

IN4MATX 133: User Interface Software

Lecture 6:
DOM Manipulation &
Package Management

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Question

What topic(s) would make you inclined to attend discussion section?

- ☐ A I would attend if lecture material was covered in more depth (current)
- ☐ B I would attend if they were office hours/direct homework help
- ☐ C I would attend if advanced material (beyond lecture) was covered
- ☐ D I would attend regardless of the topic
- ☐ E I would not attend regardless of the topic

Question

How do you feel about the coding demos?

- ☐ A They're helping me understand the coding concepts we're discussing
- ☐ B I think they'll be useful in future topics, but I feel good about HTML/CSS/JS
- ☐ C I don't think I'll ever find them useful
- ☐ D
- ☐ E

Announcements

- ICS Showcase this week, office hours schedule & locations changed slightly
 - Today is the same, but Wednesday & Friday have been moved around
 - Check the course calendar!
- Start on A2 as soon as you can
- Midterm 1 next Monday in your discussion section
 - More on exam topics on Thursday

Today's goals

By the end of today, you should be able to...

- Describe the different roles JavaScript has in client-side and server-side development
- Explain the role of the Document Object Model (DOM)
- Write code which edits the DOM using built-in JavaScript functions and jQuery
- Describe the role of package managers in web development
- Use the Node Package Manager (NPM) to install packages

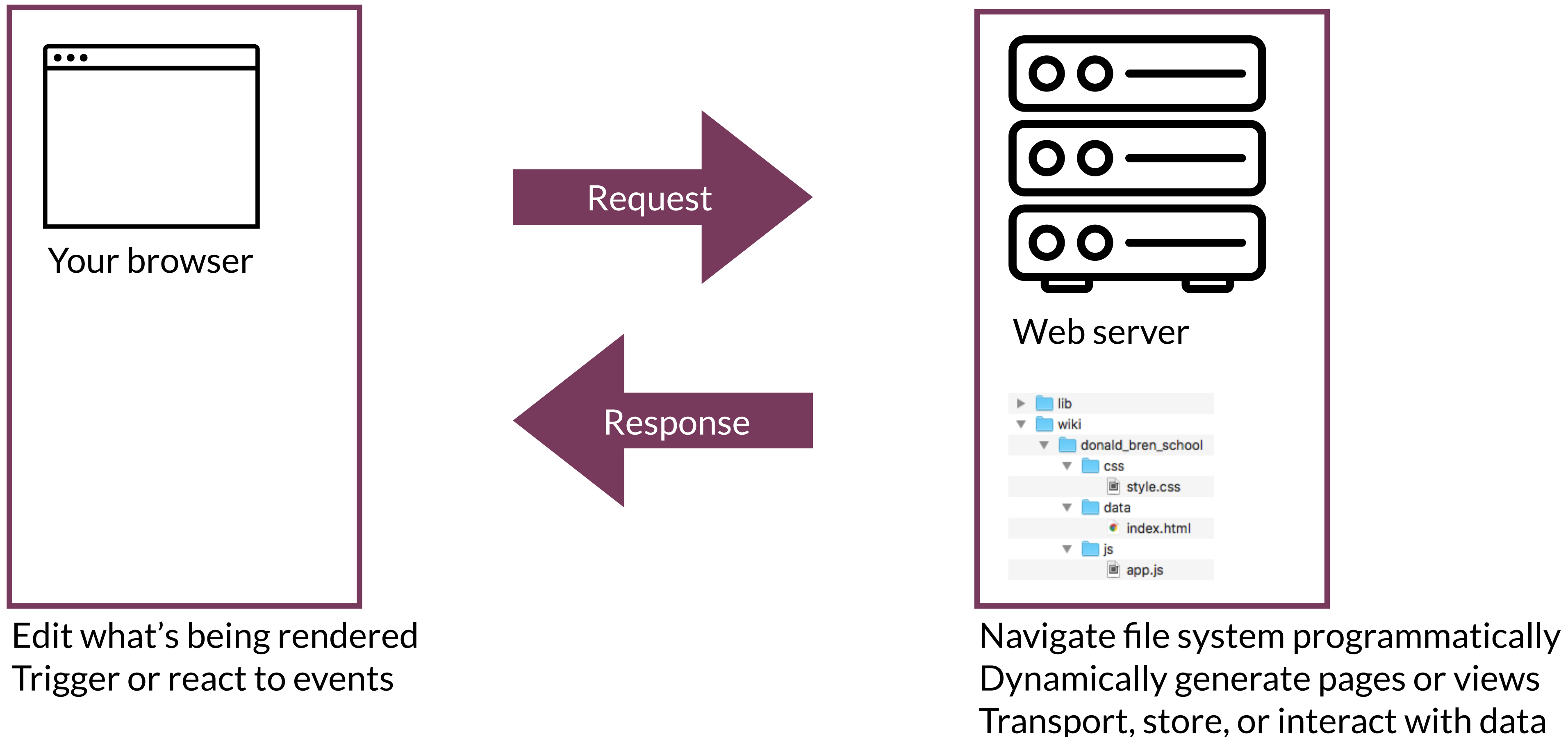
**Thus far, JavaScript looks
just like any other language**

**What about JavaScript makes it
used so widely on the web?**

**JavaScript has many functions
for editing webpages**

**Today, JavaScript is used
both client-side and server-side**

Client-side and server-side JavaScript



Client-side

- Can be seen by the user
- Changes happen in real-time in the browser
- Examples: AJAX, Angular, React, Vue.js

Server-side

- Cannot be seen by the user
- Changes happen on the server in response to HTTP requests
- Examples: Node, ASP.NET

It can be confusing to follow your code
if JavaScript is on both sides

Client-side object: Window

- The window object refers to the browser itself.

You can access properties and execute functions on it

```
/* example properties */
```

```
var width = window.innerWidth;    //viewport width
```

```
var height = window.innerHeight; //viewport height
```

```
/* example functions */
```

```
window.alert("Boo!");
```

```
var confirmed = window.confirm("Are you sure?");
```

```
var quest = window.prompt("What is your quest?");
```



Bad form, put it on your page instead

Client-side object: Window

- It's possible to use window to control the browser, but behavior varies drastically by browser

```
var xPos = window.screenX; //offset from screen edge
var yPos = window.screenY; //offset from screen edge
var scroll = window.scrollY; //pixels scrolled down
var url = window.location.href; //url for this page
```

```
window.scrollTo(0,1000); //scroll to position
window.open(url); //open a new window loading the URL
window.close(); //close window
```



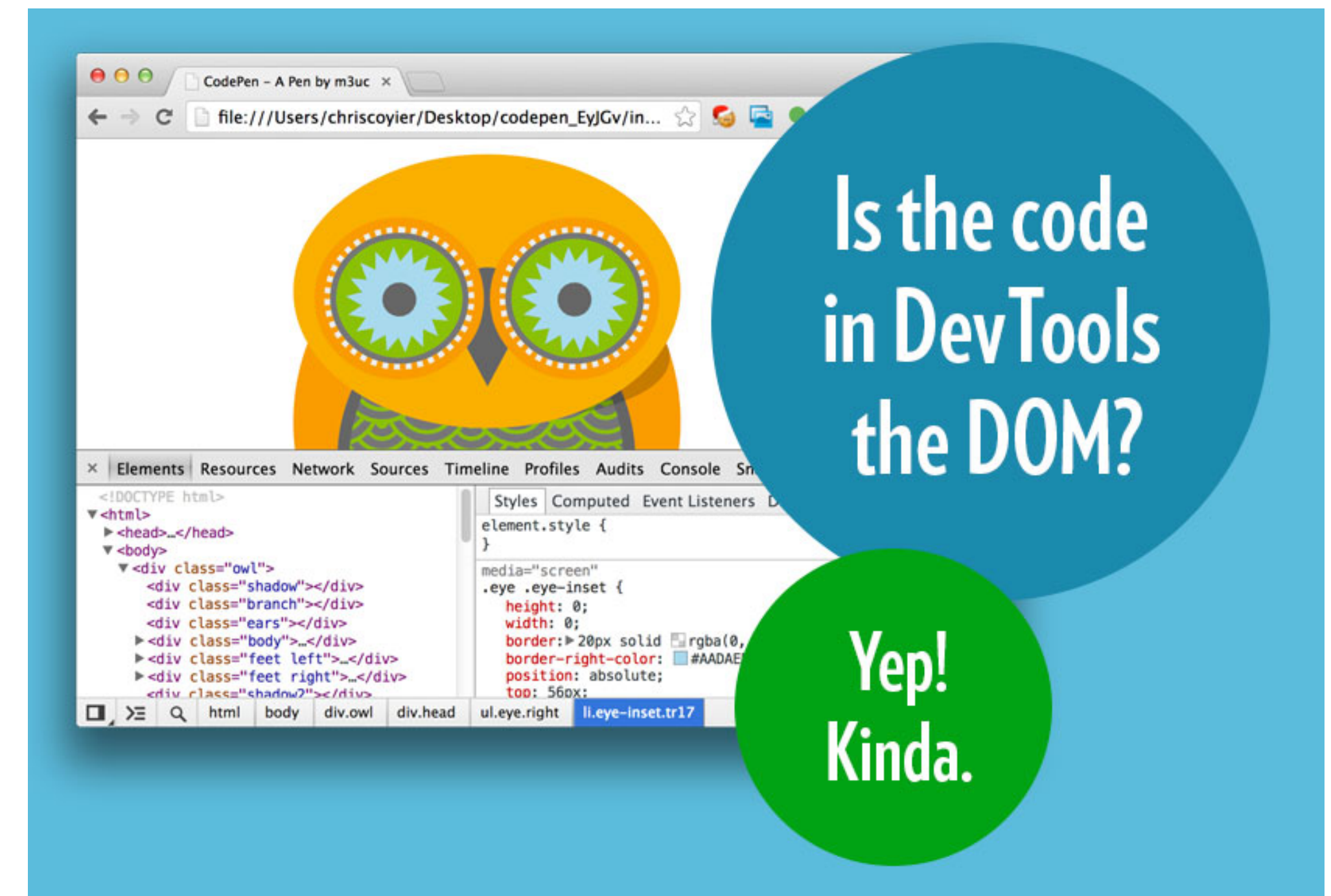
Again, better to keep your program
inside the window

Server-side: has no Window

- No window object exists in server-side JavaScript
- On a server, there would be nothing to scroll to and no one to alert
- We will see server-side development more next week

HTML Document Object Model (DOM)

- “A standard for how to get, change, add, or delete HTML elements”
- “the HTML you write is parsed by the browser and turned into the DOM”
- Client-side JavaScript can then edit the DOM
 - Server-side JavaScript might specify what HTML to show, but will not edit the DOM



<https://css-tricks.com/dom/>

JavaScript in HTML

- Can insert inline using the `<script>` tag

```
<head>
```

```
  <script>
```

```
    alert( "Hello, world!" );
```

```
  </script>
```

```
</head>
```

```
<body>
```

```
</body>
```


JavaScript in HTML

- Your script should wait until after the page has loaded
 - Otherwise elements you're trying to access might not exist

```
<head>
```

```
  <script>
```

```
    function pageLoaded( ) {  
      alert( "Page Loaded!" );  
    }
```

```
  </script>
```

```
</head>
```

```
<body onload="pageLoaded( ) ;">
```

```
</body>
```

JavaScript in HTML

- Functions can respond to events

```
<head>
```

```
  <script>
```

```
    function buttonClicked() {  
      alert("Button Clicked!");  
    }
```

```
  </script>
```

```
</head>
```

```
<body>
```

```
  <!--Bad style! Don't do this-->
```

```
  <button onclick="buttonClicked()">Click me!</button>
```

```
</body>
```

JavaScript in HTML

- Like CSS, better to load an external script

```
<head>
```

```
  <script src="js/script.js"></script>
```

```
</head>
```

Editing the DOM

- document object model
- Write into the DOM with `document.write`

<script>

```
document.write("<h1>Hello, World!</h1>");
```

```
var myCourse = "IN4MATX 133";
```

```
document.write("<h1>Hello, " + myCourse + " !");
```

</script>

Selecting elements

- We can reference individual HTML elements by calling selector functions

```
//element with id="foo"
```

```
var fooElem = document.getElementById( 'foo' );
```

```
//elements with class="row"
```

```
var rowElems = document.getElementsByClassName( 'row' );
```

```
//<li> elements
```

```
var liElems = document.getElementsByTagName( 'li' );
```

Selecting elements

- We can reference individual HTML elements by calling selector functions

```
/*easiest to select by reusing CSS selectors! */
```

```
var cssSelector = 'header p, .title > p';
```

```
//selects FIRST element that matches css selector
```

```
var elem = document.querySelector(cssSelector);
```

```
//matches ALL elements that match css selector
```

```
var elems = document.querySelectorAll(cssSelector);
```

Editing elements

- Properties and functions of elements can manipulate them

```
/* properties to access the CONTENT of the element */
```

```
var elem = document.querySelector( 'p' );
```

```
var text = elem.textContent; //the text content of the elem  
elem.textContent = "I'm different!"; //change the content
```

```
var html = elem.innerHTML; //content including tags  
elem.innerHTML = "I'm <strong>different</strong>";
```

```
var parent = elem.parentNode; //get the parent node
```

Editing elements

- Can add/remove classes, IDs, and inline style

```
<style>/*Bad form! Just for demo*/
```

```
  .title {  
    font-style: italic;  
  }
```

```
</style>
```

```
<h1>Hello, IN4MATX 133!</h1>
```

```
<script>
```

```
  var elements = document.getElementsByTagName( "h1" );
```

```
  for( var i = 0; i < elements.length; i++ ) {
```

```
    elements[i].classList.add( "title" );
```

```
    elements[i].style.color="blue";
```

```
  }
```

```
</script>
```



Changing the DOM

```
//create a new <p> (not yet in the tree)
var newP = document.createElement('p');
newP.textContent = "I'm new!";

//create Node of textContent only
var newText = document.createTextNode("I'm blank");

var div = document.querySelector('div#container');
div.appendChild(newP); //add element INSIDE (at end)
div.appendChild(newText);

//add node BEFORE element (new, old)
div.insertBefore(document.createTextNode("First!"), newP);

//replace node (new, old)
div.replaceChild(document.createTextNode('boo'), newText);

//remove node
div.removeChild(div.querySelector('p'));
```

DOM manipulation demo



Hello, IN4MATX 133!

Fill in this paragraph and add another one.

Question

Which snippet would edit the `p` to display “1, 2, 3, 4, 5”?

```
<p class="para" id="intro">1, 2, 3</p>
```

- ☐ A `document.getElementById("intro").append(", 4, 5");`
- ☐ B `document.getElementsByClassName("para").innerHTML("1, 2, 3, 4, 5");`
- ☐ C `document.getElementsByTagName("p")[0].innerHTML("1, 2, 3, 4, 5");`
- ☐ D Two of the above
- ☐ E All of the above

Question

Which snippet would edit the `p` to display “1, 2, 3, 4, 5”?

```
<p class="para" id="intro">1, 2, 3</p>
```

- ☐ A `document.getElementById("intro").append(", 4, 5");`
- ☐ B `document.getElementsByClassName("para").innerHTML("1, 2, 3, 4, 5");`
- ☐ C `document.getElementsByTagName("p")[0].innerHTML("1, 2, 3, 4, 5");`
- ☒ D Two of the above
- ☐ E All of the above

Validating data

- Check form fields before sending to a server
 - Provide instant feedback, reduce server back-and-forth

```
<script>
function validateForm() {
    var x = document.forms[ "myForm" ][ "fname" ].value;
    if(x==null || x=="") {
        alert("Name must be filled out");
        return false;
    }
}
</script>
<form name="myForm" onsubmit="return validateForm()" method="post">
    <label>Name: </label>
    <input type="text" name="fname">
    <input type="submit" value="Submit">
</form>
```

Gather and use information

- Remember: this is client-side!

```
<script>
```

```
var x = document.getElementById( "demo" );
```

```
function getLocation() {
```

```
    if (navigator.geolocation) {
```

```
        navigator.geolocation.getCurrentPosition(showPosition);
```

```
    } else {
```

```
        x.innerHTML = "Geolocation is not supported by this browser.";
```

```
    }
```

```
}
```

```
function showPosition(position) {
```

```
    x.innerHTML = "Latitude: " + position.coords.latitude +
```

```
    "<br>Longitude: " + position.coords.longitude;
```

```
}
```

```
</script>
```

How do we make interactive pages?

Listeners

- Can attach a listener to that method, specifying that we want to do something when that element causes an event

```
//respond to "click" events
```

```
elem.addEventListener('click', callback);
```

```
//often use an anonymous callback function
```

```
elem.addEventListener('click', function(){  
    console.log('clicky clicky!');  
});
```


Listeners

- Listener callback function will be passed an **event** parameter

- Sometimes useful, but can often be ignored

```
elem.addEventListener('click', function(event) {  
    console.log('You clicked me!');
```

↑
Remember, parameters are optional

```
    //get what was clicked;  
    var clickedElem = event.target;  
});
```

↑
The “target” (source) of the event

Event types

'click' //mouse or button clicked

'dblclick' //double-clicked

'hover' //mouse hover

'focus' //element gains focus (important!)

'mouseenter' //mouse is moved over an element

'mouseleave' //mouse leaves the element

'mousedown' //mouse button is pressed

'keydown' //key is pressed

//... and more!

<https://developer.mozilla.org/en-US/docs/Web/Events>

Manipulation in pure JavaScript is verbose

- If you're editing a lot of tags, your code can get very long and difficult to read

jQuery

- Predefines methods for manipulating the DOM
 - Include before your own script
- Remember:
 - Integrity: hashes to ensure the downloaded file matches what's expected
 - Crossorigin: some imports require credentials, anonymous requires none

```
<script  
src="https://code.jquery.com/jquery-3.3.1.min.js"  
integrity="sha256-FgpCb/KJQlLNfOu91ta32o/NMZxltwRo8QtmkMRdAu8="  
crossorigin="anonymous"></script>
```



jQuery selector

- Use the `jQuery()` function to select DOM elements.
The parameter is a CSS selector String (like `querySelector`)

- More common to use the `$()` shortcut

```
//selects element with id="foo" (e.g., <p id="foo">)
```

```
var fooElem = jQuery('#foo');
```

```
//selects all <a> elements (returns an array)
```

```
var allLinksArray = jQuery('a');
```

```
//selects element with id="foo" (e.g., <p id="foo">)
```

```
var fooElem = $('#foo');
```

```
//selects all <a> elements (returns an array)
```

```
var allLinksArray = $('a');
```

jQuery selector

- jQuery handles all CSS selectors, as well as some additional pseudoclasses

```
$( '#my-div' ) // by id
```

```
$( 'div' ) // by type
```

```
$( '.my-class' ) // by class
```

```
$( 'header, footer' ) // group selector
```

```
$( 'nav a' ) // descendant selector
```

```
$( 'p.red' ) // scoped selector
```

```
$( 'section:first' ) // first <section> element  
                      // not a css selector!
```

jQuery and elements

- Similar to pure JavaScript, jQuery provides methods to access and modify attributes and CSS

//Pure JavaScript

```
var txt = document.querySelector( '#my-div' ).textContent;  
document.querySelector( '#my-div' ).textContent = 'new info!';  
document.querySelector( '#my-div' ).innerHTML = '<em>new html!  
</em>';
```

//jQuery

```
var txt = $( '#my-div' ).text();           //get the textContent  
$( '#my-div' ).text( 'new info!' );        //change the textContent  
$( '#my-div' ).html( '<em>new html!</em>' ); //change the HTML
```



Changes apply to all selected elements

jQuery and the DOM tree

```
//create an element (not in DOM)
var newP = $('<p class="new">This is a new element</p>');

//add content to DOM
$('main').append(newP); //add INSIDE, at end
$('main').append('<em>new</em>'); //can create element on the fly

$('main').prepend('<em>new</em>'); //add INSIDE, at beginning

Works without closing tag
↓
$('main').before('<header>'); //insert BEFORE

↑
$('footer').insertAfter('main'); //insert target AFTER param

Selects existing element, so will move!
$('main').wrap('<div class="container"></div>'); //surround

$('footer').remove(); //remove element
$('main').empty(); //remove all child elements
```


jQuery event handling

- jQuery also provides convenience methods for registering event listeners

Like `addEventListener('click')`



```
$( '#button' ).click( function(event) {  
    console.log( 'clicky clicky!' );  
});
```

`//what was clicked` `event.target` is equivalent to this



```
var element = $(event.target);  
});
```



Get as jQuery-style element to call
jQuery methods on it (“wrap it”)

Document ready: JavaScript

- Remember earlier: your script should wait until after the page has loaded
 - Otherwise elements you're trying to access might not exist

```
<head>
```

```
  <script>
```

```
    function pageLoaded( ) {  
      alert( "Page Loaded!" );  
    }
```

```
  </script>
```

```
</head>
```

```
<body onload="pageLoaded( ) ;">
```

```
</body>
```

Document ready: jQuery

```
$(document).ready(function() {  
    //your program goes here  
    //this need not be an anonymous function  
  
});
```

Document ready: jQuery

```
//shortcut: just pass the function to the jQuery method
$(function() {
    //your program goes here
    //this need not be an anonymous function

});
```

```
//shortest cut: use the abbreviated syntax
$( () => {
    //your program goes here
    //this need not be an anonymous function

});
```

Importing JavaScript

- When your script uses document ready, convention is to load it in the `<head>` tag
 - Important to think about ordering, particularly for libraries
 - e.g., import JQuery before you use it in a script

`<head>`

```
<script src="https://code.jquery.com/  
jquery-3.3.1.min.js"></script>
```

```
<script src="index.js"></script>  
</head>
```

jQuery effects

- jQuery supports adding transitions to modify the appearance of effects

```
$( '#id' ).fadeIn( 1000 );    //fade in over 1 second
$( '#id' ).fadeOut( 500 );    //fade out over 1/2 sec
$( '#id' ).slideDown( 200 );  //slide down over 200ms
$( '#id' ).slideUp( 500 );    //slide up over 500ms
$( '#id' ).toggle( );        //toggle whether displayed
```

jQuery demo



My essay outline

Add a paragraph

Switching topics: Package Management

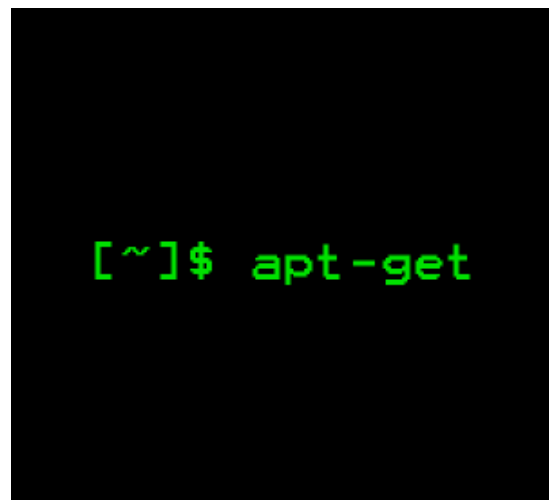
Importing packages so far

- Through content delivery networks (CDNs)
 - Pasting a “script” tag into the `<head>` of our HTML files
 - `<script src="https://cdnjs.cloudflare.com/ajax/libs/mathjs/5.2.0/math.min.js"></script>`
- Downloading from the source
 - e.g., if you downloaded Bootstrap rather than using a CDN

Package managers

- Provide an easy way to install software on your computer
 - Both new programs and libraries
- Simplify the process of updating software to the latest version
 - A challenge: packages depend on other packages, and often varied versions of those packages
 - Your package manager should deal with this for you
- They're essentially app stores, except all the content is free

OS-level package managers



apt-get (Unix)



homebrew (macOS)



chocolatey (Windows)

Language-level package managers



pip (Python)



RubyGems (ruby)



npm (JavaScript)



yarn (also JavaScript)

**Why are there
so many package managers?**

So many package managers

- There's some value in keeping language or domain-specific contexts
 - Certain languages interface better with certain file formats
- Most managers are driven by community efforts
 - New package manager solves some problem of a previous one
- But a lot of these are excuses; in reality, it's often a frustrating mess

npm and Yarn: web package managers

- npm was introduced as the package manager for Node.js (server-side JavaScript)
 - Yarn was developed later, released by Facebook as open-source
 - Uses the same registry (list of packages)
- Have a lot of useful libraries for developing webpages and web interfaces
 - Has packages for both server-side and client-side JavaScript development
- Occasionally used to install system-wide software
- package and library are often used interchangeably, which can be misleading

Yarn as an “upgrade” to npm

- Yarn intentionally uses the same concepts as npm
 - Faster, more secure
- But npm is still more widely used
 - Facebook developed Yarn, some people don't like their involvement
 - We'll stick to npm in this course

NPM vs YARN

Created By
Gant Laborde of Infinite Red

What you need to know

```
npm install === yarn
```

Install is the default behavior.

```
npm install taco --save === yarn add taco
```

The Taco package is saved to your **package.json** immediately.

```
npm uninstall taco --save === yarn  
remove taco
```

—**save** can be defaulted in NPM by npm config set save true but this is non-obvious to most developers. Adding and removing from **package.json** is default in Yarn.

```
npm install taco --save-dev === yarn  
add taco --dev
```

```
npm update --save === yarn upgrade
```

What you know about Yarn

```
npm init === yarn init
```

```
npm link === yarn link
```

```
npm outdated === yarn outdated
```

```
npm publish === yarn publish
```

```
npm run === yarn run
```

```
npm cache clean === yarn cache clean
```

```
npm login === yarn login (and logout)
```

```
npm test === yarn test
```

<https://shift.infinite.red/npm-vs-yarn-cheat-sheet-8755b092e5cc>

Some example web libraries

- Moment js: for managing time and timezones
 - <https://momentjs.com/docs/>
- Math js: for any math, unit conversion etc.
 - <http://mathjs.org/docs/>
- Express: for routing your website to different content (other pages or files)
 - <https://expressjs.com/>

npm concepts

- `package.json` file: the libraries installed in a given project
 - Kept in the root folder of your project by convention
- `package-lock.json` file
 - Used to keep track of the specific versions of other libraries that the libraries you've installed require
 - “the libraries of your libraries”
- `node_modules` folder: all the libraries you've installed in your project

npm and git

- Maybe you've seen the `.gitignore` file
 - Specifies what files should *not* be committed to your repository
- *Do* commit the `package.json` **and** `package-lock.json` files
 - Allows someone else to install the same package versions you used
- *Do not* commit the `node_modules` directory
 - Would be redundant; `package.json` specifies what versions to download
 - Add the folder to the `.gitignore` file

Using npm

- Runs in your operating system's command line
- Use in the root directory of your project (`cd path/to/project`)
- Install packages: `npm install packagename`
 - Will install package into your project's `node_modules/` folder
- Get the latest version of a package: `npm update`
 - Important for patching security vulnerabilities

Using npm

- Let's say we wanted to run the course webpage
 - Assume we've installed npm, then clone the repository
- Run `npm install` in the project's root directory
 - Will add all of the libraries the webpage depends on to `node_modules/`

<https://github.com/uci-inf-133/inf133-fa18>


Repository for IN4MATX 133, Fall 2019. [Edit](#)

[Manage topics](#)



14 commits 2 branches 0 releases 1 environment 1 contributor

Branch: master New pull request Create new file Upload files Find File Clone or download

This branch is 14 commits ahead, 16 commits behind gh-pages. [Pull request](#) [Compare](#)

 **depstein** Post a2 (still in beta) Latest commit 3cd5f0d 2 hours ago

dist/inf133-fa19	Post a2 (still in beta)	2 hours ago
e2e	Initial import	14 days ago
src	Post a2 (still in beta)	2 hours ago
.gitignore	Initial import	14 days ago
CNAME	Initial import	14 days ago
README.md	Initial import	14 days ago
angular.json	Initial import	14 days ago
deploy	Post October 1st lecture, assignment corrections, calendar fix	12 days ago
package-lock.json	Initial import	14 days ago
package.json	Initial import	14 days ago
tsconfig.json	Initial import	14 days ago
tslint.json	Initial import	14 days ago

 **README.md** 

Website

This project was generated with [Angular CLI](#) version 7.3.9.

Development server

Using npm

- npm can also install *global* packages, which are just software on your computer
 - `npm install -g packagename`
 - Usually programs which run via command line
- These global packages are programs rather than libraries, so they're not added to `package.json` or `node_modules/`
 - Though your project might depend on them to run
- Global packages are often redundant with OS-level package managers
- A2 only requires global packages

package.json

- Do not edit manually unless you know what you're doing!

```
{
  "name": "inf133-fa19",
  "version": "0.0.0",
  "scripts": {
    "ng": "ng",
    "start": "ng serve",
    "build": "ng build",
  },
  "dependencies": {
    "@angular/animations": "~7.2.0",
    "@angular/common": "~7.2.0",
    "@angular/compiler": "~7.2.0",
    "@angular/core": "~7.2.0",
    "@angular/forms": "~7.2.0",
    "@angular/platform-browser": "~7.2.0",
    "@angular/platform-browser-dynamic": "~7.2.0",
    "@angular/router": "~7.2.0",
    "bibtex-parse-js": "0.0.24",
    "component": "^1.1.0",
    "core-js": "^2.5.4",
    "moment": "^2.24.0",
    "ngx-moment": "^3.4.0",
    "rxjs": "~6.3.3",
    "tslib": "^1.10.0",
    "zone.js": "~0.8.26"
  }
}
```

← ~: Version number is “approximately the same as” (e.g., 7.2.X)

← ^: Version number is “compatible with” (e.g., 1.X.X)

Also explicit >, <, >=, =

Question

Which is correct?

`npm install
packagename`

`npm install -g
packagename`

A 1, 2, 3, 4

1, 4

B 1, 2, 3

4

C 1

4

D 1, 2, 3

2, 3, 4

E 1

1, 4

- 1 Downloads package to `node_modules`
- 2 Adds package to `package.json`
- 3 Adds package's dependencies to `package-lock.json`
- 4 Package is usable as a program from the command line

Question

Which is correct?

`npm install
packagename`

`npm install -g
packagename`

A 1, 2, 3, 4

1, 4

B 1, 2, 3

4

C 1

4

D 1, 2, 3

2, 3, 4

E 1

1, 4

- 1 Downloads package to `node_modules`
- 2 Adds package to `package.json`
- 3 Adds package's dependencies to `package-lock.json`
- 4 Package is usable as a program from the command line

Today's goals

By the end of today, you should be able to...

- Describe the different roles JavaScript has in client-side and server-side development
- Explain the role of the Document Object Model (DOM)
- Write code which edits the DOM using built-in JavaScript functions and jQuery
- Describe the role of package managers in web development
- Use the Node Package Manager (NPM) to install packages

IN4MATX 133: User Interface Software

Lecture 6:
DOM Manipulation &
Package Management

Professor Daniel A. Epstein
TA Lucas de Melo Silva
TA Jong Ho Lee

Utility functions

jQuery utility functions

- jQuery includes many utility functions to simplify syntax

//check if an item is in an array

```
$.isArray(4, [3,4,3] );
```

//this is like .filter, but works on old browsers

```
$.grep( [3,4,3], function(item) {  
    return item > 3;  
});
```

//iterate over arrays or objects -- works for either!

```
$.each( [1,3,3], function(key, value) {  
    console.log('Give me a '+value);  
});
```

```
$.each( {dept:'IN4MATX',num:'133'}, function(key, value) {  
    console.log(key+' name: '+value);  
});
```

<http://api.jquery.com/category/utilities/>

Even more utilities: Lodash

- A handy library for working with basic data structures

```
_.flatten([1, [2, [3, [4]], 5]]);  
// => [1, 2, [3, [4]], 5]
```

```
var zipped = _.zip(['a', 'b'], [1, 2], [true, false]);  
// => [['a', 1, true], ['b', 2, false]]
```

```
_.unzip(zipped);  
// => [['a', 'b'], [1, 2], [true, false]]
```

