

Programming in JavaScript

Section 3: ES6 and JavaScript

3.1 Const and Let Variables

Const and Let variables are a new feature that is introduced into ES6. The syntax is exactly the same as the var variable keyword; however, the behaviour are slightly different and will throw an error depending on the variable type used.

A const variable must be initialised when being declared i.e. we must assign it a value otherwise we would get an error.

A const or constant variable can store a value just like a variable. However, when declaring a const variable we must assign it a value (unlike var which does not require it to be initialised when declared).

```
var name;  
name = "John";  
  
const name; SyntaxError: Missing initializer in const declaration
```

```
const name = "John";
```

The var value can change its value anytime. The const variable on the other hand does not allow you to change the value of the constant variable and will result an error.

```
var name = "John";  
name = "Mary";  
  
const name = "John";  
name = "Mary"; TypeError: Assignment to constant variable.
```

Therefore, when declaring a const variable we must assign it a value when it is declared and we cannot re-assign it a new value at any point in the code hence, as the name indicates, it has a constant value.

The let variable is almost the same as var but similar to const variables there is a difference between var and let variables. A var variable has two scopes a global and a function scope. The let variable has three scopes a global scope, function scope and a block scope.

When we declare a variable outside a function the variable is said to be declared in the global scope. This means any child functions of the code can access this global variable.

```
var global = "I am a global variable";  
  
function sayMyName() {  
  console.log(global);  
};  
  
sayMyName();  
console.log(global);  
  
I am a global variable  
I am a global variable
```

A local scope (or a function scope) is a variable that is only available in the function and is not available outside in the global scope i.e. it is only local to the function it was declared in. The below code will throw a `ReferenceError` on `console.log(local)` because the global scope does not have access to the function variable outside the local scope. Therefore, the variable can only be manipulated inside of the function where it was declared.

```
function sayMyName() {  
  var local = "I am a local variable";  
  console.log(local);  
};  
  
sayMyName();  
console.log(local);
```

ReferenceError: local is not defined

The `let` variable functions exactly the same as the `var` variable i.e. it can be initialised at a later point in time and has both the global and function scope.

```
let global;  
global = "I am a global variable";  
  
function sayMyName() {  
  let local = "I am a local variable";  
  console.log(global);  
  console.log(local);  
};  
  
sayMyName();  
console.log(global);  
// console.log(local);
```

The `console.log(local)` code will throw a `ReferenceError` as seen above example for `var`. As we can see the `let` and `var` variables work exactly the same.

I am a global variable
I am a local variable
I am a global variable

The only difference as mentioned above is that the `let` variable has a third scope which is called the block scope. In JavaScript a block is anything that starts and closes with curly brackets (`{ }`). The code contained in the curly braces is part of that block of code.

The `let` variable inside of a block can only be accessed in the block scope and cannot be accessed outside of the block i.e. in the global scope (as seen below this will return a `ReferenceError`).

```
{  
  let block = "I am a block scope variable";  
  console.log(block);  
};  
  
console.log(block);
```

ReferenceError: block is not defined

When the block code completes its execution the `let` variable no longer exists which is why it gives the `ReferenceError`. This behaviour does not apply to `var` variables as demonstrated in the below example:

```
{  
  var block = "I am a block scope variable";  
  console.log(block);  
};  
  
console.log(block);
```

I am a block scope variable
I am a block scope variable

Finally, it is important to note that a `let` and `var` variable cannot have the same name (no variables can be declared with the same name) and this will throw a `SyntaxError` to inform you that the variable name has already been declared. In the below example the variable name is called 'variable' and this will change to whatever the name of the variable is that has already been declared.

SyntaxError: Identifier 'variable' has already been declared

3.2 Block Scope Functions

When a function is created outside in the global scope and another function with the same name is created in a block scope, the new block scoped function will override the global scoped function.

Remember a block scope is anything that starts and ends with the curly brackets e.g. if statements, while, do while and for each loops.

```
function foo() {
  return "b";
};

{
  function foo() {
    return "bar";
  };
  console.log(foo());
};

console.log(foo());
```

```
{
  function foo() {
    return "bar";
  };
  console.log(foo());
};

function foo() {
  return "b";
};

console.log(foo());
```

In this example the `foo()` function in the block scope has overwritten the `foo()` function in the global scope and will print 'bar' in the console twice.

Note the same does not apply in the vice versa i.e. if we declare a function inside of the block scope first and then in the global scope declare a function with the same name, this will not override the block scope.

```
bar
bar
```

```
{
  function foo() {
    return "foo";
  };

  {
    function foo() {
      return "bar";
    };

    console.log(foo());
  };

  console.log(foo());
};
```

When we have a block inside another block (nested blocks) the same behaviour occurs i.e. whereby the new function with the same name overrides the previous function as seen in the example below:

The `console.log()` in the inner block returns 'bar' to the terminal/console because the inner `foo` function overrides the outer block `foo` function.

However, the `console.log()` in the outer main block returns 'foo' in the terminal/console and is not overwritten by the inner block function.

```
{
  let variable = "foo";
  function foo() {
    return variable;
  };

  {
    let variable = "bar";
    function foo() {
      return variable;
    };

    console.log(foo());
  };

  console.log(foo());
};
```

The reason for this behaviour is because the inner block code i.e. functions will only exist in the inner block execution and will override the outer block function with the same name. Once the inner block execution completes the inner function (code block) no longer exists. Therefore, the function in the outer block is now the only function that exists in the block execution.

Therefore, when working with inner block functions that have functions with the same name as the outer block functions we need to pay special attention to this behaviour of JavaScript. This behaviour also applies to variables within block scope.

```
bar
foo
```

Important Note: If the inner block 'variable' did not have the 'let' keyword then this will overwrite the outer blocks let variable and would end up printing 'bar' twice.

3.3 Optional (Default Value) Parameters

Before ES6 when a function had parameters it was required to pass in all the function parameters within the round brackets when calling the function.

```
function peopleToString(name, age) {  
  return "Your name is: " + name + " and your are " + age + " years old.";  
};  
  
console.log(peopleToString("John", 35));    Your name is: John and your are 35 years old.
```

Now in ES6 if a parameter is not passed into a function the parameters will be replaced by the undefined data types as seen below:

```
console.log(peopleToString());Your name is: undefined and your are undefined years old.
```

ES6 also allows us to create optional parameters. To do this we simply assign a default value to the optional parameter(s) as demonstrated below. This will now use the default value unless the parameter is passed in which will override the default value.

```
function peopleToString(name, age = 30) {  
  return "Your name is: " + name + " and your are " + age + " years old.";  
};  
  
console.log(peopleToString("John"));    Your name is: John and your are 30 years old.  
console.log(peopleToString("John", 35));    Your name is: John and your are 35 years old.
```

3.4 Spread Operator

The spread operator (...) within the function parameters allows the function to receive an unlimited parameters. To have an unlimited parameters we would use the spread operator followed by the name of the parameter. This will act as an array where we can pass in any number of parameters.

```
function people(name, age = 45, ...family) {  
  console.log(family);  
};  
  
people("John Doe", 35, "Julie Doe", "Barry Doe");
```

In this example, every other parameter values passed in after the age parameter will be added into the family array.

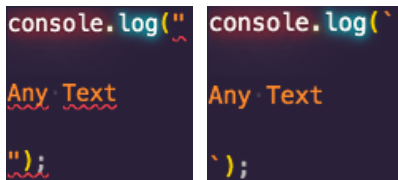
```
[ 'Julie Doe', 'Barry Doe' ]
```

This is a very powerful operator to make function parameters dynamic and have an unlimited amount of parameter that can be passed in based on the scenario. The spread operator in JavaScript is used with arrays. We can loop through the array to do some interesting things with the data.

```
function people(name, age = 45, ...family) {  
  console.log("Your name is " + name + " and you are " + age + " years old. Your family members are:");  
  for(var i = 0; i < family.length; i++) {  
    console.log(family[i]);  
  };  
};  
  
people("John Doe", 35, "Julie Doe", "Barry Doe");  
  
Your name is John Doe and you are 35 years old. Your family members are:  
Julie Doe  
Barry Doe
```

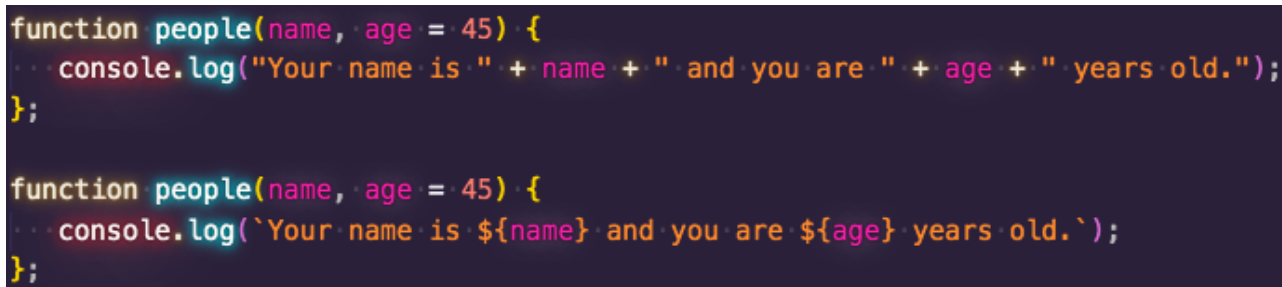
3.5 Template Literal

A template literal is a new powerful type of string which has many benefits over the regular string data type. To create a template literal we use double back ticks (``) instead of the single or double quotations.

The image shows two side-by-side code snippets. The left snippet is `console.log("Any Text");` and the right snippet is `console.log(`Any Text`);`. Both snippets are highlighted in a dark-themed editor. The output of the left snippet is a single line of text, while the output of the right snippet is also a single line of text, demonstrating that both can handle simple strings.

A regular string does not allow you to add empty new lines which will end up as a `SyntaxError`. The template literal on the other hand does not have this problem and will print the new lines.

Strings require the add operator (+) to concatenate strings with variables. This syntax can look very unusual or unreadable for humans. Template literal overcomes this by using a special syntax of a dollar sign and curly brackets (`${ }`) which contains the variable name inside of the curly brackets in order to concatenate to the string. This results in a more easy syntax to write and read as demonstrated in the examples below:

The image shows two function definitions side-by-side. The left function uses string concatenation: `function people(name, age = 45) { console.log("Your name is " + name + " and you are " + age + " years old."); }`. The right function uses template literals: `function people(name, age = 45) { console.log(`Your name is ${name} and you are ${age} years old.`); }`. Both functions are highlighted in a dark-themed editor.

3.6 Binary Numbers

ES6 introduces the use of binary numbers inside of JavaScript. Binary numbers are part of the numerical binary system. In the real world we use the decimal numeric system which compose numbers with digits between 0 to 9. In the binary number system the numbers are composed of 0s and 1s.

To use a binary number in JavaScript we simply use `0b` followed by the binary numbers for example the table below shows the binary number for 1 to 5 as an example:

| Binary Number | Decimal Number Equivalent |
|---------------|---------------------------|
| 0b001 | 1 (i.e. 1.0) |
| 0b010 | 2 (i.e. 2.0) |
| 0b011 | 3 (i.e. 3.0) |
| 0b100 | 4 (i.e. 4.0) |
| 0b101 | 5 (i.e. 5.0) |

Mathematical operators can be used with binary numbers and we can also perform math operations even when mixing both the binary number system with the decimal number system.

```
console.log(0b101 * 0b010); 10
console.log(0b101 * 3);      15
```

Binary numbers must start with 0b followed by numbers that are between 0 and 1. Any number above 1 or below 0 will result in a SyntaxError.

3.7 ES6 New JSON Features

```
let name = "John Doe";
let age = 20;

people = {
  name: name,
  age: age
};
```

In ES5 to assign a variable to a JSON object property's value we required to write the object property name followed by a colon (:) followed by the variable name. Where the property name and the variable share the same name this causes a small code repetition.

```
let name = "John Doe";
let age = 20;

people = {
  name,
  age
};
```

ES6 introduces a shorthand whereby we can emit the variable name as the value if it shares the same name as the object property name. This results in a much more neat and readable code. The object properties takes the values from the variable defined above automatically via the variable name.

```
let animal = {
  type: "Dog",
  sound: function() {
    console.log("bark");
  }
};

animal.sound();
```

In ES5 to create a function within an object we had to create a property and then assign the value to a function. To call on the object function we would write the object name followed by the period (.) followed by the property name containing the function.

```
let animal = {
  type: "Dog",
  sound() {
    console.log("bark");
  }
};

animal.sound();
```

ES6 introduces a new way to work with functions inside of a JSON object which make it more simpler and readable i.e. you no longer need to declare a property name followed by the function() keyword. Instead you treat the property name as the function instead.

These are the two new features introduced in ES6 when working with JSON objects i.e. the object property shorthand and object functions syntax.