JavaScript Basics

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Topics

- What is and Why JavaScript?
- How and Where do you place JavaScript code?
- JavaScript language
  - Variables, statements, code blocks, control flow
- JavaScript functions
  - Defining functions – 3 different ways
  - Calling functions
  - Function as a method
- JavaScript data types
- JavaScript objects
  - JavaScript object is a Hash
  - 3 different ways of creating a JavaScript object

What is and Why JavaScript?

What is JavaScript?

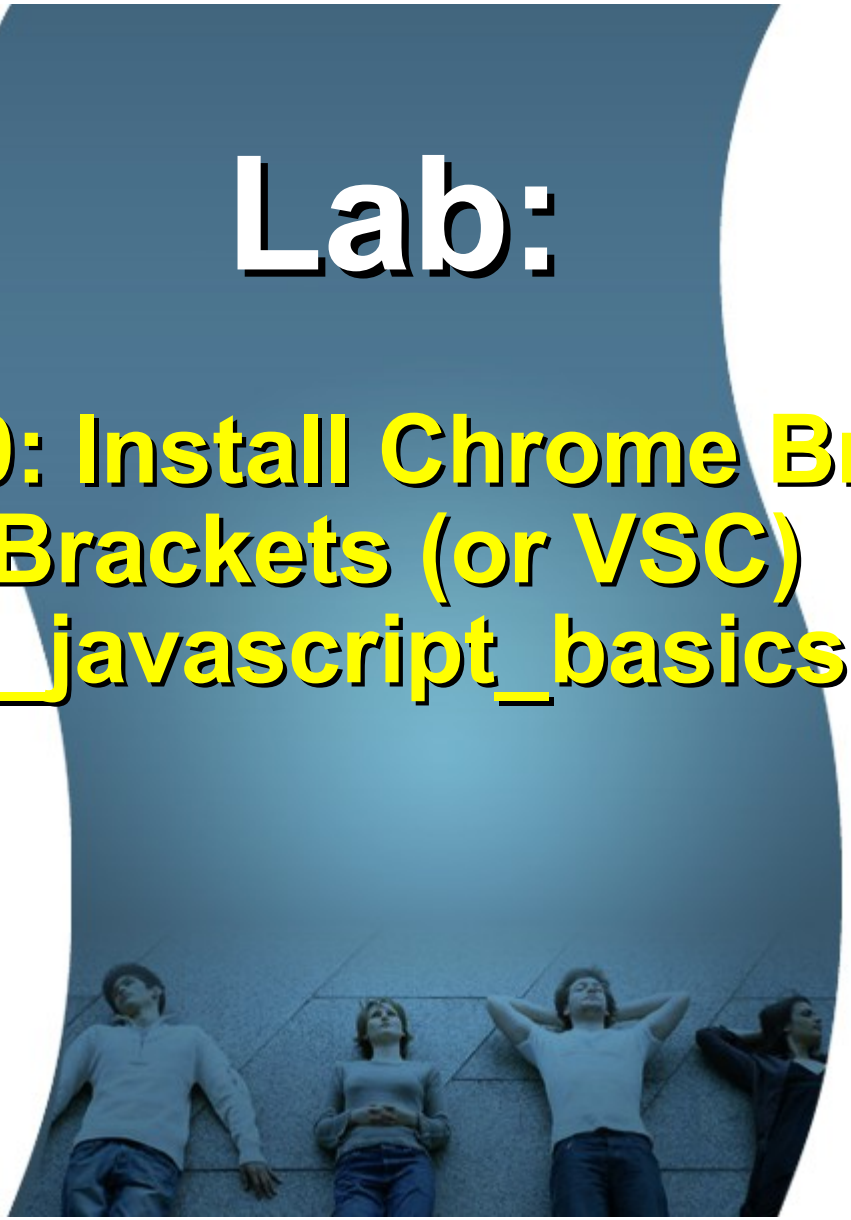
- Scripting language
  - Scripting language is a lightweight programming language
- Used to add interactivity to HTML pages
  - JavaScript code could be embedded directly into HTML pages or in a separate file, which is referenced from the HTML page
- JavaScript is traditionally used as client-only (within HTML page) language – now slowly gaining some traction as a standalone and server side language as well
  - Example: Node.js
  - Our focus in this codecamp is on the client side only

What can JavaScript do?

- JavaScript gives HTML page writers a programming tool for adding behavior
  - JavaScript can put dynamic text into an HTML page
  - JavaScript can react to events
  - JavaScript can read and write HTML elements
  - JavaScript can be used to validate input data
  - JavaScript can be used to detect the browser type & version
  - JavaScript can be used to detect whether a browser support a feature or not
  - JavaScript can be used to animate HTML elements
  - ...

Lab:

Exercise 0: Install Chrome Browser & Brackets (or VSC)
4262_javascript_basics.zip



How and Where Do You Place JavaScript Code (in an HTML page)?

How to put JavaScript code into an HTML page?

- Use the <script> tag along with type attribute
- Scripts can be in the either <*head*> section and/or <*body*> section

```
<html>
<head>
<script type="text/javascript">
...
</script>
</head>
<body>
<script type="text/javascript">
...
</script>
</body>
</html>
```

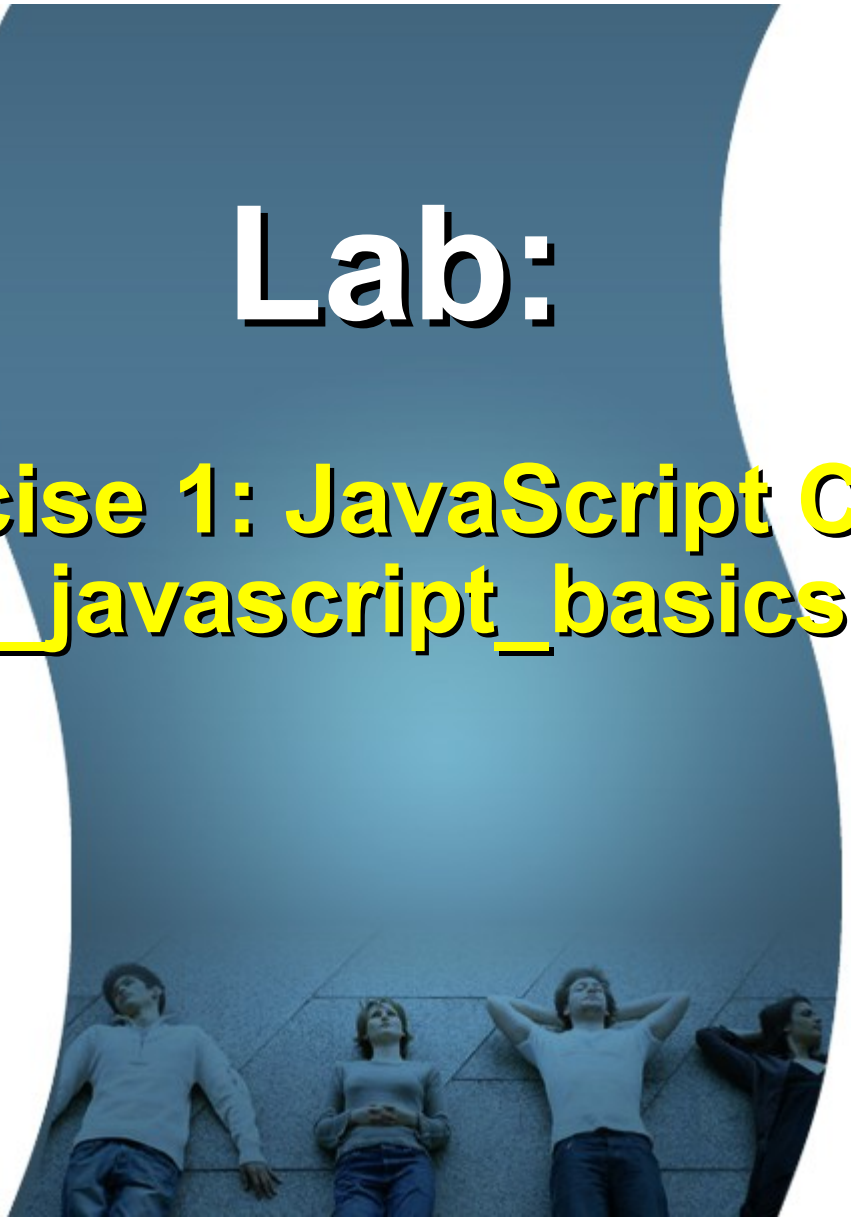
Referencing External JavaScript File

- JavaScript code can in a separate script file
- Script file can be provided locally or remotely
- Accessible via *src* attribute

```
<html>
<head>
<script language="JavaScript"
        type="text/javascript"
        src="http://somesite/myOwnJavaScript.js">
</script>
<script language="JavaScript"
        type="text/javascript"
        src="myOwnSubdirectory/myOwn2ndJavaScript.js">
</script>
```

Lab:

Exercise 1: JavaScript Code 4262_javascript_basics.zip



JavaScript Language:
Variables

JavaScript Variables

- You create a variable with or without the var keyword (scope will be different, however – explained in the following slide)

```
var strname = <some value>;
strname = <some value>;
```

- Variable names are case sensitive
  - *yes* and *Yes* are two different variables
- Variable names must begin with a letter, the $ character, or the underscore character

```
myname, my_name, $myname
```

- If you declare a variable without assigning any value to it, its type is *undefined*

```
var myvar;          // undefined
```

JavaScript Variable Scope

- In JavaScript, the variable scope is aligned with a function
  - Not with a block as in the case of C or Java
- Global scope variables (or global variables)
  - If you declare a variable outside a function, it is in global scope
  - All functions on the same page can access any global variables
  - The usage of global variables are discouraged because it is prone to be overridden accidentally
- Local scope variables (or local variables)
  - When you declare a variable with “var” and within a function, the variable can only be accessed within that function - local scope

Usage of “var” keyword & Variable Scope

- In the global scope, there's no difference between “var x” and “x” – they are both in global scope
- In the local scope – meaning inside a function, then "var" will create a local variable

```
// These are both global variables
var foo = 1;
bar = 2;

function() {
    var foo = 1; // Local
    bar = 2;     // Global

    // Execute an anonymous function
    (function() {
        var wibble = 1; // Local
        foo = 2; // Inherits from scope above (creating a closure)
        moo = 3; // Global
    }())
}
```

Lab:

Exercise 2: Variables
4262_javascript_basics.zip

JavaScript Language:
Statements & Code Blocks

JavaScript Statements

- JavaScript statements are "instructions" to be "executed"
  - JavaScript statements are often called JavaScript code
- Semicolons separate JavaScript statements (it is optional, however)

```
var x = 20;
var y = 30;
document.write("<h1>This is a heading</h1>");
document.write("<p>This is a paragraph.</p>");
document.write("<p>This is another paragraph.</p>");

// The alert message below gets executed when the page is loaded
alert("Hello Boston! This message gets displayed when a page is loaded.");

function displaymessage() {
    alert("Hello World! ");
}
```

JavaScript Code Blocks

- JavaScript statements can be grouped together in a code block, inside curly brackets {...}
- The most common form of code block is a function

```
function displaymessage() {
    var x = 20;
    var y = 30;
    alert("Result = " + (x+y));
}
```

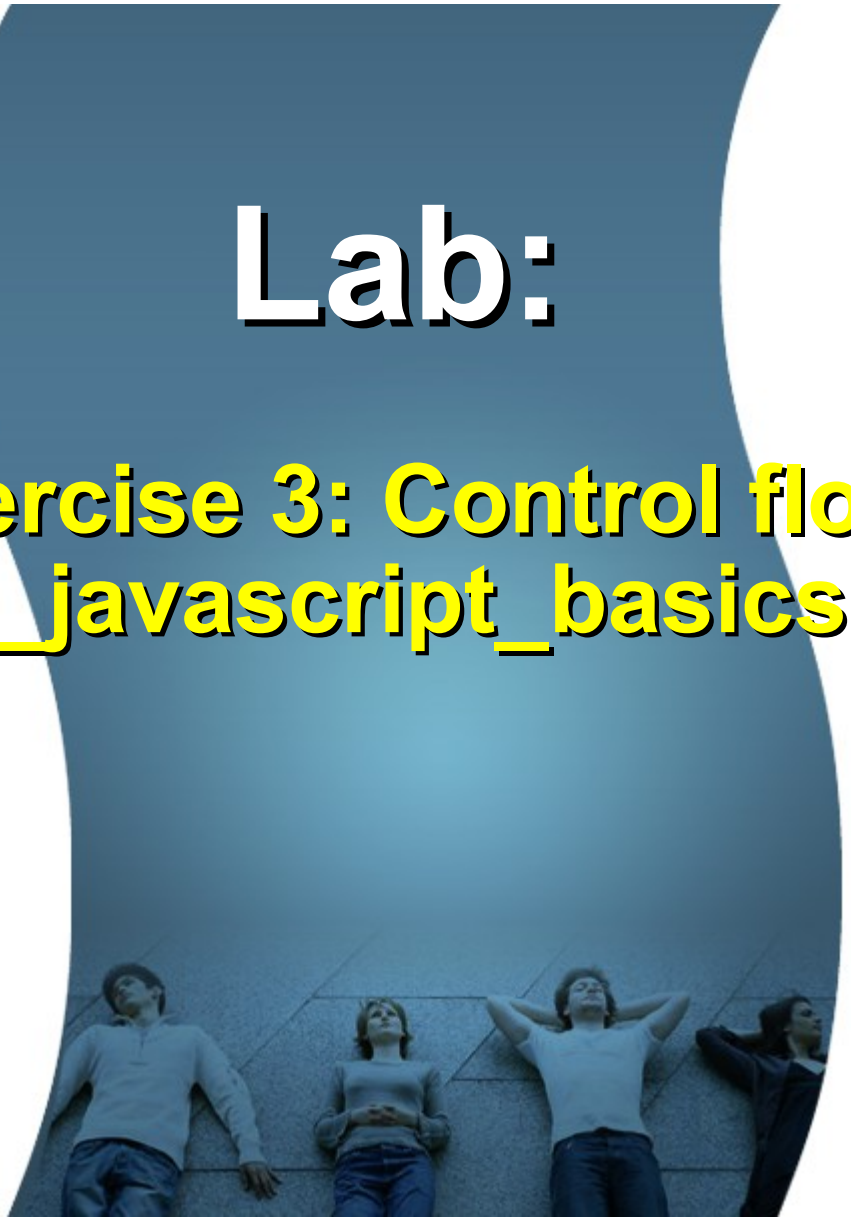
JavaScript Language:
Control flow

JavaScript Language

- Conditional statement
  - if, if.. else, switch
- Loop
  - for loop, while loop, do-while loop
- try...catch
- throw

Lab:

Exercise 3: Control flow
4262_javascript_basics.zip



JavaScript Functions:
Defining Functions

What is a Function?

- A function is a JavaScript procedure—a set of statements that performs a task or calculates a value
- A function can take 0 or more named parameters
- The function body can contain as many statements as you like, and can declare its own variables which are local to that function
  - Variables with “var” keyword within the function are local scope variables
  - Variables without “var” keyword within the function are global scope variables
- The return statement can be used to return a value at any time, terminating the function

Function Definitions (Declarations)

- A function can be defined (also called “declared”) in several ways
  1. Through function statement
  2. Through function expression
  3. Through function constructor (rarely used)
- When a function is declared, internally a function object is created and that function object is assigned to a property of the owning object
  - The owning object of the top-level function is “window” for browser
- Note that function definition (declaration) is just that – it is NOT function invocation (function execution)
  - In other words, a function object gets created but it is not executed

#1: Through function Statement

- A function statement is made of *function* keyword, followed by
  - The optional name of the function
  - A list of arguments to the function
  - The JavaScript statements enclosed in curly braces, { }
- A function statement is a genuine JavaScript statement
  - Execution of the function statement creates a function object
- A function object, once created, is assigned to a property of owner object – the property name is the same as function name

```
// Declare a named function as a function statement.
// “myNamedFunction” property of owner object points to
// newly created function object.
function myNamedFunction(arg1, arg2) {
    console.log(arg1, arg2);
}
```

#2: Through function Expression

- A function can be defined as a function expression
  - The function has to be assigned to a variable or can be passed as an argument in this case
- A function expression can be anonymous (name is optional)

```
// Create a function object via anonymous function expression and
// assign it to myFunction1 variable
var myFunction1 = function(something){
    console.log(something);
}
```

- A function object is created and then assigned to the property of the owning object – the property name is the variable name, *myFunction1* in the example above

#3: Through function Constructor

- The *Function()* constructor expects any number of string arguments
- The last argument is the body of the function - it can contain arbitrary JavaScript statements, separated from each other by semicolons

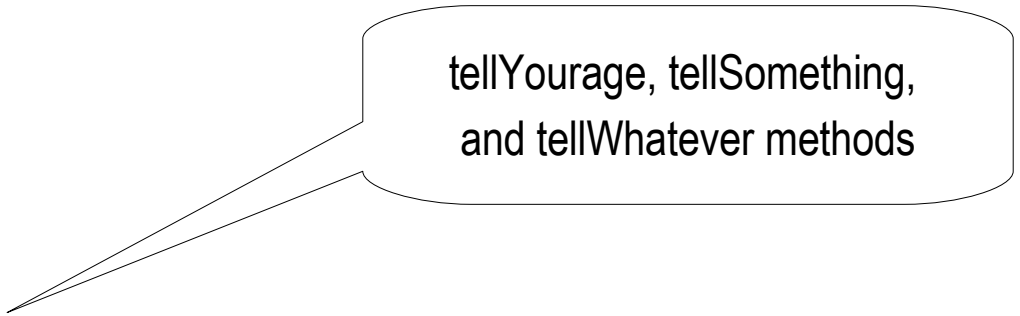
```
// Create a function through Function Constructor
var my_func = new Function("x", "y", "return x+y;");

/* This is the same as above
function my_func(x, y){
   return x+y;
}
*/

my_func(10,20);
```

JavaScript Functions:
A Function as a Method

A Function as a Method

- A property of a JavaScript object whose value is a function object is called a method

```
// Declare a function
function functionDefinedSomewhere(something) {
    console.log(something)
}

// Create a JavaScript object
var myPerson = {
    firstname : "John",
    lastname : "Doe",
    age : 50,
    tellYourage : function() { // Anonymous function without argument
        console.log("The age is " + this.age);
    },
    tellSomething : function(something) { // Anonymous function with an argument
        console.log(something);
    },
    tellWhatever : functionDefinedSomewhere // Named function
}
```



JavaScript Functions: Function Invocation (Function execution)

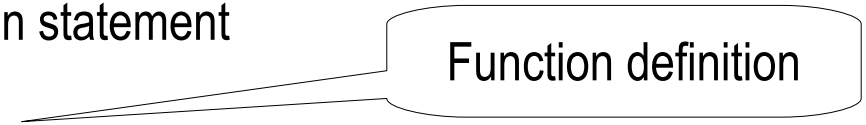
Function Invocation (Function Execution)

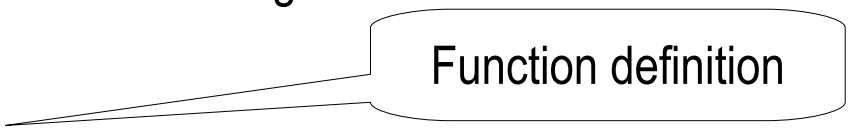
- Defining a function does not invoke(execute, call) it
  - Defining the function simply creates a function object and assigns it to a property of owning object
  - In order to execute the function (perform some task), you have to explicitly invoke it

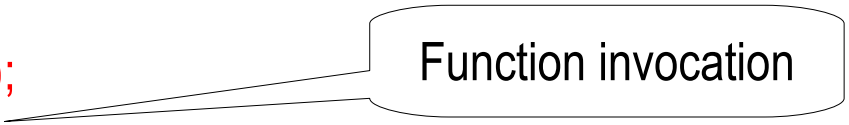
- A function gets executed only by an invocation (or by an event if the function is configured as event handler)
  - In order to prevent the browser from executing a script as soon as the page is loaded, you want to write your script as a function
- You may invoke a function from anywhere within a page (or even from other pages if the function is embedded in an external .js file)

Function Invocation (Function Execution)

```
<script type="text/javascript">

// Declare/define a named function as a function statement
function myNamedFunction(something) {
    console.log(something);
}

// Declare/define an anonymous function expression and assign it to
// myFunction1 variable
var myFunction1 = function(something){
    console.log(something);
}

var myFunction2 = myNamedFunction;

// Invoke/execute/call functions
myNamedFunction("Life is good!");
myFunction1("Hello!");
myFunction2("Goodbye!");

</script>
```





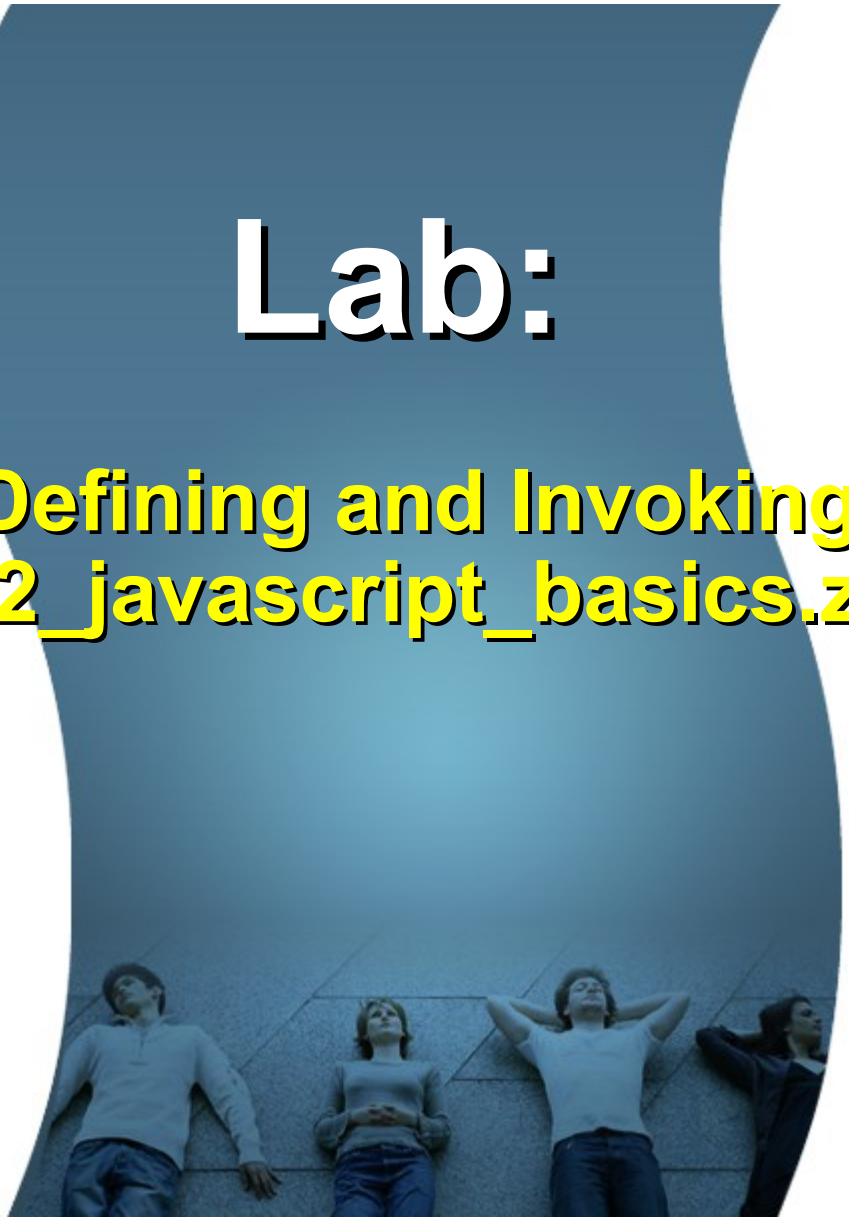


Function Invocation via Event

```
<html>
<head>
<title/>
<script type="text/javascript">
   // If alert("Hello world!!") below had not been written within a
   // function, it would have been executed as soon as the page gets loaded.
   function displaymessage() {
       alert("Hello World!")
   }
</script>
</head>

<body>
<form>
<input type="button" value="Click me!"
        onclick="displaymessage()" >
</form>
</body>
</html>
```

Lab:

Exercise 4: Defining and Invoking functions
4262_javascript_basics.zip



JavaScript Data Types

JavaScript Data Types

- JavaScript is a loosely typed or dynamic type language
  - You don't have to declare a type of a variable
  - The type gets determined automatically when the program gets executed
  - You can use a same variable as different types

```
var foo = 35;            // foo is Number type
var foo = “passion”;     // foo is String type
var foo = true;          // foo is Boolean type
```

JavaScript Data Types

- There are 7 data types
- 6 data types are primitive types
  - Boolean, Null, Undefined, Number, String, Symbol
  - Primitive types define immutable values (values, which are incapable of being changed) - these immutable values of the primitive types are valled as "primitive values"
- The remaining data type is Object type

Primitive types

- Boolean type
  - Can have two values: *true* or *false*
- Null type
  - Has exactly one value: *null*
- Undefined type
  - A variable that has not been assigned a value has the valued *undefined*
- Number type
- String type
- Symbol type (introduced in ECMAScript 6)
  - Unique and immutable

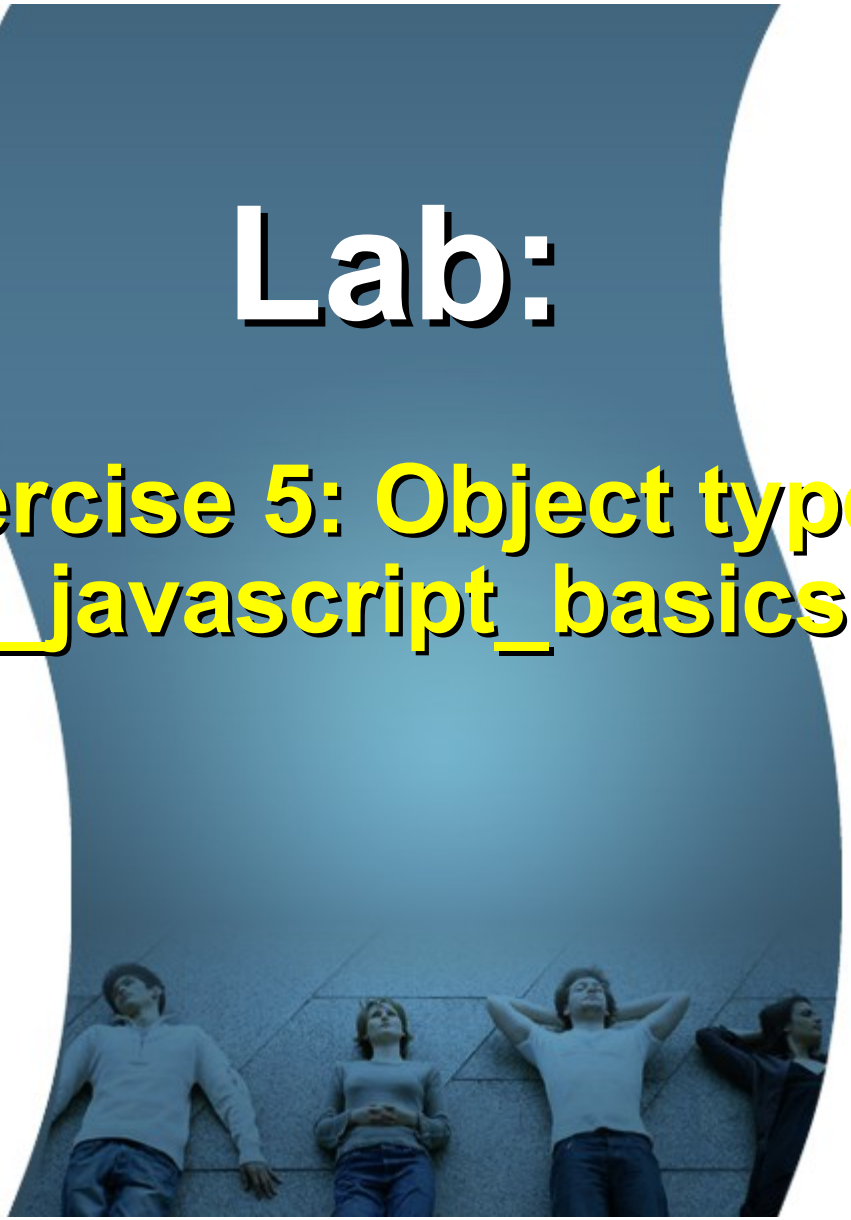
Object Type

- A JavaScript object has properties and methods
  - Example: *String* JavaScript object has *length* property and *toUpperCase()* method

```
<script type="text/javascript">

var txt="Hello World!"
document.write(txt.length)
document.write(txt.toUpperCase())

</script>
```

Lab:

Exercise 5: Object types
4262_javascript_basics.zip



JavaScript Objects:
Hash (Associative Array)

JavaScript Object is a Hash

- A JavaScript object is essentially a hash (an associative array) with property-name/value pairs
  - Property name has to be unique
  - It is like a Map in Java
  - There is no exception - even a function object is a hash

```
{
    name1: value1,
    name2: value2,
    name3: value3,
    ....
    nameN: valueN
}
```

How to Refer Property Names

- The following two lines of code are semantically equivalent

```
myObject.myfield = “something”;
myObject['myfield'] = “something”;
```

- [..] notation can take variable

```
var x = “test”;
myObject[x] = “Passion!”;
console.log(myPerson.test);  // Passion!
```

Value of a Property Can Be function object

```
var myPerson = {
        firstname: "John",
        lastname: "Doe",
        age: 50,
        tellYourage: function () {        // Anonymous function without argument
             alert("The age is " + this.age );
        },
        tellSomething: function(something) {  // Anonymous function with an argument
             alert(something);
        },
        tellWhatever: functionDefinedSomewhere  // Named function
 }

function functionDefinedSomewhere(something){
        alert(something)
}

myPerson.tellYourage();
myPerson.tellSomething("Life is good!");
myPerson.tellWhatever("Hello");
```

The value of the tellSomething property is a function object

Value can be another Java Script Object

```
var myVar = {
    count: 20,
    person: myPerson  // myPerson was defined in previous slide
}

myVar.person.tellSomething("Life is REALLY REALLY good!");
```

JavaScript Object vs. Java Object

- Similarities
  - Both has properties and methods
- Differences
  - JavaScript object can be dynamically typed (while in Java, object is statically typed)
  - In JavaScript, properties and methods can be added dynamically to a JavaScript object during runtime (while in Java, properties and methods need to be defined at compile time)
  - In JavaScript, a method is defined by assigning a function object to a property

JavaScript Objects; 3 Different Ways of Creating JavaScript Objects

3 Ways of Creating Your Own JavaScript Objects

1. Create an object instance as Hash Literal (You have already seen this) – preferred
2. Define a function as a Constructor first and then create an instance of an object from it
3. Create a direct instance of an object by using built-in constructor of the built-in "*Object*" object

Option #1: Creating JavaScript Object as a Hash Literal

```
// Create JavaScript object as a Hash Literal then assign to “personObj”
var personObj = {
        firstname: "John",
        lastname: "Doe",
        age: 50,
        tellYourage: function () {
              alert(“The age is ” + this.age );
        }
        tellSomething: function(something) {
              alert(something);
        }
 }

// Call methods of “personObj” JavaScript object
personObj.tellYourage();
personObj.tellSomething(“Life is good!”);
```

Option #2: Create from a Constructor Function (Template)

- A function defines the structure of a JavaScript object – it plays a role of a template

```
// Define a Constructor function
function Person(firstname,lastname,age,eyecolor){
    this.firstname=firstname;
    this.lastname=lastname;
    this.age=age;
    this.tellYourage=function(){
            alert("This age is " + this.age);
    }
}

// Continued in the next slide
```

Option #2: Create from a Constructor Function (Continued)

- Once you have a Constructor function (as you saw in the previous slide), you can create new instances of JavaScript object using *new* keyword

```
myFather=new Person("John","Doe",50,"blue");
myMother=new Person("Sally","Rally",48,"green");
```

- You can then add new properties and functions to new objects

```
myFather.newField = “some data”;
myFather.myfunction = function() {
    alert(this["fullName"] + ” is ” + this.age);
}
```

Option #3: Create a Direct Instance of a JavaScript Object from "Object" object

- By invoking the built-in constructor for the *Object* object

```
// Initially empty with no properties or methods
personObj=new Object();  // same as personObj = { }
```

- Add properties to it

```
personObj.firstname="John";
personObj.age=50;
```

- Add an anonymous function to the *personObj*

```
personObj.tellYourage=function(){
    alert("This age is " + this.age);
}
// You can call then tellYourage function as following
personObj.tellYourage();
```

Option #3: Create a Direct Instance of a JavaScript Object from "Object" (Continued)

- Add a pre-defined function

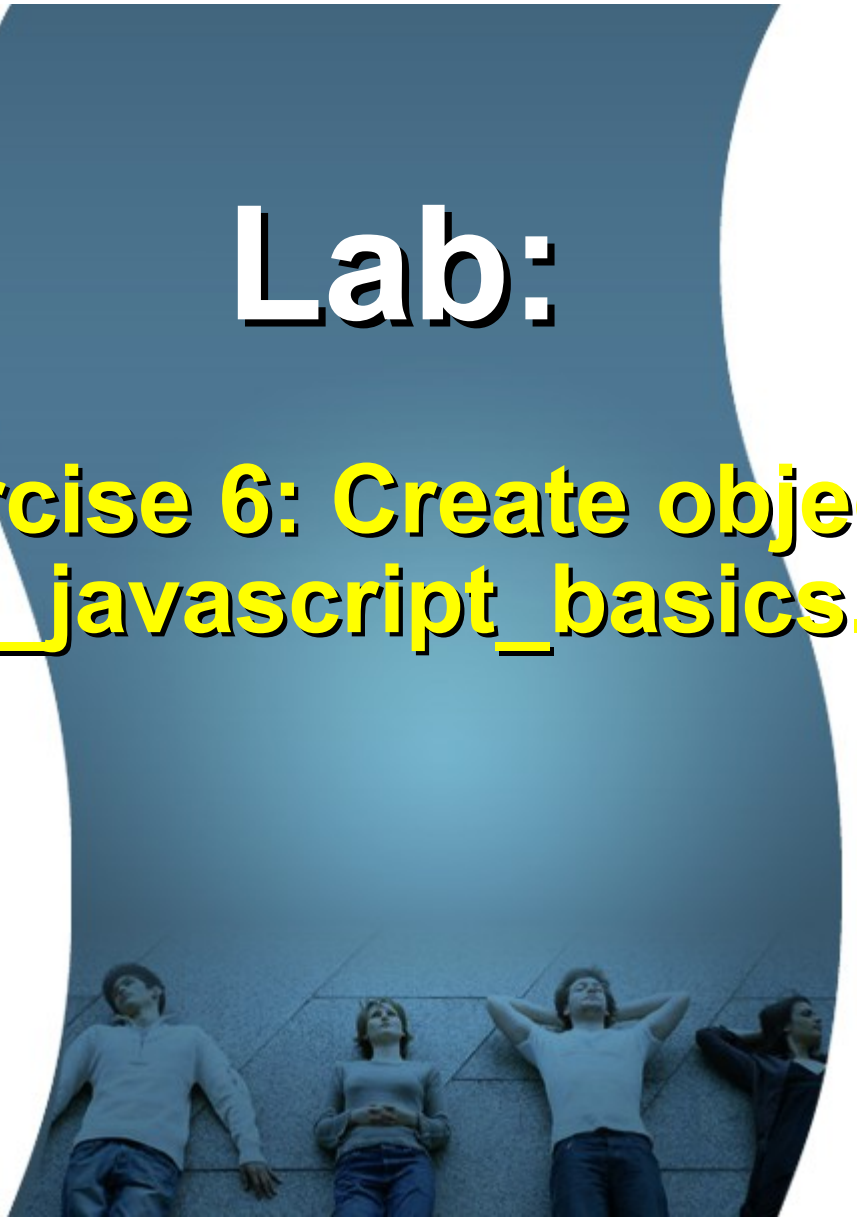
```
function tellYourage(){
    alert("The age is" + this.age);
}
personObj.tellYourage=tellYourage;
```

- By the way, note that the following two lines of code are doing completely different things

```
// Set property with a function
personObj.tellYourage=tellYourage;
// Set property with returned value of the function
personObj.tellYourage=tellYourage();
```

Lab:

Exercise 6: Create objects
4262_javascript_basics.zip



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