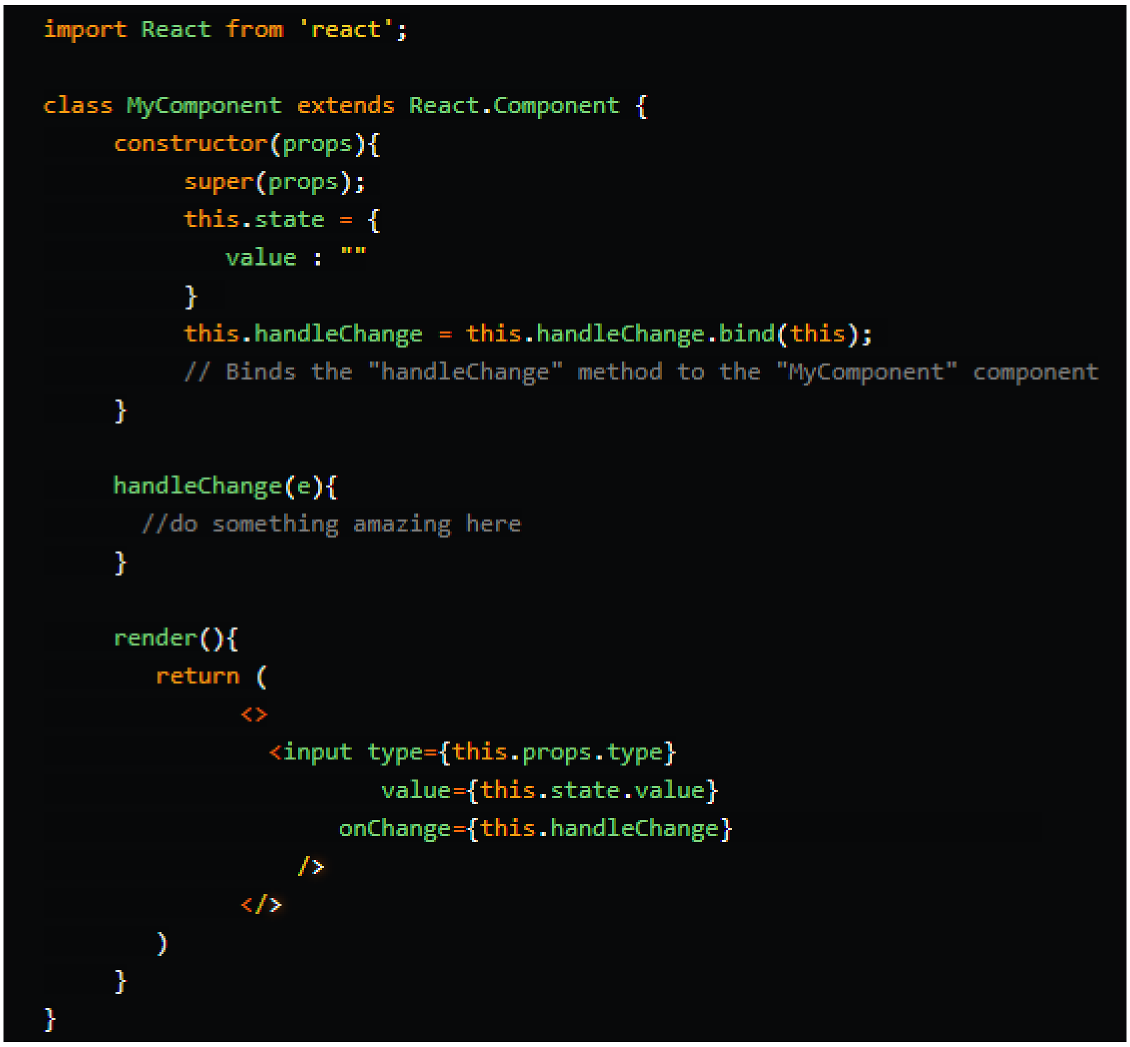
29. What’s the difference between `Function.prototype.apply` and `Function.prototype.call`?

The only difference between `apply` and `call` is how we pass the **arguments** in the function being called. In `apply`, we pass the arguements as an array. In `call`, we pass the arguments directly in the argument list.

```
const obj1 = {
 result:0
};

const obj2 = {
 result:0
};

function reduceAdd(){
   let result = 0;
   for(let i = 0, len = arguments.length; i < len; i++){
     result += arguments[i];
   }
   this.result = result;
}

reduceAdd.apply(obj1, [1, 2, 3, 4, 5]); // returns 15
reduceAdd.call(obj2, 1, 2, 3, 4, 5); // returns 15
```

30. What is the usage of Function.prototype.bind?

The bind method returns a new function that is *bound* to a specific this value or the “owner” object, so we can use it later in our code. The call, apply methods invokes the function immediately instead of returning a new function like the bind method.



```
import React from 'react';

class MyComponent extends React.Component {
     constructor(props){
          super(props);
          this.state = {
             value : ""
          }
          this.handleChange = this.handleChange.bind(this);
          // Binds the "handleChange" method to the "MyComponent" component
     }

     handleChange(e){
       //do something amazing here
     }

     render(){
        return (
              <>
                <input type={this.props.type}
                        value={this.state.value}
                     onChange={this.handleChange}
                  />
              </>
        )
     }
}
```

31. What is **Functional Programming** and what are the features of **Javascript** that makes it a candidate as a **functional language**?

Functional Programming is a **declarative** programming paradigm or pattern on how we build our applications with **functions** using **expressions** that calculates a value without mutating or changing the arguments that are passed to it.

Javascript **Array** has **map**, **filter**, **reduce** methods which are the most famous functions in the functional programming world because of their usefulness and because they don't mutate or change the array which makes these functions **pure** and Javascript supports **Closures** and **Higher Order Functions** which are a characteristic of a **Functional Programming Language**.

- The **map** method creates a new array with the results of calling a provided callback function on every element in the array.

```
const words = ["Functional", "Procedural", "Object-Oriented"];

const wordsLength = words.map(word => word.length);
```

- The **filter** method creates a new array with all elements that pass the test in the callback function.

```
const data = [
  { name: 'Mark', isRegistered: true },
  { name: 'Mary', isRegistered: false },
  { name: 'Mae', isRegistered: true }
];

const registeredUsers = data.filter(user => user.isRegistered);
```

- The **reduce** method applies a function against an accumulator and each element in the array (from left to right) to reduce it to a single value.

```
const strs = ["I", " ", "am", " ", "Iron", " ", "Man"];
const result = strs.reduce((acc, currentStr) => acc + currentStr, "");
```

32. What are Higher Order Functions?

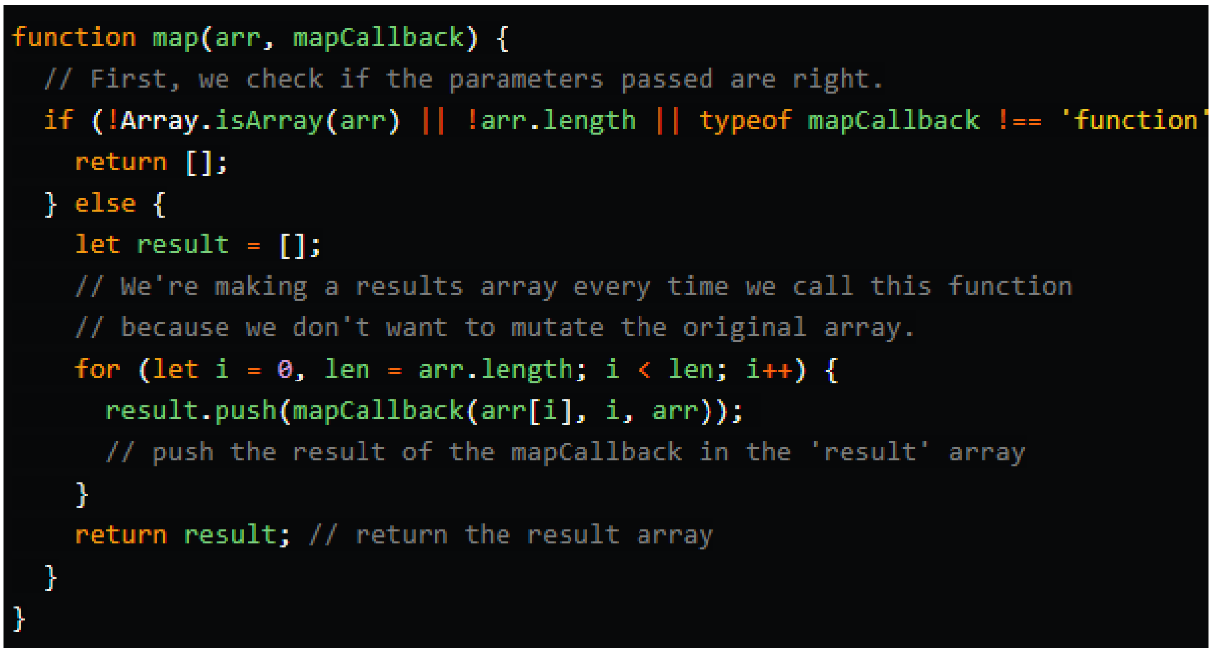
Higher-Order Functions are functions that can return a function or receive arguments or arguments which have a value of a function.

```
function higherOrderFunction(param,callback){
    return callback(param);
}
```

33. Why are functions called First-class Objects?

Functions in Javascript are **First-class Objects** because they are treated as any other value in the language. They can be assigned to **variables**, they can be **properties of an object** which are called **methods**, they can be an **item in array**, they can be **passed as arguments to a function**, and they can be **returned as values of a function**. The only difference between a function and any other value in **Javascript** is that **functions** can be invoked or called.

34. Implement the Array.prototype.map method by hand.

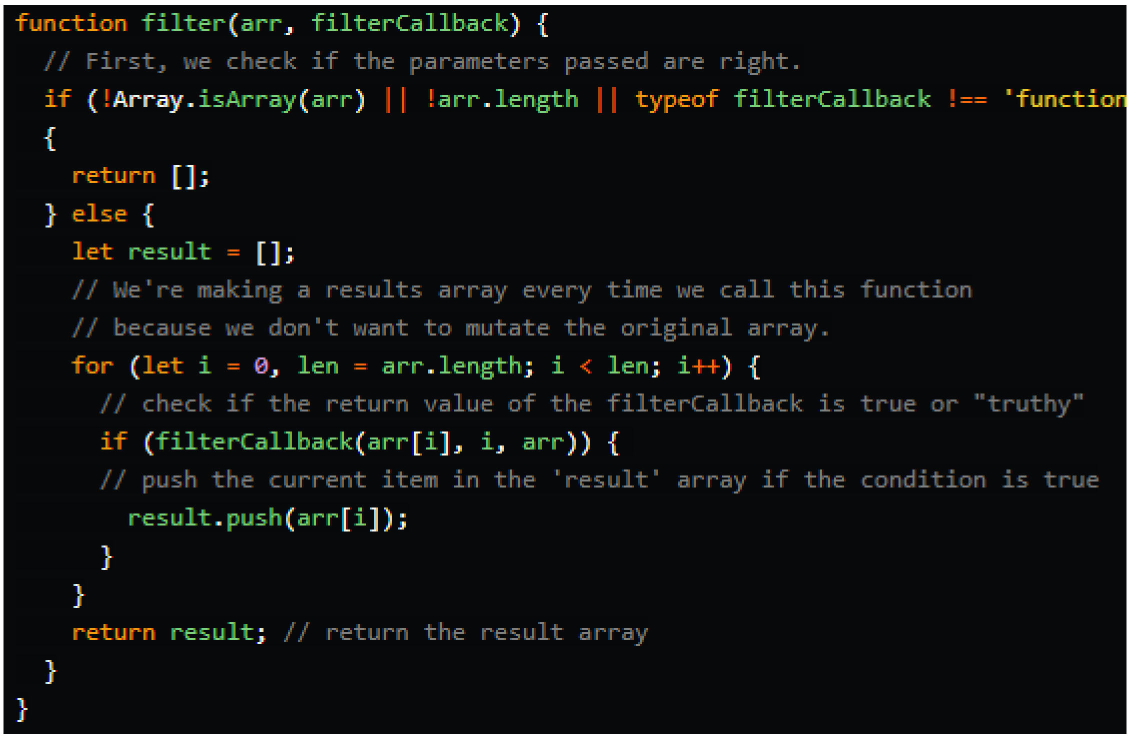


```
function map(arr, mapCallback) {
  // First, we check if the parameters passed are right.
  if (!Array.isArray(arr) || !arr.length || typeof mapCallback !== 'function'
    return [];
  } else {
    let result = [];
    // We're making a results array every time we call this function
    // because we don't want to mutate the original array.
    for (let i = 0, len = arr.length; i < len; i++) {
      result.push(mapCallback(arr[i], i, arr));
      // push the result of the mapCallback in the 'result' array
    }
    return result; // return the result array
  }
}
```

As the MDN description of the Array.prototype.map method.

The map( ) method creates a new array with the results of calling a provided function on every element in the calling array.

35. Implement the Array.prototype.filter method by hand.

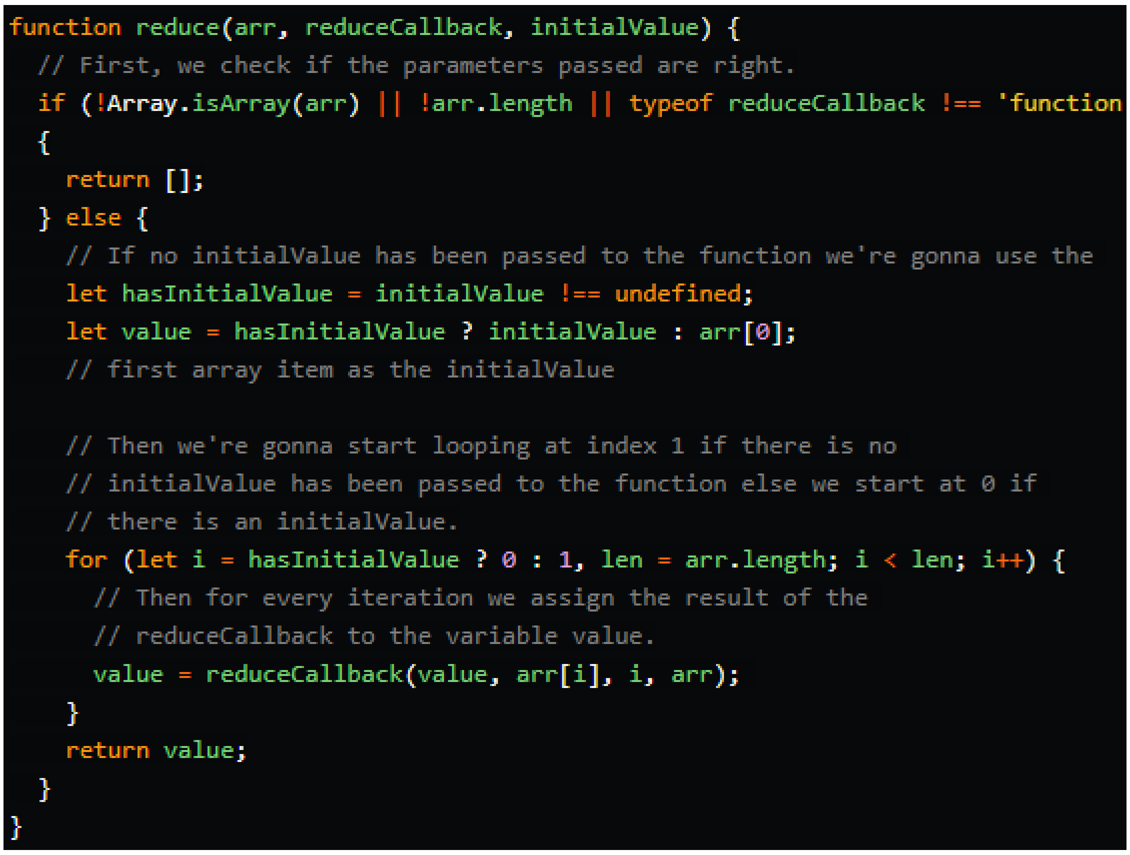


```
function filter(arr, filterCallback) {
  // First, we check if the parameters passed are right.
  if (!Array.isArray(arr) || !arr.length || typeof filterCallback !== 'function
  {
    return [];
  } else {
    let result = [];
    // We're making a results array every time we call this function
    // because we don't want to mutate the original array.
    for (let i = 0, len = arr.length; i < len; i++) {
      // check if the return value of the filterCallback is true or "truthy"
      if (filterCallback(arr[i], i, arr)) {
      // push the current item in the 'result' array if the condition is true
        result.push(arr[i]);
      }
    }
    return result; // return the result array
  }
}
```

As the MDN description of the Array.prototype.filter method.

The filter( ) method creates a new array with all elements that pass the test implemented by the provided function.

36. Implement the Array.prototype.reduce method by hand.



```
function reduce(arr, reduceCallback, initialValue) {
  // First, we check if the parameters passed are right.
  if (!Array.isArray(arr) || !arr.length || typeof reduceCallback !== 'function
  {
    return [];
  } else {
    // If no initialValue has been passed to the function we're gonna use the
    let hasInitialValue = initialValue !== undefined;
    let value = hasInitialValue ? initialValue : arr[0];
    // first array item as the initialValue

    // Then we're gonna start looping at index 1 if there is no
    // initialValue has been passed to the function else we start at 0 if
    // there is an initialValue.
    for (let i = hasInitialValue ? 0 : 1, len = arr.length; i < len; i++) {
      // Then for every iteration we assign the result of the
      // reduceCallback to the variable value.
      value = reduceCallback(value, arr[i], i, arr);
    }
    return value;
  }
}
```

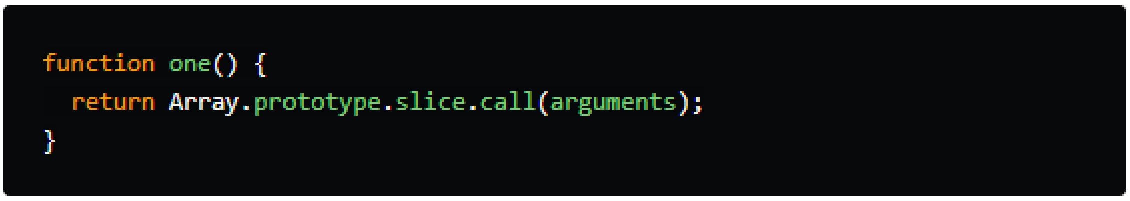
As the MDN description of the Array.prototype.reduce method.

The reduce( ) method executes a reducer function (that you provide) on each element of the array, resulting in a single output value.

37. What is the arguments object?

The **arguments** object is a collection of parameter values pass in a function. It's an **Array-like** object because it has a **length** property and we can access individual values using array indexing notation arguments[1] but it does not have the built-in methods in an array forEach, reduce, filter and map. It helps us know the number of arguments pass in a function.

We can convert the arguments object into an array using the Array.prototype.slice.



```
function one() {
  return Array.prototype.slice.call(arguments);
}
```

Note: **the arguments object does not work on ES6 arrow functions**.

```
function one() {
  return arguments;
}
const two = function () {
  return arguments;
}
const three = function three() {
  return arguments;
}

const four = () => arguments;

four(); // Throws an error  - arguments is not defined
```

When we invoke the function four it throws a ReferenceError: arguments is not defined error. We can solve this problem if your environment supports the **rest syntax**.

```
const four = (...args) => args;
```

This puts all parameter values in an array automatically.

38. How to create an object without a prototype?

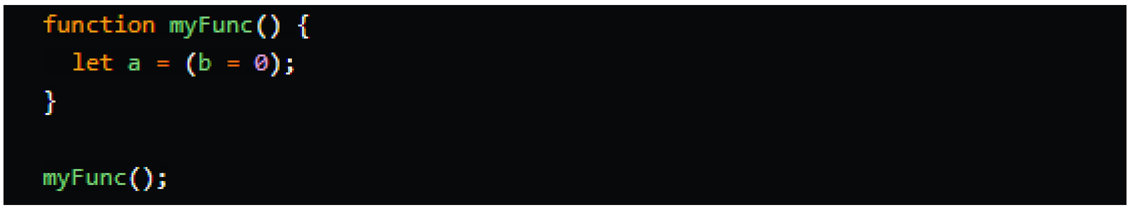
We can create an object without a *prototype* using the Object.create method.

```
   const o1 = {};
   console.log(o1.toString());
   // logs [object Object] get this method to the Object.prototype

   const o2 = Object.create(null);
   // the first parameter is the prototype of the object "o2" which in this
   // case will be null specifying we don't want any prototype
   console.log(o2.toString());
   // throws an error o2.toString is not a function
```

39. Why does b in thid code become a global variable when you call this function?

```
function myFunc() {
  let a = b = 0;
}

myFunc();
```

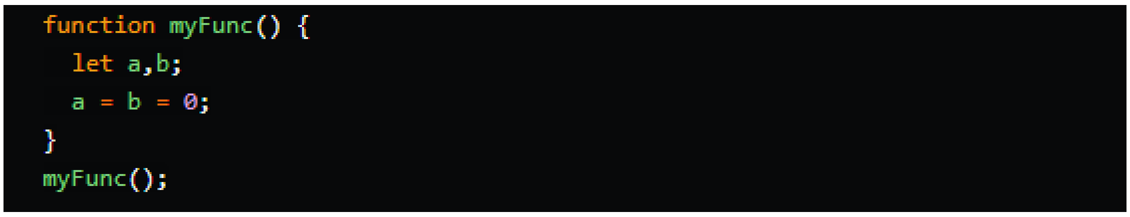
The reason for this is that **assignment operator** or **=** has right-to-left **associativity** or **evaluation**. What this means is that when multiple assignment operators appear in a single expression they evaluated from right to left. So our code becomes like this.



```
function myFunc() {
  let a = (b = 0);
}

myFunc();
```

First, the expression `b = 0` evaluated and in this example `b` is not declared. So, the JS Engine makes a global variable `b` outside this function after that the return value of the expression `b = 0` would be 0 and it's assigned to the new local variable `a` with a `let` keyword.

We can solve this problem by declaring the variables first before assigning them with value.



```
function myFunc() {
  let a,b;
  a = b = 0;
}
myFunc();
```

40. What is `ECMAScript`?

ECMAScript is a standard for making scripting languages which means that **Javascript** follows the specification changes in **ECMAScript** standard because it is the **blueprint** of **Javascript**.

41. What are the new features in `ES6` or `ECMAScript 2015`?

Arrow Functions, Classes, Template Strings, Enhanced Object literals, Object Destructuring, Promises, Generators, Modules, Symbol, Proxies, Sets, Default functions parameters, Rest and Spead, Block Scoping with let and const.

42. What's the difference between `var`, `let` and `const` keywords?

Variables declared with `var` keyword are function scoped. What this means that variables can be accessed across that function even if we declare that variable inside a block.

```javascript
function giveMeX(showX) {
  if (showX) {
    var x = 5;
  }
  return x;
}

console.log(giveMeX(false));
console.log(giveMeX(true));
```

The first `console.log` statement logs `undefined` and the second `5`. We can access the `x` variable due to the reason that it gets *hoisted* at the top of the function scope. So our function code is interpreted like this.

```javascript
function giveMeX(showX) {
  var x; // has a default value of undefined
  if (showX) {
    x = 5;
  }
  return x;
}
```

If you are wondering why it logs `undefined` in the first `console.log` statement remember variables declared without an initial value has a default value of `undefined`.

Variables declared with `let` and `const` keyword are block scoped. What this means that variable can only be accessed on that block `{ }` on where we declare it.

```javascript
function giveMeX(showX) {
  if (showX) {
    let x = 5;
  }
  return x;
}


function giveMeY(showY) {
  if (showY) {
    let y = 5;
  }
  return y;
}
```

If we call this functions with an argument of `false` it throws a `Reference Error` because we can't access the `x` and `y` variables outside that block and those variables are not *hoisted*.

There is also a difference between `let` and `const` we can assign new values using `let` but we can't in `const` but `const` are mutable meaning. What this means is if the value that we assign to a `const` is an object we can change the values of those properties but can't reassign a new value to that variable.

43. What are Arrow Functions?

Arrow Functions are a new way of making functions in Javascript. Arrow Functions takes a little time in making functions and has a cleaner syntax than a function expression because we omit the function keyword in making them.

```
//ES5 Version
var getCurrentDate = function (){
  return new Date();
}

//ES6 Version
const getCurrentDate = () => new Date();
```

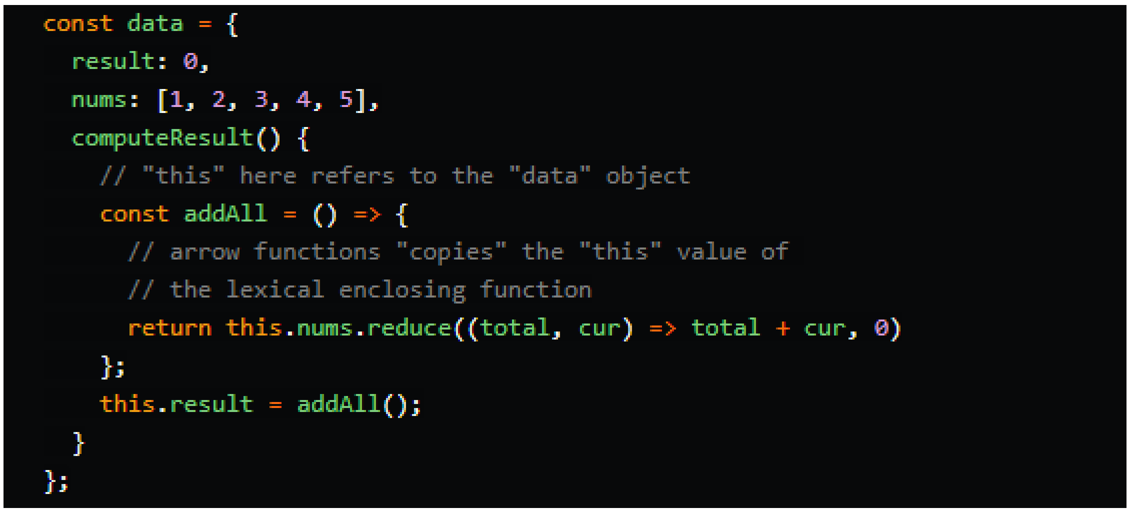
In this example, in the ES5 Version have function( ){ } declaration and return keyword needed to make a function and return a value respectively. In the **Arrow Function** version we only need the ( ) paranthese and we don't need a return statement because **Arrow Functions** have a implicit return if we have only one expression or value to return.

```
//ES5 Version
function greet(name) {
  return 'Hello ' + name + '!';
}

//ES6 Version
const greet = (name) => `Hello ${name}`;
const greet2 = name => `Hello ${name}`;
```

We can also have parameters in **Arrow Functions** the same as the **function expressions** and **function declarations**. If we have one parameter in an **Arrow Function** we can omit the parantheses.

```
const getArgs = () => arguments

const getArgs2 = (...rest) => rest
```

Arrow functions don't have access to the arguments object. So calling the first getArgs func will throw an Error. Instead we can use the **rest parameters** to get all the arguments passed in an arrow function.

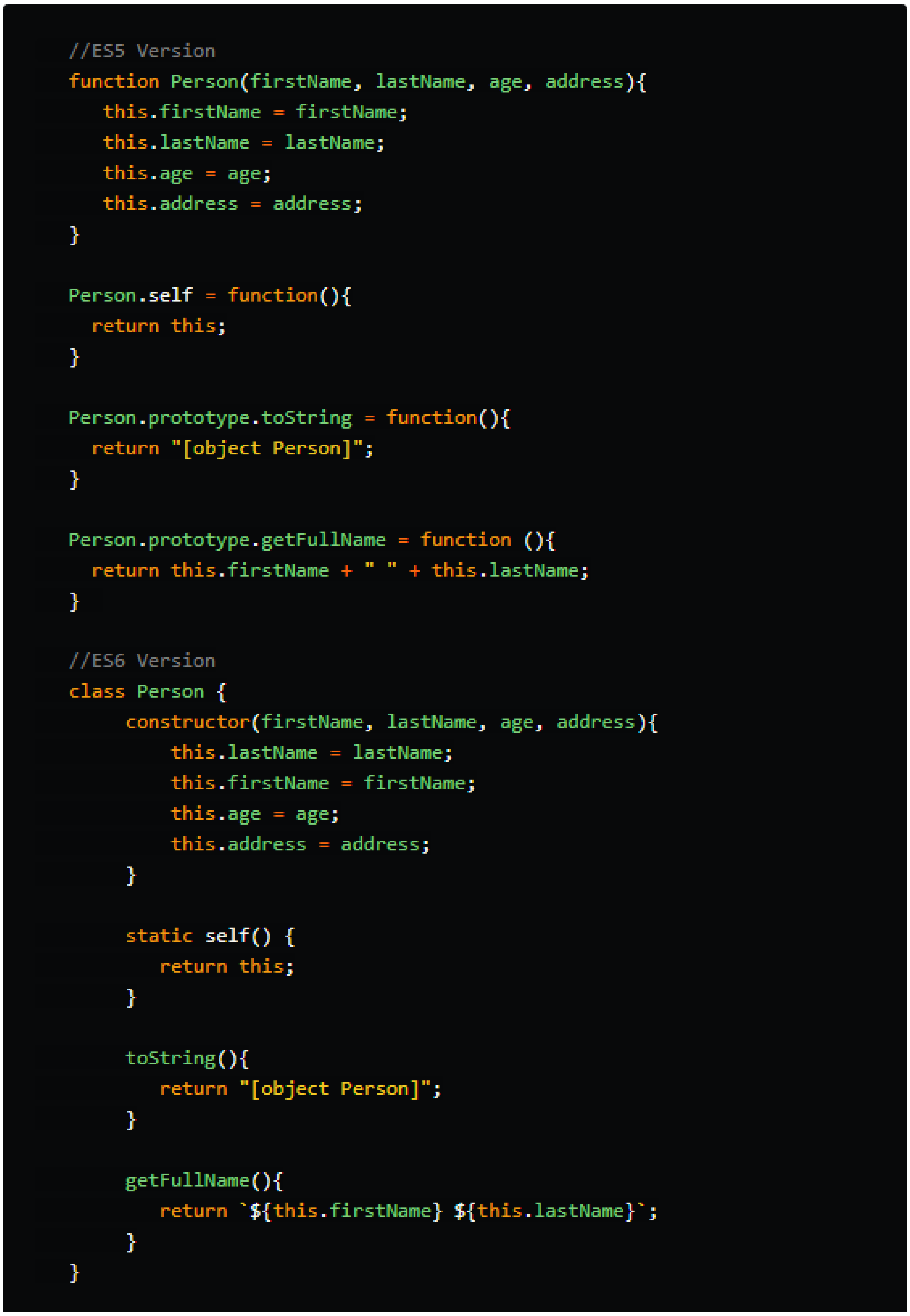


```
const data = {
  result: 0,
  nums: [1, 2, 3, 4, 5],
  computeResult() {
    // "this" here refers to the "data" object
    const addAll = () => {
      // arrow functions "copies" the "this" value of
      // the lexical enclosing function
      return this.nums.reduce((total, cur) => total + cur, 0)
    };
    this.result = addAll();
  }
};
```

Arrow functions don’t have their own this value. It captures or gets the this value of lexically enclosing function or in this example, the addAll function copies the this value of the computeResult method and if we declare an arrow function in the global scope the value of this would be the window object.

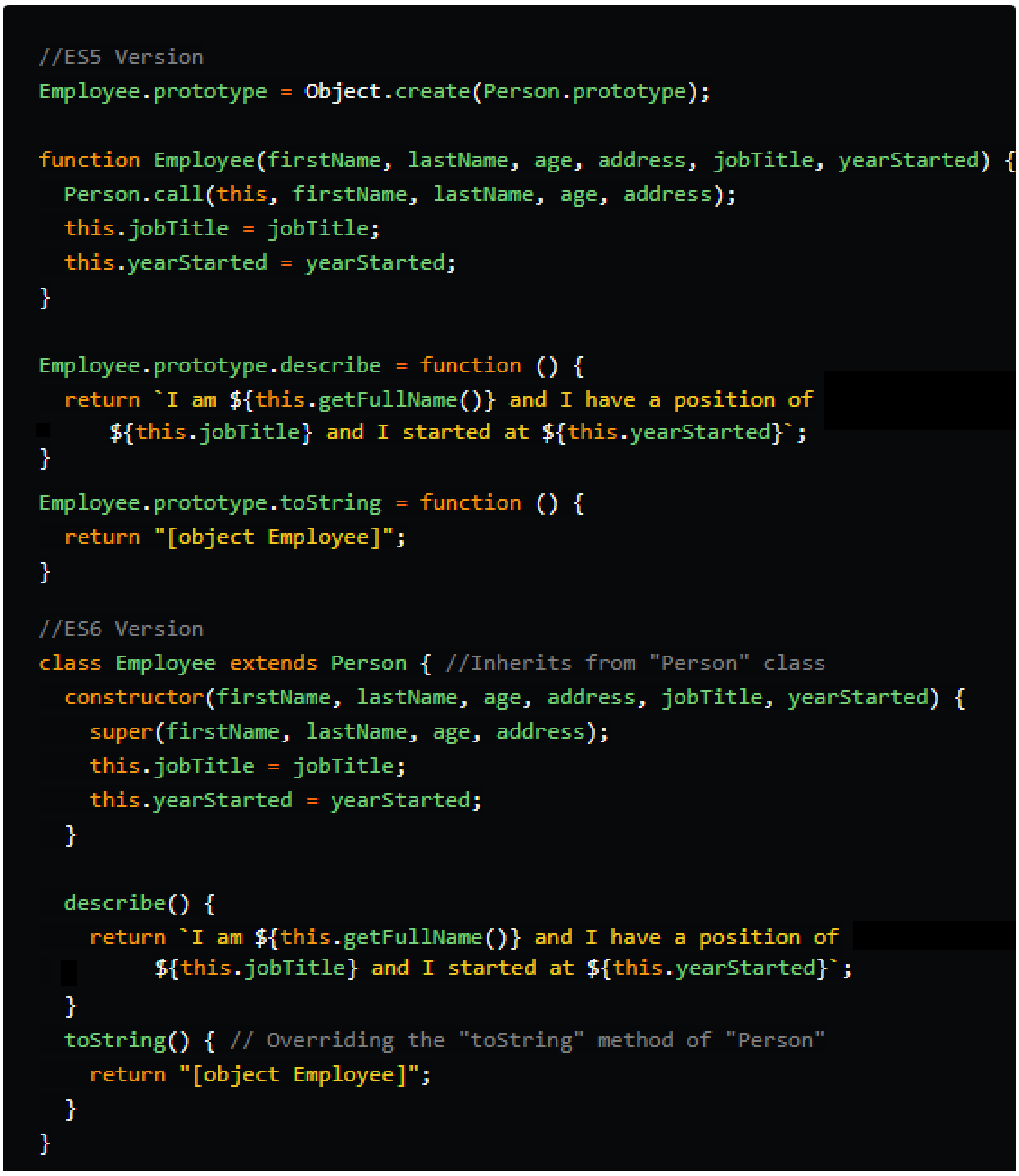
44. What are Classes?

Classes is the new way of writing *constructor functions* in **Javascript**. It is *syntactic sugar* for using *constructor functions*, it still uses **prototypes** and **Prototype-Based Inheritance** under the hood.



```
//ES5 Version
function Person(firstName, lastName, age, address){
   this.firstName = firstName;
   this.lastName = lastName;
   this.age = age;
   this.address = address;
}

Person.self = function(){
  return this;
}

Person.prototype.toString = function(){
  return "[object Person]";
}

Person.prototype.getFullName = function (){
  return this.firstName + " " + this.lastName;
}

//ES6 Version
class Person {
     constructor(firstName, lastName, age, address){
         this.lastName = lastName;
         this.firstName = firstName;
         this.age = age;
         this.address = address;
     }

     static self() {
        return this;
     }

     toString(){
        return "[object Person]";
     }

     getFullName(){
        return `${this.firstName} ${this.lastName}`;
     }
}
```

Overriding Methods and Inheriting from another class.



```
//ES5 Version
Employee.prototype = Object.create(Person.prototype);

function Employee(firstName, lastName, age, address, jobTitle, yearStarted) {
  Person.call(this, firstName, lastName, age, address);
  this.jobTitle = jobTitle;
  this.yearStarted = yearStarted;
}

Employee.prototype.describe = function () {
  return `I am ${this.getFullName()} and I have a position of
      ${this.jobTitle} and I started at ${this.yearStarted}`;
}

Employee.prototype.toString = function () {
  return "[object Employee]";
}

//ES6 Version
class Employee extends Person { //Inherits from "Person" class
  constructor(firstName, lastName, age, address, jobTitle, yearStarted) {
    super(firstName, lastName, age, address);
    this.jobTitle = jobTitle;
    this.yearStarted = yearStarted;
  }

  describe() {
    return `I am ${this.getFullName()} and I have a position of
        ${this.jobTitle} and I started at ${this.yearStarted}`;
  }
  toString() { // Overriding the "toString" method of "Person"
    return "[object Employee]";
  }
}
```

So how do we know that it uses *prototypes* under the hood?

```
class Something {

}

function AnotherSomething(){

}
const as = new AnotherSomething();
const s = new Something();

console.log(typeof Something); // logs "function"
console.log(typeof AnotherSomething); // logs "function"
console.log(as.toString()); // logs "[object Object]"
console.log(as.toString()); // logs "[object Object]"
console.log(as.toString === Object.prototype.toString);
console.log(s.toString === Object.prototype.toString);
// both logs return true indicating that we are still using
// prototypes under the hoods because the Object.prototype is
// the last part of the Prototype Chain and "Something"
// and "AnotherSomething" both inherit from Object.prototype
```

45. What are Template Literals?

Template Literals are a new way of making **strings** in Javascript. We can make **Template Literal** by using the backtick of back-quote symbol.

```
//ES5 Version
var greet = 'Hi I\'m Mark';

//ES6 Version
let greet = `Hi I'm Mark`;
```

In the ES5 version, we need to escape the ' using the \ to escape the normal functionality of that symbol which in this case is to finish that string value. In Template Literals, we don't need to do that.

```
//ES5 Version
var lastWords = '\n'
  + '   I  \n'
  + '   Am  \n'
  + 'Iron Man \n';


//ES6 Version
let lastWords = `
    I
    Am
  Iron Man
`;
```

In the ES5 version, we need to add this \n to have a new line in our string. In Template Literals, we don't need to do that.

```
//ES5 Version
function greet(name) {
  return 'Hello ' + name + '!';
}


//ES6 Version
const greet = name => {
  return `Hello ${name} !`;
}
```

In the ES5 version, if we need to add an expression or value in a string we need to use the + or string concatenation operator. In Template Listerals, we can embed an expression using ${expr} which makes it cleaner than the ES5 version.

46. What is Object Destucturing?

Object Destructuring is a new and cleaner way of getting or extracting values from an object or an array.

Suppose we have an object that looks like this.

```
const employee = {
  firstName: "Marko",
  lastName: "Polo",
  position: "Software Developer",
  yearHired: 2017
};
```

The old way of getting properties from an object is we make a variable that has the same name as the object property. This way is a hassle because we're making a new variable for every property. Imagine we have a big object with lots of properties and methods. Using this way in extracting properties will be irritating.

```
var firstName = employee.firstName;
var lastName = employee.lastName;
var position = employee.position;
var yearHired = employee.yearHired;
```

If we use **object destucturing** it looks cleaner and takes a little time than the old way. The syntax for object destructuring is that if we are getting properties in an object we use the { } and inside that, we specify the properties we want to extract and if we are getting data from an array we use the [ ].

```
let { firstName, lastName, position, yearHired } = employee;
```

If we want to change the variable name we want to extract we use the propertyName:newName syntax. In this example the value of fName variable will hold the value of the firstName property and lName variable will hold the value of the lastName property.

```
let { firstName: fName, lastName: lName, position, yearHired } = employee;
```

We can also have default values when destructuring. In this example, if the firstName property holds an undefined value in the object then when we destructure the firstName variable will hold a default of "Mark".

```
let { firstName = "Mark", lastName: lName, position, yearHired } = employee;
```

47. What are ES6 Modules?

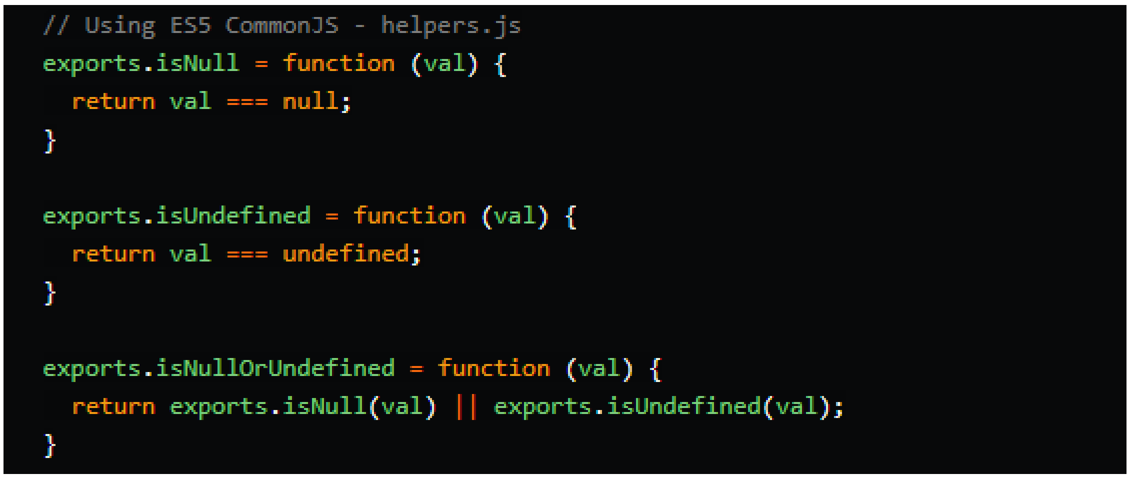
Modules lets us split our code base to multiple files for more maintainability and this lets us avoid putting all of our code in one big file. Before ES6 has supported Modules there were two popular module systems that were used for Code Maintainability in **Javascript**.

- CommonJS – **Nodejs**
- AMD (Asynchronous Module Definiton) – **Browsers**

Basically, the syntax for using modules are straightforward. import is used for *getting* functionality from another file or several functionalities or values while export is used for exposing functionality from a file or several functionalities or values.

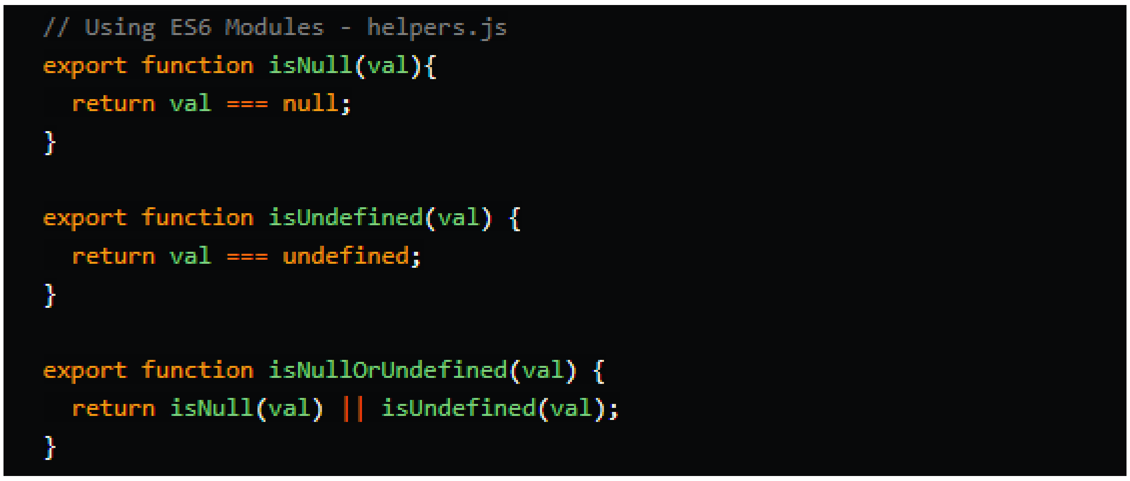
Exporting functionalities in a File or Named Exports

Using ES5 (CommonJS)



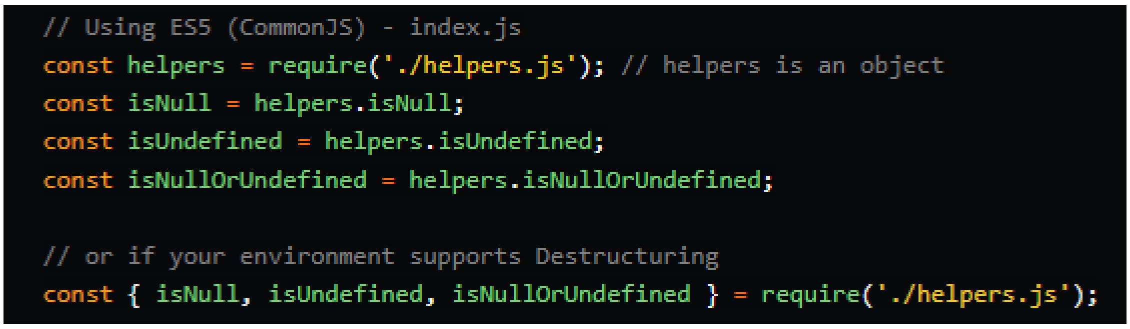
```
// Using ES5 CommonJS - helpers.js
exports.isNull = function (val) {
  return val === null;
}

exports.isUndefined = function (val) {
  return val === undefined;
}

exports.isNullOrUndefined = function (val) {
  return exports.isNull(val) || exports.isUndefined(val);
}
```

Using ES6 Modules

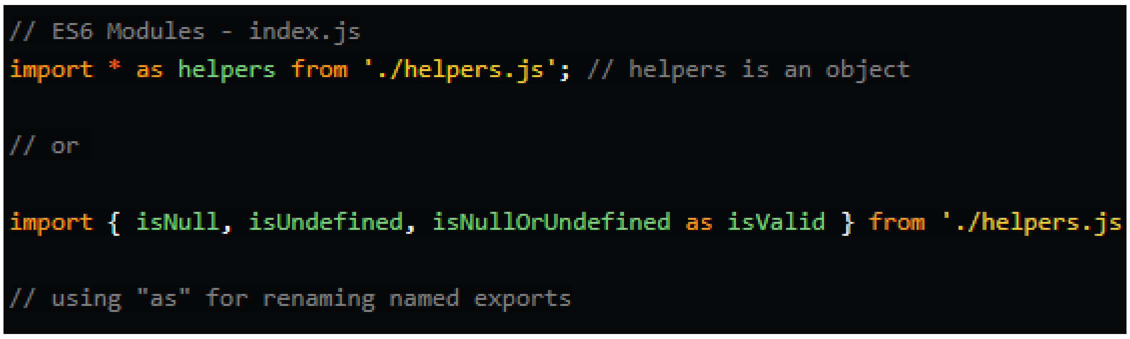


```
// Using ES6 Modules - helpers.js
export function isNull(val){
  return val === null;
}

export function isUndefined(val) {
  return val === undefined;
}

export function isNullOrUndefined(val) {
  return isNull(val) || isUndefined(val);
}
```

Importing functionalities in another File



```
// Using ES5 (CommonJS) - index.js
const helpers = require('./helpers.js'); // helpers is an object
const isNull = helpers.isNull;
const isUndefined = helpers.isUndefined;
const isNullOrUndefined = helpers.isNullOrUndefined;

// or if your environment supports Destructuring
const { isNull, isUndefined, isNullOrUndefined } = require('./helpers.js');
```



```
// ES6 Modules - index.js
import * as helpers from './helpers.js'; // helpers is an object

// or

import { isNull, isUndefined, isNullOrUndefined as isValid } from './helpers.js

// using "as" for renaming named exports
```

Exporting a Single Functionality in a File or Default Exports

Using ES5 (CommonJS)

```
// Using ES5 (CommonJS) - index.js
class Helpers {
  static isNull(val) {
    return val === null;
  }

  static isUndefined(val) {
    return val === undefined;
  }

  static isNullOrUndefined(val) {
    return this.isNull(val) || this.isUndefined(val);
  }
}


module.exports = Helpers;
```

Using ES6 Modules

```
// Using ES6 Modules - helpers.js
class Helpers {
  static isNull(val) {
    return val === null;
  }

  static isUndefined(val) {
    return val === undefined;
  }

  static isNullOrUndefined(val) {
    return this.isNull(val) || this.isUndefined(val);
  }
}

export default Helpers
```

Importing a Single Functionality from another File

Using ES5 (CommonJS)

```
// Using ES5 (CommonJS) - index.js
const Helpers = require('./helpers.js');
console.log(Helpers.isNull(null));
```

Using ES6 Modules

```
import Helpers from '.helpers.js'
console.log(Helpers.isNull(null));
```

48. What is the Set object and how does it work?

The **Set** object is an **ES6** feature that lets you store unique values, **primitives** or **object references**. A value in a Set can only occur **once**. It checks if a value exists in the set object using the **SameValueZero** algorithm.

We can make Set instance using Set constructor and we can optionally pass an Iterable as the initial value.

```
const set1 = new Set();
const set2 = new Set(["a","b","c","d","d","e"]);
```

We can add a new value into the Set instance using the add method and since the add returns the Set object we can chain add calls. If a value already exists in Set object it will not be added again.

```
set2.add("f");
set2.add("g").add("h").add("i").add("j").add("k").add("k");
// the last "k" will not be added to the set object because it already exists
```

We can remove a value from the Set instance using the delete method, his method returns a boolean indicating true if a value exists in the Set object and false indicating that value does not exist.

```
set2.delete("k") // returns true because "k" exists in the set object
set2.delete("z") // returns false because "z" does not exists in the set object
```

We can check if a specific value exists in the Set instance using the has method.

```
set2.has("a") // returns true because "a" exists in the set object
set2.has("z") // returns false because "z" does not exists in the set object
```

We can get the length of the Set instance using the size property.

```
set2.size // returns 10
```

We can delete or remove all the elements in the Set instance using the clear.

```
set2.clear(); // clears the set data
```

We can use the Set object for removing duplicate elements in an array.

```
const numbers = [1, 2, 3, 4, 5, 6, 6, 7, 8, 8, 5];
const uniqueNums = [...new Set(numbers)]; // has a value of [1,2,3,4,5,6,7,8]
```

49. What is a Callback function?

A **Callback** function is a function that is gonna get called at a later point in time.

```
const btnAdd = document.getElementById('btnAdd');

btnAdd.addEventListener('click', function clickCallback(e) {
    // do something useless
});
```

In this example, we wait for the click event in the element with an id of **btnAdd**, if it is clicked, the clickCallback function is executed. A **Callback** function adds more functionality to some data or event. The reduce, filter and map methods in **Array** expects a callback as a parameter. A good analogy for a callback is when you call someone and if they don't answer you leave a message and you expect them to **callback**. The act of calling someone or leaving a **message** is **the event or data** and the **callback** is the **action that you expect to occur later**.

50. What are Promises?

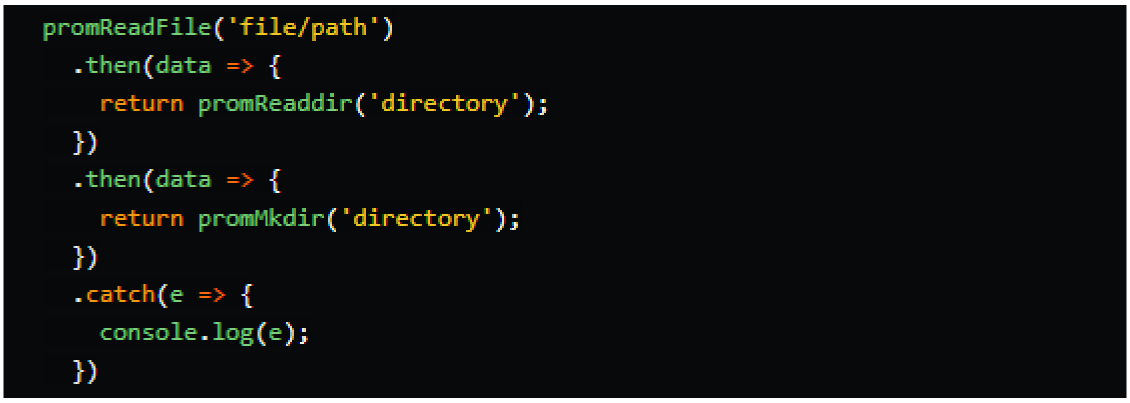
Promises are one way in handling asynchronous operations in **Javascript**. It represents the value of an asynchronous opeartion. **Promises** was made to solve the problem of doing and dealing with async code. Before promises we were using callbacks.

```
fs.readFile('somefile.txt', function (e, data) {
  if (e) {
    console.log(e);
  }
  console.log(data);
});
```

The problem with this approach if we have another async operation inside the callback and another. We will have a code that is messy and unreadable. This code is called **Callback Hell.**

```
//Callback Hell yucksss
fs.readFile('somefile.txt', function (e, data) {
  //your code here
  fs.readdir('directory', function (e, files) {
    //your code here
    fs.mkdir('directory', function (e) {
      //your code here
    })
  })
})
```

If we use promises in this code, it will be more readable and easy to undestand and easy to maintain.



```
promReadFile('file/path')
  .then(data => {
    return promReaddir('directory');
  })
  .then(data => {
    return promMkdir('directory');
  })
  .catch(e => {
    console.log(e);
  })
```

Promises have 3 different states.

Pending – The initial state of a promise. The promise's outcome has not yet been known because the operation has not been completed yet.

Fulfilled – The async operation is completed and successful with the resulting value.

Rejected – The async operation has failed and has a reason on why it failed.

Settled – If the promise has been either **Fulfilled** or **Rejected**.

The **Promise** constructor has two parameters which are functions resolve and reject respectively.

If the async operation has been completed without errors call the resolve function to resolve the promise. If an error occurred call the reject function and pass the error or reason to it. We can access the result of the fulfilled promise using the .then method and we catch errors in the .catch method. We chain multiple async promise operations in the .then method because the .then method returns a **Promise** just like the example in the image above.

```
const myPromiseAsync = (...args) => {
  return new Promise((resolve, reject) => {
    doSomeAsync(...args, (error, data) => {
      if (error) {
        reject(error);
      } else {
        resolve(data);
      }
    })
  })
}

myPromiseAsync()
  .then(result => {
    console.log(result);
  })
  .catch(reason => {
    console.log(reason);
  })
```

We can make a helper function that converts an async operation with a callback to promise. It works like the **promisify** utility function from the node core module `util`.

```
const toPromise = (asyncFuncWithCallback) => {
  return (...args) => {
    return new Promise((res, rej) => {
      asyncFuncWithCallback(...args, (e, result) => {
        return e ? rej(e) : res(result);
      });
    });
  }
}

const promReadFile = toPromise(fs.readFile);

promReadFile('file/path')
  .then((data) => {
    console.log(data);
  })
  .catch(e => console.log(e));
```

51. What is `async/await` and how does it work?

async/await is the new way of writing asynchronous or non-blocking code in **Javascript's**. It is built on top of **Promises**. It makes writing asynchronous code more readable and cleaner than **Promises** and **Callbacks**.

Using Promises.

```
function callApi() {
  return fetch("url/to/api/endpoint")
    .then(resp => resp.json())
    .then(data => {
      //do something with "data"
    }).catch(err => {
      //do something with "err"
    });
}
```

Using Async/Await.

Note: We're using the old *try/catch* statement to **catch** any errors that happened in any of those async operations inside the *try* statement.

```
async function callApi() {
  try {
    const resp = await fetch("url/to/api/endpoint");
    const data = await resp.json();
    //do something with "data"
  } catch (e) {
    //do something with "err"
  }
}
```

Note: The *async* keyword before the function declaration makes the function return *implicitly* a **Promise**.

```
const giveMeOne = async () => 1;

giveMeOne()
  .then((num) => {
    console.log(num); // logs 1
  });
```

Note: The *await* keyword can **only** be used inside an **async function**. Using *await* keyword in any other function which is not an **async function** will throw an error. The *await* keyword **awaits** the right-hand side expression (presumably a **Promise**) to return before executing the next line of code.

```
const giveMeOne = async () => 1;

function getOne() {
  try {
    const num = await giveMeOne();
    console.log(num);
  } catch (e) {
    console.log(e);
  }
}

//Throws a Compile-Time Error = Uncaught SyntaxError: await is only valid in a

async function getTwo() {
  try {
    const num1 = await giveMeOne(); //finishes this async operation first befo
    const num2 = await giveMeOne(); //this line
    return num1 + num2;
  } catch (e) {
    console.log(e);
  }
}

await getTwo(); // returns 2
```

52. What's the difference between Spread Operator and Rest Operator?

The **Spread Operator** and **Rest Parameters** have the same operator ... . The difference between is that the **Spread operator** we **give** or **spread** individual data of an array to another data while the **Rest parameters** is used in a function or an array to **get** all the arguments or values and put them in an array or **extract** some pieces of them.

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

const nums = [5, 6];
const sum = add(...nums);
console.log(sum);
```

In this example, we're using the **Spread operator** when we call the add function. We are **spreading** the nums array. So the value or parameter a will be **5** and the value of b will be **6**. So the sum will be **11**.

```
function add(...rest) {
  return rest.reduce((total,current) => total + current);
};

console.log(add(1, 2)); // logs 3
console.log(add(1, 2, 3, 4, 5)); // logs 15
```

In this example, we have a function add that accepts any number of arguments and adds them all and return the total.

```
const [first, ...others] = [1, 2, 3, 4, 5];
console.log(first); //logs 1
console.log(others); //logs [2,3,4,5]
```

In this another example, we are using the **Rest operator** to extract all the remaining array values and put hem in array others except the first item.

53. What are Default Paramters?

Default Parameters is a new way of defining default variables in **JavaScript** it is available in the **ES6** or **ECMAScript 2015** version.

```
//ES5 Version
function add(a,b){
  a = a || 0;
  b = b || 0;
  return a + b;
}

//ES6 Version
function add(a = 0, b = 0){
  return a + b;
}
//If we don't pass any argument for 'a' or 'b' then
// it's gonna use the "default parameter" value which is 0
add(1); // returns 1
```

54. What are Wrapper Objects?

Primite values like string, number and boolean with the exception of null and undefined have properties and methods even though they are not objects.

```
let name = "marko";

console.log(typeof name); // logs  "string"
console.log(name.toUpperCase()); // logs  "MARKO"
```

name is a primite string value that has no properties and methods but in this example we are calling a toUpperCase() method which does not throw an error but returns MARKO.

The reason for this is that the primite value is temporarily converted or *coerce* to an object so the name variable behaves like an object. Every primite except null and undefined have **Wrapper Objects**. The Wrapper Objects are String, Number, Boolean, Symbol and BigInt. In this case, the name.toUpperCase() invocation, behind the scenes it looks like this.

```
console.log(new String(name).toUpperCase()); // logs  "MARKO"
```

The newly created object is immediately discarded after we finished accessing a property or calling a method.

55. What is the difference between Implicit and Explicit Coercion?

Implicit Coercion is a way of converting values to another type without us programmer doing it directly or by hand.

```
console.log(1 + '6');
console.log(false + true);
console.log(6 * '2');
```

The **first** console.log statement logs 16. In other languages this would throw a compile time error but in **JavaScript** the 1 is converted to a string then concatenated with the + operator. We did not do anything, yet it was converted automatically by **Javascript** for us.

The **second** console.log statement logs 1, it converts the false to a boolean which will result to a 0 and the true will be 1 hence the result is 1.

The **third** console.log statement logs 12, it converts the '2' to a number before multiplying 6 * 2 hence the result 12.

While **Explicit** Coercion is the way of converting values to another type where we (programmers) explicitly do it.

```
console.log(1 + parseInt('6'));
```

In this example, we use the parseInt function to convert the '6' to a number then adding the 1 and 6 using the + operator.

56. What is NaN and how to check if a value is NaN?

NaN means “**Not A Number**” is a value in **Javascript** that is a result in converting or performing an operation to a number to non-number value hence results to NaN.

```
let a;

console.log(parseInt('abc'));
console.log(parseInt(null));
console.log(parseInt(undefined));
console.log(parseInt(++a));
console.log(parseInt({} * 10));
console.log(parseInt('abc' - 2));
console.log(parseInt(0 / 0));
console.log(parseInt('10a' * 10));
```

Javascript has a built-in method isNaN that tests if value is NaN value. But this function has a weird behaviour.

```
console.log(isNaN()); //logs true
console.log(isNaN(undefined)); //logs true
console.log(isNaN({})); //logs true
console.log(isNaN(String('a'))); //logs true
console.log(isNaN(() => { })); //logs true
```

All these console.log statements return true even though those values we pass are not NaN.

In **ES6** or **ECMAScript 2015**, it is recommended that we use Number.isNaN method because it really checks the value if it really is NaN or we can make our own helper function that check for this problem because in **Javascript** NaN is the only value that is not equal to itself.

```
function checkIfNaN(value) {
  return value !== value;
}
```

57. How to check if a value is an Array?

We can check if a value is an **Array** by using the Array.isArray method available from the **Array** global object. It returns true when the parameter passed to it is an **Array** otherwise false.

```
console.log(Array.isArray(5));  //logs false
console.log(Array.isArray("")); //logs false
console.log(Array.isArray()); //logs false
console.log(Array.isArray(null)); //logs false
console.log(Array.isArray({ length: 5 })); //logs false

console.log(Array.isArray([])); //logs true
```

If your environment does not support this method you can use the polyfill implementation.

```
function isArray(value){
  return Object.prototype.toString.call(value) === "[object Array]"
}
```

58. How to check if a number is even without using the % or modulo operator?

We can use the **bitwise AND** & operator for this problem. The & operates on its operand and treats them as binary values and performs the **AND** operation.

```
function isEven(num) {
  if (num & 1) {
    return false;
  } else {
    return true;
  }
};
```

0 in binary is **000**.
1 in binary is **001**.
2 in binary is **010**.
3 in binary is **011**.
4 in binary is **100**.
5 in binary is **101**.
6 in binary is **110**.
7 in binary is **111**.
and so on...

a	b	a & b
0	0	0
0	1	0
1	0	0
1	1	1

So when we console.log this expression 5 & 1 it returns 1. Ok, first the & operator converts both numbers to binary so 5 turns to **101** and 1 turns to **001**.

Then it compares every bit using the bitwise **AND** operator. **101** & **001**. As we can see from the table the result can be only 1 if a **AND** b are 1.

`101 & 001`
101
001
001

- So first we compare the left most bit 1 & 0 the result should be 0.
- Then we compare the middle bit 0 & 0 the result should be 0.
- Then we compare the last bit 1 & 1 the result should be 1.
- Then the binary result 001 will be converted to a decimal number which will be 1.

If we console.log this expression 4 & 1 it will return 0. Knowing the last bit of 4 is 0 and 0 & 1 will be 0. If you have a hard time understand this we could use a **recursive** function to solve this problem.

```
function isEven(num) {
  if (num < 0 || num === 1) return false;
  if (num == 0) return true;
  return isEven(num - 2);
}
```

59. How to check if a certain property exists in an object?

There are three possible ways to check if a property exists in an object.

First, using the in operator. The syntax for using the in operator is like this propertyname in object. It returns true if the property exists otherwise it returns false.

```
const o = {
  "prop" : "bwahahah",
  "prop2" : "hweasa"
};

console.log("prop" in o); //This logs true indicating the property "prop" is
console.log("prop1" in o); //This logs false indicating the property "prop" i
```

Second, using the hasOwnProperty method in objects. This method is available on all objects in Javascript. It returns true if the property exists otherwise it returns false.

```
//Still using the o object in the first example.
console.log(o.hasOwnProperty("prop2")); // This logs true
console.log(o.hasOwnProperty("prop1")); // This logs false
```

Third, using the bracket notation obj["prop"]. If the property exists it returns the value of that property otherwise this will return undefined.

60. What is AJAX?

AJAX stands for **Asynchronous Javascript and XML**. It is a group of related technologies used to display data asynchronously. What this means is that we can send data to the server and get data from the server without reloading the web page.

Technologies use for **AJAX**.

- **HTML** – web page structure
- **CSS** – the styling for the webpage
- **Javascript** – the behaviour of the webpage and updates to the **DOM**
- **XMLHttpRequest API** – used to send and retrieve data from the server
- **PHP**, **Python**, **Nodejs** – Some Server-Side language

61. What are the ways of making objects in JavaScript?

Using Object Literal.

```
const o = {
  name: "Mark",
  greeting() {
     return `Hi, I'm ${this.name}`;
  }
};

o.greeting(); //returns "Hi, I'm Mark"
```

Using Constructor Functions.

```
function Person(name) {
   this.name = name;
}

Person.prototype.greeting = function () {
   return `Hi, I'm ${this.name}`;
}

const mark = new Person("Mark");

mark.greeting(); //returns "Hi, I'm Mark"
```

Using Object.create method.

```
const n = {
   greeting() {
      return `Hi, I'm ${this.name}`;
   }
};

const o = Object.create(n); // sets the prototype of "o" to be "n"

o.name = "Mark";

console.log(o.greeting()); // logs "Hi, I'm Mark"
```

62. What's the difference between `Object.seal` and `Object.freeze` methods?

The difference between these two methods is that when we use the `Object.freeze` method to an object, that object's properties are immutable. Meaning we can't change or edit the values of those properties. While in the `Object.seal` method, we can change those existing properties.

63. What's the difference between the `in` operator and the `hasOwnProperty` method in objects?

As you know both of these features check if a property exists in an object. It will return `true` or `false`. The difference between them is that the `in` operator also checks the objects' **Prototype Chain** if the property was not found in the current object while the `hasOwnProperty` method just checks if the property exists in the current object ignoring the **Prototype Chain**.

```
// We'll still use the object in the previous question.
console.log("prop" in o); // This logs true;
console.log("toString" in o); // This logs true, the toString method is availab


console.log(o.hasOwnProperty("prop")); // This logs true
console.log(o.hasOwnProperty("toString")); // This logs false, does not check t
```

64. What are the ways to deal with `Asynchronous Code` in Javascript?

Callbacks, Promises, async/await, libraries like async.js, bluebird, q, co.

65. What’s the difference between a `function expression` and `function declaration`?

Suppose we have an example below.

```
hoistedFunc();
notHoistedFunc();

function hoistedFunc(){
  console.log("I am hoisted");
}

var notHoistedFunc = function(){
  console.log("I will not be hoisted!");
}
```

The `notHoistedFunc` call throws an error while the `hoistedFunc` call does not because the `hoistedFunc` is *hoisted* while the `notHoistedFunc` is not.

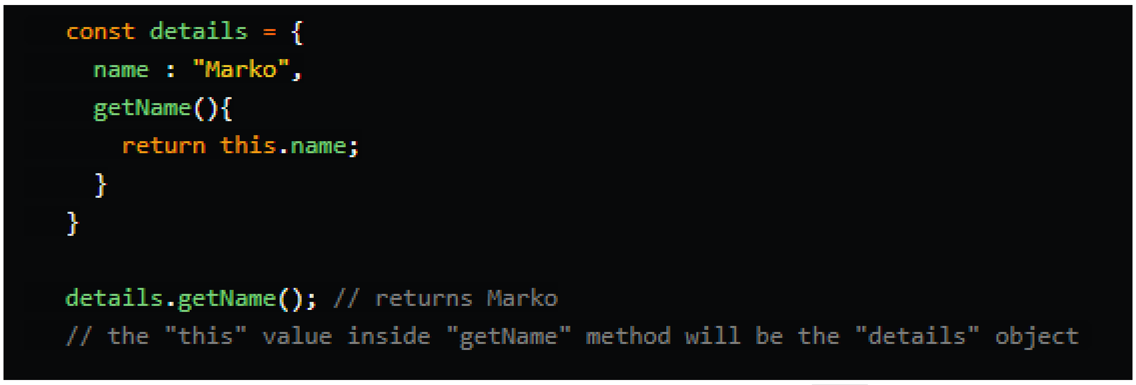
66. How many ways can a function be *invoked*?

There are 4 ways that a function can be invoked in **Javascript**. The **invocation** determines the value of `this` or the owner object of that function.

- **Invocation as a function** – If a function isn’t invoked as a method, as a constructor or with the `apply`, `call` methods then it is **invoked as a function**. The “owner” object of this function will be the `window` object.

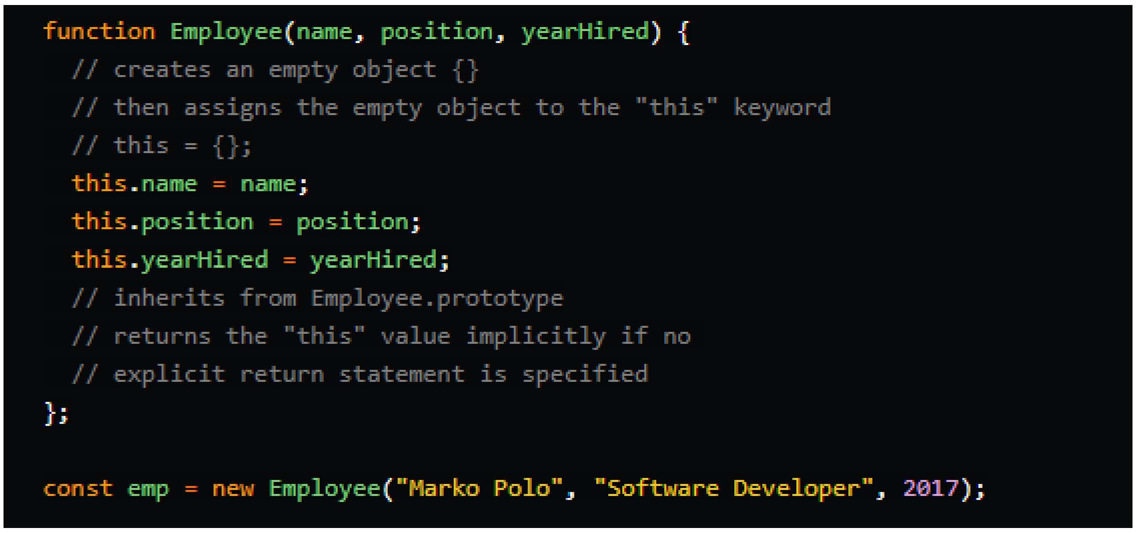
```
  //Global Scope

  function add(a,b){
    console.log(this);
    return a + b;
  }

  add(1,5); // logs the "window" object and returns 6

  const o = {
    method(callback){
      callback();
    }
  }

  o.method(function (){
      console.log(this); // logs the "window" object
  });
```

- **Invocation as a method** – If a property of an object has a value of a function we call it a **method**. When that **method** is invoked the this value of that method will be that object.



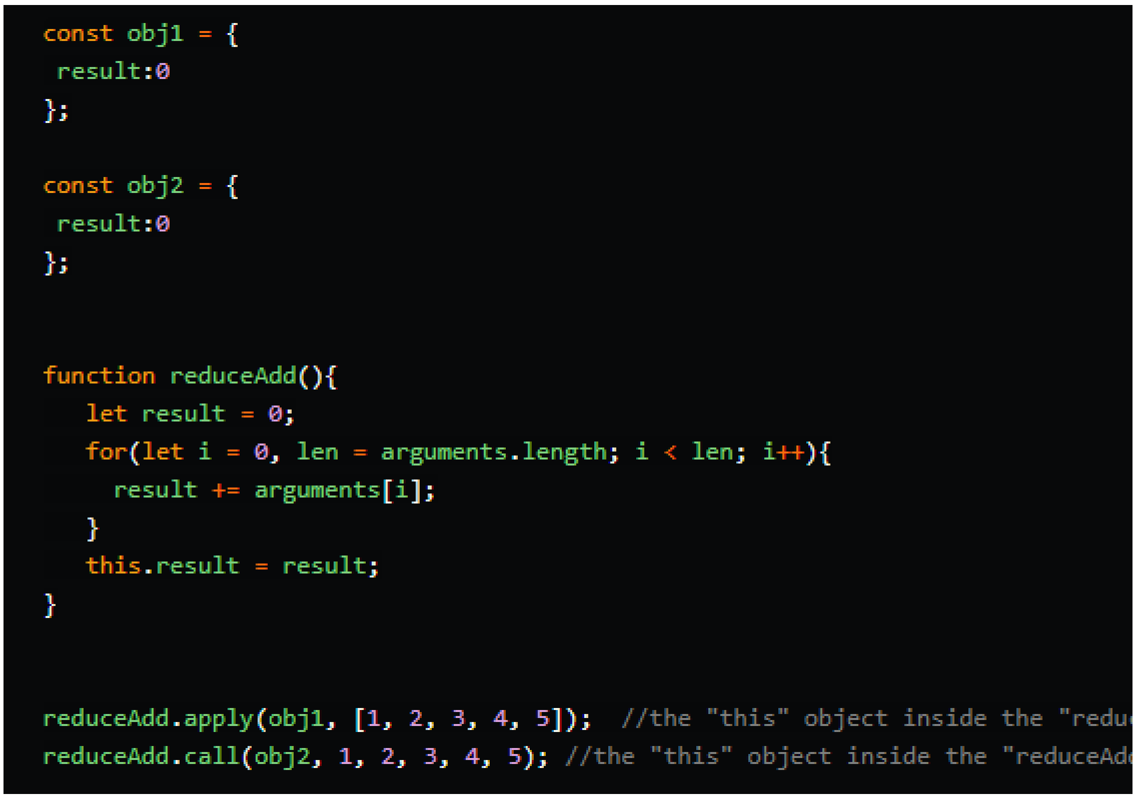
```
const details = {
  name : "Marko",
  getName(){
    return this.name;
  }
}

details.getName(); // returns Marko
// the "this" value inside "getName" method will be the "details" object
```

- **Invocation as a constructor** – If a function was invoked with a new keyword before it then it's called a function constructor. An empty object will be created and this will point to that object.



```
function Employee(name, position, yearHired) {
  // creates an empty object {}
  // then assigns the empty object to the "this" keyword
  // this = {};
  this.name = name;
  this.position = position;
  this.yearHired = yearHired;
  // inherits from Employee.prototype
  // returns the "this" value implicitly if no
  // explicit return statement is specified
};

const emp = new Employee("Marko Polo", "Software Developer", 2017);
```

- **Invocation with the apply and call methods** – If we want to *explicitly* specify the this value or the "owner" object of a function we can use these methods. These methods are available for all functions.

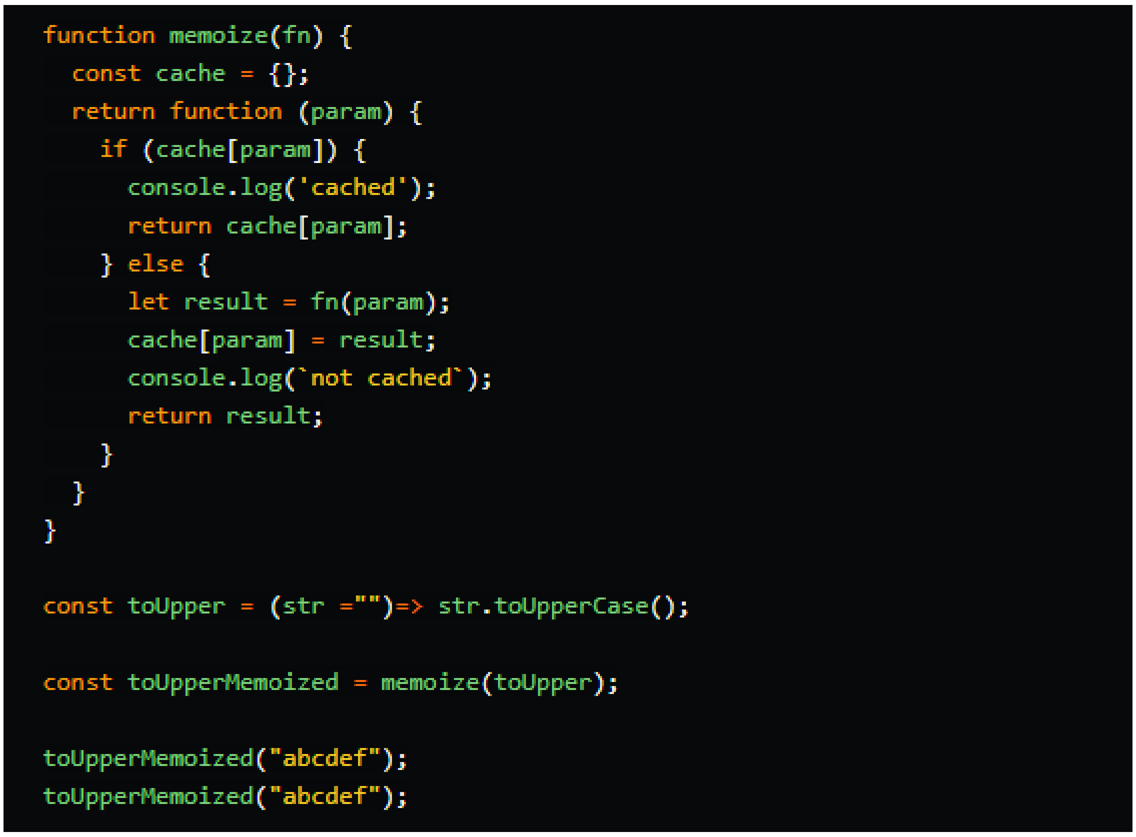


```
const obj1 = {
 result:0
};

const obj2 = {
 result:0
};


function reduceAdd(){
   let result = 0;
   for(let i = 0, len = arguments.length; i < len; i++){
     result += arguments[i];
   }
   this.result = result;
}


reduceAdd.apply(obj1, [1, 2, 3, 4, 5]);  //the "this" object inside the "redu
reduceAdd.call(obj2, 1, 2, 3, 4, 5); //the "this" object inside the "reduceAd
```

67. What is memoization and what's the use it?

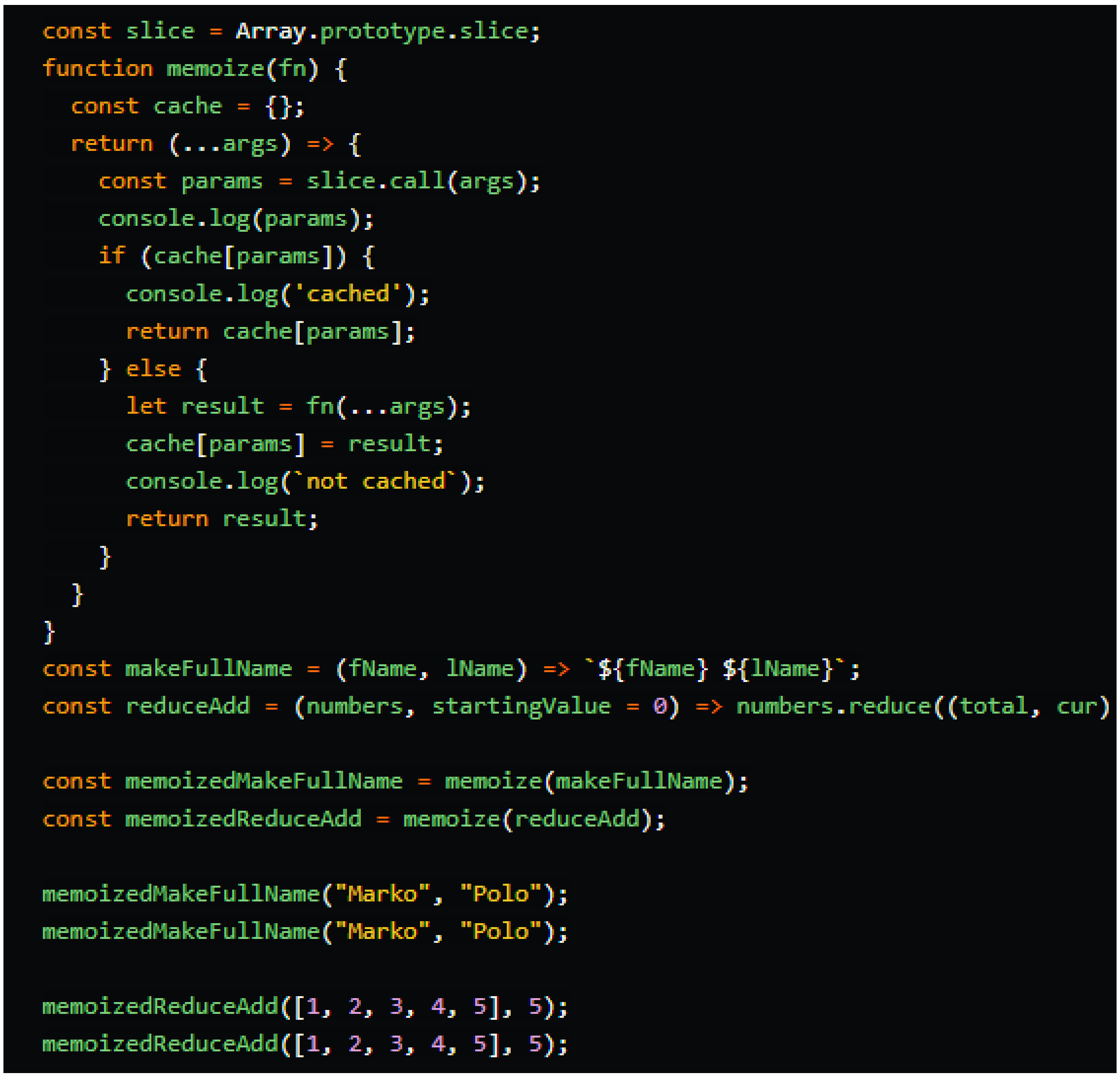
Memoization is a process of building a function that is capable of **remembering** it's previously computed results or values. The use of making *memoization* function is that we avoid the computation of that function if it was already performed in the last calculations with the same arguments. This saves time but has a downside that we will consume more memory for saving the previous results.

68. Implement a memoization helper function.



```
function memoize(fn) {
  const cache = {};
  return function (param) {
    if (cache[param]) {
      console.log('cached');
      return cache[param];
    } else {
      let result = fn(param);
      cache[param] = result;
      console.log(`not cached`);
      return result;
    }
  }
}

const toUpper = (str ="")=> str.toUpperCase();

const toUpperMemoized = memoize(toUpper);

toUpperMemoized("abcdef");
toUpperMemoized("abcdef");
```

This *memoize* helper function only works on a function that accepts one *argument*. We need to make a *memoize* helper function that accepts multiple *arguments*.



```javascript
const slice = Array.prototype.slice;
function memoize(fn) {
  const cache = {};
  return (...args) => {
    const params = slice.call(args);
    console.log(params);
    if (cache[params]) {
      console.log('cached');
      return cache[params];
    } else {
      let result = fn(...args);
      cache[params] = result;
      console.log(`not cached`);
      return result;
    }
  }
}
const makeFullName = (fName, lName) => `${fName} ${lName}`;
const reduceAdd = (numbers, startingValue = 0) => numbers.reduce((total, cur)

const memoizedMakeFullName = memoize(makeFullName);
const memoizedReduceAdd = memoize(reduceAdd);

memoizedMakeFullName("Marko", "Polo");
memoizedMakeFullName("Marko", "Polo");

memoizedReduceAdd([1, 2, 3, 4, 5], 5);
memoizedReduceAdd([1, 2, 3, 4, 5], 5);
```

69. Why does typeof null return object? How to check if a value is null?

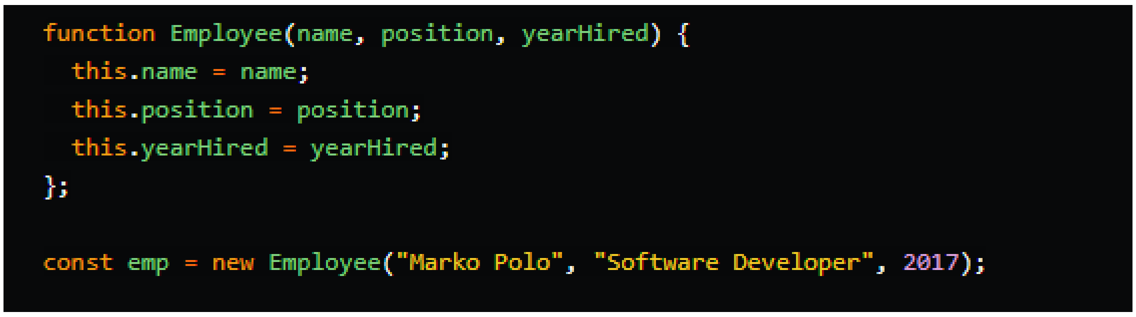
typeof null == "object" will always return true because this was the implementation of null since the birth of **Javascript**. A fix was proposed to change typeof null == "object" to typeof null == "null" but was rejected because it will lead to more bugs.

We can use the === or **strict equality** operator to check if a value is null.

70. What does the new keyword do?

The new keyword is used with constructor functions to make objects in **Javascript**.

Suppose we have an example code below.



```
function Employee(name, position, yearHired) {
  this.name = name;
  this.position = position;
  this.yearHired = yearHired;
};

const emp = new Employee("Marko Polo", "Software Developer", 2017);
```

The new keyword does 4 things.

- Creates an empty object.
- Assigns that empty object to the this value.
- The function will inherit from **functionName.prototype**.
- Returns the this if no Explicit return statement is used.

In the above image, it will first create an empty object { } then it will the this value to that empty object this = { } and add properties to that this object. Because we don't have a explicit return statement it automatically returns the this for us.