

JavaScript Advanced

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Topics

1. JavaScript functions as first-class objects
2. Self-invoking function
3. Function scope
4. What is Closure? (Closure examples)
5. Why use Closure? (Closure usage examples)
6. Global object, non-global object, and “this”

JavaScript Functions as First-class Objects

A function is a first-class JavaScript Object (like String or Number object)

- Functions are a bit like Java methods (like in Java)
 - > They contain statements for performing some tasks
 - > They have arguments and return values
- A function is a first-class object in JavaScript (unlike in Java 7)
 - > Can be considered as a descendant of Object object
 - > Can do everything a regular JavaScript object can do such as having properties and their values
 - > Function objects can have other function objects as methods
- A function behaves like a first-class object (unlike in Java 7)
 1. It can be saved into a variable (like String object)
 2. It can be passed as an argument to another function
 3. It can be returned as a object

Function Object as First Class Object

- #1: Function object can be assigned to a variable

```
// Define a function – function object gets created
function myMethod(x) {
  console.log("myMethod is invoked with " + x);
}
```

```
// Save function object into a variable
var my_function_var = myMethod;
```

```
// Invoke the function
my_function_var("Function as a variable");
```

```
// Save anonymous function into a variable
var my_function_var2 = function (something){
  console.log("anonymous function is invoked with " + something);
};
```

```
// Invoke the function
my_function_var2("Function as a variable");
```

Function Object as First Class Object

- #2: Function object can be passed as an argument to another function

```
// Define a function – function object gets created
function myFunction(x) {
    console.log("myMethod is invoked with " + x);
}
```

```
// Define another function, which takes an argument
function yourMethod(y) {
    y("Function as an argument");
}
```

```
// Pass your function object as an argument
yourMethod(myFunction);
```

Function Object as First Class Object

- #3: Function object can be returned as a return value

```
// Define a function – function object gets created
function myFunction(x) {
  console.log("myFunction is invoked with " + x);
}
```

```
// Return function object as a return value
function hisFunction() {
  return myFunction;
}
```

```
// Call function, which returns myFunction function
var y = hisFunction();
```

```
// Invoke the function
y("Function as a return value");
```

Lab:

Exercise 1: Functions as First-class Objects

4266_javascript_advanced.zip



Self-invoking Function

What is a Self-invoking Function?

- Typically you define a function and then invoke the function

```
// Declare a function first
function myFunction(something) {
    console.log("Hello " + something);
}
```

```
// Then invoke the defined function
myFunction("JPassion"); // Hello JPassion
```

- Self-invoking function lets you define and invoke a function at the same time
 - > Self-invoking function is typically anonymous (because you don't need to reference it by name)
 - > Sometimes called immediately-invoked function

```
// Self-invoking anonymous function - define and invoke function at the same time
(function (something) {
    console.log("Hello " + something);
})("JPassion"); // Hello JPassion
```

Self-Invoking Function Usage example #1

- To avoid global variables conflict
- Problem code:
 - > \$ is used both in jquery.js and prototype.js
- Code that solves global conflict of \$ between jquery.js & prototype.js

```
<script type="text/javascript" src="jquery-1.7.2.js"></script>  
<script type="text/javascript" src="prototype.js"></script>  
<script type="text/javascript">>
```

```
// Create a plugin - there is no $ namespace conflict with  
// prototype.js since $ is used in private scope here.  
(function($) {  
    $.fn.sayGreeting = function() {  
        this.prepend("Hello, ");  
    };  
})(jQuery);
```

Self-Invoking Function Usage example #2

- To substitute “setInterval(..)”
- Problem code:
 - > If you are in a situation where you want to run a piece of code repeatedly, your first thinking might be using setInterval(..) - The problem is that doSomething() function gets called repeatedly irrespective of whether doSomething() function actually finished doing what it is supposed to do

```
setInterval(doSomething, 3000);
```

- Code that uses self-invoking function
 - > This code will also repeat itself again and again with one difference. setTimeout will never get triggered unless the task is finished.

```
(function doSomething(){  
  // Do some task  
  
  // Wait until the above task is done then schedule the task again in 3 seconds  
  setTimeout(doSomething, 3000);  
})();
```

Lab:

Exercise 2: Self-invoking Function 4266_javascript_advanced.zip



Function Scope

Function Scope

- Variables defined inside a function cannot be accessed from anywhere outside the function, because they are defined only in the scope of the function
 - > They are called “local scope” variables
- However, a function can access all variables and functions defined in the same scope the function is defined
 - > A function (inner function) defined inside another function (outer function) can also access all variables defined in it's outer function and any other variable to which the outer function has access
 - > A function defined in the global scope can access all variables and functions defined in the global scope

Lab:

Exercise 3: Function Scope 4266_javascript_advanced.zip



What is Closure? (Closure Examples)

What is a Closure?

- A formal description
 - > A "closure" is an expression (typically a function) that can have "free variables" together with an environment that binds those variables (that "closes" the expression) - In computer programming, the term "free variable" refers to variables used in a function that are not local variables nor parameters of that function
- An informal description
 - > A "closure" gets created when an inner function X is declared/defined (note that is "declared/defined" not "invoked/executed") in which, when the function gets executed, it is allowed to access variables and other declared inner functions, within its outer (parent) function, in other words, in the same scope the function X is declared

Closure Example

- When the inner function `bar()` is declared, which occurs when outer function `foo()` gets executed, a closure is formed, in which when the inner function `bar()` gets executed, it can access variable `x` that is declared in the same scope of `bar()`

```
function foo() {  
  var x = 10;  
  function bar() {  
    console.log(x);  
  };  
  return bar;  
}
```

```
// "foo" returns inner function  
// "bar" and this returned function can  
// access variable "x", which is set to 10
```

```
var returnedFunction = foo(); // outer function foo() gets executed
```

```
// let's define a global variable "x"  
var x = 20;
```

```
// execution of the returned function  
returnedFunction(); // 10, but not 20
```

Lab:

**Exercise 4: What is Closure?
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Why Use Closure? (Closure Usage Examples)

Why Use Closure?

- Can reduce the amount and complexity of code
- Can create code that is simply not possible (or too complex) to create without using Closure
- Examples of Closure-enabled code
 - > Make variables private
 - > Indexing in a loop
 - > Timers

Closure Usage Example #1: Make Variables Private

- JavaScript doesn't have special syntax for private members, but you can make variables private using a closure

```
function Person() {  
  // private properties and methods  
  var name = 'jPassion';  
  var myPrivateGetAgeMethod = function () {  
    return 20;  
  }  
  
  this.getPersonallInfo = function() {  
    return name + " is " + myPrivateGetAgeMethod();  
  };  
}  
var myPerson = new Person();  
  
// 'name' is undefined, it's private  
console.log(myPerson.name); // undefined  
  
// 'myPrivateGetAgeMethod' is undefined, since it it's private  
//console.log(myPerson.myPrivateGetAgeMethod());  
  
// public method has access to private members  
console.log(myPerson.getPersonallInfo()); // "jPassion is 20"
```



name and myPrivateGetAgeMethod properties cannot be accessed directly

Lab:

**Exercise 5.1: Why use Closure?
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Indexing a loop example #1

- This is a classic problem in JavaScript

```
function addLinksExample1() {
  for ( var i = 0, link; i < 5; i++) {
    link = document.createElement("a");
    link.innerHTML = "LinkWithoutClosure " + i + "<br/>";

    // Indexing a loop without closure
    //
    // Inner anonymous function is defined with
    // the value of variables of outer function
    // when the outer function is executed.
    link.onclick = function() {
      alert(i);
    };
    document.body.appendChild(link);
  }
}
addLinksExample1();
```

Example #2: Indexing a loop Example 2

- Use another closure inside a self-invoking function

```
function addLinksExample2() {  
  for ( var i = 0, link; i < 5; i++) {  
    link = document.createElement("a");  
    link.innerHTML = "LinkWithClosure " + i + "<br/>";  
  
    // Indexing a loop with a closure  
    //  
    // Outer function is self-invoking function.  
    // In other words, outer function is defined and invoked.  
    // The outer function gets invoked with correct index, which  
    // will be the value that inner function takes when it gets executed.  
    link.onclick = (function(value) {      // Outer function  
      return function() {                  // Inner function  
        alert(value);  
      }  
    })(i);  
    document.body.appendChild(link);  
  }  
}  
addLinksExample2();
```

Lab:

Exercise 5.2, 5.3:

closure_usage_index_loop_*.html
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**Global Object &
Non-global Object &
“this”**

Global Object

- All global variables and functions become properties of the global object
 - > The global object is the owning object of the global variables and global functions
 - > They are in “global” scope
- In browsers, the “window” object is the global object

What does “this” refer to?

- In JavaScript, “this” refers to the object that a function is a method of
- In global scope, it refers to global object

```
<script type="text/javascript">  
  // Global variable, it is a property of global object  
  var myGlobalVariable = "John";  
  
  // Global function, it is a property of global object  
  function myGlobalFunction() {  
  
  }  
  
  // Display global object, “window” object in browser  
  console.dir(this);  
</script>
```

What does “this” refer to?

- In non-global scope, it refers to non-global object

```
// to personObj variable.
var personObj = {
    firstname : "John",
    lastname : "Doe",
    age : 50,
    tellYourage : function() {
        console.log("The age is " + this.age);
        console.dir(this); // "this" points to personObj instance
    },
}

personObj.tellYourage();
```

Lab:

Exercise 6: Global Object
4262_javascript_basics.zip



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