

CSC435: Web Programming

Lecture 8: Intro to JavaScript, data types, variables, functions.

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American University

Feb 12, Tuesday, 2018

What we have learned so far

How to write content for a webpage using HTML

How to add styles to a webpage using CSS and link a CSS file to an HTML file

How to inspect HTML and CSS webpages in a browser and use Validators to check the correctness

TMNT (2007)



33%

***** "Ditching the cheeky, self-aware wink that helped to excuse the concept's inherent corniness, the movie attempts to look polished and 'cool,' but the been-there animation can't compete with the then-cutting-edge puppetry of the 1990 live-action movie."

Peter Debruge
Variety

+ "TMNT is a fun, action-filled adventure that will satisfy longtime fans and generate a legion of new ones."

Todd Gilchrist
IGN Movies

***** "It stinks!"

Jay Sherman (unemployed)

***** "The rubber suits are gone and they've been redone with fancy computer technology, but that hasn't stopped them from becoming dull."

Joshua Tyler
CinemaBlend.com

***** "YOUR REVIEW HERE"

NAME
PUBLICATION

***** "The turtles themselves may look prettier, but are no smarter; torn irreparably from their countercultural roots, our superheroes on the half shell have been firmly co-opted by the industry their creators once sought to spoof."

Jeannette Catsoulis
New York Times

***** "Impersonally animated and arbitrarily plotted, the story appears to have been made up as the filmmakers went along."

Ed Gonzalez
Slant Magazine

+ "The striking use of image and motion allows each sequence to leave an impression. It's an accomplished restart to this franchise."

Mark Palermo
Coast (Halifax, Nova Scotia)

***** "The script feels like it was computer generated. This mechanical presentation lacks the cheesy charm of the three live action films."

Steve Rhodes
Internet Reviews

***** "YOUR REVIEW HERE"

NAME
PUBLICATION

GENERAL OVERVIEW



STARRING

Patrick Stewart
Mako
Sarah Michelle Gellar
Kevin Smith

DIRECTOR

Kevin Munroe

RATING

PG

THEATRICAL RELEASE

Mar 23, 2007

MOVIE SYNOPSIS

After the defeat of their old arch nemesis, The Shredder, the Turtles have grown apart as a family.

MPAA RATING

PG, for animated action violence, some scary cartoon images and mild language

RELEASE COMPANY

Warner Bros.

RUNTIME

90 mins

GENRE

Action/Adventure, Comedies, Childrens, Martial Arts, Superheroes, Ninjas, Animated Characters

BOX OFFICE

\$54,132,596

LINKS

[The Official TMNT Site](#)
[RT Review](#)
[RT Home](#)

TMNT (2007)



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Float
Left

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Float
right

GENERAL OVERVIEW



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Mako
Sarah Michelle Gellar
Kevin Smith

DIRECTOR

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RATING

PG

THEATRE

Mar 23, 2007

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Clear

(1-10) of 88

Brief tips on HW2

Use class to group common elements (e.g. the movie reviews).

Use class to group elements that share the same layout (e.g. float to the right or left).

Use percentage to specify the width of the columns

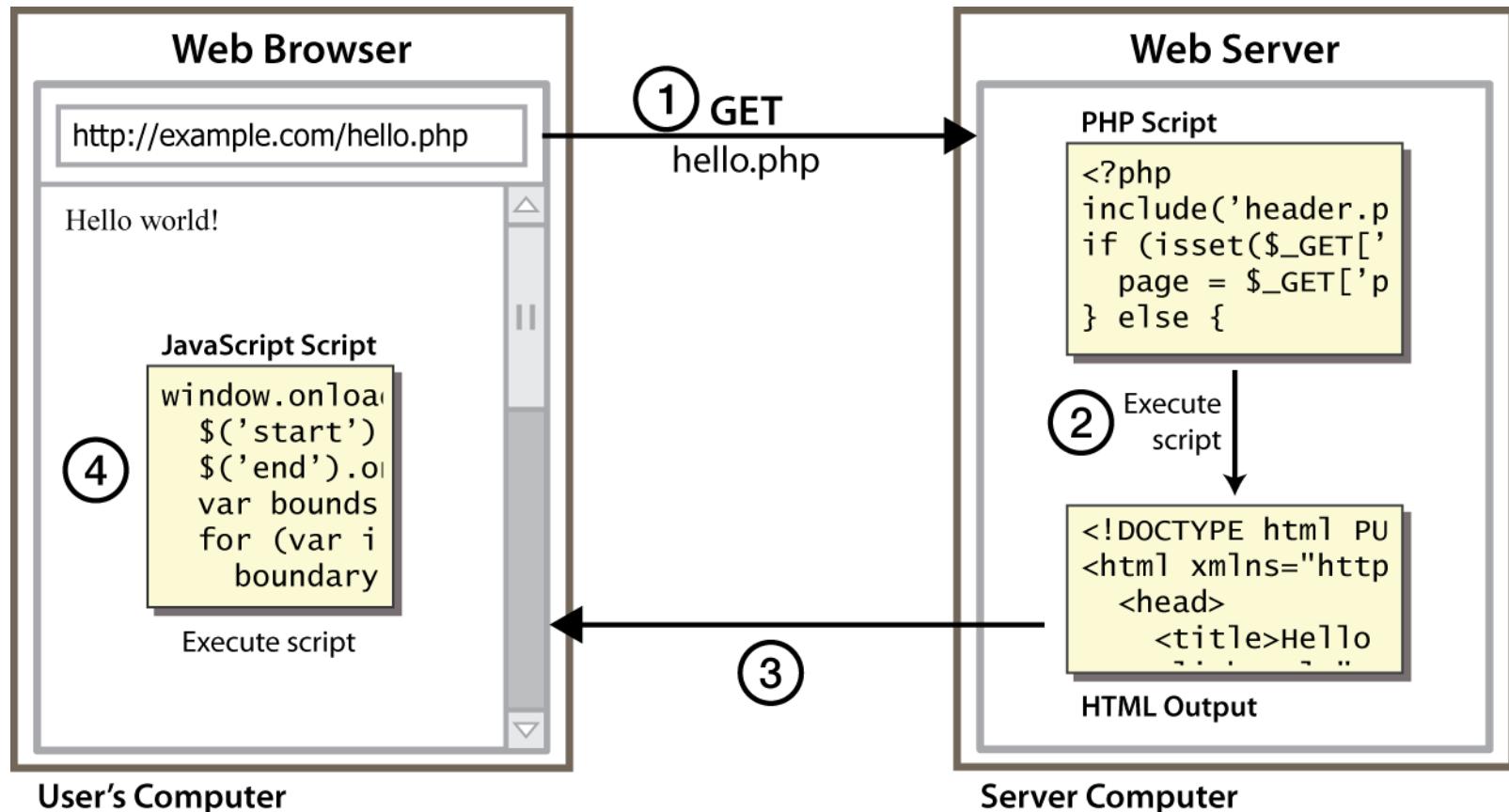
Activity Outline

- What is JavaScript
- Linking to JavaScript
- Demo of simple scripts
- Variable types
- JavaScript Objects: Array, Data, Math,
- Defining Functions
- Exercises
- Homework 3 is out and due next Sunday.

Learning goal

- Write very simple JavaScript functions to do stuff like:
 - A. Simple Math
 - B. Simple string manipulations.
 - D. Dates, time, year.
 - C. Alert the results to Browser

Client-side scripting



- **client-side script:** code runs in browser *after* page is sent back from server often this code manipulates the page or responds to user actions

JavaScript Demo

- Matrix:

<http://codepen.io/neilcarpenter/pen/oeGwD>

- JavaScript and Canvas

<http://fabricjs.com/intersection/>

HTML, CSS, JavaScript

- HTML: Content
- CSS: Style
- JavaScript: Behavior

What is **JavaScript**

- A lightweight **object-oriented** programming language ("scripting language")
- Created in 1995 (over 10 days) by Brendan Eich (originally called Mocha then LiveScript)
- used to make web pages interactive
 - insert dynamic text into HTML (ex: user name)
 - react to events (ex: page load user click)
 - get information about a user's computer (ex: browser type)
 - perform calculations on user's computer (ex: form validation)
- a web standard (but not supported identically by all browsers)
- NOT related to Java other than by name and some syntactic similarities

Links to JavaScript

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

- `script` tag should be placed in HTML page's `head`
- script code is stored in a separate `.js` file
- JS code can be placed directly in the HTML file's `body` or `head` (like CSS)
 - but this is bad style (should separate content, presentation, and behavior)

Very first JS

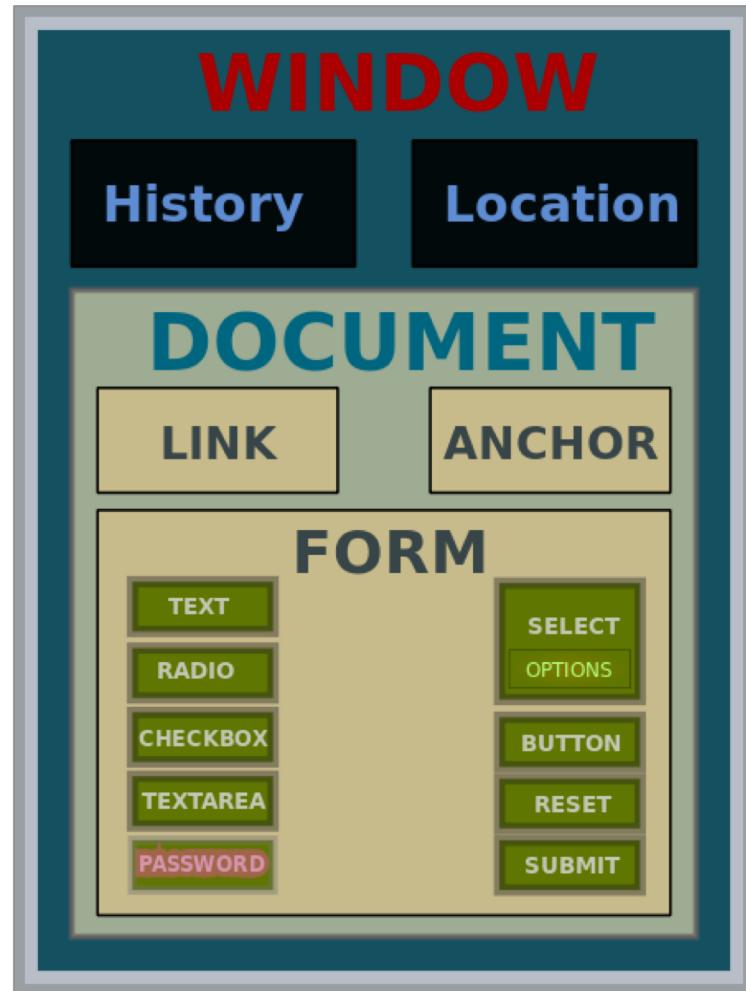
```
function first() {  
    alert("Welcome to Web Programming");  
}
```

This Page Says

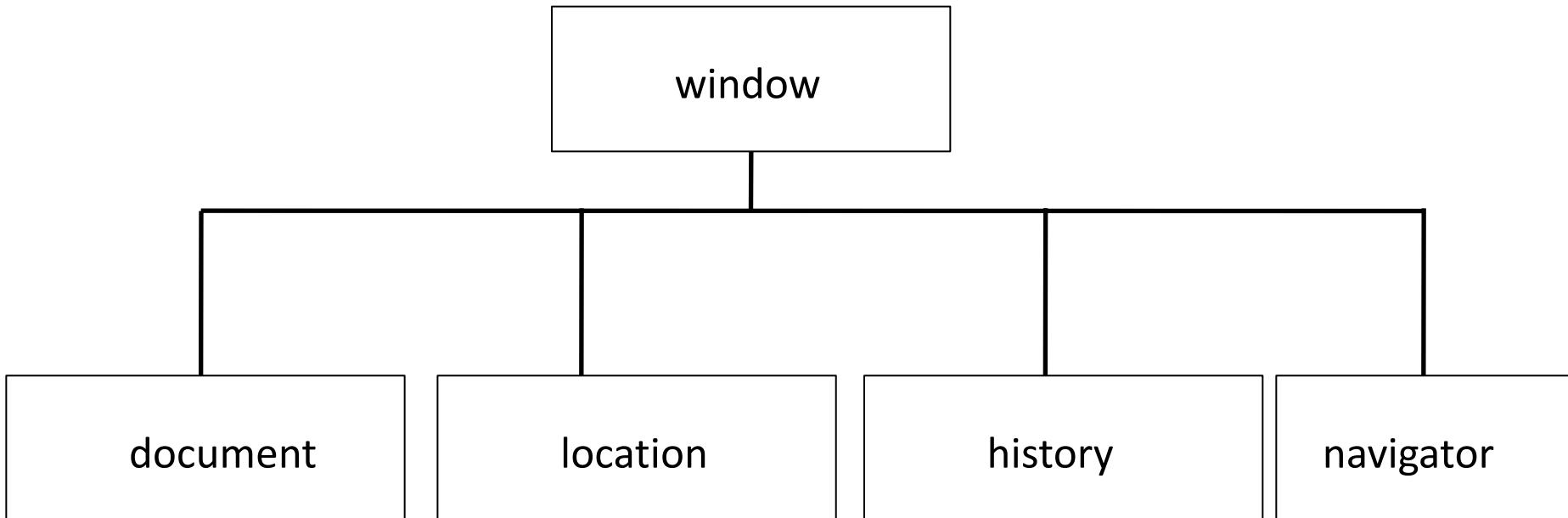
Welcome to Web Programming

OK

Document Object Model (DOM)



Document Object Model



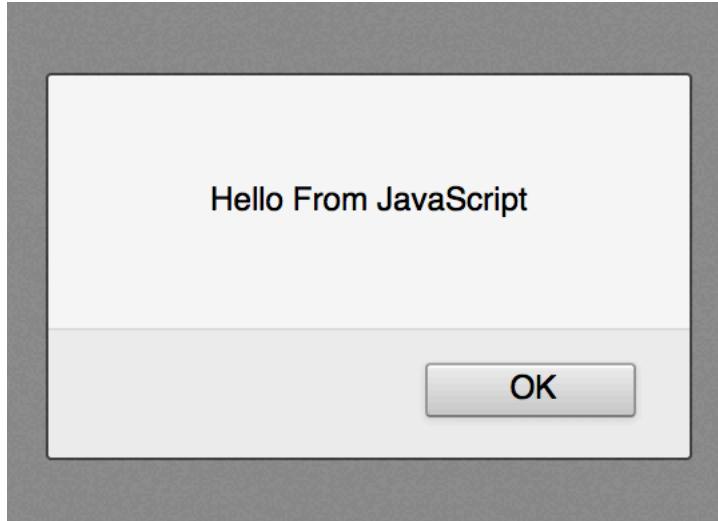
Object Notation

- Window object, document object
- Object notation: parent.child
- Examples: window. document
- window. document. body

Example: window.alert

```
window.alert("Hello From JavaScript!");
```

```
<script type="text/javascript">  
alert(document.title);  
</script>
```



- a JS command that pops up a dialog box with a message

Example: `document.write`

`Document.write`

How do you write to the browser the title of your HTML?

- a JS command that pops up a dialog box with a message

Example: document.write

Document.write

How do you write to the browser the title of your HTML?

```
<script type="text/javascript">  
    document.write(document.title)  
</script>
```

- a JS command that pops up a dialog box with a message

Quiz

The top level of the DOM hierarchy is occupied by

- a. The document property
- b. The window object
- c. The document object
- d. The document method

Variables and types

```
let name = expression;
```

```
let age = 32;  
let weight = 127.4;  
let clientName = "Connie Client";
```

- variables are declared with the `let` keyword (case sensitive). You might also use `var` instead of `let`- this is an older convention.
- types are not specified, but JS does have types ("loosely typed")
 - `Number`, `Boolean`, `String`, `Array`, `Object`, `Function`, `Null`, `Undefined`
 - can find out a variable's type by calling [typeof](#)

let vs. var

- **let** allows you to declare variables that are **limited in scope to the block**, statement, or expression on which it is used. This is unlike **var** keyword, which defines a variable globally, or locally to an entire function regardless of block scope.

Further reading:

<https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Statements/let>

Why let not var?

<https://hackernoon.com/why-you-shouldnt-use-var-anymore-f109a58b9b70>

let vs. var

```
function varTest() {  
    var x = 1;  
    if (true) {  
        var x = 2; // same variable!  
        console.log(x); // 2  
    }  
    console.log(x); // 2  
}
```

```
function letTest() {  
    let x = 1;  
    if (true) {  
        let x = 2; // different variable  
        console.log(x); // 2  
    }  
    console.log(x); // 1  
}
```

Number type

```
let enrollment = 99;  
let medianGrade = 2.8;  
let credits = 5 + 4 + (2 * 3);
```

- integers and real numbers are the same type
(no `int` vs. `double`)
- same operators: `+` `-` `*` `/` `%` `++` `--` `=` `+=` `-=` `*=` `/=` `%=`
- similar precedence to Java
- many operators auto-convert types: `"2" * 3` is `6`
- Practice!

String type

- String is an array of characters (can use both "" and '')

```
let myString1 = "hello";
let myString2 = "world ";
let len = myString.length;
let S = " ";
document.write(myString[0]+myString[1]) \\ "ho"
```

- concatenation with + : 1 + 1 is 2, but "1" + 1 is "11"

String property and methods

```
"hello".length; // 5  
"hello".charAt(0); // "h"  
"hello,world".replace("hello", "goodbye");  
// "good bye, world"  
"hello".toUpperCase(); // "HELLO"  
"hello,world".indexOf('world'); // 6  
"hello,world".lastIndexOf('l'); // 9
```

- length is a property (not a method), like Java
- methods: [charAt](#), [charCodeAt](#), [fromCharCode](#), [indexOf](#), [lastIndexOf](#), [replace](#), [split](#), [substring](#), [toLowerCase](#), [toUpperCase](#)
- Practice [repeat](#), [containsTwice](#)

More on String

escape sequences behave as in Java: \ ' \" \& \n \t \\

[https://msdn.microsoft.com/en-us/library/2yfce773\(v=vs.94\).aspx](https://msdn.microsoft.com/en-us/library/2yfce773(v=vs.94).aspx)

to convert between numbers and Strings:

```
let count = 10;
let s1 = "" + count;                                // "10"
let s2 = count + " bananas, ah ah!";                // "10
bananas, ah ah!"
let n1 = parseInt("42 is the answer");               // 42
let n2 = parseFloat("booyah");                      // NaN
```

to access characters of a String, use [index]

or s.charAt(index):

```
let s = 'Hello World';
let firstLetter = s[0];
let firstLetter = s.charAt(0);
let lastLetter = s.charAt(s.length - 1);
```

Converting strings to number

- `parseInt()` function parse a string and returns an integer.

```
let a = parseInt("10"); //10
let b = parseInt("10.33"); //10
let c = parseInt("40 years"); //40
let d = parseInt("He was 40"); /NaN
let e = parseFloat('1.45kg'); //1.45
```

- Only the first number in a string is returned.
- If the first character can't be converted to a number, it returns NaN
- `parseFloat()` pass a string and returns a floating number.
- Read more: <http://www.javascripter.net/faq/convert2.htm>

Number to string

```
let num = 15;  
let n = num.toString(); //string "15"  
let n = num.toString(2); //string "1111"  
let num = num+ " ";    //string "15"  
Math.PI + " " // string "3.1415"
```

Comments

```
// single-line comment  
/* multiple-line comments */
```

Recall: 3 comment syntaxes

HTML: <!-- comment -->

CSS/Java/JS: /* comment */

Java/JS: // comment

for loop

```
for (initialization; condition; update) {  
    statements;  
}
```

```
let sum = 0;  
for (let i = 0; i < 100; i++) {  
    sum = sum + i; // same as sum += i;  
}
```

What is the output of this?

```
let s1 = "It's a-me, Mario!";  
let s2 = "";  
for (let i = 0; i < s.length; i++) {  
    s2 += s1[i] + s1[i];  
}
```

Define Functions

```
function name() {  
    statement ;  
    statement ;  
    ...  
    statement ;  
}
```

```
function myFunction() {  
    alert("Hello!");  
    alert("How are you?");  
}
```

The above could be the contents of example.js linked to our HTML page.
Statements placed into functions can be evaluated in responses to user events.
To display results, you can use document.write()

Exercise : converting length in cm to inches

- Write a .js that converts inches to cm.
- First start with a .html and put this in the head:

```
<!DOCTYPE html>
<html>
<head>
<meta charset=utf-8 />
<title>Conerting length in cm to inches</title>
<script src="Exercise3.js" type="text/javascript"></script>
</head>
<body>

</body>
</html>
```

Exercise : converting length in cm to inches

- Write a .js that converts inches to cm.
- Write the result to browser as the following:
 - “length in inches”, 10 inches
 - “length in cm, 25.4 cm
- Hint: use document.write

Math object

```
let rand1to10 = Math.floor(Math.random() * 10 + 1);  
let three = Math.floor(Math.PI);  
let power = Math.pow(Math.random(), 2); // power of 2  
Math.round(10*x)/10; // round to the tenth.
```

- methods: [abs](#), [ceil](#), [cos](#), [floor](#), [log](#), [max](#), [min](#), [pow](#), [random](#), [round](#), [sin](#), [sqrt](#), [tan](#)
- properties: E, PI
- http://www.w3schools.com/js/js_math.asp

Boolean type

```
let iLikeJS = true;
let ieIsGood = "IE6" > 0;      // false
if ("web dev is great") { /* true */ }
if (0) { /* false */ }
```

- any value can be used as a Boolean
 - "falsey" values: `0`, `0.0`, `NaN`, `""`, `null`, and `undefined`
 - "truthy" values: anything else
- converting a value into a Boolean explicitly:
 - `var boolValue = Boolean(otherValue);`

Logical operators

- Relational: `>` `<` `>=` `<=`
- Logical: `&&` `||` `!`
- Equality: `==` `!=` `====` `!==`
 - Most logical operators automatically convert types.
 - These are all true:
 - `5 < "7"`
 - `42 == 42.0`
 - `"5.0" == 5`
 - The `====` and `!==` are strict equality tests; checks both **type and value**:
 - `"5.0" === 5` is false

Typeof

```
typeof "John"           // Returns string
typeof 3.14             // Returns number
typeof NaN              // Returns number
typeof false             // Returns boolean
typeof [1,2,3,4]         // Returns object
typeof {name:'John', age:34} // Returns object
typeof new Date()        // Returns object
typeof function () {}    // Returns function
typeof myCar              // Returns undefined (if myCar is not declared)
typeof null               // Returns object
```

More no type conversions:

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

Arrays

```
let name = [];                                // empty array
let name = [value, value, ..., value];        // pre-filled
name[index] = value;                          // store element
```

```
let ducks = ["Huey", "Dewey", "Louie"];

let stooges = [];                // stooges.length is 0
stooges[0] = "Larry";          // stooges.length is 1
stooges[1] = "Moe";            // stooges.length is 2
stooges[4] = "Curly";          // stooges.length is 5
stooges[4] = "Shemp";          // stooges.length is 5
```

- Two ways to initialize an array
- `length` property (grows as needed when elements are added)

Array Methods

```
let a = ["Stef", "Jason"];      // Stef, Jason
a.push("Brian");             // Stef, Jason, Brian
a.unshift("Kelly");          // Kelly, Stef, Jason, Brian
a.pop();                     // Kelly, Stef, Jason
a.shift();                   // Stef, Jason
a.sort();                    // Jason, Stef
```

- array serves as many data structures: list, queue, stack, ...
- methods: concat, join, pop, push, reverse, shift, slice, sort, splice, toString, unshift
 - push and pop add / remove from back
 - unshift and shift add / remove from front
 - shift and pop return the element that is removed
 - Lear more here:
 - http://www.w3schools.com/js/js_array_methods.asp

Splitting strings

```
var s = "the quick brown fox";
var a = s.split(" "); // ["the", "quick", "brown",
"fox"]
a.reverse(); // ["fox", "brown",
"quick", "the"]
s = a.join("!"); // "fox!brown!quick!the"
```

- `split` breaks apart a string into an array using a delimiter
- `join` merges an array into a single string, placing a delimiter between them
- `s.splice()` can add new items into the array.
- `s.splice(position, howmany, item)`
- `s.splice(0,1);` can remove the first element

Exercise

- What are the outputs?
 - let fruits = ['banana', 'kiwi','melon']
 - fruits[fruits.length] = 'apple'
 - fruits.shift()
 - fruits.unshift('pear') ['pear', 'kiwi','melon','apple']
 - fruits.splice(2, 0, 'lemon', 'mongo')
['pear','kiwi','lemon','mongo','apple']
 - fruits.reverse()

If/else statement (same as java)

```
if (condition) {  
    statements;  
} else if (condition) {  
    statements;  
} else {  
    statements;  
}
```

- identical structure to Java's `if/else` statement
- JavaScript allows almost anything as a *condition*

If/else statement (same as java)

```
var name = "kittens";
If (name == "puppies") {
    name += "!";
} else if (name == "kittens") {
    name += "!!";
} else {
    name = "!" + name;
}
name == "kittens!!"
```

- identical structure to Java's `if/else` statement
- JavaScript allows almost anything as a *condition*

Exercise 1: smallest

Write a function named **findMin** that accepts an array of numbers as a parameter and returns the smallest number in the array. For example, if an array variable named `nums` stored the following values:

```
let nums = [-1, 3.2, 12, 15, -4, 1, -12.5, 1, 8];
```

Then the call of `findMin(nums)` should return `-12.5` since that is the smallest numerical value in the array.

You may assume that the array passed to your function is non-empty and contains only number types.

To display results, you can use `document.write()`

Exercise 2: reverse a number

- Write a JavaScript function that reverse a number. E.g:
25368 -> 86352
- Step 1: Create a simple .html file.
- Step 2: Write a function and save it as ReverseString.js
- Step 3: link the .js into the <head></head> in your .html
- First change the number to string.
- Then `n.split("").reverse().join("")`;

Exercise 3: guess a number

- Write a JavaScript program where the program takes a random integer between 1 and 10, the user then prompted to input a guess number. If the user input matches the guess number, the program will display “good work”, otherwise, it will display “not matched”.

Hint: use alert() function to pop out text message.

Use Prompt() for user input. E.g.

```
var gnum = prompt('Guess the number between 1 and  
10')
```

Exercise 4: split string

- Write a JavaScript function to split a string and convert it to an array of words.
- `alert(string_to_array(" Monday is blue")) ;`

Output: “Monday”, “is”, “Blue”

Exercise 5: show today's date

- Write a JavaScript function to display today's day in the following format:
- Today is Thursday. It is 5:30pm.

```
var d = new Date();           //get the date
var day = d.getDay(); // get the day of the date
var hour = d.getHours(); // get hours
var minuets = d.getMinutes(); //get minuets
```

You can use `document.write` or `alert` to display the message.

Consider makes the days into an array of strings. Again array starts with 0.

Exercise 5 (take home): show dates until Christmas

- Write a JavaScript to display how many dates until Christmas of 2016.
- You might find the following function useful:

```
var d = new Date();           //get the date
var n = d.getFullYear();    // get the year of the date
var d = d.getMonth();        // get the month of the
date
d.setFullYear(2020, 10, 3); // Tue Nov 03 2020 11:17:37
GMT -500 (EST)
```

- Expected month from 0 to 11. 11 will be December, 12 will be start of the next year
- JS complete date references:
- http://www.w3schools.com/jsref/jsref_obj_date.asp

Next Class

JavaScript Loops

Event-Driven Programming (Buttons, Forms)

JavaScript and DOM

Take-home reading and exercise

Introduction to JavaScript (must read):

[https://developer.mozilla.org/en-US/docs/Web/JavaScript/A re-introduction to JavaScript](https://developer.mozilla.org/en-US/docs/Web/JavaScript/A_re-introduction_to_JavaScript)

DOC model:

https://developer.mozilla.org/en-US/docs/Web/API/Document_Object_Model/Introduction

JavaScript tutorial:

- <https://www.codecademy.com/learn/javascript>