

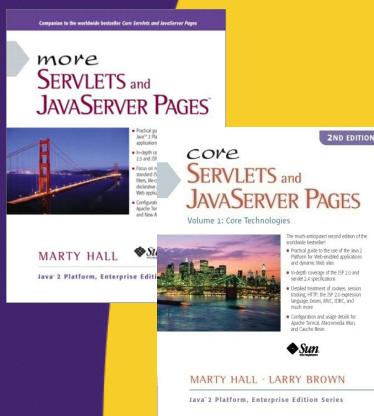


JavaScript: A Crash Course

Part I: Basics and Core Language Syntax

Originals of Slides and Source Code for Examples:
<http://courses.coreservlets.com/Course-Materials/ajax.html>

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Taught by the author of *Core Servlets and JSP*, *More Servlets and JSP*, and this tutorial. Available at public venues, or customized versions can be held on-site at your organization.

- Courses developed and taught by Marty Hall
 - Java 6, servlets/JSP (intermediate and advanced), Struts, JSF 1.x, JSF 2.0, Ajax, GWT 2.0 (with GXT), custom mix of topics
 - Ajax courses can concentrate on 1 library (jQuery, Prototype/Scriptaculous, Ext-JS, Dojo, Google Closure) or survey several
- Courses developed and taught by coreservlets.com experts (edited by Marty)
 - Spring, Hibernate/JPA, EJB3, Web Services, Ruby/Rails

Contact hall@coreservlets.com for details

Topics in This Section

- Overview
- JavaScript references
- Embedding in browser
- HTML versions
- Basic syntax
- Arrays
- Strings and regular expressions

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Intro

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Books

- **JavaScript the Definitive Guide**
 - By David Flanagan, O'Reilly. The only really complete reference on the JavaScript language. Thorough and well-written.
 - Makes the global variable blunder when covering Ajax.
- **JavaScript: The Good Parts**
 - By Douglas Crockford (of JSON and YUI fame), O'Reilly
 - Outstanding advanced guide to best practices in core JavaScript, especially functions, objects, and regular expressions. *Very* short.
 - No coverage of Ajax or DOM scripting. "The *Effective Java* of JS".
- **Pro JavaScript Techniques**
 - By John Resig (of jQuery fame), APress
 - Excellent guide to best practices; not a thorough reference
 - Makes the global variable blunder when first covering Ajax.
- **DOM Scripting**
 - By Jeremy Keith, FriendsOf Press
 - Focuses on manipulating DOM and CSS
 - Makes the global variable blunder when briefly covering Ajax.

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Online References

- **JavaScript tutorial (language syntax)**
 - <http://www.w3schools.com/js/>
 - http://developer.mozilla.org/en/docs/Core_JavaScript_1.5_Guide
- **JavaScript API references (builtin objects)**
 - <http://www.w3schools.com/jsref/>
 - <http://www.devguru.com/technologies/ecmascript/QuickRef/>
 - <http://www.devguru.com/technologies/JavaScript/>
 - <http://www.javascriptkit.com/jsref/>
 - http://developer.mozilla.org/en/docs/Core_JavaScript_1.5_Reference
- **HTML DOM reference (with JavaScript Examples)**
 - http://www.w3schools.com/html/dom/dom_reference.asp
- **Official ECMAScript specification**
 - <http://www.ecma-international.org/publications/standards/Ecma-262.htm>

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Firebug

- **Install Firebug in Firefox**
 - <http://getfirebug.com/>
- **Use Firebug command line for interactive testing**
 - <http://getfirebug.com/commandline>
- **Can use Firebug Lite in IE, Opera, Chrome**
 - Not great, but better than nothing
 - But Chrome and IE 8 now have Firebug Wannabe environments that are reasonably good
 - <http://getfirebug.com/firebuglite>
 - See especially “bookmarklet” link
- **For more details on Firebug usage**
 - See section on Ajax development and debugging tools

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Embedding JavaScript in HTML

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Loading Scripts

- **script with src**

- `<script src="my-script.js" type="text/javascript"></script>`

- Purpose

- To define functions, objects, and variables.
 - Functions will later be triggered by buttons, other user events, inline script tags with body content, etc.

- **script with body content**

- `<script type="text/javascript">JavaScript code</script>`

- Purpose

- To directly invoke code that will run as page loads
 - E.g., to output HTML content built by JavaScript
 - Don't use this approach for defining functions or for doing things that could be done in external files.
 - Slower (no browser caching) and less reusable

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Example (phish.js)

```
function getMessage() {
    var amount = Math.round(Math.random() * 100000);
    var message =
        "You won $" + amount + "!\n" +
        "To collect your winnings, send your credit card\n" +
        "and bank details to oil-minister@phisher.com.";
    return(message);
}

function showWinnings1() {
    alert(getMessage());
}

function showWinnings2() {
    document.write("<h1><blink>" + getMessage() +
        "</blink></h1>");
}
```

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Example (loading-scripts.html)

```
<!DOCTYPE ...><html xmlns="http://www.w3.org/1999/xhtml">
<head><title>Loading Scripts</title>
...
<script src="./scripts/phish.js"
      type="text/javascript"></script>
</head>
<body>
...
  <input type="button" value="How Much Did You Win?"
        onclick='showWinnings1()' />
...
  <script type="text/javascript">showWinnings2()</script>
...
</body></html>
```

Loads script from previous page

Calls showWinnings1 when user presses button. Puts result in dialog box.

Calls showWinnings2 when page is loaded in browser. Puts result in page.

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Example (Results)



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Loading Scripts: Special Cases

- **Internet Explorer bug**
 - Scripts with src fail to load if you use `<script.../>`.
 - You must use `<script src="..." ...></script>`
- **XHTML: Scripts with body content**
 - It is an error if the body of the script contains special XML characters such as `&` or `<`
 - E.g. `<script...>if (a<b) { this(); } else { that(); }</script>`
 - So, use CDATA section unless body content is simple and clearly has no special characters
 - `<script type="text/javascript"><![CDATA[
JavaScript Code
]]></script>`

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HTML Versions and JavaScript

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Summary

- **XHTML**
 - Most common version used with Ajax apps or Dynamic HTML apps (JavaScript apps that manipulate the DOM)
 - Follows XML syntax, lowercase tags
- **HTML 5 (sort of)**
 - Growing in popularity for Ajax or DHTML apps.
 - Version used now is basically XHTML but with a simpler DOCTYPE and <html> start tag
 - Doesn't matter if browser really supports HTML 5
- **HTML 4**
 - Very common in non-JavaScript apps
 - Not recommended for Ajax apps

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XHTML

- **Summary**
 - Follows XML syntax. Lowercase tags, end tags required, quotes around attribute values.
- **Basic structure**

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
  "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head><title>...</title></head>
<body> ... </body></html>
```
- **Pros**
 - Code corresponds very directly to internal (DOM) representation by the browser
- **Cons**
 - DOCTYPE and <html> start tag are long and tedious

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Pseudo-HTML 5

- **Summary**

- Follows XML syntax. XHTML (transitional) syntax but with simpler DOCTYPE and <html> start tag.

- **Basic structure**

```
<!DOCTYPE html>
```

```
<html>
```

```
<head><title>...</title></head>
```

```
<body> ... </body></html>
```

- **Pros**

- Code corresponds very directly to internal (DOM) representation by the browser

- **Cons**

- Not strictly compliant with spec. May get warnings from formal validators, especially with non-CSS formatting.

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HTML 4

- **Summary**

- Does not follow XML syntax. Tags not case sensitive. End tags and quotes on attribute values sometimes optional.

- **Basic structure**

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 Transitional//EN">
```

```
<HTML>
```

```
<HEAD><TITLE>...</TITLE></HEAD>
```

```
<BODY> ... </BODY></HTML>
```

- **Pros**

- Simple code. Widely used in non-Ajax apps.

- **Cons**

- Source code and internal browser representation can be substantially different, requiring mental translation when thinking of how to manipulate DOM from JavaScript.

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Basic JavaScript Syntax

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Variables

- **Introduce with “var”**
 - For global variables (!) and local variables.
 - No “var” for function arguments
- **You do not declare types**
 - Some people say JavaScript is “untyped” language, but technically it is “dynamically typed” language
 - JavaScript is *very* liberal about converting types
- **There are only two scopes**
 - Global scope
 - Be very careful with this when using Ajax.
 - Can cause race conditions.
 - Function (lexical) scope
 - There is *not* block scope as in Java

Operators and Statements

- **Almost same set of operators as Java**
 - + (addition and String concatenation), -, *, /
 - &&, ||, ++, --, etc
 - The == comparison is more akin to Java's "equals"
 - The === operator (less used) is like Java's ==
- **Statements**
 - Semicolons are technically optional
 - But highly recommended
 - Consider
 - return x
 - return
x
 - They are not identical! The second one returns, then evaluates x. You should act as though semicolons are required as in Java.
- **Comments**
 - Same as in Java (/* ... */ and // ...)

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Conditionals and Simple Loops

- **if/else**
 - Almost identical to Java except test can be converted to true/false instead of strict true/false
 - "false": false, null, undefined, "" (empty string), 0, NaN
 - "true": anything else (including the string "false")
- **Basic for loop**
 - Identical to Java except for variable declarations
 - for(**var** i=0; i<someVal; i++) { doLoopBody(); }
- **while loop**
 - Same as Java except test can be converted to boolean
 - while(someTest) { doLoopBody(); }
- **do/while loop**
 - Same as Java except test can be converted to boolean

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Other Conditionals and Loops

- **switch**

- Differs from Java in two ways
 - The “case” can be an expression
 - Values need not be ints (compared with ===)

- **for/in loop**

- On surface, looks similar to Java for/each loop, but
 - For arrays, values are array indexes, not array values
 - Use this loop for objects (to see property names), not arrays!
Fails with Prototype or other extended arrays
 - For objects, values are the property names
- `var person = { firstName: "Brendan", lastName: "Eich"};`
`for(var property in person) {`
`doSomethingWith(person[property]);`
`}`

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The Math Class

- **Almost identical to Java**

- Like Java, static methods (Math.cos, Math.random, etc.)
 - As we will see in next lecture, these are not *really* static methods, but syntax is similar to static methods in Java.
- Like Java, logs are base e, trig functions are in radians

- **Functions**

- Math.abs, Math.acos, Math.asin, Math.atan, Math.atan2, Math.ceil, Math.cos, Math.exp, Math.floor, Math.log, Math.max, Math.min, Math.pow, Math.random, Math.round, Math.sin, Math.sqrt, Math.tan

- **Constants**

- Math.E, Math.LN10, Math.LN2, Math.LOG10E, Math.PI, Math.SQRT1_2, Math.SQRT2

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Arrays

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Array Basics

- **One-step array allocation**
 - `var primes = [2, 3, 5, 7, 11, 13];`
 - `var names = ["Joe", "Jane", "John", "Juan"];`
 - No trailing comma after last element (see later slide)
- **Two-step array allocation**
 - `var names = new Array(4);`
`names[0] = "Joe";`
...
`names[3] = "Juan";`
- **Indexed at 0 as in Java**
 - `for(var i=0; i<names.length; i++) {`
`doSomethingWith(names[i]);`
`}`

Looping Down Arrays in JavaScript

- **Java-style for loop**

- Roughly same as in Java. Don't forget the "var"!

```
for(var i=0; i<someArray.length; i++) {  
    var value = someArray[i];  
    doSomethingWith(value);  
}
```

- **JavaScript-specific for loop**

- Relies on fact that a nonexistent array index results in a value of undefined (not an exception) and that undefined means "false" in a test.

```
for(var i=0, value; value=someArray[i]; i++) {  
    doSomethingWith(value);  
}
```

- **for-in loop**

- *Not* recommended for looping down normal arrays.
 - Returns indexes, not values
 - Array-like objects can have extra properties

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More on Arrays

- **Arrays can be sparse**

- ```
var names = new Array();
names[0] = "Joe";
names[100000] = "Juan";
```

- **Arrays can be resized**

- Regardless of how arrays is created, you can do:
  - ```
myArray.length = someNewLength;
```
 - ```
myArray[anyNumber] = someNewValue;
```
  - ```
myArray.push(someNewValue)
```
- These are legal regardless of which way myArray was made

- **Arrays have methods**

- **push**, **pop**, join, reverse, sort, concat, slice, splice, etc.
 - See API reference

- **Regular objects can be treated like arrays**

- You can use numbers (indexes) as object properties

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Arrays Example

```
function arrayLoops() {
    var names =
        ["Joe", "Jane", "John"];
    printArray1(names);
    printArray2(names);
    names.length = 6;
    printArray1(names);
    printArray2(names);
}

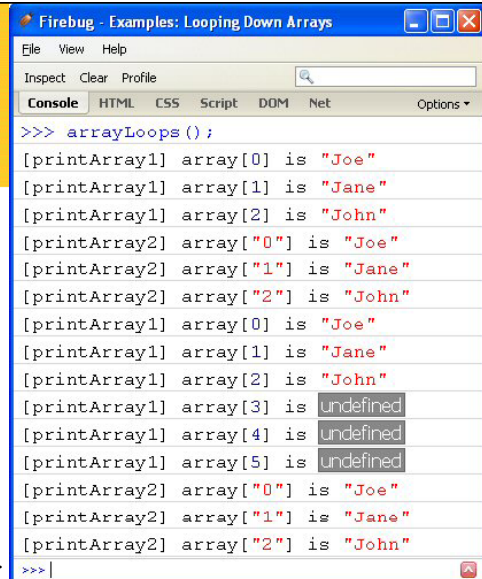
function printArray1(array) {
    for(var i=0; i<array.length; i++) {
        console.log("[printArray1] array[%o] is %o", i, array[i]);
    }
}

function printArray2(array) {
    for(var i in array) {
        console.log("[printArray2] array[%o] is %o", i, array[i]);
    }
}

arrayLoops();
```

console.log is a printf-like way to print output in Firebug Console window. For testing/debugging only.

Direct call for interactive testing in Firebug console. (Cut/paste all code into console command line.)



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Strings and Regular Expressions

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String Basics

- **You can use double or single quotes**
 - `var names = ["Joe", 'Jane', "John", 'Juan'];`
- **You can access length property**
 - E.g., `"foobar".length` returns 6
- **Numbers can be converted to strings**
 - Automatic conversion during concatenations.
 - `var val = 3 + "abc" + 5; // Result is "3abc5"`
 - Conversion with fixed precision
 - `var n = 123.4567;`
`var val = n.toFixed(2); // Result is 123.46 (not 123.45)`
- **Strings can be compared with ==**
 - `"foo" == 'foo'` returns true
- **Strings can be converted to numbers**
 - `var i = parseInt("37 blah"); // Result is 37 – ignores blah`
 - `var d = parseFloat("6.02 blah"); // Ignores blah`

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Core String Methods

- **Simple methods similar to Java**
 - `charAt`, `indexOf`, `lastIndexOf`, `substring`, `toLowerCase`, `toUpperCase`
- **Methods that use regular expressions**
 - `match`, `replace`, `search`, `split`
- **HTML methods**
 - `anchor`, `big`, `bold`, `fixed`, `fontcolor`, `fontsize`, `italics`, `link`, `small`, `strike`, `sub`, `sup`
 - `"test".bold().italics().fontcolor("red")` returns
`'<i>test</i>'`
 - These are technically nonstandard methods, but supported in all major browsers
 - But I prefer to construct HTML strings explicitly anyhow

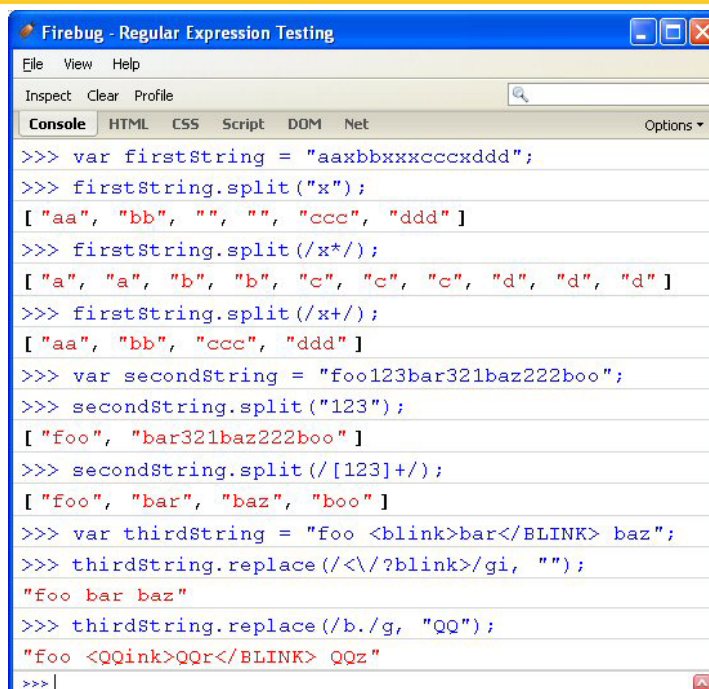
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Regular Expressions

- **You specify a regexp with /pattern/**
 - *Not* with a String as in Java
- **Most special characters same as in Java/Unix/Perl**
 - ^, \$, . – beginning, end of string, any one char
 - \ – escape what would otherwise be a special character
 - *, +, ? – 0 or more, 1 or more, 0 or 1 occurrences
 - {n}, {n,} – exactly n, n or more occurrences
 - [] – grouping
 - \s, \S – whitespace, non-whitespace
 - \w, \W – word char (letter or number), non-word char
- **Modifiers**
 - /pattern/g – do global matching (find all matches, not just first one)
 - /pattern/i – do case-insensitive matching
 - /pattern/m – do multiline matching

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Regular Expression: Examples



```
Firebug - Regular Expression Testing
File View Help
Inspect Clear Profile
Console HTML CSS Script DOM Net Options
>>> var firstString = "aaxbbxxxcccddd";
>>> firstString.split("x");
[ "aa", "bb", "", "", "ccc", "ddd" ]
>>> firstString.split(/x*/);
[ "a", "a", "b", "b", "c", "c", "c", "d", "d", "d" ]
>>> firstString.split(/x+/);
[ "aa", "bb", "ccc", "ddd" ]
>>> var secondString = "foo123bar321baz222boo";
>>> secondString.split("123");
[ "foo", "bar321baz222boo" ]
>>> secondString.split(/[123]+/);
[ "foo", "bar", "baz", "boo" ]
>>> var thirdString = "foo <blink>bar</BLINK> baz";
>>> thirdString.replace(/<\/?blink>/gi, "");
"foo bar baz"
>>> thirdString.replace(/b./g, "QQ");
"foo <QQink>QQr</BLINK> QQz"
>>> |
```

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More Information on Regular Expressions

- **Online API references given earlier (See RegExp class)**
 - http://www.w3schools.com/jsref/jsref_obj_regexp.asp
 - <http://www.devguru.com/technologies/ecmascript/QuickRef/regexp.html>
- **JavaScript Regular Expression Tutorials**
 - http://www.evolt.org/article/Regular_Expressions_in_JavaScript/17/36435/
 - <http://www.javascriptkit.com/javatutors/re.shtml>

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Wrap-up

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Summary

- **Use Firebug for testing and debugging**
- **Bookmark references**
 - <http://www.w3schools.com/js/>
- **Embedding in browser**
 - `<script src="blah.js" type="text/javascript"></script>`
 - Use XHTML or pseudo-HTML 5 syntax
- **Basic JavaScript syntax**
 - Declare local variables with var. No type declarations.
 - Loops and conditionals similar to Java.
- **JavaScript arrays**
 - Arrays are very different than in Java. Can have extra properties. Can resize them. Can be sparse.
 - But, you usually treat them like normal arrays, except that pop and push are widely used.

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Questions?

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