Comp 388/424 - Client-side Web Design

Spring Semester 2016 - Week 5

Dr Nick Hayward

Contents

Weekly Discussion

- weekly discussion topic posted on Slack
  - `#weekly-discussion` *channel*
- specific considerations each week
- discuss websites and patterns
- consider interface design, interaction...
- aesthetics
- organisation of information
- user options, tools...

JS Basics - logic - blocks

- simple act of grouping contiguous and related code statements together
  - *known as **blocks***
- block defined by wrapping statements together
  - *within a pair of curly braces, { }*
- **blocks** commonly attached to other forms of control statement

```
if (a > b) {
...do something useful...
}
```

JS Basics - logic - conditionals - part I

- conditionals, conditional statements require a decision to be made
- code statement, application, consults **state**
  - *answer will predominantly be a simple **yes** or **no***
- JS includes many different ways we can express **conditionals**
- most common example is the `if` statement
  - *if this given condition is true, do the following...*

```
if (a > b) {
console.log("a is greater than b...");
}
```

- `if` statement requires an expression between the parentheses
  - *evaluates as either true or false*

JS Basics - logic - conditionals - part 2

- additional option if this expression returns false
  - *using an **else** clause*

```
if (a > b) {
console.log("a is greater than b...");
} else {
console.log("no, b is greater...");
}
```

- for an `if` statement, JS expects a `boolean`
- JS defines a list of values that it considers *false*
  - *eg: 0...*
- any value not on this list of *false* values will be considered true
  - *coerced to true when defined as a `boolean`*
- conditionals in JS also exist in another form
  - *the `switch` statement*
  - *more to come...*

JS Basics - logic - loops

- loops allow repetition of sets of actions until a condition fails
- repetition continues whilst the requested condition holds
- loops take many different forms and follow this basic behaviour
- loop includes the *test condition* as well as a *block*
  - *normally within curly braces*
  - *block executes, an iteration of the loop has occurred*
- good example of this behaviour are `while` and `do...while` loops
- basic difference between these loops, `while` and `do...while`
  - *conditional tested is before the first iteration (`while` loop)*
  - *after the first iteration (`do...while`) loop*
- if the condition is initially false
  - *a `while` loop will never run*
  - *a `do...while` will run through for the first time*
- also stop a JS loop using the common `break` statement
- `for` loop has three clauses, including
  - *initialisation clause*
  - *conditonal test clause*
  - *update clause*

JS Basics - logic - functions - part I

- define once, then re-use as needed throughout our application
- **function** is a named grouping of code
  - *name can be called, and code will be run each time*
- JS functions can be designed with optional arguments
  - *known as **parameters***
  - *allow us to pass values to the function*
- functions can also optionally return a value

```
function outputTotal(total) {
  console.log(total);
}
var a = 49;
a = a * 3;

outputTotal(a);
```

JS Basics - logic - functions - part 2

```
function outputTotal(total) {
  console.log(total);
}

function calculateTotal(amount, times) {
  amount = amount * times;
  return amount;
}

var a = 49;
a = calculateTotal(a, 3);
outputTotal(a);
```

- JSFiddle Demo

JS Basics - logic - scope

- scope or **lexical scope**
  - *collection of variables, and associated access rules by name*
- in JS each function gets its own scope
- variables within a function's given **scope**
  - *can only be accessed by code inside that function*
- variable name has to be unique within a function's scope
- same variable name could appear in different scopes
- nest one scope within another
  - *code in inner scope can access variables from either inner or outer scope*
  - *code in outer scope cannot, by default, access code in the inner scope*

JS Basics - logic - scope example

```
function outerScope() {
  var a = 49;
  //scope includes outer and inner
  function innerScope() {
    var b = 59;
    //output a and b
    console.log(a + b); //returns 108
  }
  innerScope();

  //scope limited to outer
  console.log(a); //returns 49
}

//run outerScope function
outerScope();
```

- JSFiddle Demo

JS Basics - strict

- intro of ES5 - JS now includes option for **strict** mode
  - *ensures tighter code and better compliance...*
  - *often helps ensure greater compatibility, safer use of language...*
  - *can also help optimise code for rendering engines*
- add **strict** at different levels within our JS code
  - *eg: single function level or enforce for whole file*

```
function outerScope() {
  "use strict";
//code is strict

  function innerScope() {
  //code is strict

  }
}
```

- if we set **strict** mode for complete file - set at top of file
  - *all functions and code will be checked against **strict** mode*
  - *eg: check against auto-create for global variables*
  - *or missing `var` keyword for variables...*

```
function outerScope() {
  "use strict";
  a = 49; // `var` missing - ReferenceError
}
```

JS Core - values and types

- JS has typed values, not typed variables
- JS provides the following built-in types
  - *boolean*
  - *null and undefined*
  - *number*
  - *object*
  - *string*
  - *symbol*
- more help provided by JS's `typeof` operator
  - *examine a value and return its type*

```
var a = 49;
console.log(typeof a); //result is a number
```

- as of ES6, there are 7 possible return types JS
- **NB:** JS variables do not have types, mere containers for values
  - *values specify the type*

```
var a = null;
console.log(typeof a); //result is object
```

JS Core - objects - part I

Objects

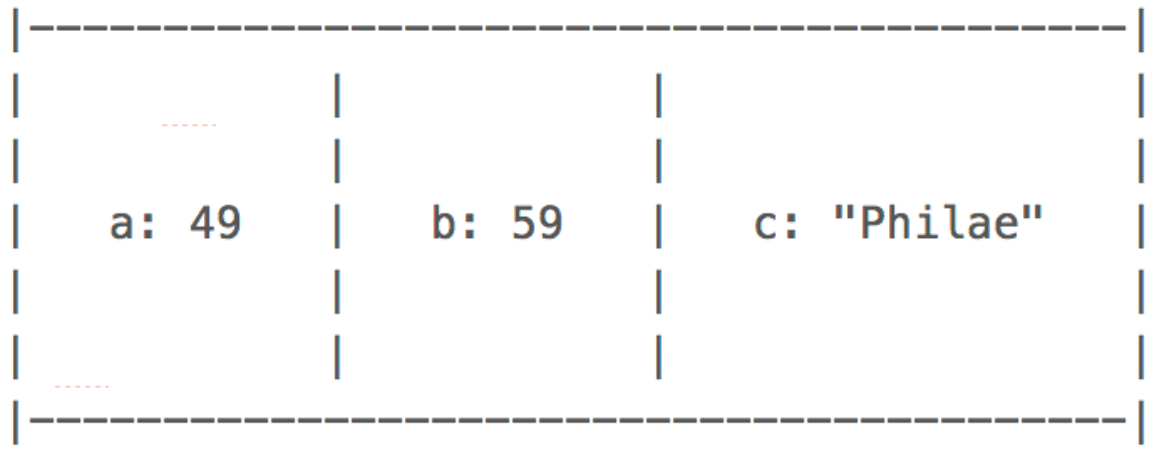
- **object** type includes a compound value
  - *JS can use to set properties, or named locations*
- each of these properties holds its own value
  - *can be defined as any type*

```
var objectA = {
  a: 49,
  b: 59,
  c: "Philae"
};
```

- access these values using either **dot** or **bracket** notation
  - ***dot*** *notation more common in JS...*

```
//dot notation
objectA.a;
//bracket notation
objectA["a"];
```

Image - JS Object



JS Object

JS Core - objects - part 2

Arrays

- JS array an object that contains values, of any type, in numerically indexed positions
  - *store a number, a string...*
  - *array will start at index position 0*
  - *increments by **1** for each new value*
- arrays can also have properties
  - *eg: automatically updated **length** property*

```
var arrayA = [
  49,
  59,
  "Philae"
];
arrayA.length; //returns 3
```

- each value can be retrieved from its applicable index position,

```
arrayA[2]; //returns the string "Philae"
```

Image - JS Array

JS Array

JS Core - checking equality - part I

- JS has four equality operators, including two **not equal**
  - *==, ===, !=, !==*
- == - checks for value equality, whilst allowing coercion
- === - checks for value equality but without coercion

```
var a = 49;
var b = "49";

console.log(a == b); //returns true
console.log(a === b); //returns false
```

- first comparison checks values
  - *if necessary, try to coerce one or both values until a match occurs*
  - *allows JS to perform a simple equality check*
  - *results in* `true`
- second check is simpler
  - *coercion is not permitted, and a simple equality check is performed*
  - *results in* `false`

JS Core - checking equality - part 2

- which comparison operator should we use
- useful suggestions for usage of comparison operators
  - *use === if either side of the comparison could be true or false*
  - *use === if either value could be one of the following specific values,*
  - *0, "", [ ]*
  - *otherwise, it's safe to use ==*
  - *simplify code in a JS application due to the implicit coercion.*
- **not equal** counterparts, `!` and `!==` work in a similar manner
- equality operators with non-primitive values, such as objects
  - *comparison will simply check if underlying references match, not the values*

```
var a = [49,59,69];
var b = [49,59,69];
var c = "49,59,69";

console.log(a == c); //returns true
console.log(b == c); //returns true
console.log(a == b); //returns false
```

JS Core - checking inequality - part 1

- known as **relational comparison**, we can use the inequality operators,
  - *<, >, <=, >=*
- inequality operators often used to check comparable values like numbers
  - *inherent ordinal check*
- can be used to compare strings

```
"hello" < "world"
```

- coercion also occurs with inequality operators
  - *no concept of* ***strict inequality***

```
var a = 49;
var b = "59";
var c = "69";

a < b; //returns true
b < c; //returns true
```

JS Core - checking inequality - part 2

- we can encounter an issue when either value cannot be coerced into a number

```
var a = 49;
var b = "nice";

a < b; //returns false
a > b; //returns false
a == b; //returns false
```

- issue for < and > is string is being coerced into invalid number value, `NaN`
- == coerces string to `NaN` and we get comparison between `49 == NaN`

JS Core - more variables - part I

- a few rules and best practices for naming valid **identifiers**
- using typical ASCII alphanumeric characters
  - *an identifier must begin with* `a-z, A-Z, $, _`
  - *may contain any of those characters, plus* `0-9`
- property names follow this same basic pattern
- careful not to use certain keywords, or reserved words
- reserved words can include such examples as,
  - `break, byte, delete, do, else, if, for, this, while` *and so on*
  - *further details are available at the W3 Schools site*
- in JS, we can use different declaration keywords relative to intended scope
  - `var` *for local,* `global` *for global...*
- such declarations will influence scope of usage for a given variable
- concept of **hoisting**
  - *defines the declaration of a variable as belonging to the entire scope*
  - *by association accessible throughout that scope as well*
  - *also works with JS functions - hoisted to the top of the scope*

JS Core - more variables - part 2

- concept of nesting, and scope specific variables
- ES6 enables us to restrict variables to a block of code
- use keyword **let** to declare a block-level variable

```
if (a > 5){
let b = a + 4;

console.log(b);

}
```

- **let** restricts variable's scope to `if` statement
- variable `b` is not available to the whole function

JS Core - more variables - part 3

- add **strict mode** to our code
- without we get a variable that will be hoisted to the top either
  - *set as a globally available variable, although it could be deleted*
  - *or it will set a value for a variable with the matching name*
- bubbled up through the available layers of scope
- becomes similar in essence to a declared global variable
- can create some strange behaviour in our applications
  - *tricky and difficult to debug*
- remember to declare your variables correctly and at the top

JS Core - more variables - example

```
var a;

function myScope() {
    "use strict";
    a = 49;
}

myScope()
a = 59;
console.log(a);
```

JS Core - variable declarations - example I

```
"use strict";
//global
var a = 49;

function myScope() {
  //local
  var b = 59;

    if (a > b) {
    //block
     let c = "a won";
     return c;
    } else {
    //block
     let c = "b won";
     return c;
    }
}

console.log(myScope());
```

JS Core - variable declarations - example 2

```
"use strict";
//global
var a = 69;

function myScope() {
  //local
  var b = 59;
  var c;

    if (a > b) {
     c = "a won";
    } else {
     c = "b won";
    }
  return c;
}

console.log(myScope());
```

We can see the difference here with a simple change to the scope our variables. Therefore block variables have a time and a place, but we need to consider their usage carefully relative to security, access, and brevity of code.

- abstract and refine further with parameters, ternary operator...

JS Core - functions and values

- variables acting as groups of code and blocks
- act as one of the primary mechanisms for scope within our JS applications
- also use functions as values
- effectively using them to set values for other variables

```
var a;

function scope() {
  "use strict";
    a = 49;
  return a;
}

b = scope() * 2;
console.log(b);
```

- useful and interesting aspect of the JS language
  - *allows us to build values from multiple layers and sources*

JS Core - more conditionals - part 1

- briefly considered conditional statements using the `if` statement,

```
if (a > b) {
console.log("a is the best...");
} else {
console.log("b is the best...");
}
```

- Switch statements effectively follow the same pattern as `if` statements
  - *designed to allow us to check for multiple values in a more succinct manner*
  - *enable us to check and evaluate a given expression*
  - *then attempt to match a required value against an available `case`*
- addition of `break` is important, ensures only matched case is executed
  - *then the application breaks from the switch statement*
- if no `break` execution after that case will continue
  - *commonly known as **fall through***
  - *may be an intentional feature of your code design*
  - *allows a match against multiple possible cases*

JS Core - Switch - example

The addition of `break` is important to ensure that only a matched case is executed, and then the application breaks from the switch statement. If not, execution after that case will continue. This is commonly known as **fall through** in programming. Be aware, however, that this may be an intentional feature of your code design as well. For example, we may wish to allow a match against multiple possible cases, therefore a premature break is not required within the code.

```
var a = 4;

switch (a) {
case 3:
  //par 3
  console.log("par 3");
  break;
case 4:
  //par 4
  console.log("par 4");
  break;
case 5:
  //par 5
  console.log("par 5");
  break;
case 59:
  //dream score
  console.log("record");
  break;
default:
  console.log("more practice");
}
```

JS Core - more conditionals - part 2

- a more concise way to write our conditional statements
- known as the **ternary** or **conditional** operator
- consider this operator a more concise form of standard `if...else` statement

```
var a = 59;
var b = (a > 59) ? "high" : "low";
```

- equivalent to the following standard `if...else` statement

```
var a = 59;

if (a > 59) {
  b = "high";
} else {
  b = "low";
}
```

JS Core - closures - part I

- important and useful aspect of JavaScript
- dealing with variables and scope
  - *continued, broader access to ongoing variables via a function's scope*
- closures as a useful construct to allow us to access a function's scope
  - *even after it has finished executing*
- can give us something similar to a private variable
  - *then access through another variable using relative scopes of outer and inner*
- inherent benefit is that we are able to repeatedly access internal variables
  - *normally cease to exist once a function had executed*

```
"use strict";

function addTitle(a) {
  var title = "hello ";
  function updateTitle() {
    var newTitle = title+a;
    return newTitle;
  }
    return updateTitle;
}

var buildTitle = addTitle("world");
console.log(buildTitle());
```

JS Core - closures - part 2

```
function count(a) {
return function(b) {
      return a + b;
  }
}

var add1 = count(1);
var add5 = count(5);
var add10 = count(10);

console.log(add1(8));
console.log(add5(8));
console.log(add10(8));
```

- using one function to create multiple other functions, `add1`, `add5`, `add10`, and so on.

JS - test and try out

- JSFiddle - Functions 1
- JSFiddle - Scope 1

References

JavaScript & Libraries

- MDN - JS
  - *MDN - JS Grammar and Types*
  - *MDN - JS Objects*
- W3 - JS Object
- W3 - JS Performance