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Include JS from a file (recommended):
`<html><head> <script type="text/javascript" src="myjavascripts.js"></script> </head></html>`

Inside HTML:
`<html><body> <script type="text/javascript">alert('Javascript here');</script> </body></html>`

Duck Typing: `var a = 1, b = ”1”; a + b; // returns string “11”`

Check for **equality**: == (`var a = 1, b = "1";  a == b // true, a gets casted to string`)
Check for **identity**: === (`var a = 1, b = "1";  a === 1 // true  a === b // false`)

Function: `function nameOfFunction(argument1, argument2) { return argument1 + argument2; }`
Arrow style: `nameOfFunction = (argument1, argument2) => { return argument1 + argument2; }`

```
var functionOne = function() {…}; // Gets evaluated at runtime
function functionTwo() {…} // Gets evaluated at parse-time

functionOne();
var functionOne = function() {}                    // error

functionTwo();
function functionTwo() {}                          // works
```

Self-executing anonymous function: `(x => console.log('Hello world'))()` (avoid polluting global namespace)

Callbacks: `setTimeout(x => alert('Hi there!'), 5000)`

Strict mode: `"use strict";` (silent error → throw error, fix mistakes for JS Engines difficult to optimize)

CoffeeScript: Syntactic sugar, compiles to JS

Primitive Types: numbers, strings, booleans, null, undefined, symbol (other: Objects)
Objects (References): Mutable keyed collections, container of properties (property has name and value), objects are class-free
`var empty_object = {};`
`var stooge = { "first-name": "Jerome", last-name: "Howard" };`
Retrieval: `stooge[“first-name”]` or `stooge.first-name`
Retrieve non-existant member (e.g. `stooge[“FIRST-NAME”]`) → `undefined`
Default values: `var middle = stooge["middle-name"] || "(none)";`
Attempting to retrieve value from undefined → throw TypeError exception. Guard:
`flight.equipment // undefined`
`flight.equipment.model // throw "TypeError"`
`flight.equipment && flight.equipment.model // undefined`
Update: `stooge['first-name'] = 'Jerome';`

this: Object which “owns” the method (can be different each time the function is called)
Manually set `this` in function: apply and call
`theFunction.apply(valueForThis, arrayOfArgs)`
`theFunction.call(valueForThis, arg1, arg2, …)`, e.g.
```
var carl = { name: "Carl", age: 23 }
var sayHello = function() { alert("Hi, my name is "+this.name); }
sayHello.call(carl); // Hi, my name is Carl
sayHello.apply(carl); // Hi, my name is Carl
```
New: `bind` (create new function where `this` is bound to an object)
```
var carlSaysHello = sayHello.bind(carl); // creates a new function with 'carl' as 'this'
carlSaysHello(); // Hi, my name is Carl
```

Constructor: `var Quo = function (string) { this.status = string; };`
Public method: `Quo.prototype.getStatus = function ( ) { return this.status; };`
Make instance: `var myQuo = new Quo("confused"); console.log(myQuo.getStatus( )); // confused`

Prototype inheritance:
```
var person = { canTalk : true,
  greet : function() {
    if (this.canTalk) {
      console.log("Hi, I'm "+this.name)
} } }
var Customer = function(name) { this.name = name; } // “subclass”
Customer.prototype = person; // Inherit customer from person
var joe = new Customer('Joe');
joe.greet();
```

Class: ES6 Syntactic sugar (type of function, prototype based, create objects with `new`, super class with `super`, …)

Jasmine: Let a single test sound like a sentence in a specification
Example: Code: `function Player() { }`
```
Player.prototype.play = function(song) {
  this.currentlyPlayingSong = song;
  this.isPlaying = true;
};
```
Tests: `describe("Player", function() {`
```
  var player;
  var song;
  beforeEach(function() {
    player = new Player();
    song = new Song();
  });
  it("should be able to play a Song", function() {
    player.play(song);
    expect(player.currentlyPlayingSong).toEqual(song);
  });
});
```

`toEqual`	Checks if equal (not neceseraly same object)	`expect({}).toEqual({});`
`toBeTruthy` `toBeFalsy`	Checks if something evaluates to true Falsy examples: false, 0, “”, undefined, null, NaN	`expect(true).toBeTruthy();` `expect(null).toBeFalsy();`

`not`	Reverse Matchers	`expect(foo).not.toEqual(bar);`
`toContain`	Element is member of array (also works with strings)	`expect([1, 2, 3, 4]).toContain(3);`
`toBeNull`	Checks if something is null	`expect(null).toBeNull();`
`toBeGreaterThan` `toBeLessThan`	Check greater / smaller	`expect(8).toBeGreaterThan(5);` `expect("a").toBeLessThan("z");`
`toBeCloseTo`	Check number close given decimal precision	`expect(12.34).toBeCloseTo(12.3, 1);`

`toMatch`	Regex, argument as regex or string	`expect("foo bar").toMatch(/bar/);`
		`expect("jasmine@example.com")`
		`.toMatch("\w+@\w+\.\w+");`

Situations to use **Mocks**: breaks isolation (e.g. network requests), supplies non-deterministic replies (e.g. current time/temperature), has states that are difficult to reproduce (e.g. network error), is slow (e.g. complete database), does not yet exist or may change behaviour.

Spies example:
```
describe("Person", function() {
it('uses the dictionary to say "hello world"', function() {
  var dictionary = new Dictionary;
  var person = new Person;
  spyOn(dictionary, "hello"); // replace hello function with a spy
  spyOn(dictionary, "world"); // replace world function with another spy
  person.sayHelloWorld(dictionary);
  expect(dictionary.hello).toHaveBeenCalled();
  expect(dictionary.world).toHaveBeenCalled();
});
});
```

Make dictionary in other language → still works because method invocation checked not output.
Check output → specify return value of spy: `spyOn(dictionary, "hello").and.returnValue("bonjour");`
Create a spy for a function that doesn't yet exist: `person.getName = jasmine.createSpy("Name spy");`
`person.getName();`
`expect(person.getName).toHaveBeenCalled();`
spyOn "eats" an existing function, jasmine.createSpy doesn't have to.
Spy Object: `var tape = jasmine.createSpyObj('tape', ['play', 'pause', 'stop', 'rewind']);`
`tape.play();`
`tape.rewind(10);`

JS: `var songName = document.getElementById("songTextInput").value;`
jQuery: `var songName = $("#songTextInput").value;`

Der $-Funktion eine Funktion übergeben → wird ausgeführt wenn DOM fertig geladen ist: `$(function() {  $("table tr:nth-child(even)").addClass("even");  });`

Chaining: `$("div.notLongForThisWorld").fadeOut().addClass("removed");` (der Class removed wird erst ausgeführt, wenn fadeOut fertig)

CSS Selectors:	`$("a");`	All link elements	`$("#specialID");`	Elements with ID specialID
	`$(".specialClass");`	Elements with class specialClass	`$("div .specialClass")`	Class specialClass within elements
	`$("p:even");`	All even elements	`$("tr:nth-child(1)");`	First row of each table
	`$("body > div");`	Direct children of	`$("a[href$=pdf]");`	Links to PDF files
	`$("body > div:has(a)")`	Direct child of div containing links		

Custom jQuery Selectors:	`:animated`	Elements that are currently under animated control	`:button`	Any button (input[type=submit], input[type=reset], input[type=button])
	`:checkbox`	Checkboxes (input[type=checkbox])	`:checked`	Checkboxes or Radiobuttons that are checked
	`:contains(foo)`	Elements containing text foo	`:disabled / :enabled`	Form elements that are disabled / enabled
	`:header`	h1 to h6	`:images`	Images (input[type=image])
	`:input`	Form elements (input, select, textarea, button)	`:not(filter)`	Negates specified filter

Generate new HTML: `$("<div>Hello, world</div>");` (ready to be added to page)
Generate and append to DOM: `$("<p>Generated content.</p>").css("color", "red").appendTo(".row > .span4");`

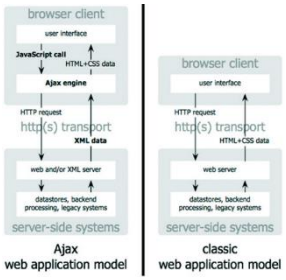
Wrapped Sets are like arrays: `$("#specialID").html('There are '+$('a').length+' link(s) on this page.');`

Get value of attribute of first element in set of matched elements: `.attr()`, e.g. `$("#myImage").attr("title")`
Remove an attribute from each element in set of matched elements: `.removeAttr()`
Set value: `$("#myImage").attr("alt", "New alternative text")`, set multiple attributes: `$('input').attr( { value: '', title: 'Please enter a value' } );` (sets value of all input elements to empty and title to enter value)
Set attributes with a function: `$('*').attr('title', function(index) { 'I am element ' + index + ' and my name is ' +  (this.id ? this.id : 'unset'); });`
Class methods: `.hasClass()`, `.addClass()`, `.removeClass()`, `.toggleClass()`
Get/Set HTML content of every matched element: `.html()`, get text including descendants: `.text()`
`.append`: Insert content to end of each element, `.appendTo()`: Insert every matched element to end of target; `.prepend()`, `.prependTo()`: Insert beginning
Wrap HTML structure around each matched element: `.wrap()`; Wrap HTML structure around all matched elements: `.wrapAll()`; Wrap HTML structure around content of each matched element: `.wrapInner()`
Removing elements: Remove all child nodes of matched elements from DOM: `.empty()`; Remove set of matched elements from DOM, leaving matched elements in their place: `.remove()`
Get current value of first matched element or set value for all: `.val()`; Limitations: if first element not form element JS error is thrown, doesn't say checkbox/radiobutton checked (return value defined by value attribute) → radiobuttons with same name: `$('[name=radioGroup]:checked').val()` returns value of checked rb or undefined.
Commands: `.show()`, `.hide()`, `.toggle()`, `.fadeIn()`, `.fadeOut()`, `.fadeTo()` (Adjust Opacity), `.slideUp()` (Hide), `.slideDown()` (Display), `.slideToggle()` (display or hide), `.stop()` (stops animation)

Events: JS is single-threaded → blocking in JS blocks whole page (Blocking: `sleep(5000); alert('Hi there!');`, asynchronous: `setTimeout(function() { alert('Hi there!') }, 5000);`)
Bind event: `.on(events, handler(eventObject))`, e.g. `$('img').on('click', function(event) {alert('Hi there!');});`
A few shortcut commands (`$('img').click(function(event) {alert('Hi there!');});`): change, dblclick, error, focus, keypress, keyup, load, mousemove, mousedown, resize, scroll, select, …
Execute event handle only once (once executed handler removed): `.one(eventType,data,listener)`, data optional (caller-supplied data that's attached to event instance as property named data available to handler functions)
Remove event handler: `.off(events,listener)` (events optional, not supplied → remove all events; listener optional, not supplied → remove all listeners for event)
`this` in event handler: reference element where event is being delivered (create jQuery object: `$(this)`)
Event instance (first parameter to function): altKey (t/f), ctrlKey, data, keyCode, metaKey, pageX/Y, screenX/Y, shiftKey, target, type (eg. click, for one event handler multiple events), which (MB), …
Prevent Default: `preventDefault()` (block links for a-Elements, form submission, toggle state of checkbox, …)
New HTML injected to page: Handler not added automatically → **Delegated** events (apply event to handler). Normal: `$("#dataTable tbody tr").on("click", function(event) { alert( $(this ).text()); });`, delegate: `$("#dataTable tbody").on("click", "tr", function(event) { alert($( this ).text()); });`

`event.delegateTarget`: DOM-Element that handler was attached to, `event.target`: DOM-Element that triggered event
Trigger event handler: `.trigger(eventType)`

Protocols:
REST (Representational State Transfer) operations: GET, POST, PUT, PATCH, DELETE
XHR (XMLHttpRequest): Send HTTP(S) to server and load response data back to script. Can be used to alter current document in browser window without loading new web page → Responsive, dynamic web applications. Request Methods same verbs as HTTP responses.
JSON (JS object notation): Human readable data interchange. Represents simple data structures (objects). Language independent (parsers available in many languages). Used for serializing and transmitting data over network.



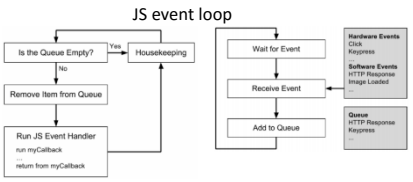
Ajax (Asynchronous JavaScript and XML): Web application can send and receive data to/from server asynchronously. Data retrieved using XHR object. Change state (e.g. data received) notify via events. Ajax is group of technologies (HTML/CSS for presentation, DOM for dynamic display&interaction with data, XML for interchange of data, XSLT for manipulation of data, XHR for asynchronous communication, JS to bring everything together).
Example command: `$('#someContainer').load('/serverResource');` (load whatever server returns into someContainer)
Load content: `.load(url,parameters,callback)` (url: server side resource, parameters optional (GET default, give parameter → object serialized and POST), callback optional)
GET request: `$.get(url,parameters,callback)` (parameters: query string to add to url)
Get JSON data: `$.getJSON(url,parameters,callback)` (arguments same as normal get)
POST request: `$.post(url,parameters,callback)` (arguments same as get)
Ajax request with full control: `$.ajax(options)` (type: GET/POST, data (in GET query string / POST data), dataType (expected type to be returned), timeout (in ms, else error callback called), global (t/f), contentType, success (function callback), error (function callback), complete (function callback success or error), beforeSend (function), async (synchronous/asynchronous), processData, ifModified (t/f))
Testing Ajax: Integration tests aren't isolated, servers need to be running, housekeeping, …; Unit tests: no network connection, response of server mocked.
Mock Ajax GET:

```
// mock the ajax call to the server loading the tasklist
spyOn($, "getJSON").and.callFake(function(url, callback) {
  callback({ title: 'the list', tasks: [
    { title: 'first task', done: true },
    { title: '2nd task', done: false },
  ]});
});
// execute a mocked ajax call and populate tasklist into result
var result;
TaskList.load('testlist', function(taskList) {
  result = taskList;
});
expect(result.title).toEqual('the list');
```

Stateless HTTP: HTTP is stateless, every request in isolation → each request contains all information to fulfill request
Advantages: easier to distribute across servers (scaling application: add servers), easy to cache, URIs work when re-visited/shared/bookmarked

REST: Collection URI (e.g. http://example.com/products): GET (List URIs & details of collection's members), PUT/PATCH (Replace entire collection), POST (new entry in collection (new URI as return value)), DELETE (del entire collection)
Member URI (e.g. http://example.com/products/17): GET (retrieve member in Internet Media Type), POST/PUT/PATCH (Replace member of collection or create if doesn't exist), DELETE (del member)
jQuery GET: `$.getJSON('http://zhaw.herokuapp.com/task_lists/demo', function(data) { console.log(data); })` (getJSON returns a jqXHR Object)
jQuery POST: `$.post('http://zhaw.herokuapp.com/task_lists/', '{"tasks":[{"title": "Do homework"}]}', function(data) { console.log(data); })`

Promises: *"Easier"* / more readable than callbacks, errors handled outside primary application logic. 3 states: pending, fulfilled, rejected (fulfilled & rejected are immutable)
Listeners are always called (run script line for line and when script finished check if EventListener returned anything) → Priority1: run script, Priority2: process events
The jqXHR returned after Ajax request supports Promises. `var promise = $.getJSON('http://zhaw.herokuapp.com/task_lists/demo'); promise.done(function(data) {console.log(data)}); promise.error(...);`
Multiple consumers possible (called in order of being registered) (`promise.then(…); promise.then(…);`)
Create a resolved promise: `new Promise(function (resolve, reject) { resolve('the long way') });` OR `Promise.resolve('the short way');` (same with reject)
When one promise is rejected all subsequent promises in chain are rejected



Node.js: Application server written in JS
Ember.js: Client side application framework

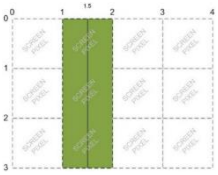
Utility function with promises:

```
function loadImage(url) {
var promise = new Promise(
function resolver(resolve, reject) {
  var img = new Image(); img.src = url;
  img.onload = function () { resolve(img); };
  img.onerror = function (e) { reject(e); };
});
return promise; }
```

Usage with promises:

```
var promise = loadImage('zhaw.png');
promise.then(function (img) {
  document.body.appendChild(img);
});
promise.catch(function (e) {
  console.log('Error occured while loading image');
  console.log(e);
});
```

Canvas: Dynamic scriptable rendering of 2D shapes (updates a bitmap → raster graphics, not vectors) ((`0, 0`) is top left)
Markup: `<canvas width="300" height="225"></canvas>` (all drawings are programmed with JS)
Get context: `$('canvas#a').click(function() { var context = this.getContext("2d"); });` (context has to be '2D')
`fillStyle` / `strokeStyle`: CSS color / pattern / gradient (default: solid black)
`fillRect(x, y, width, height)`: draw rectangle with current fill style
`strokeRect(x, y, width, height)`: draw rectangle with current stroke style
`clearRect(x, y, width, height)`: clear pixels in specified rectangle



Paths: `moveTo(x, y)`: move pencil to starting point, `lineTo(x, y)`: draw line to end point, `stroke()`: actually draw lines on canvas
Draw on 0.5 instead of 0: Most screens can't display half a pixel, expand line to cover total of 2 pixels
`beginPath()`: begin path or reset current path (resets most information on context but not fillStyle and strokeStyle.
Text: `fillText()`: No box model (margin, padding, word wrapping, …), font can be anything in CSS font rule, e.g.: `context.font = "bold 12px sans-serif"; context.fillText("abc", 760, 580);`
Other: `drawImage`: draw image on canvas, `arc()`: Takes center point x,y, radius, start&end angle (radians), direction flag (f: clockwise, t: counter-clockwise)
Draw a circle: `context.beginPath(); context.arc(x, y, radius, 0, Math.PI * 2, false); context.closePath(); context.stroke();`

LocalStorage: up to 64KB userData, 10x more for intranet sites (XML based structure). Up to 100KB "Flash Cookies". Google Gears SQLite DB.
Cookies disadvantages: Included in every HTTP request (more traffic), sending data unencrypted (unless whole web-app over SSL), max 4KB.
Session storage (intended for short-lived data): Only shared with pages from same domain, doesn't persist after window/tab closed (new session storage for each window/tab).
Local Storage: Store data for more than a session (same as sessionStorage but persistent), shared across windows/tabs, 5MB space by default (using too much throws QUOTA_EXCEEDED_ERR), based on key/value pairs. Set value: `localStorage.setItem("key", value);` or `localStorage["key"] = value;`, get value: `var value = localStorage.getItem("key");` or `var value = localStorage["key"];` (if not retrieving strings: parseInt() / parseFloat() / …), delete value: `localStorage.removeItem("key");` (if doesn't exist nothing happens), clear all values: `localStorage.clear();`

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Save Object: `localStorage.setItem('test', myObject);` saves string representation"[object Object]" → `localStorage.setItem('test', JSON.stringify(myObject));`, `JSON.parse(localStorage.getItem('test'));`

Websockets: Persistente Verbindung Client/Server mit einfachem API. Verbindungsaufbau über HTTP (`Connection: Upgrade` in Header). Minimale ws:// oder wss:// Header. Bidirektionale Übertragung.

Beispiel: `var connection = new WebSocket('ws://html5rocks.websocket.org/echo', ['soap', 'xmpp']);`

```
connection.onopen = function () {  // When the connection is open, send some data to the server
  connection.send('Ping'); // Send the message 'Ping' to the server
};
connection.onerror = function (error) {  // Log errors
  console.log('WebSocket Error ' + error);
};
connection.onmessage = function (e) { // Log messages from the server
  console.log('Server: ' + e.data);
};
```