Final Exam

Wednesday, May 11, 4:00–5:50 p.m.
Room 201, Warren Weaver Hall
Web Development and Programming
CSCI-UA 61

Class 1
Introduction and Overview
Web Development

The Internet and the Web

The Internet and the Web are separate but related things.

The Internet is a massive network of networks, a networking infrastructure that connects computers globally.

The Web is a way of accessing information over the medium of the Internet, an information sharing model that is built on top of the Internet.

The Web is just one of the ways that information can be disseminated over the Internet but it is the one we are focused on in this class.
Web Development and Programming

Monday and Wednesday, 3:30–4:45 p.m.
Room 201, Warren Weaver Hall

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Overview

This course provides concrete knowledge in Web technologies and programming. Students build interactive, secure, and powerful Web programs while covering client- and server-side technologies for the World Wide Web. We will explore technical foundations of the Web and learn key technologies including HTML, CSS, JavaScript, and PHP.
Web Development
Front End

“Front end” Web development refers to the elements of a website that a person sees and interacts with.

The languages most often employed in front end web development are HTML, CSS, and JavaScript:

• HTML describes content
• CSS defines appearance
• JavaScript facilitates interaction

All of the above happen directly in the Web browser.
“Back end” Web development refers to the functionality of a website that is not visible to a person.

If you buy something online, you interact with the front end of the store; the transaction takes place on the back end of a database on a Web server.

The back end usually consists of a server, an application, and a database.

The languages most often employed in back end web development are PHP, Ruby, and Python.
Progressive Enhancement

An approach to web design that emphasizes accessibility, semantic HTML, and external stylesheets and JavaScript.

Uses web technologies in a layered way that allows anyone to access the basic content and functionality of a website, using any browser or Internet connection.

Also provides an enhanced version of the page to those with more advanced web browsers or greater bandwidth.
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HTML
HyperText Markup Language

Illustration by Dave Stewart
HTML

HyperText Markup Language

A language for describing Web pages

HTML is not a programming language, it is a markup language

JavaScript is a programming language

A markup language is a set of markup tags

HTML uses markup tags to describe Web pages
HTML Tag
Opening/Closing

Keywords surrounded by angle brackets, for example: `<html>`

HTML tags normally come in pairs, like `<h1>` and `</h1>`

The first tag in a pair is the “start tag,” the second tag is the “end tag”

Start and end tags are also called “opening” and “closing” tags
**HTML Element**

Everything from the start tag to the end tag

Example:

```html
<p>This is a paragraph.</p>
```

Start tag:

```html
<p>
```

Element content:

This is a paragraph.

End tag:

```html
</p>
```
Web Pages

HTML Documents

Web pages are plain text documents that contain HTML tags.

HTML documents are Web pages.

Recommended plain text editors: Atom, Sublime Text, Text Wrangler, Notepad++.
Web Browsers

Reads HTML documents and displays them as Web pages

Web browsers do not display HTML tags, but use them to interpret the content of the page

This is also where most of our programs will be executed

Recommended browsers: Chrome, Safari, Firefox
This is where we will publish our projects during the semester.

A server is just a computer that is always on, ready to serve files when they are requested.

i6 is a secure, Unix-based Web server.

You will receive an email with your account information (if you don’t already have one).
i6 URL
i6.cims.nyu.edu/~netid
FTP
File Transfer Protocol

FTP, like HTTP, is a communications protocol of the Internet.

FTP allows us to transfer files between computers (i.e. laptop to Web server).

i6 requires a secure FTP connection, known as SFTP.

Recommended SFTP clients: Fetch, Cyberduck, WinSCP, Transmit.
**File Permissions**

**chmod**

Standard file permission:
644
Owner can read and write file;
group can read file;
others can read file

Standard directory permission:
755
Owner can read, write and execute file;
group can read and execute file;
others can read and execute file
HTML5
New standard for HTML

- First version published in 2008
- An official W3C recommendation as of October 2014
  - Simpler doctype declaration
  - New elements
  - New attributes
  - Full CSS3 support
  - Video and audio elements
  - 3D graphics support
  - Web applications
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CSS
Cascading Style Sheets
CSS
Cascading Style Sheets

Defines a Web page’s appearance

CSS separates style and content

Consists of a plain text file with rules for the display of HTML elements

Formatting includes fonts and colors as well as layout and position

Can be created outside of your HTML and applied to multiple Web pages

Well-formed HTML is important for your CSS to work properly
Application

CSS can be applied in three different ways to a Web page:

• In an external .css file

• In the <head> section of an HTML document

• Inline with HTML code
Style Construction

Selector: Indicates which HTML element will be formatted

Declaration block: Describes the formatting to apply

Property/value pair: Specifies format

Style rules are separated by a ;

```css
h1 {
  color: green;
  background: yellow;
}
```
The principle of the “cascade” is applied when style rules are in conflict. Three primary factors determine which style rule wins out:

- Inheritance
- Specificity
- Location
CSS3

Latest standard for CSS

CSS2 is best supported

CSS3 is still evolving but offers new features for designers and developers

Modern browsers support many aspects of CSS3

Backwards compatible with CSS2
CSS Box Model
Setting an Element’s Dimensions

- **Auto**: Browser calculates the width
- **Length**: Defines the width in a unit like pixels
- **%**: Defines the width in percent of the containing block
- **Inherit**: Specifies that the value should be inherited from the parent element
Responsive Web Design
Responsive Web Design

Media Queries

Features you can include in media queries:
- width
- height
- device-width
- device-height
- orientation
- aspect-ratio
- device-aspect-ratio
- color
- color-index
- monochrome
- resolution
- scan grid

Most of the above can be combined with min- and max- prefixes

Most common are min-width and max-width prefixes

Media queries can be used to load an alternate style sheet or offer alternate styles within an existing style sheet.
Responsive Web Design

Media Query Syntax

Two possible values: only or not

only screens out older browsers from reading the rest of the query

not negates the result: not screen

means everything except screen type is the media type

feature: value

Enclosed by parentheses and preceded by the word, and

Predefined media features

Multiple features and values can also be combined with and
Basic Style Sheet Link

```html
<link rel="stylesheet" href="main.css">
```

Style Sheet Link with Media Query

```html
<link rel="stylesheet" media="only screen and (min-width: 640px)" href="main.css">
```
Basic CSS Rule Set

body {background-color: orange;}

CSS Rule Set with @media Rule

@media only screen and (min-width: 480px) {
  body {background-color: orange;}
}
You can think of a web page as consisting of three layers: structure, presentation, and behavior

- HTML is the structure layer
- CSS is the presentation layer
- JavaScript is the behavior layer

JavaScript is a programming language for creating interactivity and functionality in web browsers
JavaScript was invented by Brendan Eich and introduced by Netscape in 1995.

At that time, the Java language was ascendant and the name “JavaScript” was an attempt to ride this popularity.

Eventually, browsers other than Netscape began to support JavaScript functionality, calling it “ECMAScript”.

Today, JavaScript is not only a lingua franca of the Web but a basis for many other computational media projects.
JavaScript
Introduction
As with CSS, JavaScript targets HTML elements to do something with them.

There are three ways you can apply JavaScript to HTML:

- Inline JavaScript
- Embedded JavaScript
- External JavaScript

External and embedded JavaScript are preferable for their separation of content and behavior.
JavaScript
Front-End Language

Like HTML and CSS, JavaScript is usually rendered in the web browser.

Because it’s rendered in the browser rather than on a server, JavaScript is considered a “front-end language.”

A browser’s “JavaScript engine” interprets and executes JavaScript code in the browser.

There are different JavaScript engines for different web browsers.
## JavaScript Engines

<table>
<thead>
<tr>
<th>Browser</th>
<th>JS Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chrome</td>
<td>V8</td>
</tr>
<tr>
<td>Firefox</td>
<td>Spidermonkey</td>
</tr>
<tr>
<td>IE and Edge</td>
<td>Chakra</td>
</tr>
<tr>
<td>Opera</td>
<td>V8</td>
</tr>
<tr>
<td>Safari</td>
<td>Nitro</td>
</tr>
</tbody>
</table>
Computationally speaking, there isn’t much JavaScript can’t do; it’s a robust programming language. Core functionality includes modifying HTML and CSS, communicating with the server, and storing data. We will use JavaScript and associated libraries for page content, style, data, interactivity, and more. As with any technology, it’s good to consider when to—and not to—use it.
JavaScript
Document Object Model
Document Object Model

When a browser loads a web page, it creates a model of that page.

This is called a “DOM tree” and it is stored in the browser’s memory.

Every element, attribute, and piece of text in the HTML is represented by its own “DOM node.”
Document Object Model

Types of DOM Nodes

There are four main types of nodes.

- The Document node, which represents the entire page
- Element nodes, which represent individual HTML tags
- Attribute nodes, which represent attributes of HTML tags, such as class
- Text nodes, which represent the text within an element, such as the content of a p tag

We talk about the relationship between element nodes as “parents,” “children,” and “siblings.”
<html>
  <head>
    <title>New York University</title>
  </head>

  <body>
    <h1>Web Development</h1>

    <p>This course provides concrete knowledge in Web technologies and programming.</p>

    <p>Class notes are available <a href="notes.html">here</a>.</p>
  </body>
</html>
html
  head
    title
    New York University
  body
    h1
      Web Development
    p
      This course provides concrete knowledge . . .
    p
      Class notes are available a here.
JavaScript methods that find elements in the DOM tree are called “DOM queries.”

DOM queries may return one element, or they may return a “node list.”

Which DOM query you use depends on what you want to do and the scope of browser support required.
Document Object Model

DOM Query

JavaScript methods that return a single element node:

- `getElementById()`
- `querySelector()`
Document Object Model

DOM Query

JavaScript methods that return one or more elements:

• getElementsByClassName()
• getElementsByTagName()
• querySelectorAll()
Event Types

UI Events

load
unload
error
resize
scroll
Event Types

Keyboard Events

keydown
keyup
keypress
Event Types

Mouse Events

click
dblclick
mousedown
mouseup
mousemove
mouseover
mouseout
Event Types

Focus Events

focus
blur
Event Types

Form Events

input  
change  
submit  
reset  
cut  
copy  
paste  
select
Event Types

Mutation Events

DOMSubtreeModified
DOMNodeInserted
DOMNodeRemoved
DOMNodeInsertedIntoDocument
DOMNodeRemovedFromDocument
jQuery

jQuery is a JavaScript framework that makes it easier to achieve common JavaScript tasks.

It is simpler to access elements using jQuery’s CSS-style selectors.

jQuery takes many common tasks and wraps them inside methods that you can call with a single line of code.

Furthermore, jQuery takes the guess work out of browser support, since it runs in legacy browsers as well.
jQuery

Features

• HTML/DOM manipulation
• CSS manipulation
• HTML event methods
• Effects and animation
• AJAX
jQuery

And JavaScript

jQuery does not do anything that couldn’t be done with pure JavaScript.

jQuery itself is just a JavaScript file.

Its goal is for you to be able to do more with less code.

jQuery’s prevalence on the Web indicates that many people prefer coding with it than without it.

There are other JavaScript frameworks, but jQuery is by far the most popular.
jQuery
Considerations

However, JavaScript has come a long way since 1995.

Some of the things that made jQuery popular, like CSS-style selectors, are now part of the JavaScript specification.

Moreover, it is often unnecessary to add all the extra code of jQuery if you just need to do a few simple JS tasks.

Therefore, it’s good to know the basics of JavaScript before moving into other JS libraries and frameworks.
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PHP
Hypertext Preprocessor
PHP
Hypertext Preprocessor

PHP is an open-source language for server-side scripting.

PHP code is executed on the server and the result is returned to the browser as plain HTML.

PHP in conjunction with HTML, CSS, JavaScript, and MySQL forms the basis of dynamic web development.
Request and Response

Basic HTML Sequence

1. You enter a URL in the address bar
2. The browser looks up the IP address
3. The browser requests the page
4. The request crosses the Internet and arrives at the web server
5. The server looks for the web page on its hard disk
6. The Web page is retrieved and returned to the browser
7. The browser displays the web page
Request and Response With PHP

If, after a web server access a page, it notices that it includes PHP, the page is passed to the PHP interpreter.

The interpreter executes the PHP code.

The interpreter returns the results of the PHP code to the web server.

Then the web page is returned to the browser and the browser displays it.
PHP
Capability

- Generate dynamic page content
- Create, open, read, write, delete, and close files on the server
- Collect form data
- Send and receive cookies
- Add, delete, and modify data in a database
- Control user-access
- Encrypt data
AJAX
Asynchronous JavaScript and XML
AJAX

AJAX is not a new programming language but a newer way to work with existing standards.

It’s a technique for loading data into part of a page without having to refresh the entire page.

AJAX stands for Asynchronous JavaScript and XML.
AJAX

Asynchronous

AJAX uses an “asynchronous” processing model

When a browser comes across a script tag, it usually stops processing the rest of the page until the script is executed

This is a “synchronous” model

With AJAX, the browser can request some data from the server and continue to load the rest of the page

When the server responds with the data, an event is fired that can call a function to process the data
AJAX
Asynchronous JavaScript and XML

W3Schools: AJAX Introduction
www.w3schools.com/ajax/ajax_intro.asp
AJAX

XMLHttpRequest

The keystone of AJAX is the XMLHttpRequest object.

All modern browsers support the XMLHttpRequest object.

The XMLHttpRequest object is used to exchange data with a server with the `open()` and `send()` methods.

To get the response from a server, we will use the `responseText` or `responseXML` property of the XMLHttpRequest object.
When a request is sent to the server, we want to evaluate the response it gives before proceeding.

readyState holds the status of the XMLHttpRequest:
0: request not initialized
1: server connection established
2: request received
3: processing request
4: request finished and response ready

The onreadystatechange event is triggered when readyState changes.

After the request, a status of 200, “OK” or 404, “Page not found” will be given.
AJAX

Caution

In many cases, AJAX can be employed to improve user experience.

There are, however, drawbacks to using AJAX on your site:

- Your back and refresh buttons will not work for that portion of the page.
- Search engines will not be able to catalog sections of content that are updated with AJAX.
- Users with JavaScript disabled will not be able to access this content.
API
Application Programming Interface

Whereas a user interface (UI) allows people to interact with programs, an API allows programs to interact with each other.

Different types of Web APIs include:
- Browser-specific APIs, such as the DOM and HTML5 geolocation
- Script APIs, such as jQuery
- Platform APIs, such as Google Maps and OpenWeatherMap

To work with an API you only need to know what it can do, how to access it, and the syntax it uses.
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