LING 408/508: Computational Techniques for Linguists

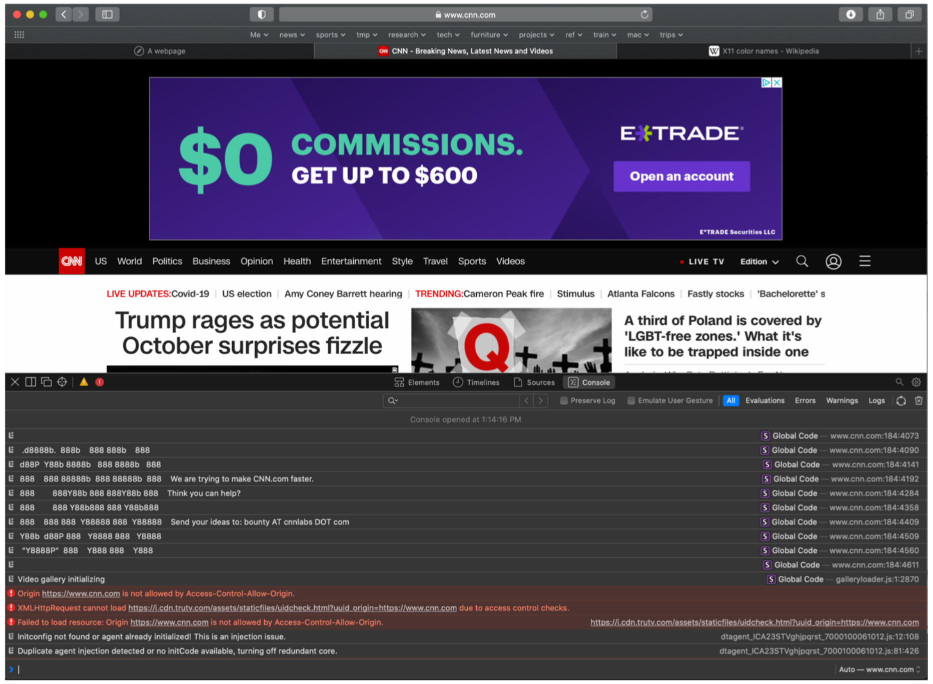
Lecture 17

Today's Topic

- How to access Javascript directly on the browser
  - from the search field
  - from the console
- Javascript
- DOM (Document Object Model)

CNN Webpage

Look at the errors on loading cnn.com!

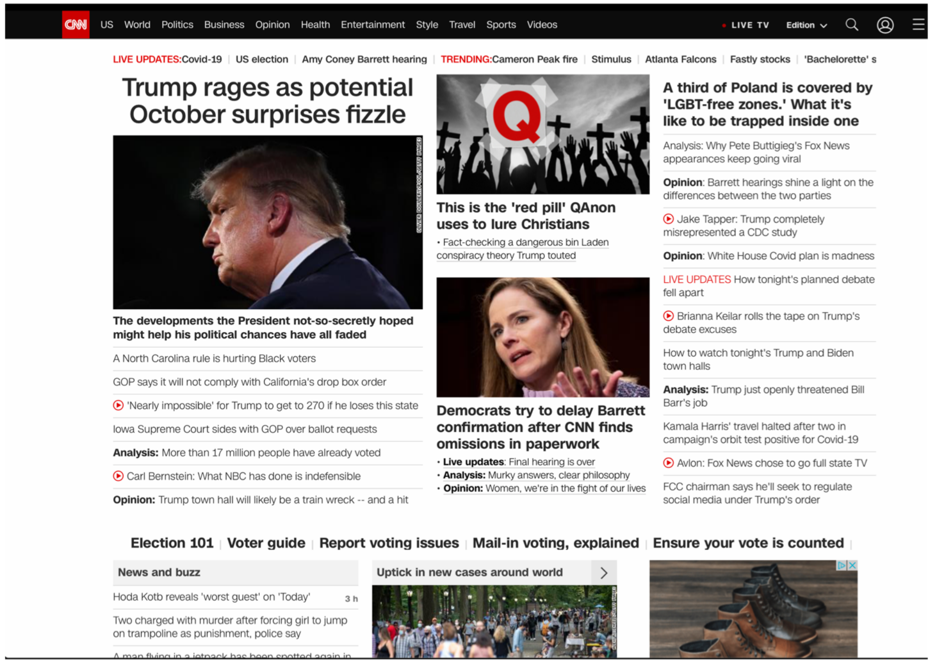

www.cnn.com
Me news sports tmp research tech furniture projects ref train mac trips
A webpage
CNN - Breaking News, Latest News and Videos
X11 color names - Wikipedia
$0 COMMISSIONS. GET UP TO $600
E*TRADE
Open an account
E*TRADE Securities LLC
US World Politics Business Opinion Health Entertainment Style Travel Sports Videos
LIVE TV Edition
Elements Timelines Sources Console
Preserve Log Emulate User Gesture All Evaluations Errors Warnings Logs
Auto — www.cnn.com

LIVE UPDATES:Covid-19 | US election | Amy Coney Barrett hearing | TRENDING:Cameron Peak fire | Stimulus | Atlanta Falcons | Fastly stocks | 'Bachelorette' s

Trump rages as potential October surprises fizzle

A third of Poland is covered by 'LGBT-free zones.' What it's like to be trapped inside one

```
                                                   Console opened at 1:14:16 PM
                                                                                    Global Code — www.cnn.com:184:4073
 .d8888b.  888b    888 888b    888                                                  Global Code — www.cnn.com:184:4090
d88P  Y88b 8888b   888 8888b   888                                                  Global Code — www.cnn.com:184:4141
888    888 88888b  888 88888b  888   We are trying to make CNN.com faster.          Global Code — www.cnn.com:184:4192
888        888Y88b 888 888Y88b 888   Think you can help?                            Global Code — www.cnn.com:184:4284
888        888 Y88b888 888 Y88b888                                                  Global Code — www.cnn.com:184:4358
888    888 888  Y88888 888  Y88888   Send your ideas to: bounty AT cnnlabs DOT com  Global Code — www.cnn.com:184:4409
Y88b  d88P 888   Y8888 888   Y8888                                                  Global Code — www.cnn.com:184:4509
 "Y8888P"  888    Y888 888    Y888                                                  Global Code — www.cnn.com:184:4560
                                                                                    Global Code — www.cnn.com:184:4611
Video gallery initializing                                                          Global Code — galleryloader.js:1:2870
Origin https://www.cnn.com is not allowed by Access-Control-Allow-Origin.
XMLHttpRequest cannot load https://i.cdn.trutv.com/assets/staticfiles/uidcheck.html?uuid_origin=https://www.cnn.com due to access control checks.
Failed to load resource: Origin https://www.cnn.com is not allowed by Access-Control-Allow-Origin.   https://i.cdn.trutv.com/assets/staticfiles/uidcheck.html?uuid_origin=https://www.cnn.com
Initconfig not found or agent already initialized! This is an injection issue.      dtagent_ICA23STVghjpqrst_7000100061012.js:12:108
Duplicate agent injection detected or no initCode available, turning off redundant core.   dtagent_ICA23STVghjpqrst_7000100061012.js:81:426
```


US World Politics Business Opinion Health Entertainment Style Travel Sports Videos
LIVE TV Edition

LIVE UPDATES:Covid-19 | US election | Amy Coney Barrett hearing | TRENDING:Cameron Peak fire | Stimulus | Atlanta Falcons | Fastly stocks | 'Bachelorette' s

Trump rages as potential October surprises fizzle

The developments the President not-so-secretly hoped might help his political chances have all faded

A North Carolina rule is hurting Black voters

GOP says it will not comply with California's drop box order

'Nearly impossible' for Trump to get to 270 if he loses this state

Iowa Supreme Court sides with GOP over ballot requests

Analysis: More than 17 million people have already voted

Carl Bernstein: What NBC has done is indefensible

Opinion: Trump town hall will likely be a train wreck -- and a hit

This is the 'red pill' QAnon uses to lure Christians

- Fact-checking a dangerous bin Laden conspiracy theory Trump touted

Democrats try to delay Barrett confirmation after CNN finds omissions in paperwork

- **Live updates**: Final hearing is over
- **Analysis:** Murky answers, clear philosophy
- **Opinion:** Women, we're in the fight of our lives

A third of Poland is covered by 'LGBT-free zones.' What it's like to be trapped inside one

Analysis: Why Pete Buttigieg's Fox News appearances keep going viral

Opinion: Barrett hearings shine a light on the differences between the two parties

Jake Tapper: Trump completely misrepresented a CDC study

Opinion: White House Covid plan is madness

LIVE UPDATES How tonight's planned debate fell apart

Brianna Keilar rolls the tape on Trump's debate excuses

How to watch tonight's Trump and Biden town halls

Analysis: Trump just openly threatened Bill Barr's job

Kamala Harris' travel halted after two in campaign's orbit test positive for Covid-19

Avlon: Fox News chose to go full state TV

FCC chairman says he'll seek to regulate social media under Trump's order

Election 101 | Voter guide | Report voting issues | Mail-in voting, explained | Ensure your vote is counted |

News and buzz

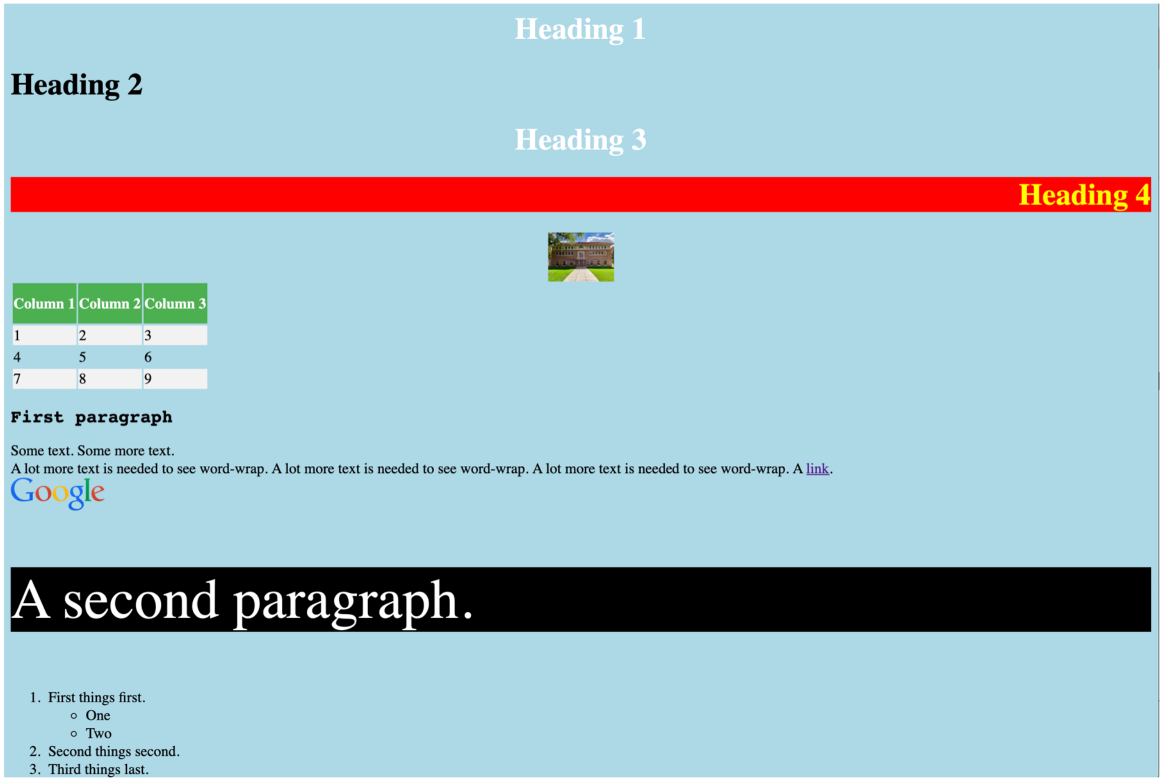
Hoda Kotb reveals 'worst guest' on 'Today' 3 h

Two charged with murder after forcing girl to jump on trampoline as punishment, police say

Uptick in new cases around world

Look at the bounty offered to developers! ⇧

sample2.html



Heading 1

Heading 2

Heading 3

Heading 4

Column 1	Column 2	Column 3
1	2	3
4	5	6
7	8	9

First paragraph

Some text. Some more text.
A lot more text is needed to see word-wrap. A lot more text is needed to see word-wrap. A lot more text is needed to see word-wrap. A link.

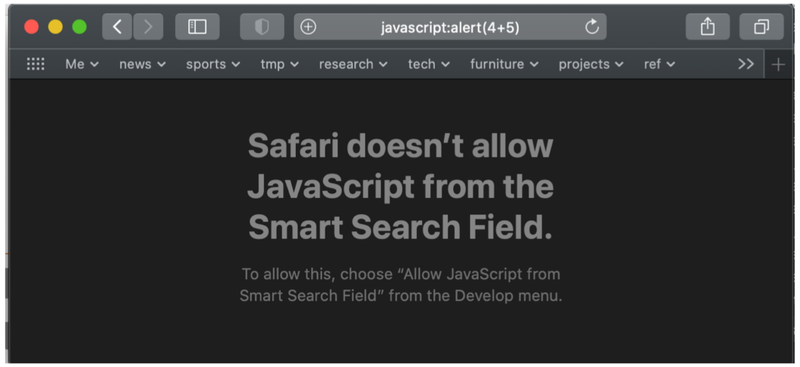
Google

A second paragraph.

1. First things first.
   - One
   - Two
2. Second things second.
3. Third things last.

Javascript pop-up notification

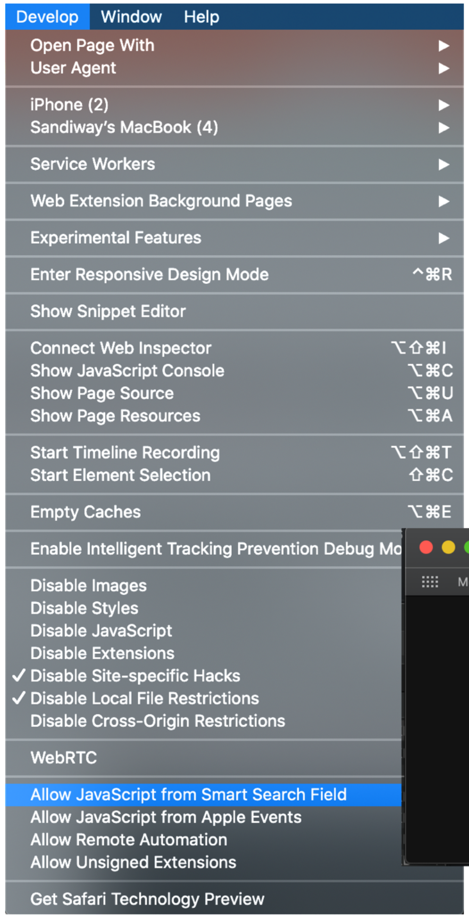
- For browser programming:
  - alert(*string*)
  - *no print function*
- Example (from address bar):
  - `javascript:alert(4+5)`



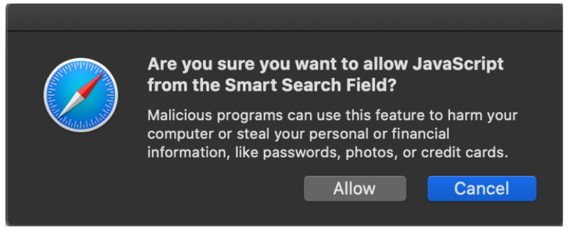
javascript:alert(4+5)

Safari doesn't allow JavaScript from the Smart Search Field.

To allow this, choose "Allow JavaScript from Smart Search Field" from the Develop menu.

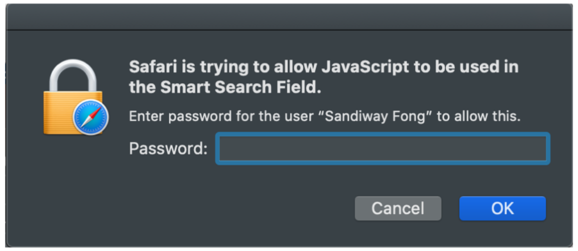


Develop
Window
Help
Open Page With
User Agent
iPhone (2)
Sandiway's MacBook (4)
Service Workers
Web Extension Background Pages
Experimental Features
Enter Responsive Design Mode ^⌘R
Show Snippet Editor
Connect Web Inspector ⌥⇧⌘I
Show JavaScript Console ⌥⌘C
Show Page Source ⌥⌘U
Show Page Resources ⌥⌘A
Start Timeline Recording ⌥⇧⌘T
Start Element Selection ⇧⌘C
Empty Caches ⌥⌘E
Enable Intelligent Tracking Prevention Debug Mo
Disable Images
Disable Styles
Disable JavaScript
Disable Extensions
✓ Disable Site-specific Hacks
✓ Disable Local File Restrictions
Disable Cross-Origin Restrictions
WebRTC
Allow JavaScript from Smart Search Field
Allow JavaScript from Apple Events
Allow Remote Automation
Allow Unsigned Extensions
Get Safari Technology Preview



Are you sure you want to allow JavaScript from the Smart Search Field?

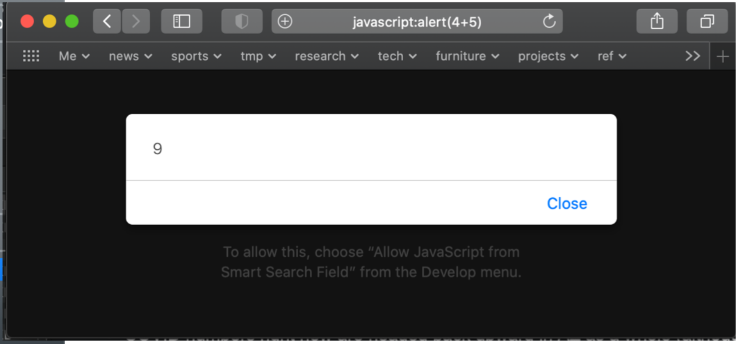
Malicious programs can use this feature to harm your computer or steal your personal or financial information, like passwords, photos, or credit cards.



Safari is trying to allow JavaScript to be used in the Smart Search Field.

Enter password for the user "Sandiway Fong" to allow this.

Password:

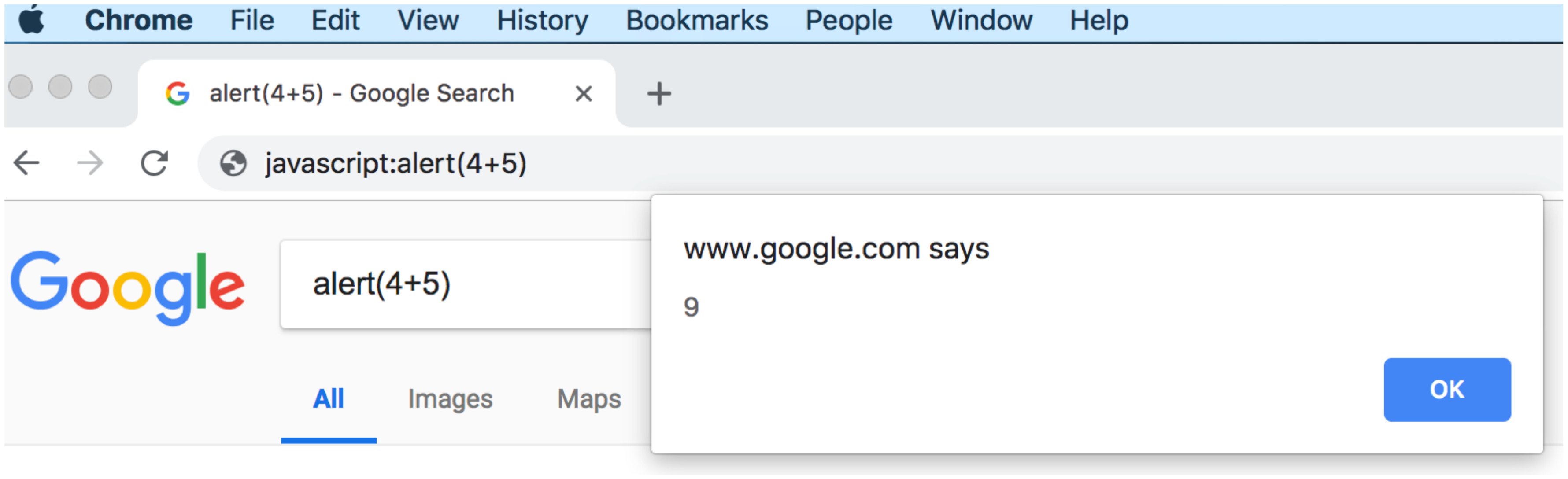


javascript:alert(4+5)

9

To allow this, choose "Allow JavaScript from Smart Search Field" from the Develop menu.

Javascript pop-up notification



```
javascript:alert(4+5)
```

alert(4+5)

www.google.com says

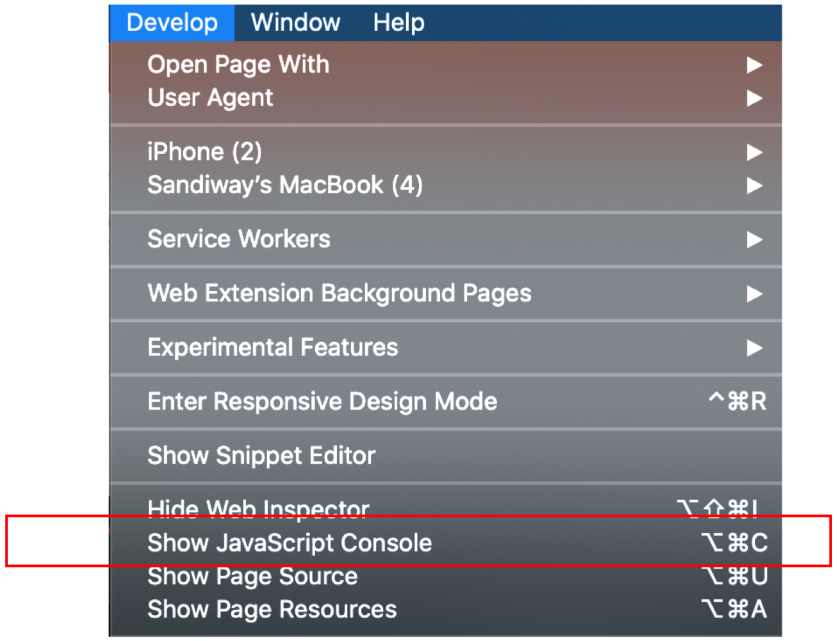
9

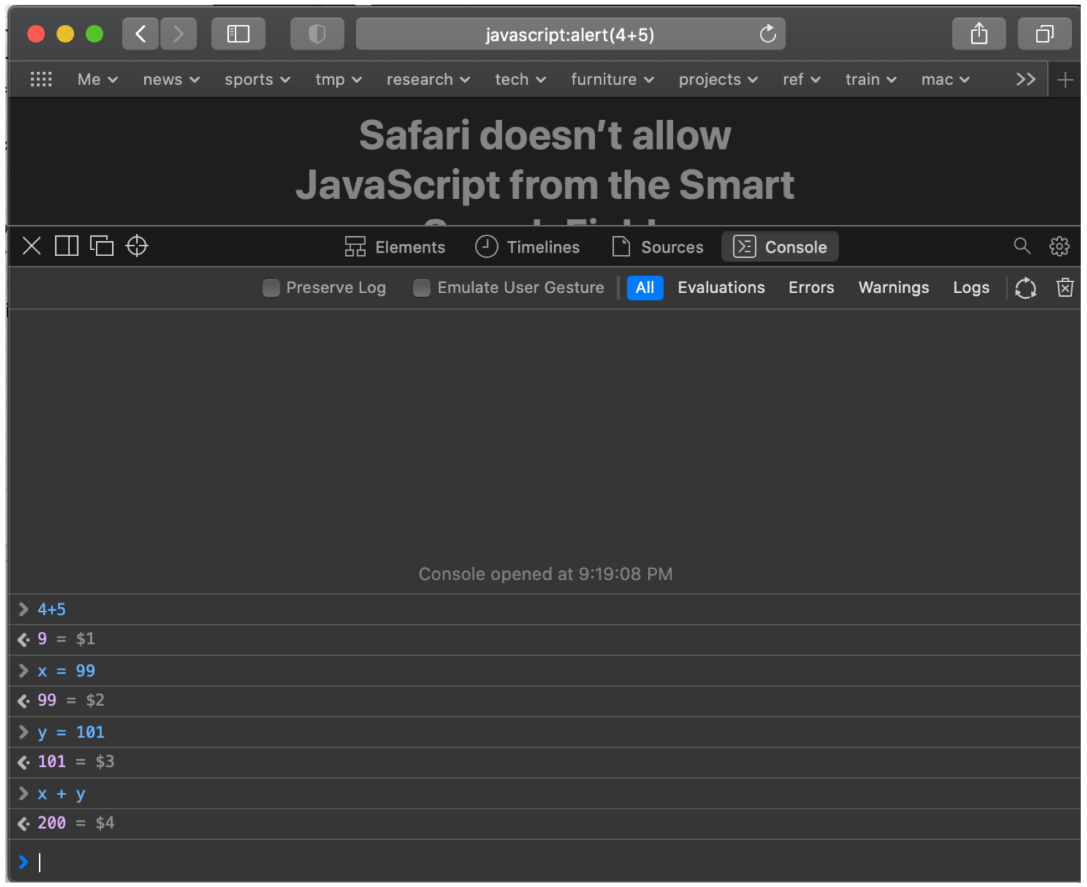
Javascript

- Javascript:
  - invented in 1995 as a browser programming language
  - not the same as Java (also appeared in 1995)
- Javascript code:
  - **`<script> ..   </script>`**
  - **`<script src="filename.js"></script>`**
- HTML element events:
  - **`onclick="`*`js code`*`"`**
  - **`onmouseover="`*`js code`*`"`**
  - **`onkeydown="`*`js code`*`"`**
- Reference:
  - http://www.w3schools.com/jsref/dom_obj_event.asp

code snippets can be placed in
`<head>..</head>`
or
`<body>..</body>`

Javascript Console

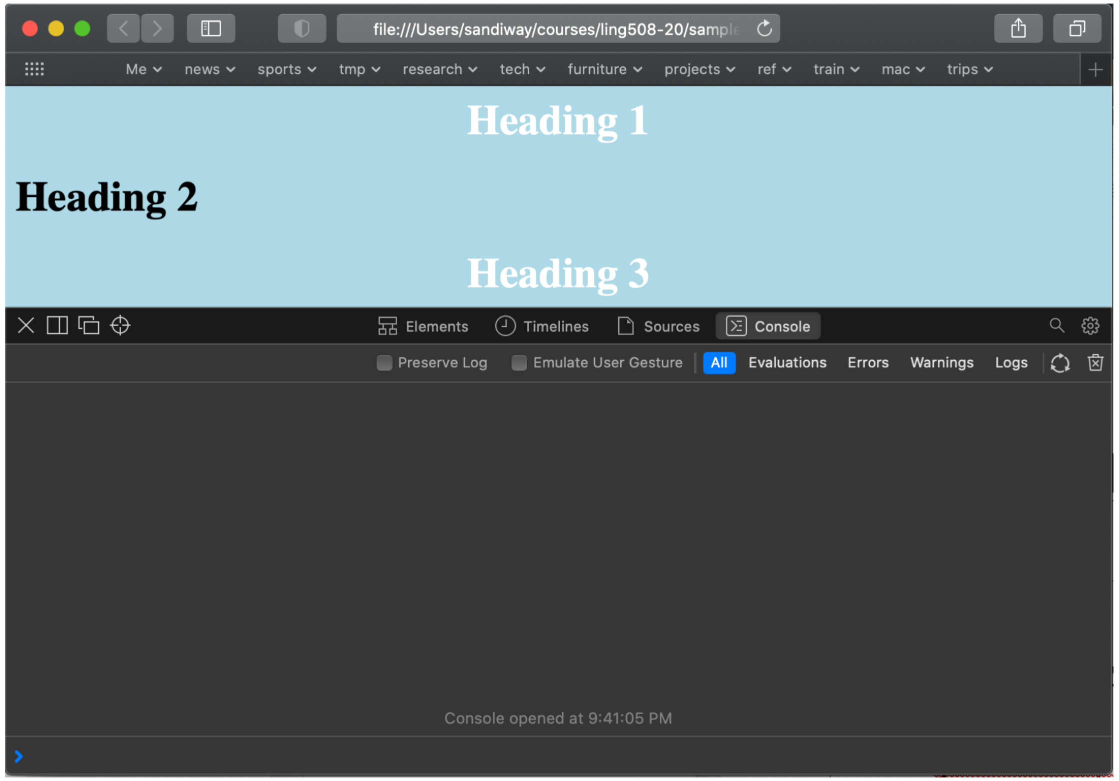




```
Console opened at 9:19:08 PM
> 4+5
< 9 = $1
> x = 99
< 99 = $2
> y = 101
< 101 = $3
> x + y
< 200 = $4
> |
```

Javascript Console

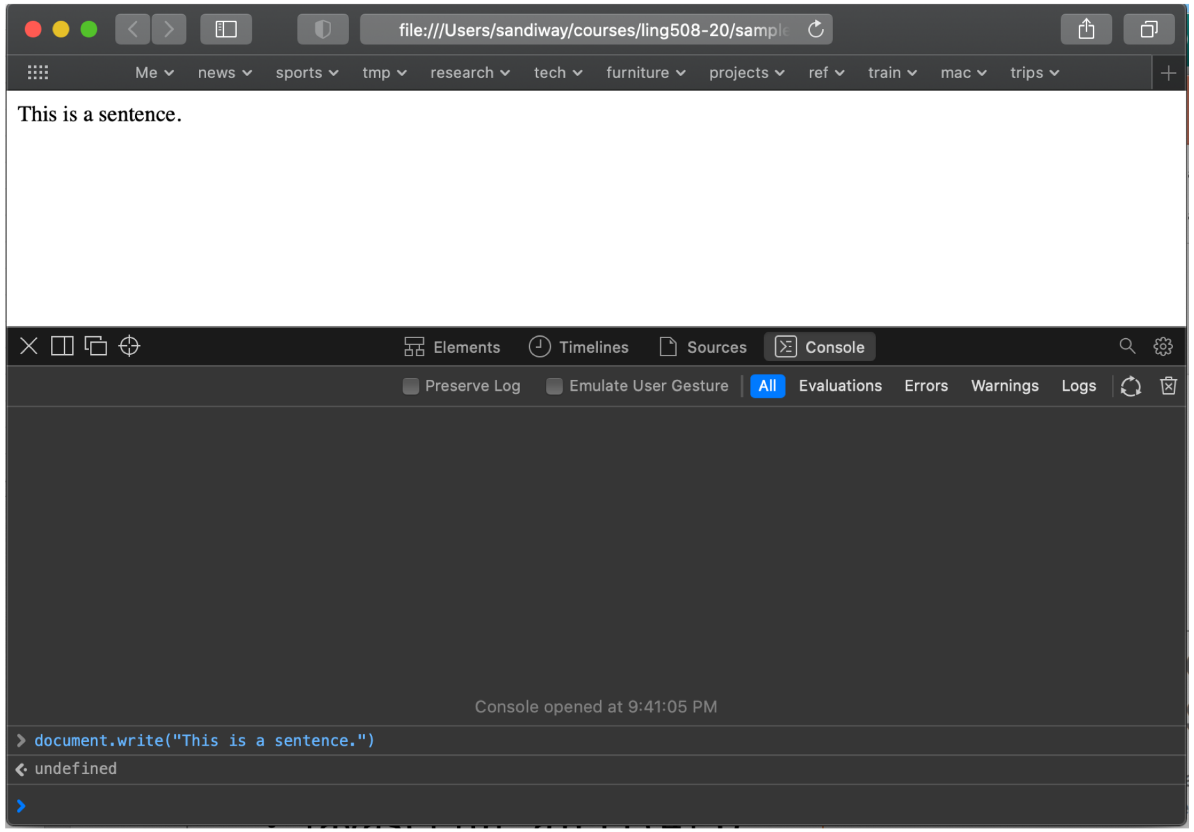
- Suppose we have `sample2.html` loaded
- Show Javascript Console
- Changing the html document:
  - `document.write(`*`string`*`)`
    - *overwrites html document*
  - *`html_element`*`.innerHTML = "`*`string`*`"`
    - *modifies html_element*



Console opened at 9:41:05 PM

Javascript Console

- Suppose we have `sample2.html` loaded
- Show Javascript Console
- Changing the html document:
  - `document.write(`*`string`*`)`
    - *overwrites html document*
  - *`html_element`*`.innerHTML = "`*`string`*`"`
    - *modifies html_element*

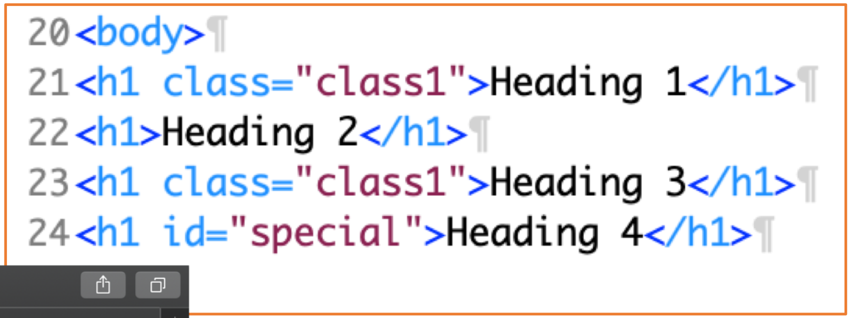


This is a sentence.

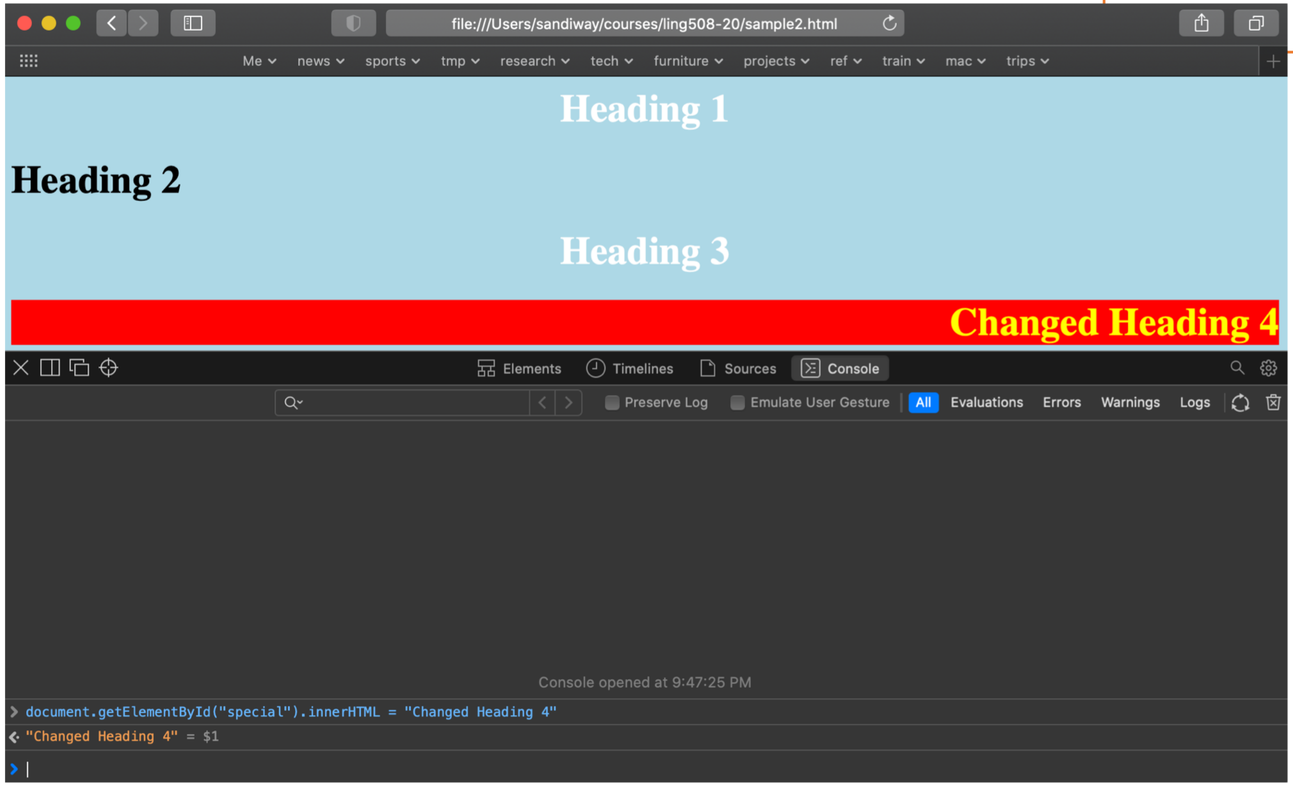
```
Console opened at 9:41:05 PM
> document.write("This is a sentence.")
< undefined
>
```

Javascript Console

- *html_element*.innerHTML = "*string*"



```
<body>
<h1 class="class1">Heading 1</h1>
<h1>Heading 2</h1>
<h1 class="class1">Heading 3</h1>
<h1 id="special">Heading 4</h1>
```



file:///Users/sandiway/courses/ling508-20/sample2.html
Me news sports tmp research tech furniture projects ref train mac trips
Elements Timelines Sources Console
Preserve Log Emulate User Gesture All Evaluations Errors Warnings Logs

Heading 1

Heading 2

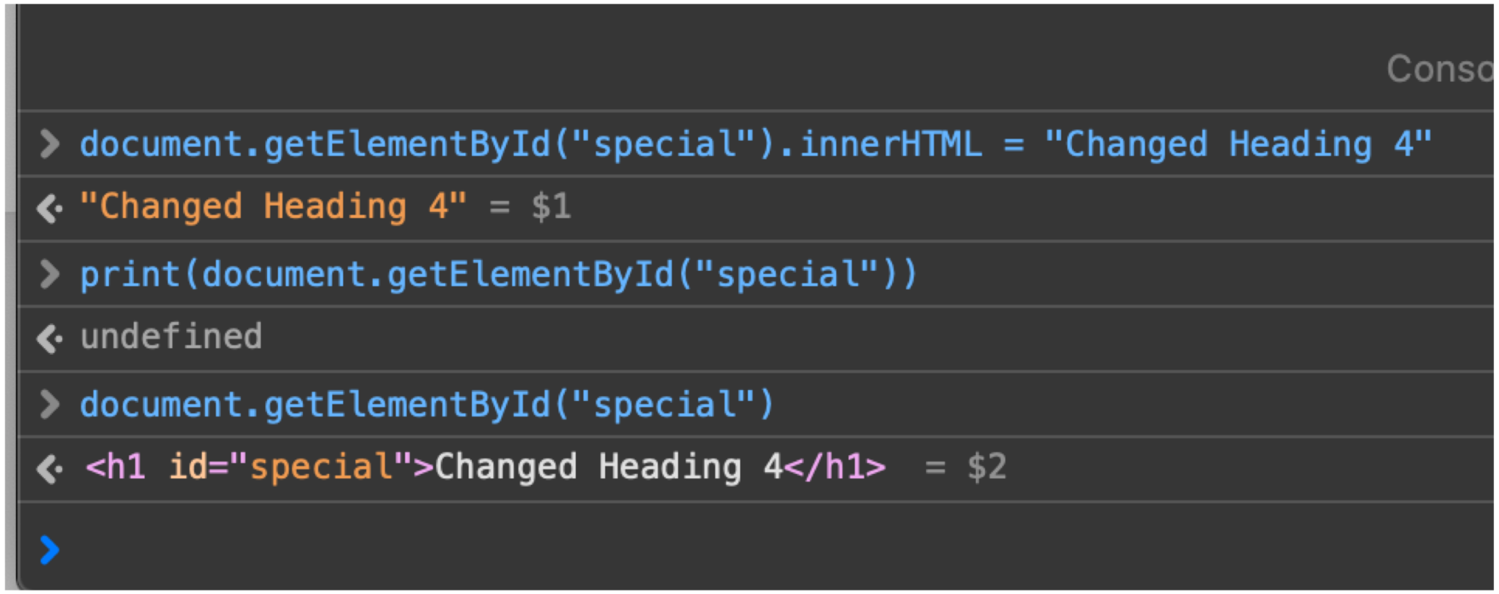
Heading 3

Changed Heading 4

```
Console opened at 9:47:25 PM
> document.getElementById("special").innerHTML = "Changed Heading 4"
< "Changed Heading 4" = $1
>
```

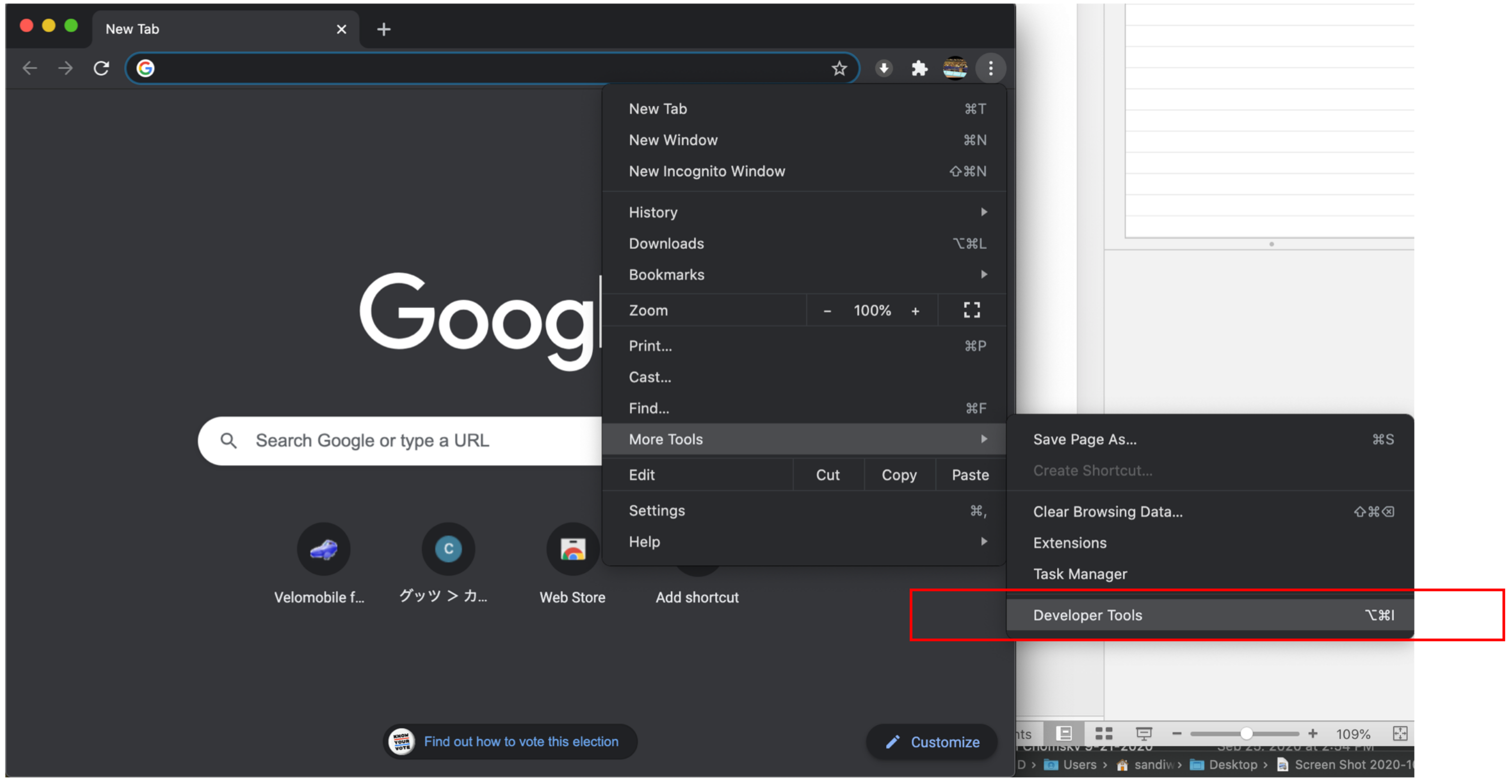
Javascript Console

`DOM: document.getElementById(ID)`

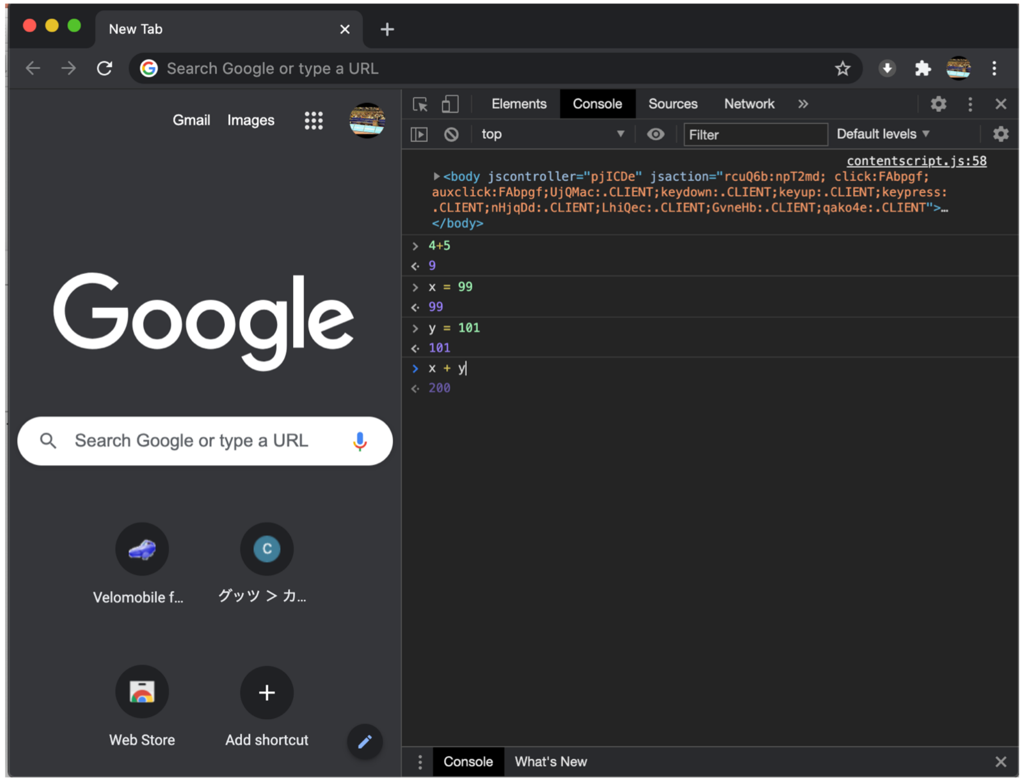


```
> document.getElementById("special").innerHTML = "Changed Heading 4"
<· "Changed Heading 4" = $1
> print(document.getElementById("special"))
<· undefined
> document.getElementById("special")
<· <h1 id="special">Changed Heading 4</h1>  = $2
>
```

Javascript Console: Chrome



Javascript Console: Chrome



```
                                                    contentscript.js:58
  ▸<body jscontroller="pjICDe" jsaction="rcuQ6b:npT2md; click:FAbpgf;
  auxclick:FAbpgf;UjQMac:.CLIENT;keydown:.CLIENT;keyup:.CLIENT;keypress:
  .CLIENT;nHjqDd:.CLIENT;LhiQec:.CLIENT;GvneHb:.CLIENT;qako4e:.CLIENT">…
  </body>
> 4+5
<· 9
> x = 99
<· 99
> y = 101
<· 101
> x + y
<· 200
```

Variables

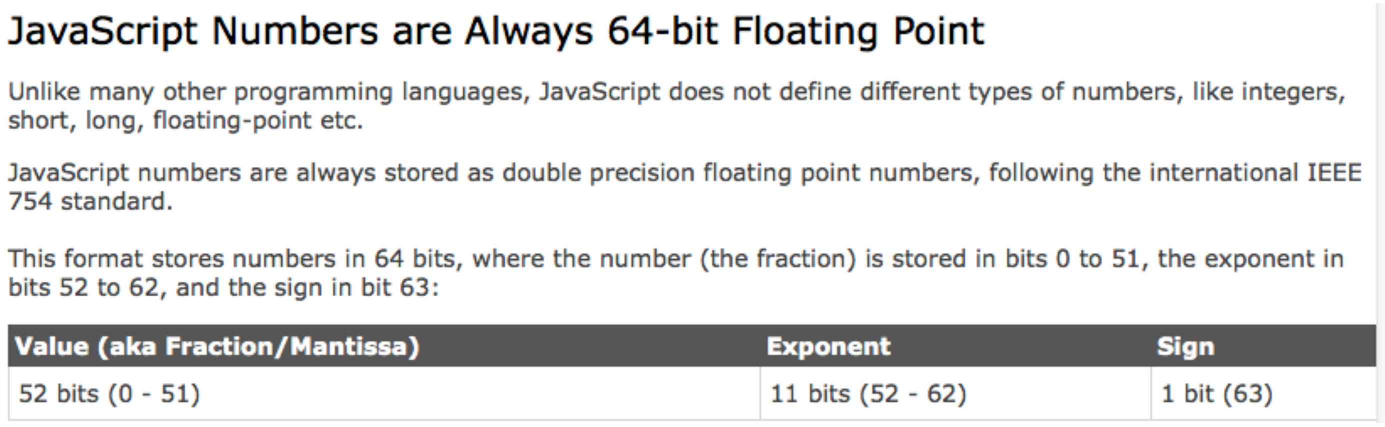
- Declared variables:
  - **`var x = 9;`**   ***`// number variable`***
  - **`var name = "String";`**   ***`// string variable`***
  - **Note**: *names are case sensitive, no $ like the bash shell, // for in-line comments*
- function local variables:
  - **`function f() {`**
  - **`  var x = 99;`**
  - **`}`**
- Not declared:
  - i.e. *just used without declaration*
  - treated as a global variable
- Strict: prevents use of undeclared variables etc.
  - **`"use strict";`**   quotes for backwards compatibility with older versions
- Comments:
  - **`//`**   *until the end of the line*
  - **`/* … */`**   *multiline* (*same as CSS*)

Strings

- Use either **double quotes** or **single quotes** (no difference)
  - escape using backslash, e.g. **\"**, **\n**, \\
- Properties:
  - **"*string*".length**
- Methods (like a function but object-based):
  - **.indexOf(*string*)** returns position (0…length), -1 if not found
  - **.search(regex)** returns position
  - .**replace(regex,string)** replaces with string, returns result
  - **.slice(index,index)** substring from position to position
  - **.substr(index,length)** substring
  - **.toLowerCase()** case conversion
  - **.toUpperCase()**
  - **.trim()** remove whitespace from both ends
  - .**charAt(index)** single character at position
  - .**split(separator)** returns array, single characters if separator=""

Numbers

http://www.w3schools.com/js/js_numbers.asp



JavaScript Numbers are Always 64-bit Floating Point

Unlike many other programming languages, JavaScript does not define different types of numbers, like integers, short, long, floating-point etc.

JavaScript numbers are always stored as double precision floating point numbers, following the international IEEE 754 standard.

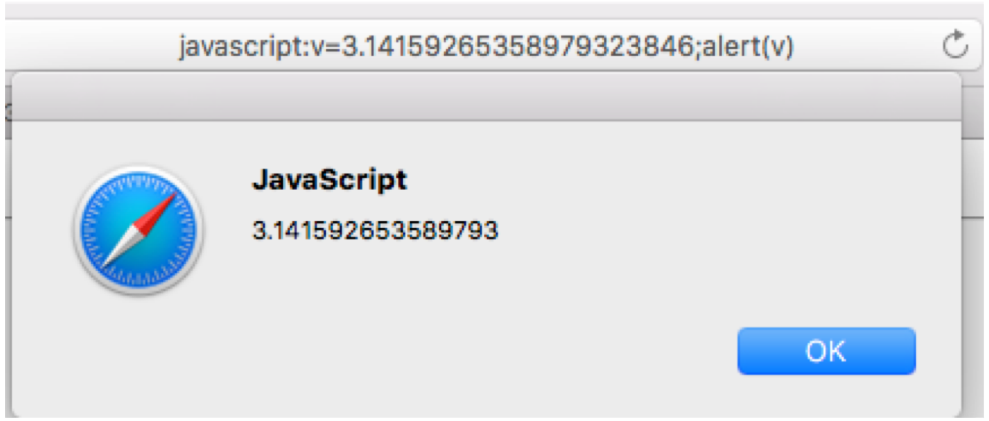
This format stores numbers in 64 bits, where the number (the fraction) is stored in bits 0 to 51, the exponent in bits 52 to 62, and the sign in bit 63:

Value (aka Fraction/Mantissa)	Exponent	Sign
52 bits (0 - 51)	11 bits (52 - 62)	1 bit (63)

- Recall the discussion in lectures at the beginning of the semester about number representation?
  - Integers are considered accurate up to 15 digits.

Numbers

- Pi to 20 decimal places
  - 3.14159 26535 89793 23846
  - 3.14159 26535 89793 (Javascript)



```
javascript:v=3.14159265358979323846;alert(v)
```

JavaScript

```
3.141592653589793
```

Operators

Arithmetic Operators:

- +, -, *, /, % (mod), ++, --

Assignment Operators:

- =, +=, -=, *= /=, %=

String Operators:

• +	concatenation
• +=	append to string

alert("string" + 5)
produces string5

Comparison Operators:

• ==	can be made equal (type coercion)
• !=	not equal
• ===	same type and equal (no type coercion)
• !==	not equal (no type coercion)
• >, <, >=, <=	
• &&	logical and
• ||	logical or
• !	negation

(Javascript: Boolean true/false)

Note: & , !, ~ (not), ^ (xor) are bitwise operators

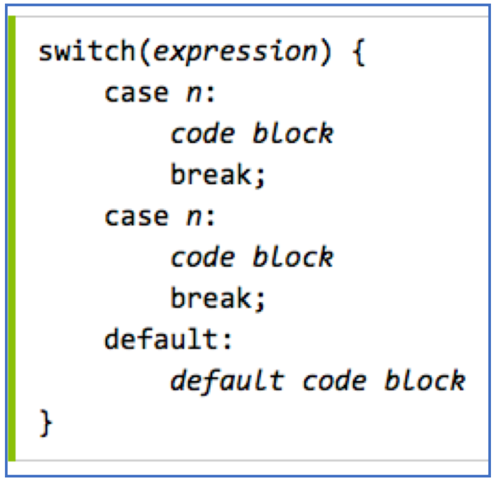
Conditionals

- if-then

```
if (condition) { … }
else if (condition) { … }
else { … }
```

- switch

```
switch (expression) {
   case value: … break;
   …
   default: …
}
```



```
switch(expression) {
    case n:
        code block
        break;
    case n:
        code block
        break;
    default:
        default code block
}
```

Idea: compute *expression* first
2nd stage: compare computed value with each case

Loops

- for loop (just like C):
  - **example**:
    - **`for (i = 0; i < 100; i++) {  … }`**
- for/in loop (object properties):
  - **`for (x in object) { … }`**

- while loop:
  - **example**:
    - **`while (true) { … }`**

- do/while loop (like traditional repeat/until):
  - **`do { … } while (`*`condition`*`)`**

- loop exit:
  - **`break`** (jump out of loop immediately)
  - **`continue`** (skip rest of current iteration)

Miscellaneous

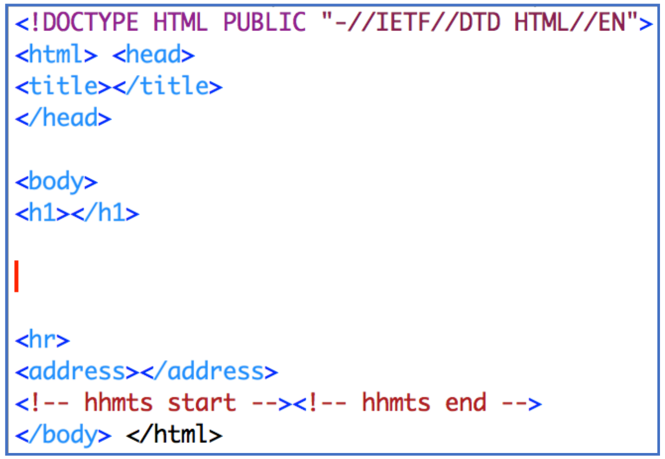
- Random number `[0,n-1]`:
  - `Math.floor(Math.random()*n)`
- Swapping two variables (normally):
  - `var a; var b; var temp;`
  - `temp = a;`
  - `a = b;`
  - `b = temp;`
- Javascript arithmetic):
  - `var a; var b;`
  - `b=a+(a=b)-b;`
  - `a = b + (b=a, 0);`

Arithmetic priority:
Set a to the value of b first,
`(a=b)` evaluates to b,
then evaluate rest of expression

DOM

Document Object Model (DOM)

- HTML document



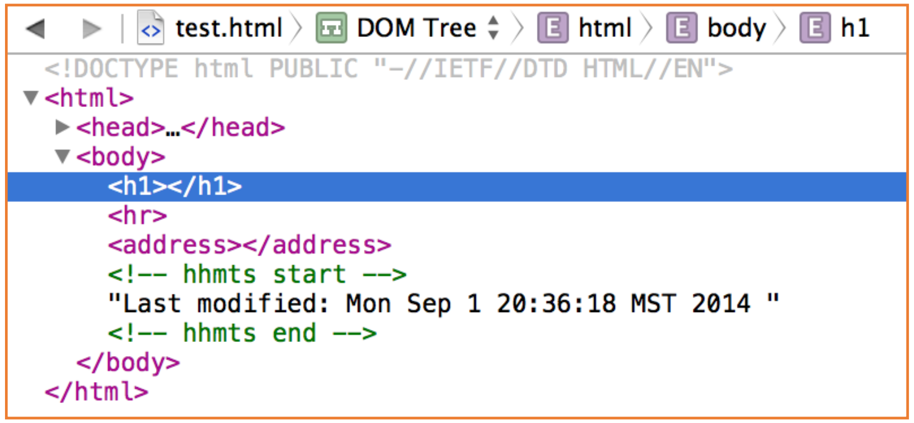
```
<!DOCTYPE HTML PUBLIC "-//IETF//DTD HTML//EN">
<html> <head>
<title></title>
</head>

<body>
<h1></h1>



<hr>
<address></address>
<!-- hhmts start --><!-- hhmts end -->
</body> </html>
```

- Tree representation



```
  <!DOCTYPE html PUBLIC "-//IETF//DTD HTML//EN">
▼<html>
  ▶<head>…</head>
  ▼<body>
      <h1></h1>
      <hr>
      <address></address>
      <!-- hhmts start -->
      "Last modified: Mon Sep 1 20:36:18 MST 2014 "
      <!-- hhmts end -->
    </body>
  </html>
```

html: document.documentElement
body: document.body

Document Object Model (DOM)

Properties for traversing the DOM:

- *e*.childNodes
  - children of element el as an array, e.g. childNodes[0]
- *e*.children
  - element nodes only (excludes text nodes)
- *e*.firstChild
- *e*.lastChild
- *e*.parentNode
- *e*.nextSibling
- *e*.previousSibling

Object properties:

- *e*.nodeType
  - 1 = element, 3 = text
- *e*.nodeName
  - uppercase
- *e*.innerHTML
  - for element nodes
  - value is html as text
  - writeable
- *e*.nodeValue
  - for text nodes
    (null: for element nodes)
  - writeable

Document Object Model (DOM)

New content:

- document.createElement(tag)
  - tag = ‘div’, ‘p’ etc.
  - creates new DOM element
- document.createTextNode(text)
  - creates new DOM element of type text

For non-HTML elements:

- document.createElementNS(NS,tag)
  - NS = Namespace URL identifier
  - e.g. http://www.w3.org/2000/svg and tag “rect” (rectangle)

Place new_el:

- e.appendChild(new_el)
  - new_el is inserted as last child of el
- e.insertBefore(new_el,next_el)
  - new_el inserted as previous sibling of next_el
  - el is common parent
- e.removeChild(child_el)
  - child_el is deleted
  - el is parent
- e.replaceChild(new_el,child_el)
  - new_el replaces child_el
  - el is parent

Old way:

- document.write(text)
- document.writeln(text)
  - adds a newline

Document Object Model (DOM)

Locating an element:

- document.getElementById(id)
  - useful if you have named the document element using the id='Name' property
- document.getElementsByTagName(tag)
  - all document elements of type tag
  - returns an array
- e.getElementsByTagName(tag)
  - all elements of type tag under el
  - returns an array
- document.getElementsByName(name)
  - useful for elements that support name='Name'
- (document|e).getElementsByClassName(class)
- (document|e).querySelector(query)
  - example query 'BODY > UL > LI'
  - '>' means immediately dominates
  - returns first matching element
- (document|e).querySelectorAll(query)
  - returns an array