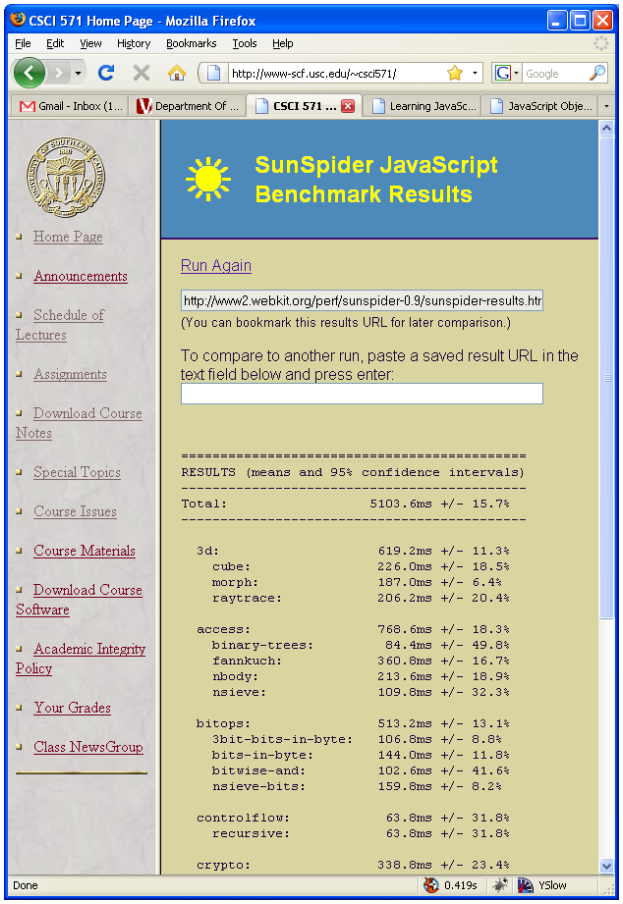
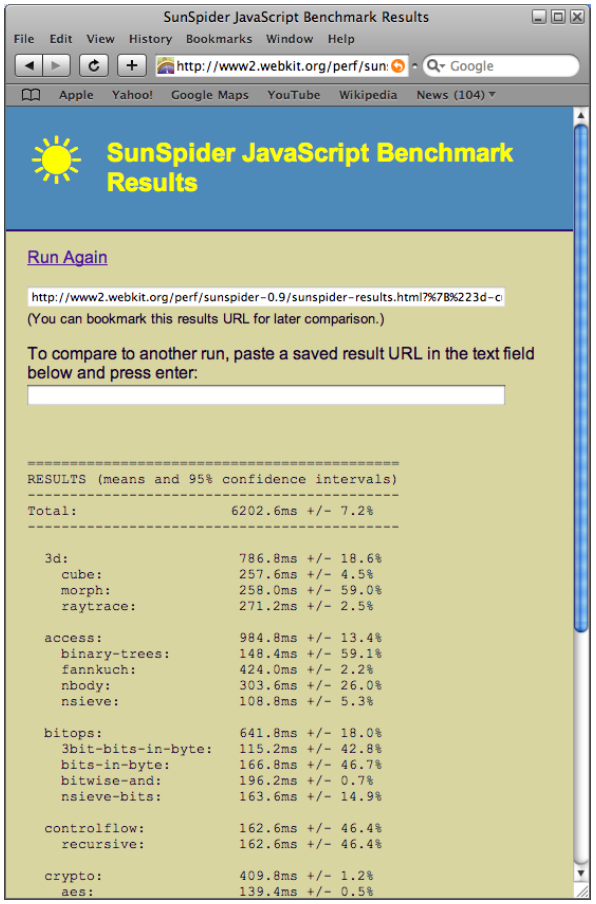
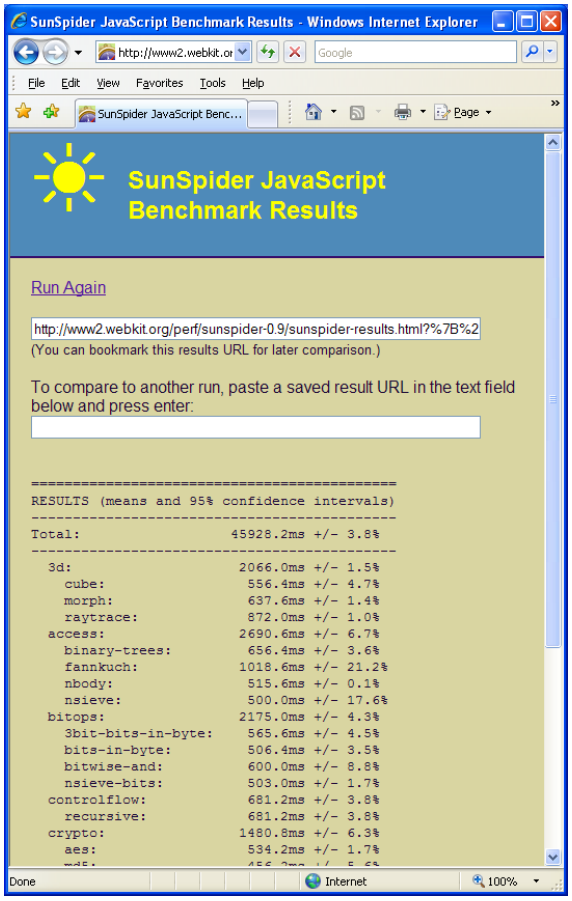
Lecture

JavaScript and Browser Manipulation

Testing the Speed of Your JavaScript (2009)





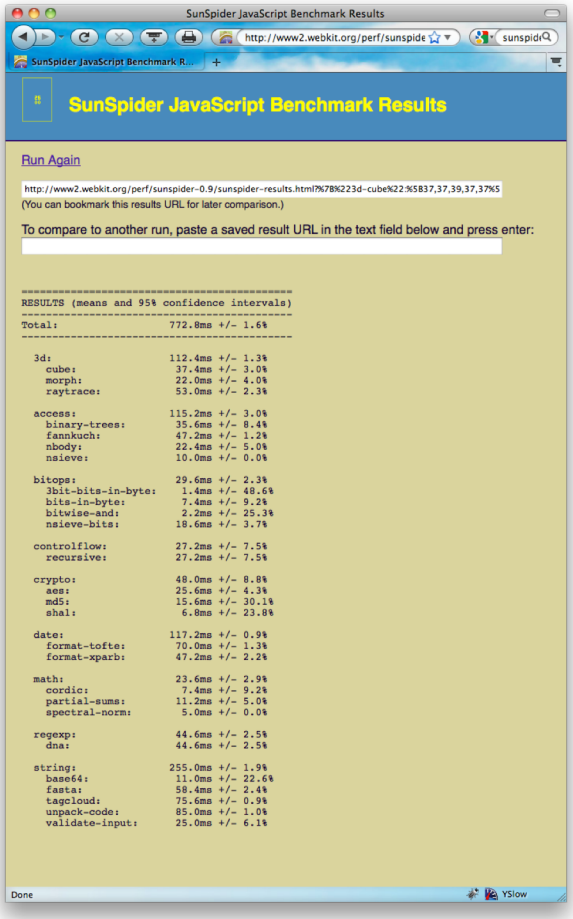


Firefox, v 3.0
5103ms

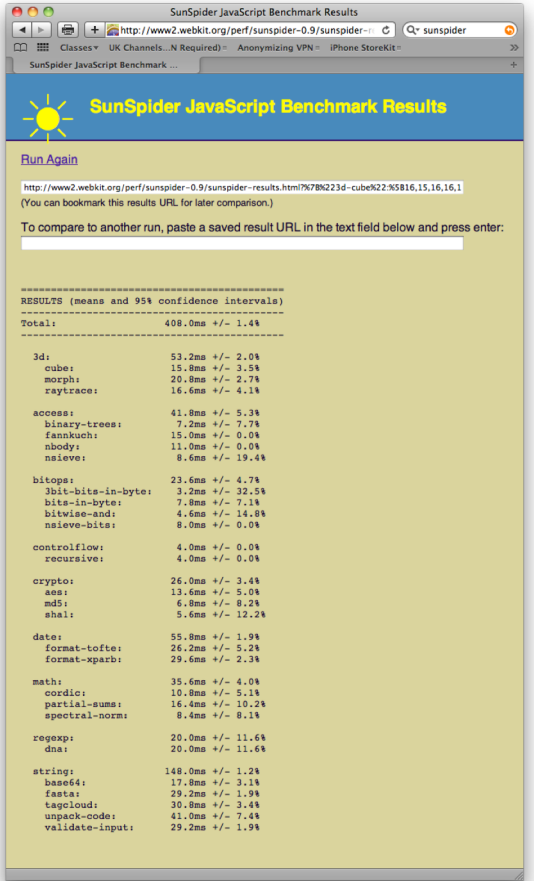
Safari v 3.2
6202ms

I.E. 7.0
45,928ms

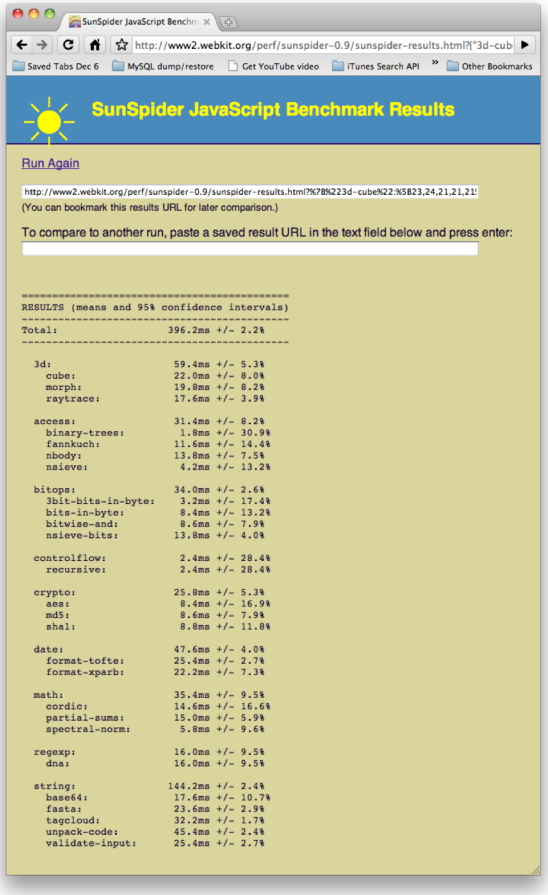
Testing the Speed of Your JavaScript (2010)



Firefox, v 3.6
772 ms

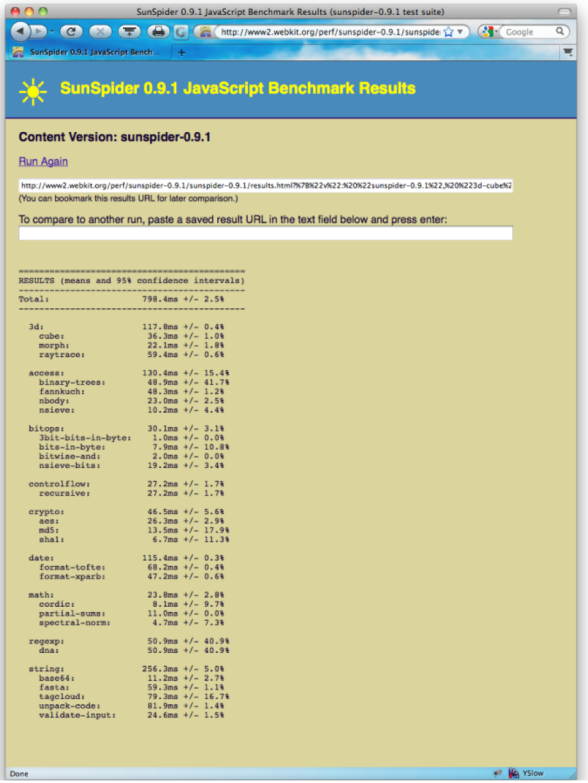


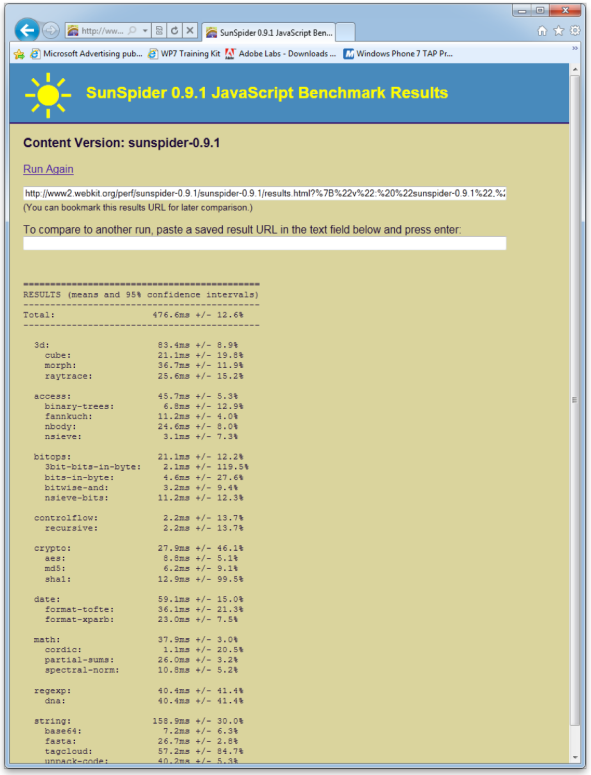
Safari v 4.0
408 ms



Chrome v 4.0
396 ms
Chrome v 14.0
214 ms

Testing the Speed of Your JavaScript (2011)



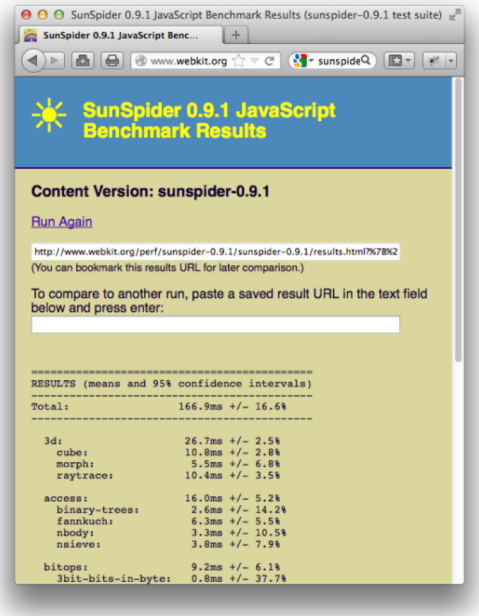


Firefox, v 3.6.13
798 ms
Firefox, v.6.0.2
187 ms

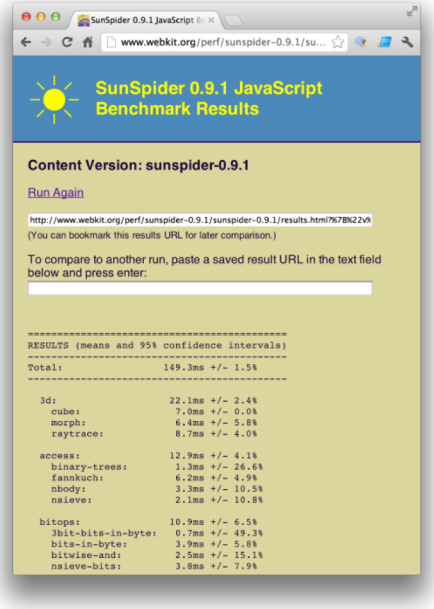
Safari v 5.0.3
310 ms
Safari v. 5.1
198 ms

IE v 9.0 (beta)
476 ms
IE v 9.0
314 ms

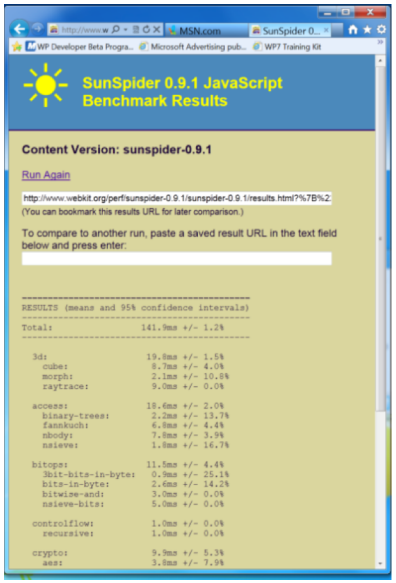
Testing the Speed of Your JavaScript (2012)



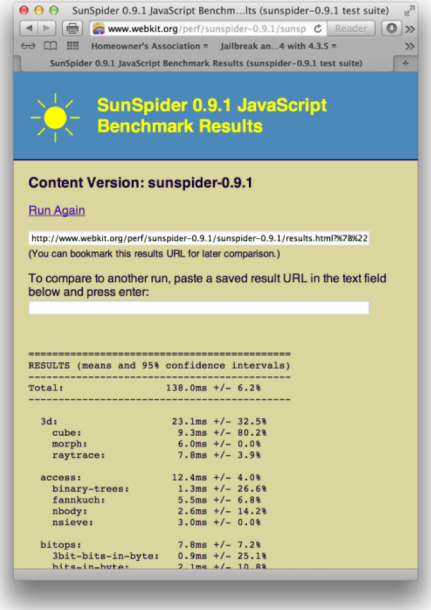
Firefox 16
166 ms



Chrome 21.0
149 ms



Internet Explorer 9.0
141 ms

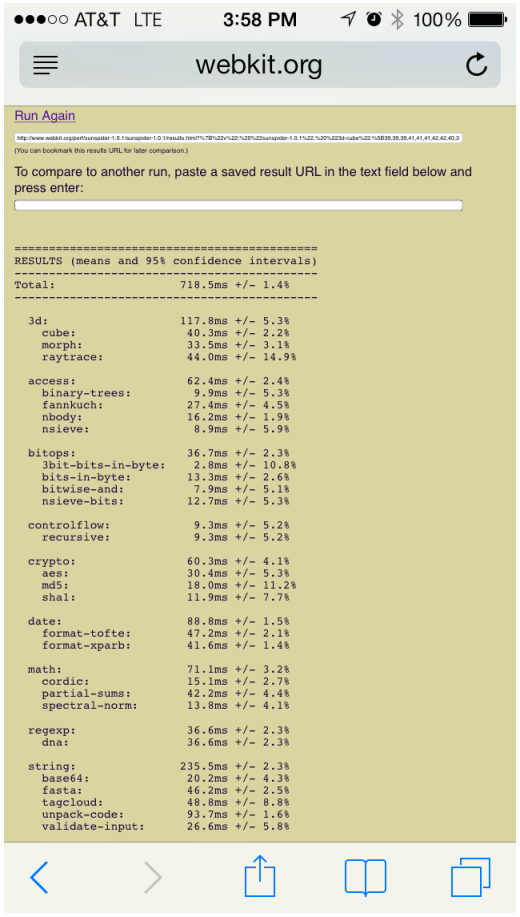


Safari 6.0
138 ms

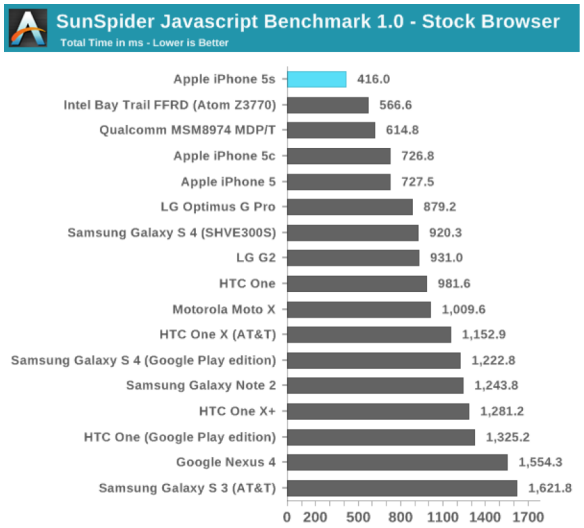
Summary over the years →

	Firefox	Safari	I.E.	Chrome
2009	5,103	6,202	45,928	
2010	772	408		214
2011	187	198	314	
2012	166	138	141	149

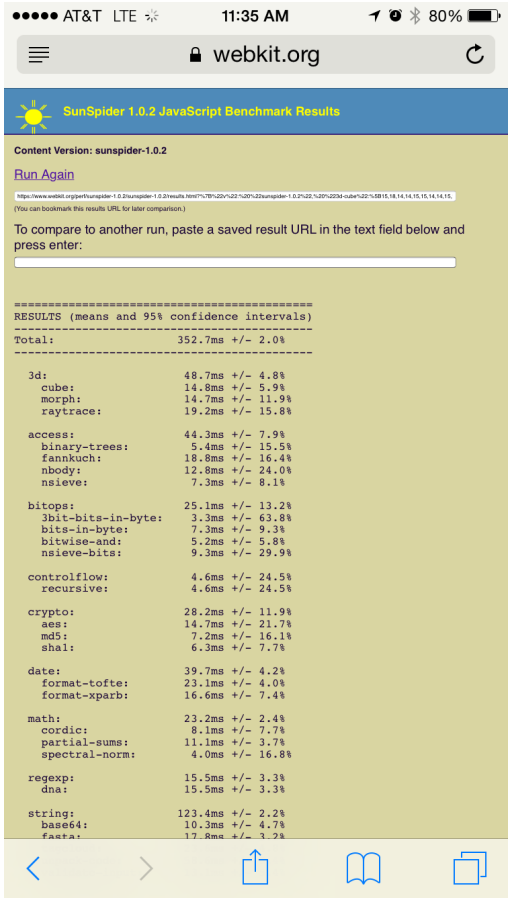
Mobile Speed of JavaScript (2012-2014)



Safari, iPhone 5
718ms

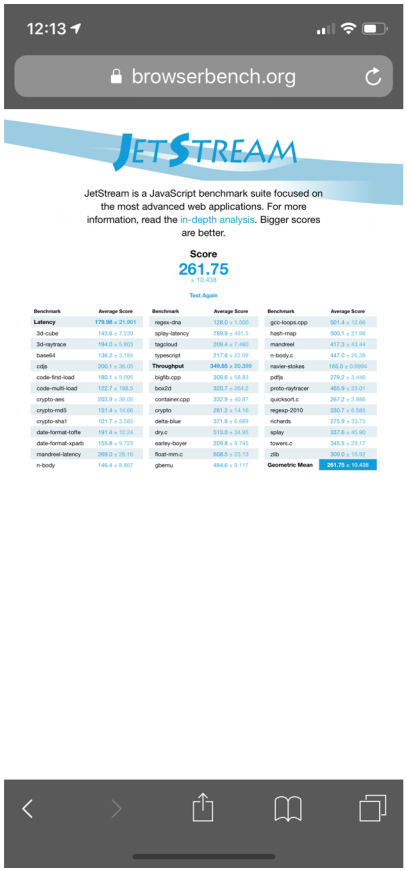


Safari, iPhone 5S
416ms

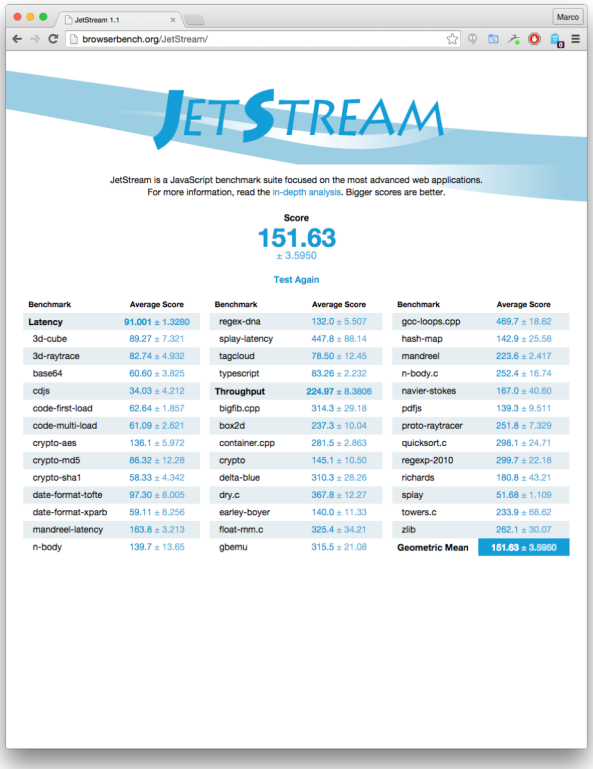


Safari, iPhone 6
352ms

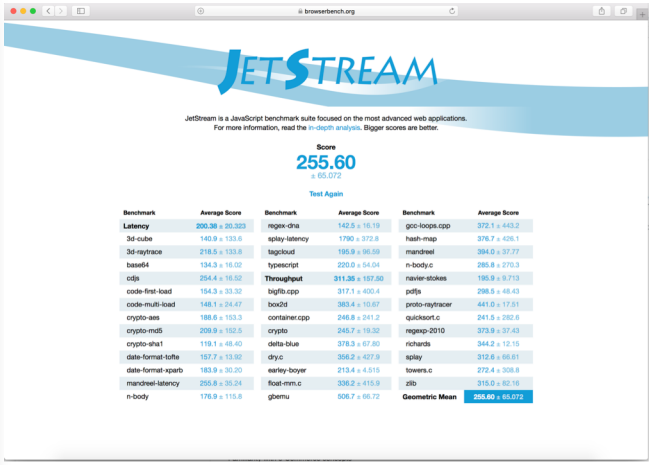
JetStream (2015-2017)



Safari 9, iPhone 6s
111.75 score
Safari 10, iPhone 7
164.79 score
Safari 11, iPhone X
216.74 score
Safari 12, iPhone XS
261.75



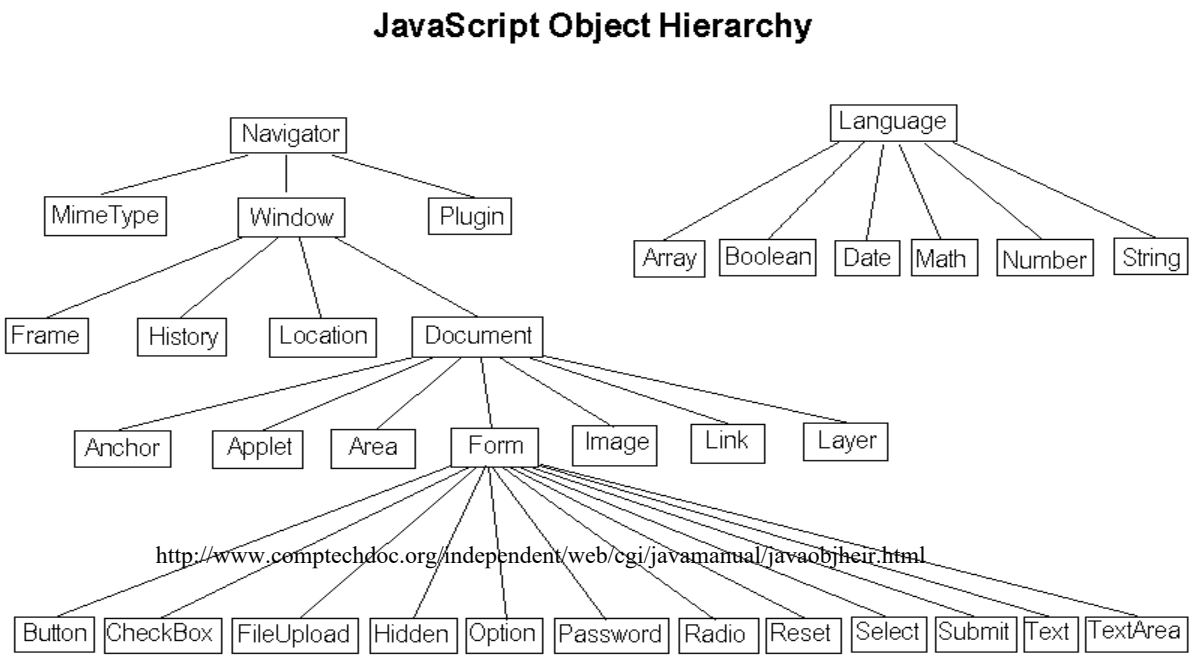
Chrome 45, OS X
151.62 score



Safari 10, OS X
155.76 score
Safari 11, OS X
246-255.60

Javascript Object Hierarchy

JavaScript contains a set of built in objects related to the browser. Each object includes a set of properties and methods



The Window Object

- The **window** object is the highest level built-in JavaScript object; it corresponds to the browser window
- Some properties of the Window object include:
  - window.closed – a boolean indicating if the window is closed or not
  - window.history – returns the history object
  - window.location – returns the location object
  - window.navigator – returns the navigator object
  - Window.parent – returns the parent window of the current window
  - Window.self – returns the current window
  - Window.status – sets the text in the statusbar window
- Some methods of the Window object include:
  - open() – opens a new window
  - blur () – removes focus from the current window
  - close() – closes the current window
  - focus() – sets the focus to the current window
  - resizeBy () – resizes the window by the specified pixels
- For a complete list see, e.g. http://www.w3schools.com/jsref/obj_window.asp

Examples Using the Window Object

- To create a new window that shows only the toolbar and status bar and is resizable

  window.open("newURL", "New Window","toolbar,status,resizable")

- The height and width defaults are the same as the browser
- The new window is positioned in the upper left hand corner of the screen
- A call to window.open() returns a value of the new window's object; this should always be assigned to a variable, e.g.

```
newWindow = window.open("","")
if (newWindow != null) {
        newWindow.document.write("<HTML><HEAD>
        <TITLE>Hi</TITLE></HEAD>") }
```

- Try http://cs-server.usc.edu:45678/examples/js/js_22_2.html

Parameters of windows.open()

- The open() method includes three top level parameters:

newWin = open(url, name, [features, [replace]]);

  - newWin: is a reference to the new window object
  - url: a string URL value to be fetched by the new window (can be empty)
  - name: this name can be used with the HTML target attribute (do not use spaces in the name)
  - features: a string that specifies the desired browser features (syntax: feature=value)
  - replace: allows new entries to be made to the browser history

More on the features argument of the windows.open method

- The 'features' string is a comma separated list of items (original list)
  - toolbar Back, Forward Buttons
  - location the URL input field
  - directories What's New, What's Cool, etc
  - status browser status line
  - menubar browser menu bar
  - scrollbars enables scrollbars when needed
  - resizable allows the window to be resizable
  - width,height window dimensions in pixels
- When the 'features' string is absent, the new browser window has all of the standard controls
- New, much larger set of recent 'features' available at:

https://developer.mozilla.org/en-US/docs/Web/API/Window/open

- Chrome does not support most of the 'features'

Sample Code to open a window with attributes:

width=640, height=480, URL bar, browser toolbar, Menus, Directory buttons, Window status bar, window resizable, window scrollable

- **Here is the code**
- window.open(‘http://www.usc.edu', 'Sam', 'location=yes,toolbar=yes,menubar=yes,directories=yes,status=yes,resizable=yes,scrollbars=yes,height=480,width=640', false);

- **Three possible ways to invoke the code above:**

1. Triggered at page load time
   - <**body** onload="[open new window code];"> </**body**>
2. Triggered by clicking on a hyperlink
   - <**a** href="javascript:[open new window code]; void 0;">click me to open a new window!</**a**>
3. Triggered by clicking on a button
   - <**input** type="button" value="click me to open a new window" onclick="[open new window code];" />

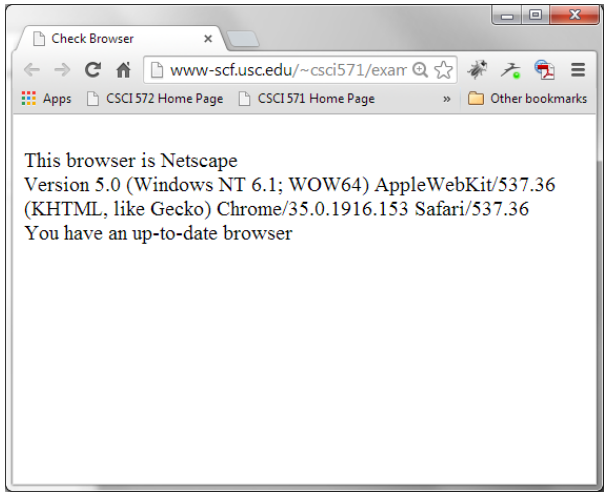
Determining the Browser

- navigator is a built-in object with properties that describe the browser
  - **navigator.appName** is a string with the browser name
  - **navigator.appVersion** is a string with the version number
    - to determine the correct version you may need to convert from string to number; parseFloat returns a number from a string, and ignores any part of the string after the number
  - **navigator.cookieEnabled** determines whether cookies are enabled
  - **navigator.language** returns the language of the browser
  - **navigator.userAgent** returns the user-agent header sent by the browser

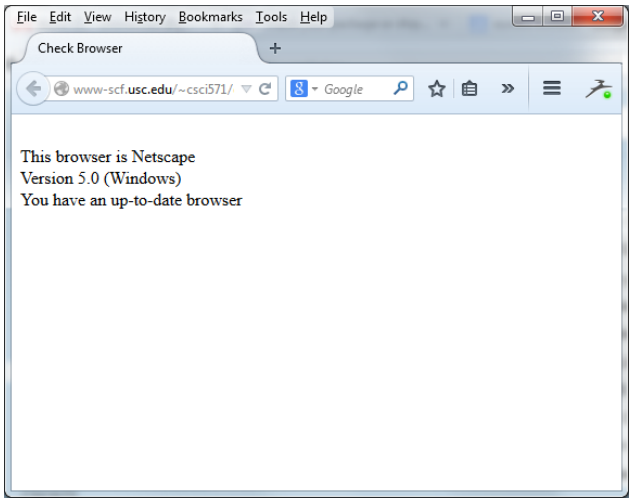
Determining the Browser Version

```
<HTML>
<HEAD>
<TITLE>Check Browser</TITLE>
</HEAD>
<BODY>
<SCRIPT language=JavaScript>
document.write("<BR> This browser is " + navigator.appName);
document.write("<BR> Version "  + navigator.appVersion);
if (parseFloat(navigator.appVersion) >= 7)
  { document.write("<BR> You have an up-to-date browser"); }
</SCRIPT>
</BODY>
</HTML>
```

Example: Browser Output

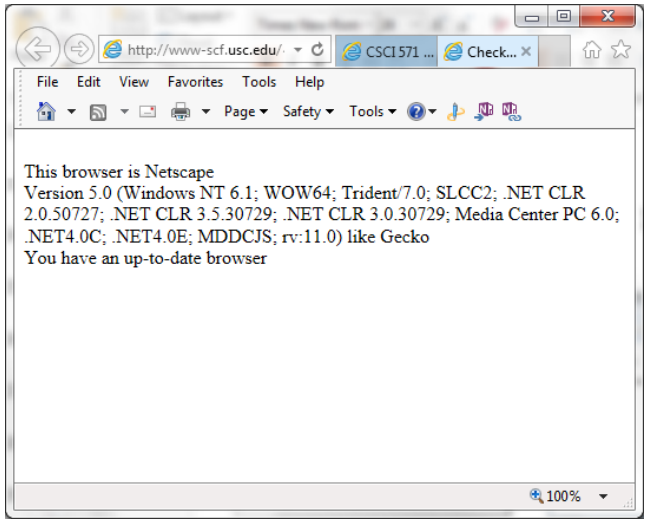


Chrome



Firefox

It is an historical anomaly that they all return Netscape; to determine the browser the appname value must be carefully analyzed, or use UserAgent



Internet Explorer

Avoiding Errors

- Since IE and Firefox differ somewhat in JavaScript, it is useful to first check if an object, property or method exists
- One can refer to any name in a conditional and if it is undefined the conditional returns false

```
newItem = something;
```

produces an error if something is undefined

```
if ( something ) { newItem = something; }
```

does not produce an error, but only changes newItem if something exists

Example: Checking Window Size

- Firefox and IE use different object properties to hold the window size
  - IE8-: document.body.clientwidth or clientheight
  - Firefox, IE 9+, other browsers: window.innerWidth or innerHeight
- Suppose you want to vary the response depending upon the size of the browser window
  - lets write a program that does this

Re-Direct the Browser

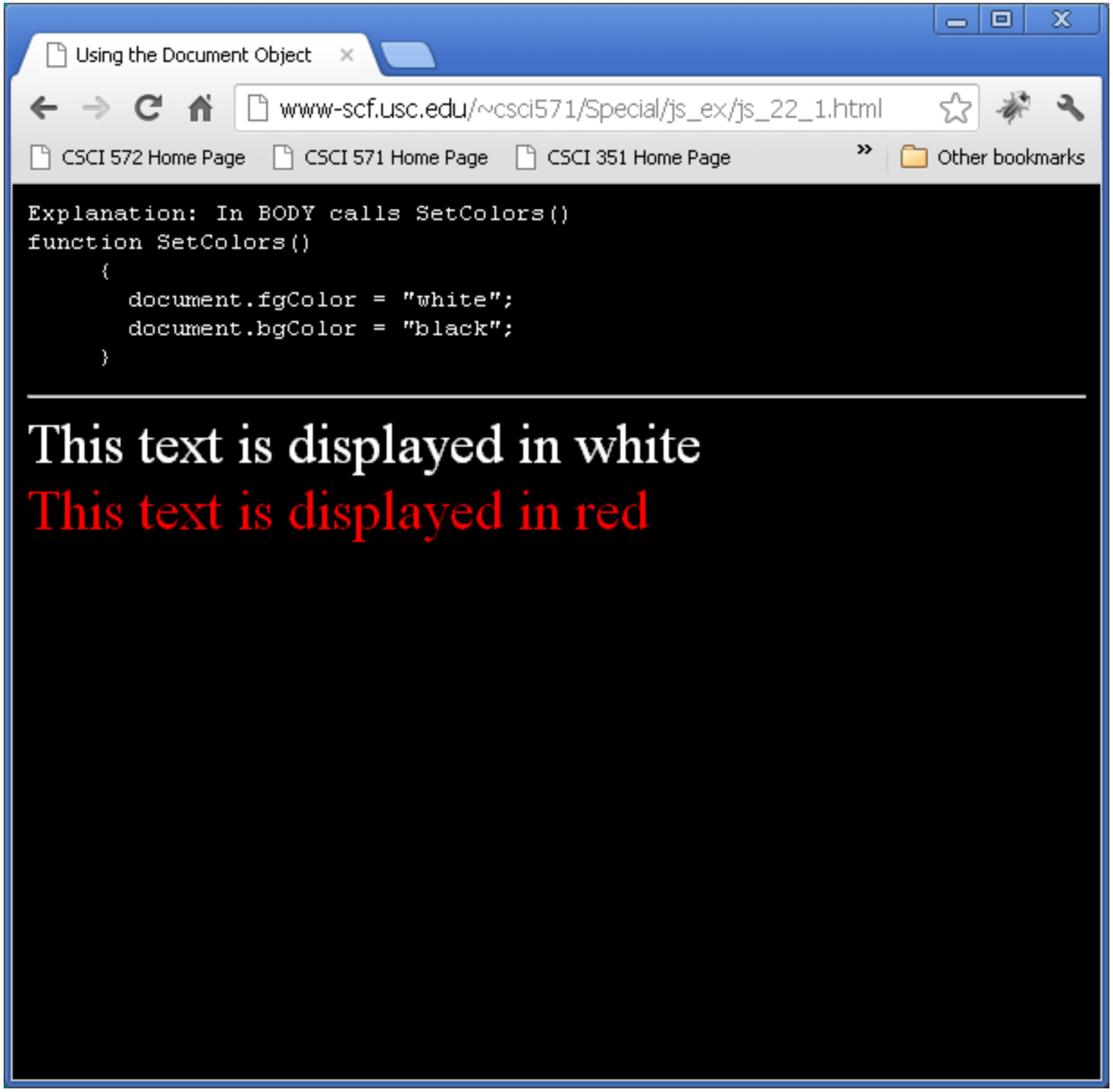
```
<HTML><HEAD><TITLE>re-direct based upon window
   size</TITLE></HEAD>
<BODY><SCRIPT language=JavaScript>
function windowHeight( ) {
  if (document.body &&  document.body.clientHeight) //test for IE
   { return document.body.clientHeight;}
   else if (window.innerHeight)                 //test for NS
   { return window.innerHeight; }
   else {return 0;}; //both tests have failed
}
if (windowHeight() >= 500) {
              document.location = "fancy.html";}
   else {document.location = "lessfancy.html";};
</SCRIPT></BODY></HTML>
```

The Document Object

- Each HTML document loaded into a browser window becomes a Document object.
- The Document object provides access to all HTML elements in a page, from within a script
- Some properties of the document object include:
  - Document.anchors – returns a collection of all anchors in the document
  - Document.applets – returns a collection of all applets in the document
  - Document.body – returns the body element of the document
  - Document.cookie – returns all name/value paris of cookies in the document
  - Document.forms – returns a collection of all forms in the document
  - Document.images – returns a collection of all the images in the document
  - Document.lastModified – returns the date/time the document was last modified
- Some methods of the document object include:
  - Document.close() – closes the output stream previously opened
  - Document.open() – opens an output stream to collect the output from document.write
  - Document.write() – writes HTML expressions or JavaScript to a document

Setting Document Object Attributes

```
<HTML><HEAD><TITLE>Using the Document Object</TITLE>
<SCRIPT LANGUAGE="JavaScript">
function SetColors() {
   document.fgColor = “white";
   document.bgColor = “black"; }
</SCRIPT>
</HEAD>
<BODY><SCRIPT LANGUAGE="JavaScript">
SetColors()
</SCRIPT>
<font size=+3>This text is displayed in white<br>
<font color=red>This text is displayed in
   red</font></font>
</BODY></HTML>
```


Using the Document Object
www-scf.usc.edu/~csci571/Special/js_ex/js_22_1.html
CSCI 572 Home Page
CSCI 571 Home Page
CSCI 351 Home Page
Other bookmarks
Explanation: In BODY calls SetColors()
function SetColors()
{
document.fgColor = "white";
document.bgColor = "black";
}
This text is displayed in white
This text is displayed in red

The Location Object

- A reference to the URL of the current document
- Properties: hash, host, hostname, top, status, defaultStatus, window
- No Methods and no Event Handlers
- Example

http://www.site.com:8080/ads/newitems.html#widget1

Property	Value
protocol	"http"
hostname	"www.site.com"
port	"8080"
host	"www.site.com:8080"
pathname	"/ads/newitems.html"
hash	"#widget1"
href	http://www.big.com:8080/ads/newitems.html#widget1

History Object Example

- The history object contains the URLs visited by the user within a browser window
- The history object is part of the window object

```
<HTML><HEAD><TITLE>Using the History Object</TITLE>
<SCRIPT LANGUAGE=”JavaScript”>
function showHistNumber() {
   var histNumb = window.history.length;
   alert(“you have already visited ” + histNumb + “ web pages
   so far”);
}
</SCRIPT></HEAD>
<BODY><FORM>
<INPUT TYPE=”button” NAME=”history” VALUE=”myHistory”
   onClick=”showHistNumber()”>
</FORM></BODY></HTML>
```

Browser Output

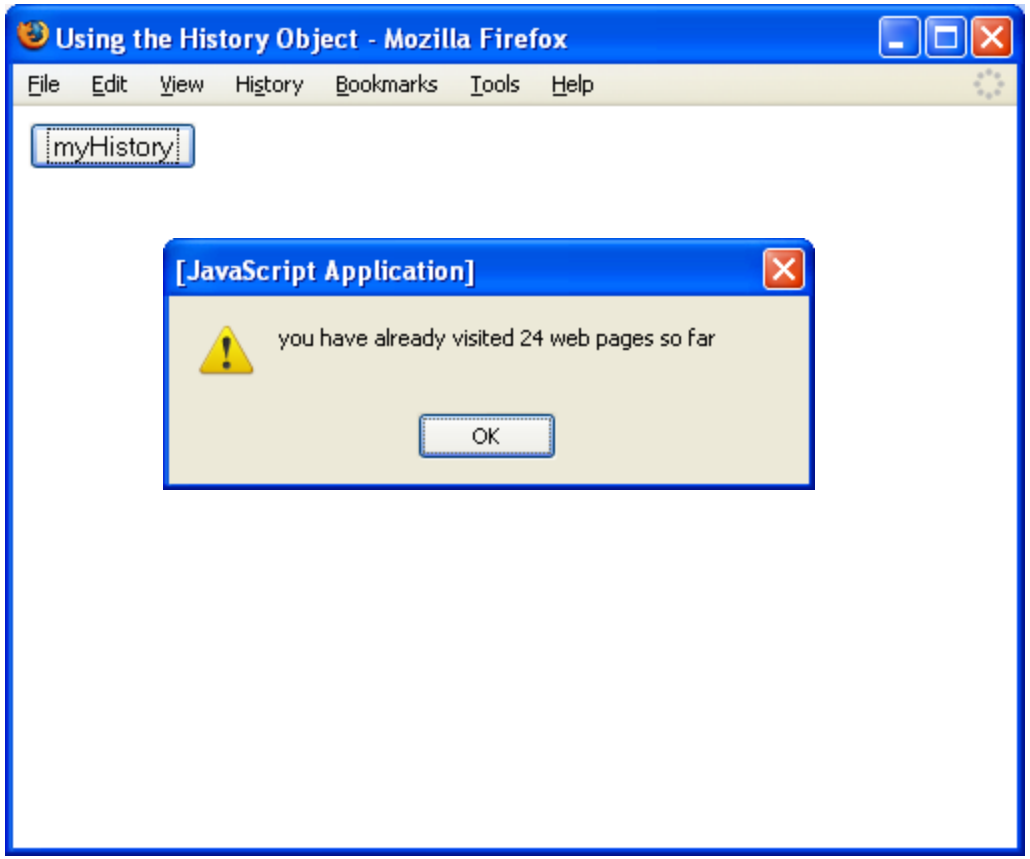


Image Object

- Each image in an HTML document has an associated JavaScript object
  - the properties of the object include
    - **width** and **height** in pixels
    - **src**, URL of the image file
      - Assigning to the src changes the image
    - **complete**, true after an image finishes loading
    - **alt**, text string returned if image is unavailable
- To manipulate an image in JavaScript one can refer to it EITHER by its NAME attribute or by a built-in array of images that is automatically created by JavaScript, e.g.
    - document.images.name
    - document.images[index] where index is either a number or a string containing the name of the image
- An image object can also be created in JavaScript

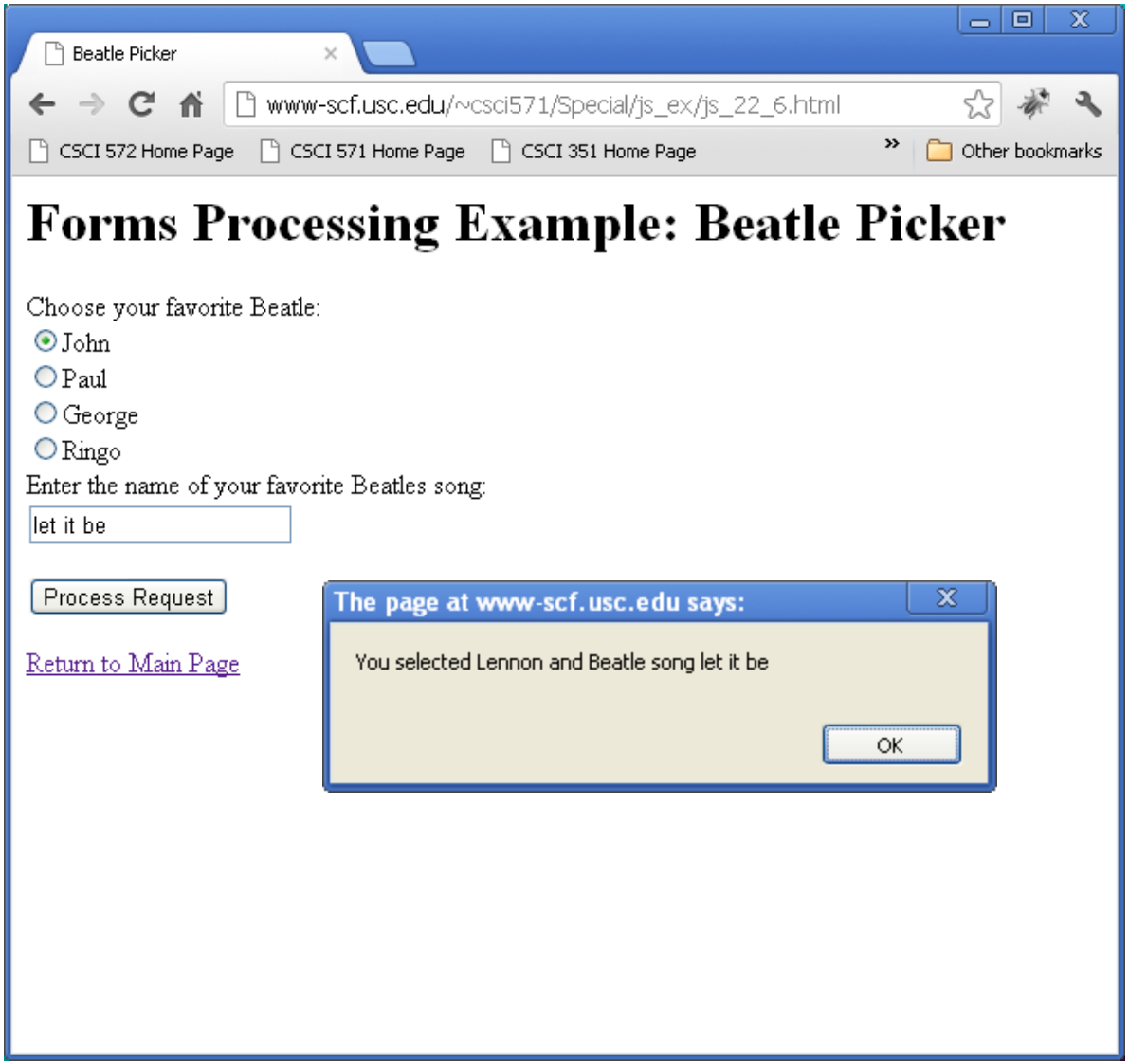
```
var myImage = new Image();
```

  - this can be used to load images into a document that are not visible in the displayed document
  - pre-fetching to make images appear immediately; coming up is an example

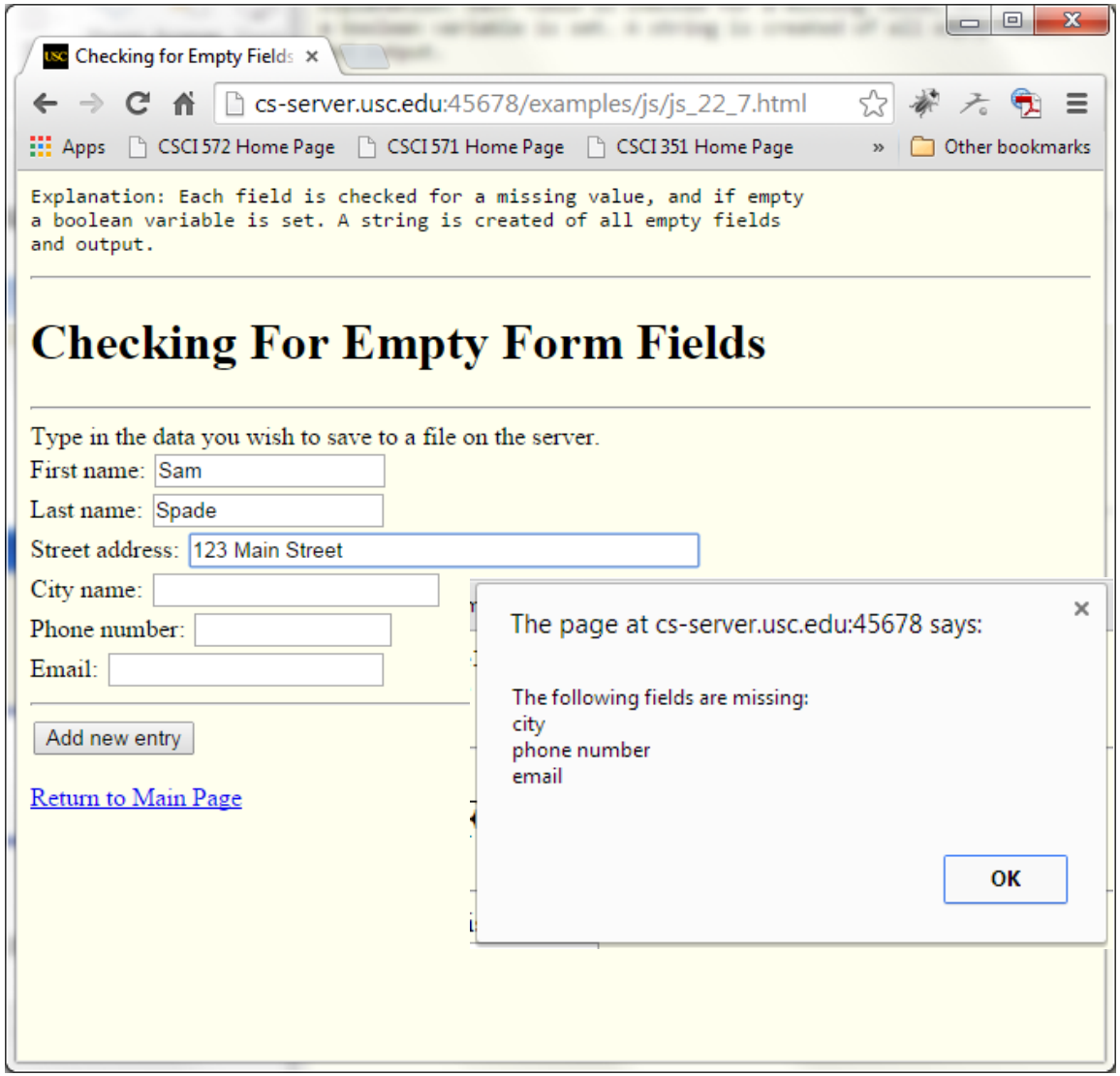
Example Working with Radio Buttons

```
<HTML><HEAD><TITLE>Beatle Picker</TITLE>
<SCRIPT LANGUAGE="javaScript">
function processData(form) {
for(var j = 0 ; j < form.Beatles.length ; ++j)
   if(form.Beatles[j].checked) {
    var RadioValued = form.Beatles[j].value; break;}
alert("You selected " + form.name + " form  and Beatle " + "\n" +
   RadioValued + " and Beatle song " + document.forms[0].song.value
   );}
</SCRIPT></HEAD><BODY><FORM NAME="Abbey Road">
Choose your favorite Beatle: <BR>
<INPUT TYPE=radio NAME="Beatles" VALUE="Lennon" CHECKED="true">John<BR>
<INPUT TYPE=radio NAME="Beatles" VALUE="MCcartney">Paul <BR>
<INPUT TYPE=radio NAME="Beatles" VALUE="Harrison">George <BR>
<INPUT TYPE=radio NAME="Beatles" VALUE="Starr">Ringo <BR>
Enter the name of your favorite Beatles song:<BR>
<INPUT TYPE="text" NAME="song"><P>
<INPUT TYPE="button" NAME="process" VALUE="process Request..."
onClick="processData(this.form)">
</FORM></BODY></HTML>
```

Beatle Picking Form



Checking for Empty Form Fields



Form Elements Checking (cont'd)

```
<html><head><title>Checking for Empty Fields</title><script language=JavaScript>
     function checkEmpty() { /* This function checks all of the fields of the form and
    notifies the client
                    which if any, form fields are empty. It returns a 1 if all the fields
    are full, and a 0 otherwise. */
var firstname_filled = lastname_filled = streetaddress_filled = city_filled =
    phonenumber_filled = youremail_filled = false;
var blank="";
          if (document.myform.firstname.value != blank) firstname_filled=true;
          if (document.myform.lastname.value != blank) lastname_filled=true;
          if (document.myform.streetaddress.value != blank) streetaddress_filled=true;
          if (document.myform.city.value != blank) city_filled=true;
          if (document.myform.phonenumber.value != blank) phonenumber_filled=true;
          if (document.myform.youremail.value != blank) youremail_filled=true;
if ( (firstname_filled) && (lastname_filled) && (streetaddress_filled) && (city_filled) &&
    (phonenumber_filled) && (youremail_filled) )       { alert("No missing fields");
    return(true); }
                      else {/* check which fields are missing */
          var alertstring="The following fields are missing:\n";
          if (!firstname_filled) alertstring=alertstring + "first name\n";
          if (!lastname_filled) alertstring=alertstring + "last name\n";
          if (!streetaddress_filled) alertstring=alertstring + "street address\n";
          if (!city_filled) alertstring=alertstring + "city\n"; if (!phonenumber_filled)
    alertstring=alertstring + "phone number\n";
if (!youremail_filled) alertstring=alertstring + "email\n";
    alert(alertstring); return(false); } }</script></head>
```

Form Elements Checking (cont'd)

```
<BODY bgcolor="#ffffee">
 <pre>Explanation: Each field is checked for a missing value,  and if empty a
    boolean variable is set.    A string is created of all empty fields and output.
</pre><hr>
    <H1><FONT color="#000000”>Checking For Empty Form Fields</H1></FONT><HR>
    Type in the data you wish to save to a file on the server
    <FORM NAME="myform" METHOD="GET">
        First name:       <INPUT type="text" name="firstname" size=16 ><br>
        Last name:       <INPUT type="text" name="lastname" size=16 ><br>
        Street address: <INPUT type="text" name="streetaddress" size=41 ><br>
        City name:        <INPUT type="text" name="city" size=21 ><br>
        Phone number: <INPUT type='text' name='phonenumber' size=13 ><br>
        Email:                <INPUT type='text' name='youremail' size =20><br> <hr>
                               <INPUT type='button' value='Add new entry'
    onClick="checkEmpty()" ><br>
    </FORM>
</BODY>
</HTML>
```

Note: **HTML5** provides the **REQUIRED attribute** for many Elements

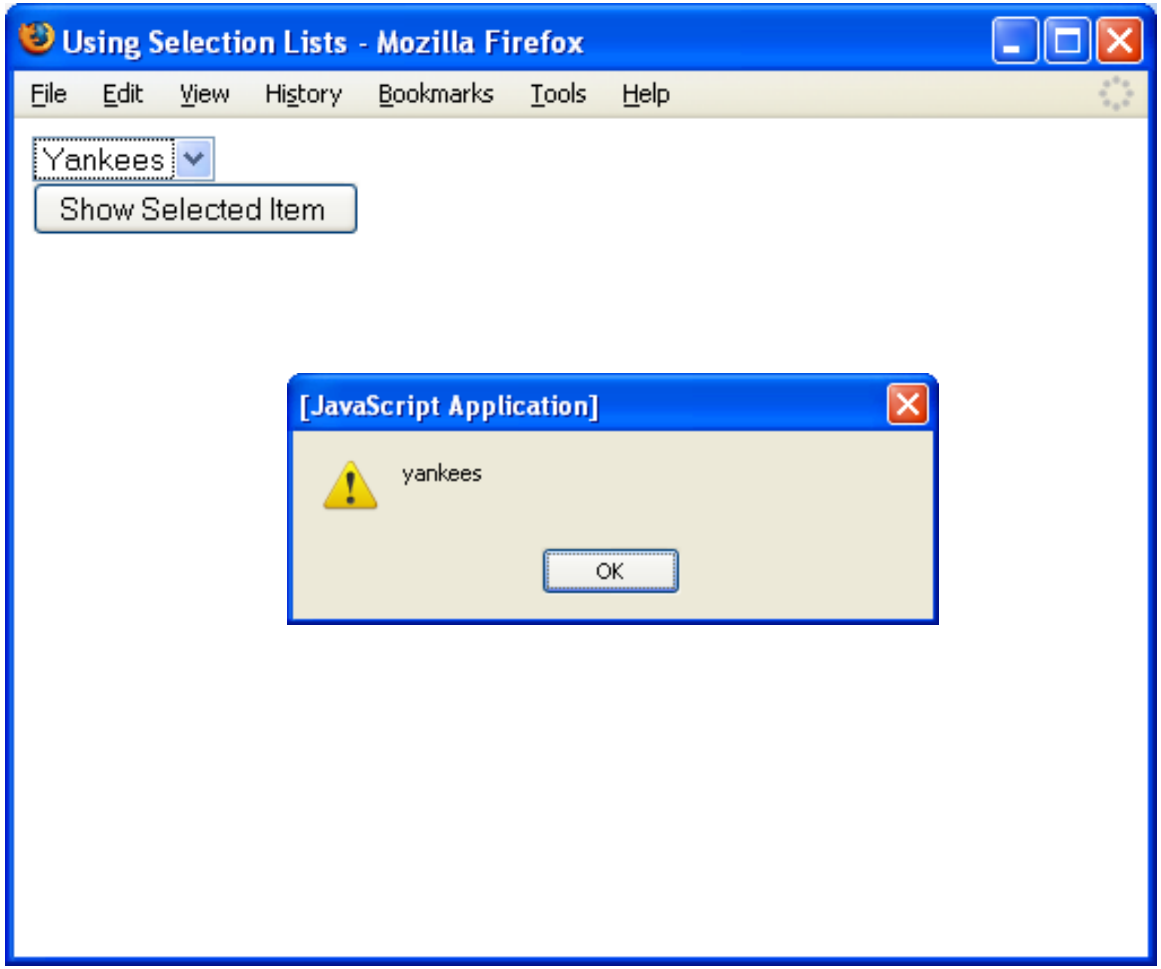
Use libraries to support older browsers. See:

http://www.useragentman.com/blog/2010/07/27/creating-cross-browser-html5-forms-now-using-modernizr-webforms2-and-html5widgets-2/

Example Selecting Using Selection Lists

```
<HTML><HEAD><TITLE>Using Selection Lists</TITLE>
<SCRIPT LANGUAGE="JavaScript">
function getSelectValue(selectObject) {
   return
   selectObject.options[selectObject.selectedIndex].value
   }
</SCRIPT></HEAD>
<BODY>
<FORM NAME="myform" method="POST">
<SELECT NAME="teams">
<OPTION value="dodgers">Dodgers
<OPTION value="yankees">Yankees
<OPTION value="angels">Angels
</SELECT><BR>
<INPUT TYPE="button" value="Show Selected Item "
onClick="alert(getSelectValue(this.form.teams))">
</FORM>
</BODY></HTML>
```

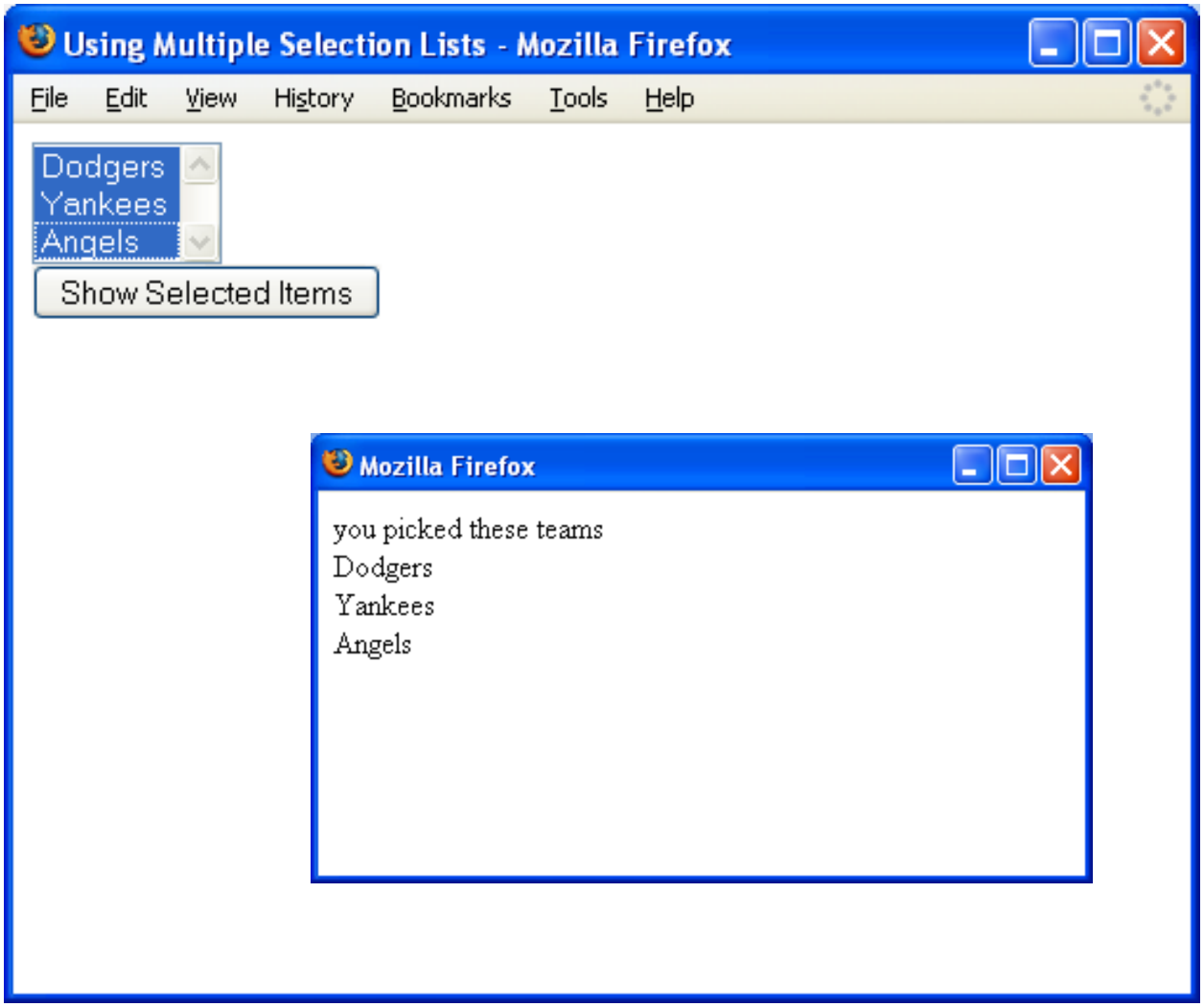
Browser Output



Example Selection Using Multi-selection Lists

```
<HTML><HEAD><TITLE>Using Multiple Selection Lists</TITLE>
<SCRIPT LANGUAGE="JavaScript">
function displaySelectionValues(objectName) { var ans = ""
   for (var i = 0; i < objectName.length; i++) {
        if(objectName.options[i].selected) {
                ans += objectName.options[i].text + "<BR>" } }
   myWin = window.open("", "Selections",
   "height=200,width=400")
   myWin.document.write("you picked these teams<BR>")
   myWin.document.write(ans) }
</SCRIPT></HEAD><BODY>
<FORM NAME="myform" method="POST">
<SELECT NAME="teams" size=3 multiple>
<OPTION value="dodgers">Dodgers<OPTION value="yankees">Yankees
<OPTION value="angels">Angels </SELECT><BR>
<INPUT TYPE="button" value="Show Selected Items"
onClick="displaySelectionValues(this.form.teams)">
</FORM></BODY></HTML>
```

Browser Output



JavaScript: addEventListener

- The addEventListener() method attaches an event handler to the specified element.
  - it does not overwrite existing event handlers.
  - You can add many event handlers to one element.
  - You can add event listeners to any DOM object not only HTML elements. i.e the window object
- **Example: Add an event listener that fires when a user clicks a button:**

```
document.getElementById("myBtn").addEventListener("click", displayDate);
```

- **Example: Use the alert function to print "Hello World!" when the user clicks on an element:**

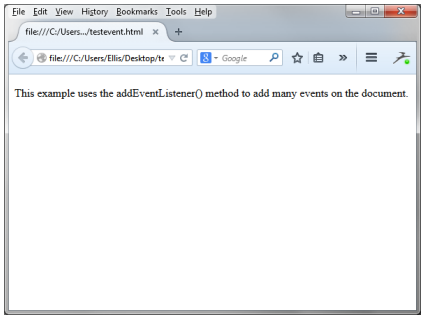
```
element.addEventListener("click", function(){ alert("Hello World!"); });
```

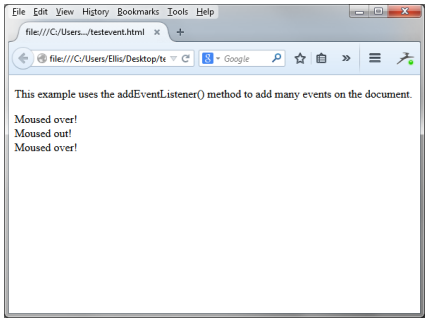
- **Example: on a click event change the associated text to Hello World; note the reference to an external function**

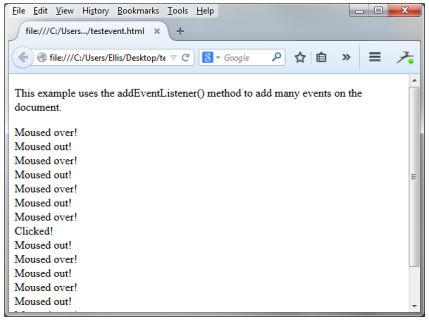
```
document.addEventListener("click", myFunction);
    function myFunction() {
        document.getElementById("demo").innerHTML = "Hello World";
    }
```

Example: Adding 3 Events to a Document

```
<!DOCTYPE html><html><body>
<p>This example uses the addEventListener() method to add many events on the document.</p>
<p id="demo"></p>
<script>
document.addEventListener("mouseover", myFunction);
document.addEventListener("click", mySecondFunction);
document.addEventListener("mouseout", myThirdFunction);
function myFunction() {
    document.getElementById("demo").innerHTML += "Moused over!<br>"  }
function mySecondFunction() {
    document.getElementById("demo").innerHTML += "Clicked!<br>"  }
function myThirdFunction() {
    document.getElementById("demo").innerHTML += "Moused out!<br>"  }
</script></body></html>
```







See: http://csci571.com/examples/js/Add3Events.html

JavaScript Language Issues

Outline

- Functions as first class objects
- Functions as methods
- Functions as constructors
- Functions have unlimited arguments
- By-value vs. By-reference
- Data Types
- Strings
- Expressions and Operator Anomalies
- Regular Expressions

Functions

- Functions are a type of object

```
function twice(x) { return x * x }
```

creates an object whose variable name is twice

- Therefore functions can be treated as an object
  - assigned to new variables
  - stored in arrays
  - assigned to properties of objects
  - passed as arguments to functions
- Example of function names

```
var twice_again = twice;
var sum = twice(5) + twice_again(10);
```

Methods of Functions

- One can associate a function with an object
- If func() is a function, and obj is an object,

  obj.method = func; assigns the function as an object method

- To invoke the method, do

  obj.method()

- the this keyword refers to object obj
- Example

```
function compute_area() { return this.length * this.width}

var rect = new Object();

rect.length = 10; rect.width = 20;

rect.area = compute_area; //passing the method

ans = rect.area; //invoke the method
```

Special Purpose Functions - Constructors

- Used with new to initialize fields of an object
- Example

```
function Rectangle(l, w)
{ this.length = l; this.width = w;
this.area = compute_area; }
. . .
var rect1 = new Rectangle(150, 100);
var rect1_area = rect1.area;
```

- **this** refers to the newly created object
- Rectangle creates properties length, width, and method area

By-Value versus By-Reference

	By-Value	By-Reference
copy (as in variable assignment)	value is copied	reference to value is copied
pass (as in an actual parameter to a formal parameter)	a new copy of the value is passed to the function	reference to the value is passed to the function
compare (as in a conditional clause)	two different values are compared	two references are compared

Handling Data Types

	Copied by	Passed by	Compared by
numbers	value	value	value
boolean	value	value	value
string	immutable	immutable	value
object	reference	reference	reference
array	reference	reference	reference
function	reference	reference	reference

- Changes to object properties are visible outside the function
- See: http://docstore.mik.ua/orelly/webprog/jscript/ch11_02.htm

JavaScript Strings

- Strings are immutable, once created they can never be changed
- You can search a string and extract substrings, but you cannot modify a string
- "immutable" means that once you instantiate the object, you can't change its properties.
- So, when calling methods on a string, JavaScript will return the modified string, but it won't change the initial string
- Now this doesn't mean that you can't assign a new string object to the str variable. You just can't change the current object that str references.
- One generally builds a string through concatenation

```
var newWebPage = ""

newWebPage += "<HTML><HEAD>"

newWebPage += "<TITLE>A Sample
   Page</TITLE></HEAD>"

newWebPage += "<BODY>My Home Page</BODY>"

newWebPage += "</HTML>"
```

Properties of Strings

- Strings have a length property

```
"Lincoln".length // result = 7

"Four score".length //result = 10

"One\ntwo".length // result = 7

"".length // result = 0
```

- Some String methods

```
string.tolowerCase(); string.toupperCase()

string.indexOf(searchstring [, startindex]) //returns
index value of char within string where searchString
begins

string.charAt(index) //returns the one char at
position index

string.substring(indexA, indexB) //returns characters
of string between indexA and indexB
```

Expressions and Operators

- Most of the C/C++ operators (lowest to highest order)

```
comma                   ,
assignment              = += -= *= /= %= <<= >>= >>>= &= ^= |=
conditional             ?:
logical or              ||
logical and             &&
bitwise or              |
bitwise xor             ^
bitwise and             &
equality                      == !=
comparison              < <= > >=
bitwise shift           << >> >>>
addition/subtraction+ -
multiply/divide         * / %
negation/increment      ! ~ - ++ --
call, data structure() [] .
```

Operator Anomalies

- Implicit conversions

  "a" * "b" is illegal

  "3" * "5" is legal, result is 15, not "15"

- Plus as concatenation

  "a" + "b" is legal "ab"

  "a" + 1 is legal "a1"

- Right associativity makes sense

  i = j = k = m; is the same as i = (j = (k = m));

  d = e ? f : (g ? h : (i ? j : k));

Equality Operator

- **== (!=) returns true or false**
- **Recall**
  - numbers, strings, booleans are compared by value
  - objects, arrays and functions are compared by reference
- **Implication**
  - to test if two objects have identical values, or to test if two arrays have identical values, check the fields element-by-element
- Some examples

  "1" == 1 evaluates to true

  true == 1 evaluates to true

  false == 0 evaluates to true

- The identity (===) operator behaves identically to the equality (==) operator **except** no type conversion is done, and the types must be the same to be considered equal, e.g. if x = 5, then
  - X == 8 is false
  - X == 5 is true
  - X === "5" is false
  - X === 5 is true

Regular Expressions in JavaScript

- Introduced in Javascript 1.2
  - [Netscape >=4 & IE >=5.5]
- Modeled after Perl's regular expressions
- There is a regular expression object, with properties and methods
- The constructor function for a regular expression is RegExp
- A regular expression object is created using the new operator
- See http://www.w3schools.com/jsref/jsref_obj_regexp.asp

Regular Expressions in JavaScript

- Constructing a regular expression
  - var re = /ab+c/ initializes re to an expr
  - re = new RegExp("ab+c") compiles the expr
- *test* and *exec* are methods of object RegExp
  - exec executes a search for a match in a string; it returns an array
  - test tests for a match and returns true/false
  - Both exec and test set properties during execution
- *match* and *search* are methods of String
  - match executes a search for a match in a string and returns an array or null
  - search tests for a match in a string and returns the index or -1

Regular Expression Examples

- Uses exec method to locate a string

```
<script language=javascript1.2>
myRe = /d(b+)d/g;          //a d,1 or more b, and a d
myArray = myRe.exec("cdbbdbsbz");
</script>
```

- An alternate approach

```
<script language=javascript1.2>
myArray = /d(b+)d/g.exec("cdbbdbsbz");
</script>
```

- An alternate approach

```
<script language=javascript1.2>
myRe = new RegExp ("d(b+)d", g:);
myArray = myRe.exec("cdbbdbsbz");
</script>
```

Parenthesized Substring Matches

- Example that uses the replace method to switch the words

```
<script language=javascript1.2>
re = /(\w+)\s(\w+)/;
str = "John Smith";
newstr = str.replace(re, "$2, $1");
document.write(newstr)
</script>
```

This prints "Smith, John"

Parenthesized Substring Matches

- Example using RegExp.input set by the Change event; in getInfo, the exec method uses the value of RegExp.input as its argument

```
<HTML>
<script language=javascript1.2>
function getInfo() {
 RegExp.input=document.myform.NameAge.value;
 re =/(\w+)\s(\d+)/;
 re.exec(RegExp.input);
 window.alert(RegExp.$1 + ", your age is " + RegExp.$2);}
</script>
Enter your first name and your age and press Enter
<form name=myform>
<input Name=NameAge onChange="getInfo(this); ">
</form></html>
```

Regular Expression Flags

- Regular expressions have two flags that permit global and case insensitive searching
- g stands for global match; i stands for ignore case
- Syntax

```
re = /pattern/[g|i|gi]
re = new RegExp("pattern", ['g'|'i'|'gi'])
```

- Example that creates a regular expression that looks for one or more characters followed by a space, throughout the string

```
<script language=javascript1.2>
re = /\w+\s/g;
str = "fee fi fo fum";
myArray = str.match(re);
document.write(myArray);
</script>
```

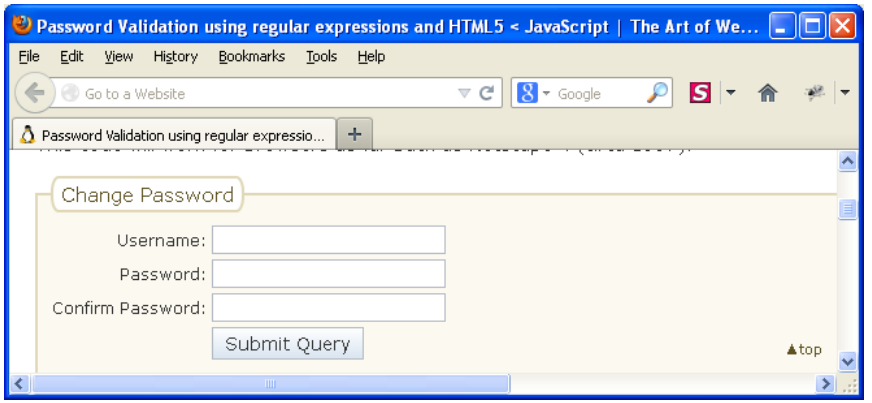
- Output is ["fee ", "fi ", "fo "]

Example

- User enters a number, click Test, and script checks validity

```
<script language=javascript1.2>
re = /\(?\d{3}\)?([-\/\.])\d{3}\1\d{4}/
function testInfo() {
RegExp.input=document.myform.Phone.value;
OK = re.exec(RegExp.input)
if (!OK)
        window.alert(RegExp.input + "isn't a phone number with area code")
 else
        window.alert("Thanks, your phone number is" + OK[0]) }
</script>
Enter your phone number with area code and then click Test
<form name=myform><input name=Phone>
<input type=button name=PhoneButton value="Test"
 onClick=testInfo(this);>
</form></ html>
```

Using Regular Expressions for Password Validation




```
<script type="text/javascript">
 function checkForm(form) {
if(form.username.value == "")
{ alert("Error: Username cannot be blank!");
    form.username.focus(); return false; }
 re = /^\w+$/;
if(!re.test(form.username.value)) {
        alert("Error: Username must contain only letters, numbers and underscores!"); form.username.focus(); return false; }
if(form.pwd1.value != "" && form.pwd1.value == form.pwd2.value) {
   if(form.pwd1.value.length < 6) { alert("Error: Password must contain at least six characters!");
                                    form.pwd1.focus(); return false; }
if(form.pwd1.value == form.username.value) { alert("Error: Password must be different from Username!");
                                             form.pwd1.focus(); return false; }
re = /[0-9]/;
if(!re.test(form.pwd1.value)) { alert("Error: password must contain at least one number (0-9)!"); form.pwd1.focus(); return false; }
re = /[a-z]/;
if(!re.test(form.pwd1.value)) { alert("Error: password must contain at least one lowercase letter (a-z)!");
                                form.pwd1.focus(); return false; }
re = /[A-Z]/;
if(!re.test(form.pwd1.value)) { alert("Error: password must contain at least one uppercase letter (A-Z)!");
                                form.pwd1.focus(); return false; }
} else { alert("Error: Please check that you've entered and confirmed your password!"); form.pwd1.focus(); return false; }
alert("You entered a valid password: " + form.pwd1.value); return true; } </script>
```

Simplifying the Regular Expression

- The code on the previous slide is fine in that it checks everything that we wanted to check, but uses a lot of code to test each requirement individually and present different error messages.
- Simpler way to accomplish it, with a single regular expression
- See: **http://www.the-art-of-web.com/javascript/validate-password/**
- Guide here: **https://developer.mozilla.org/en-US/docs/Web/JavaScript/Guide/Regular_Expressions**
- Consider the following:

```
<script type="text/javascript">
// at least one number, one lowercase, one uppercase letter
// at least six characters
var re = /(?=.*\d)(?=.*[a-z])(?=.*[A-Z]).{6,}/;
var validPassword = re.test(input);
</script>
```

the thing that is new is the notation ?=

?=.*\d means at least one character that is a number
and
?=.*[a-z] means at least one character that is a lower case letter
and
?=.*[A-Z] means at least one character that is an upper case letter
and
.{6,} means at least 6 characters

Implementation

```
<script type="text/javascript">
function checkPassword(str) {
         var re = /^(?=.*\d)(?=.*[a-z])(?=.*[A-Z])\w{6,}$/; return re.test(str); }
function checkForm(form) {
      if(form.username.value == "") { alert("Error: Username cannot be blank!");
                                      form.username.focus(); return false; }
     re = /^\w+$/;
     if(!re.test(form.username.value)) {
        alert("Error: Username must contain only letters, numbers and underscores!");
                      form.username.focus(); return false; }
if(form.pwd1.value != "" && form.pwd1.value == form.pwd2.value) {
 if(!checkPassword(form.pwd1.value)) {
                 alert("The password you have entered is not valid!");
                 form.pwd1.focus(); return false; }
 } else { alert("Error: Please check that you've entered and confirmed your password!");
             form.pwd1.focus(); return false; }
return true; }
</script>
<form method="POST" action="form-handler.php" onsubmit="return checkForm(this);">
 <p>Username: <input type="text" name="username"></p>
<p>Password: <input type="password" name="pwd1"></p>
<p>Confirm Password: <input type="password" name="pwd2"></p>
<p><input type="submit"></p> </form>
```

JavaScript: use strict

- The idea of “strict” mode:
  - in normal JavaScript, mistyping a variable name creates a new global variable. In strict mode, this will throw an error, making it impossible to accidentally create a global variable.
  - In normal JavaScript, a developer will not receive any error feedback assigning values to non-writable properties.
  - In strict mode, any assignment to a non-writable property, a getter-only property, a non-existing property, a non-existing variable, or a non-existing object, will throw an error.
- Strict mode is declared by adding "use strict"; to the beginning of a JavaScript file, or a JavaScript function.
- Declared at the beginning of a JavaScript file, it has global scope (all code will execute in strict mode).
- Declared inside a function, it has local scope (only the code inside the function is in strict mode).

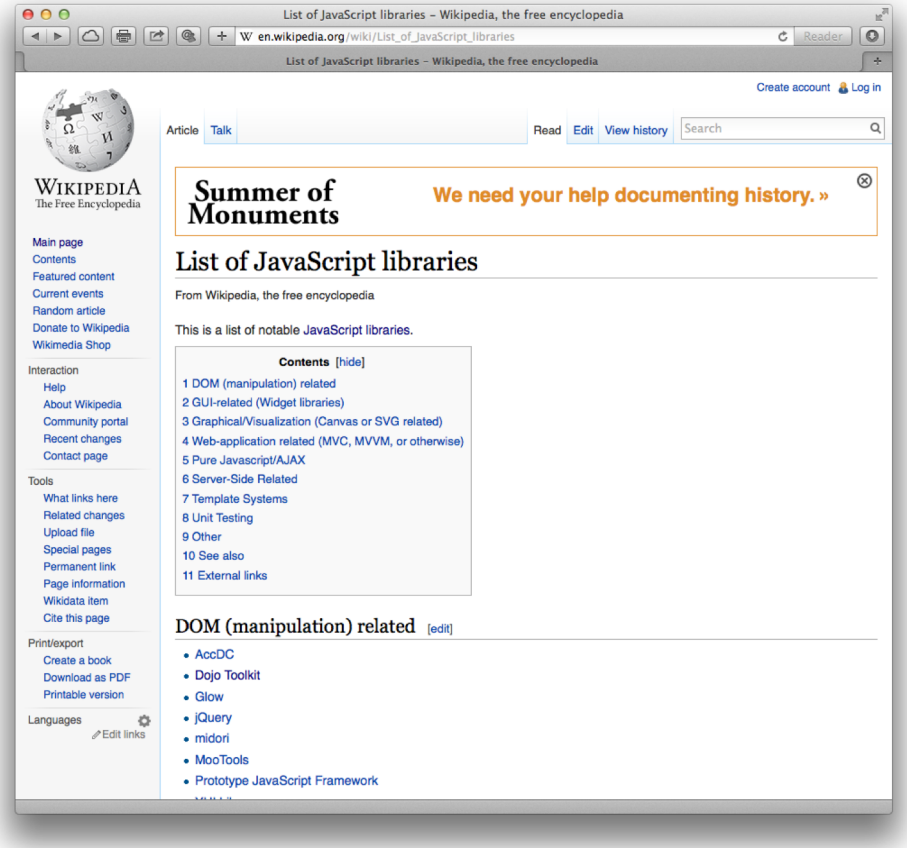
Common JavaScript Mistakes

1. Undefined may not be null
   - In JavaScript something that has not been assigned to is not null, but undefined. Undefined is different from null when using != = but not when using the weaker != because JavaScript does some implicit casting in the later case
   - For details see http://weblogs.asp.net/bleroy/archive/2005/02/15/373815.aspx
2. You cannot overload a function
   - If you try to define two different functions with the same name but with different arguments, assuming the proper function will be called when the number of arguments match (this is overloading), then your assumption is incorrect. JavaScript will simply the latest-defined version of the function and call it;
   - If a parameter is omitted it is undefined
3. Undeclared variables are global
   - If a variable is NOT declared using var, then it is global. Two variables of the same name, both undeclared will create conflicts that are hard to debug

JavaScript Libraries

- See http://en.wikipedia.org/wiki/List_of_JavaScript_libraries

- Each library listed includes a link to the respective Wikipedia page, which links to library home page



How do you judge a JavaScript programmer by only 5 questions?

- **1. Can you explain the difference between “call” and “apply” to me?**

  The answer to this question is a bit of a factoid, so that someone can answer it doesn't give you any information, but if they cannot, it gives a truckload. Almost all JavaScript programmer that has written a library or two (which most curious ones will, after programming it a few years) will know this.

  Addendum: Several people are calling #1 into question. I must be very clear here that I stand firm on this one. If you haven't used apply, you are most likely missing out on the most powerful and overlooked aspects of the language. It's also an indicator that you haven't tried your hand at building a library yet, because when building libraries, apply and call are very commonly used.

- **2. Can you explain “map” to me?**

  Map is a an extremely useful functional programming concept that any computer science person will know. If someone doesn't know this, it's a sign that they lack an understanding of computer science and/or lack an understanding of the language. In addition, the explanation itself will give you a sense of how much the person knows about the language just in the way they talk. If the person does well on this question, ask about reduce as a follow up. If you do not know what map is, it means that you have done zero functional programming and you're missing out. Severely.

- **3. Can you explain “bind” to me?**

  This is a really great question, because it delves into the concept of this. You can basically drill the interviewee for quite some time on this, as it is a very large subject. You'll get a good sense of a programmer by having this discussion.

- **4. Can you explain how “closures” work to me?**

  This is a great question to ask programmers that claim to be experienced in general, but not with JavaScript. Closures are a general programming concept that is extraordinarily important in JavaScript. If they understand closures well, they will learn JavaScript pretty quickly.

- **5. Can you please tell me a story about a JavaScript performance problem that you've encountered and how you approached solving it?**

  This will tell you a lot about how much programming a person has actually done, in their own words. A big one to keep an eye out for is that they should be praising the Google Developer tools, and not rely too much on theoretical time complexity.