Final Exam
Monday, December 19, 10:00–11:50 a.m.
Room 201, Warren Weaver Hall
Introduction to Web Design & Computer Principles
CSCI-UA 4

Class 1
Introduction and Overview
What is the Internet?

A computer network consisting of a worldwide network of computer networks that use standardized network protocols to facilitate data transmission and exchange.
Node
From the Latin for “knot”

A point at which lines or pathways intersect or branch; a central connecting point

In computing, a piece of equipment, such as a PC or peripheral, attached to a network
The Internet and the World Wide Web
The Internet and the World Wide 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.
Internet Access
1980s–Present

• Personal Computing
• Portable Computing
• Mobile Computing
• Ubiquitous Computing
• Ambient Computing
IBM 5150
1981
Apple PowerBook 540c
1993
Apple iPhone
2007
Introduction to Web Design & Computer Principles

Class 1
Introduction and Overview

Arduino Uno
2010

Nike+ Fuelband
2012

Apple Watch
2015
Ambient Intelligence (AmI)
2010–
Introduction to Web Design & Computer Principles
CSCI-UA 4

Class 1
Introduction and Overview
Digital Revolution

Afterglow

Represents a shift from analog and electronic technology to digital.

These technological developments build upon and continue to inform each other today.
Digital Media
Modern vernacular of 1s and 0s

On/Off
Electrical impulses (+5v / -5v)

• Single 0 or 1 = 1 “bit”
• A group of 8 bits = 1 “byte”
• 1 million bytes ≈ 1 “megabyte”
• 1,024 megabytes = 1 “gigabyte”
• 1,000 gigabytes = 1 “terabyte”
Introduction and Overview

curve shows transistor count doubling every two years
Moore’s Law
Describes a constant rate of change in computer processor speed

The number of transistors that can be placed inexpensively on an integrated circuit doubles every two years.

The number of transistors is closely connected to processor speed, memory, etc.

Computer processor speed has doubled approximately every two years.

Moore’s Law seems to be plateauing but held steady for the past 40 years.

Digital media is in a constant state of flux.
Anyone is free to use it
Usually free of charge
Source code is made available
Can be modified and redistributed
Introduction to Web Design & Computer Principles
CSCI-UA 4

Operating Systems
1950s to Present
Operating Systems

Software that manages a computer’s resources

Allocates resources among other programs

Resources include the central processing unit (CPU), computer memory, file storage, input/output (I/O) devices, and network connections

Runs indefinitely and terminates only when the computer is turned off
Operating Systems

Examples

DOS (Generic term)
Microsoft OS
Mac OS
Linux
iOS
Android
Symbian OS
Operating Systems

History

First digital computers had no operating systems

Ran one program at a time, which had command of all system resources

A human operator would provide any special resources needed

First operating systems were developed in the mid-1950s
Command Line Interface / Graphical User Interface
Unix

Operating system by AT&T Bell Labs

Originally developed in 1969

Command line interface

Portable, multi-tasking, multi-user

Free distribution, open system

Servers, workstations, mobile devices

Basis of Linux and MacOS
Unix

Commands

See Reading section of course site for basic Unix commands.
Chmod

chmod sets permissions

Every file and directory has nine permissions associated with it.

Files and directories have three types of permissions (or none):

- r (read)
- w (write)
- x (execute)
- - (no permission)

The above permissions occur for each of the following classes or users:

- u (user/owner)
- g (group)
- o (other/world)
<table>
<thead>
<tr>
<th>Permission</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>chmod 777 filename</td>
</tr>
<tr>
<td>G</td>
<td>chmod 775 filename</td>
</tr>
<tr>
<td>W</td>
<td>chmod 755 filename</td>
</tr>
<tr>
<td>rw-</td>
<td>chmod 664 filename</td>
</tr>
<tr>
<td>rw-</td>
<td>chmod 644 filename</td>
</tr>
<tr>
<td>r--</td>
<td></td>
</tr>
<tr>
<td>r--</td>
<td></td>
</tr>
</tbody>
</table>
Chmod

Files and folders

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
Introduction to Web Design & Computer Principles
CSCI-UA 4

HTML
HyperText Markup Language
HTML
HyperText Markup Language

A language for describing Web pages

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

A markup language is a set of markup tags

HTML uses markup tags to describe Web pages
HTML

Early history key dates

1990: Original HTML specification written by physicist, Tim Berners-Lee for cross-referencing documents

1993: First text-based browser, Lynx, released

1993: Mosaic browser released, adding images, nested lists, forms

1994: First World Wide Web conference held in Geneva

1994: Netscape is formed

1994: The World Wide Web Consortium is formed, w3.org
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:
<p>This is a paragraph.</p>

Start tag:
<p>

Element content:
This is a paragraph.

End tag:
</p>
Web Pages

HTML Documents

HTML documents describe Web pages
Contain HTML tags in plain text
HTML documents are Web pages
Recommended plain text editors: Atom, Text Wrangler, Notepad++
Web Browsers

Render HTML Documents

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

Recommended browsers: Chrome, Safari, Firefox
Example

Bare minimum

<!DOCTYPE html>
<html>
<head>
    <meta charset="UTF-8">
    <title>Page Title</title>
</head>
<body>
    <p>Text</p>
</body>
</html>
Example Explained

<!DOCTYPE html> tells browsers that they are interpreting an HTML document

Text between <html> and </html> describes the Web page

Text between <title> and </title> is displayed as the page title

Text between <body> and </body> is the visible page content

Text between <p> and </p> is a paragraph of text
SFTP
Secure File Transfer Protocol

Web pages are usually created “locally” on a personal computer, then uploaded to a web server.

A web page is not publicly accessible until it is published to a web server.

An SFTP client is used to transfer files from a personal computer to a server.

Fetch, Cyberduck, and WinSCP are a few good SFTP client options.

“Local” files are those on a personal computer, “remote” files are those on a web server.
HTML5

New standard for HTML

First version published in 2008
An official W3C recommendation as of October 2014

- New Elements
- New Attributes
- Full CSS3 Support
- Video and Audio
- 2D/3D Graphics
- Web Applications
- Smartphone Apps
Introduction to Web Design & Computer Principles
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
History

Prior to CSS, Web pages were commonly styled with HTML tags and structured with tables.

This was both tedious and inefficient.

Nine different style sheet languages were proposed, two were chosen as the foundation.

CSS Level 1 emerged as a W3C Recommendation in December 1996.

Browsers began to support CSS over the next few years.
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 semicolon

h1 {
    color: green;
    background: yellow;
}
Cascade

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
**CSS Layout**

**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 (parent element)

- **Inherit**
  Specifies that the value should be inherited from the parent element
<div>
CSS Layout
Page Structure

The HTML div tag can be used to give your page structure.
It has no specific meaning except to outline a section of content.
The div tag is only used in the body section of an HTML document.
Initially, this structure will not be visible to the user.
Used in conjunction with CSS, we will have more control over the form and layout of web pages.
CSS Layout

Types

- Fixed
  A fixed layout uses pixel-based widths.

- Fluid
  A fluid layout uses percentages for widths.

- Elastic
  An elastic layout uses ems for all dimensions.
Introduction to Web Design & Computer Principles
CSCI-UA 4

Image Editing
Photoshop
Introduction to Web Design & Computer Principles
CSCI-UA 4

Image Editing
Photoshop
Photoshop
1987

Created by Thomas Knoll, then a PhD student at the University of Michigan

Originally called “Display”

For displaying grayscale images, scanned into a computer

Acquired by Adobe in 1988

Released as Photoshop 1.0 for Macintosh in 1990
Introduction to Web Design & Computer Principles
CSCI-UA 4

Image Editing
Photoshop
**Technological Basis**

**Bitmap/raster graphics**

A grid of picture elements, “pixels,” each of which contain color and brightness information.

Pixels can be changed individually or as a group with program algorithms.

Contrast vector graphics which describe lines.

Layer support introduced in version 3 (c. 1993).
Introduction to Web Design & Computer Principles
CSCI-UA 4

Image Editing
Photoshop
GIF
Bitmap Animation
What is a GIF?
Graphics Interchange Format

Bitmap image format
Introduced by CompuServe in 1987
Designed to minimize file size and electronic transfer time
One of the first two image formats commonly used on Web sites
Technical Aspects

Color palette of up to 256 distinct colors

Preserves transparency

Uses a compression algorithm to reduce file size

Also supports sequential frame animation

“Dithering” approximates a wider range of colors with a small color palette
Thought
Thought

Design is a process that involves you.
Form

Photography
Illustration
Line and Shape
Texture
Color
Typography
Composition
<table>
<thead>
<tr>
<th>Form</th>
<th>Hue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Value</td>
</tr>
<tr>
<td></td>
<td>Intensity</td>
</tr>
</tbody>
</table>
Form

Typography

Font selection
Type size
Alignment
Letter spacing
Line spacing
Grammar
Form
Composition

Rhythm
Proportion
Structure
Variation
Balance
Boundary
Space
Context
Context

Age
Ethnicity
Geography
Interest
Education
Market
Social Group
Cultivating a mindful design approach allows you to do more with less.
Introduction to Web Design & Computer Principles

CSCI-UA 4

Wireframing
Website Layout and Design
Wireframing

Website wireframing allows you to plan the layout of your website.

It is the process of making design decisions before they are implemented.

Wireframing can range from a simple skeletal framework to a detailed mockup of each page.

Spending time planning your site makes coding easier.
Wireframing
And Prototyping

Here is an approach to wireframing that can be adapted to a variety of design projects.

• Think
• Design
• Implement
• Revise

This sequence can be looped through as necessary.
Website Layout

CSS float property

Specifies whether or not an element should be positioned alongside of another element on a web page.

none (default)
Element is not floated, and will be displayed where it occurs in the text.

left
Element floats to the left.

right
Element floats to the right.

The clear property removes a float from HTML elements.
Website Layout
CSS position property

Specifies the type of positioning used for an element on a web page.

**static** (default)
Elements render in order, as they appear in the document flow

**absolute**
Element is positioned relative to its first positioned (not static) parent element

**fixed**
Element is positioned relative to the browser window

**relative**
Element is positioned relative to its normal position
Responsive Web Design

“The control which designers know in the print medium, and often desire in the web medium, is simply a function of the limitation of the printed page. We should embrace the fact that the web doesn’t have the same constraints, and design for this flexibility. But first, we must ‘accept the ebb and flow of things.’”

– John Allsopp, “A Dao of Web Design”
Responsive Web Design

Mobile traffic is as relevant as desktop traffic now.

We should build for the type of screens that will be used to access our sites.

One way to do this is with alternate style sheets.

Responsive web design uses “media queries” to figure out what resolution of device it’s being served on.

Flexible images and fluid grids size correctly to fit the screen.

Design for flexibility.
Media Queries

Features you can include in a query:

- 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.
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 CSS Rule Set

body {background-color: orange;}

CSS Rule Set with @media Rule

@media only screen and (min-width: 480px) {
    body {background-color: orange;}
}
Basic Style Sheet Link

<link rel="stylesheet" href="style/basic.css">

Style Sheet Link with Media Query

<link rel="stylesheet" media="only screen and (min-width: 640px)" href="style/main.css">
Introduction to Web Design & Computer Principles
CSCI-UA 4
Bootstrap
Front End Web Framework
Bootstrap

Bootstrap is a front end framework for developing responsive, mobile-first projects on the Web.

It contains HTML and CSS design templates as well as optional JavaScript extensions.

Originally developed as an internal toolkit for Twitter, the project was released as open-source code in 2010.

It has since become one of the most popular front end Web frameworks and is used by many different kinds of sites.
“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.
The Bootstrap framework is responsive with a mobile-first approach. It starts with a baseline of shared styles and introduces more advanced layout rules when screen size permits. Media queries are used to determine screen size and apply different styles accordingly. Bootstrap also offers a grid layout system which organizes page content into a series of rows and columns.
Bootstrap

Interactivity

Additional interactive components, or “widgets,” can extend the behavioral aspect of Bootstrap Web pages.

Such interactivity would normally require an understanding of JavaScript to add to a website.

Bootstrap simplifies this process by providing several common widgets including tabs, carousels, and tooltips.
Introduction to Web Design & Computer Principles

CSCI-UA 4

Web Audio and Video

HTML5 Media Elements
Sound

Sound consists of pressure waves moving through air

Without air, there is no sound

Our ears are sensitive to pressure waves and transmit these signals to the brain
Hand Clap

![Graph of a hand clap sound](image-url)
Periodic Wave
Sound Recording
Acoustic waves to electrical waves

A microphone consists of a small membrane that vibrates

Movements of the membrane are translated into electrical signals

Higher pressure typically corresponds to higher voltage
Digital Audio

Analog to digital

An audio signal is an analog (continuous) format.

The electrical waves must be converted to digital information for computational processing.

Digital recording is accomplished with an analog-to-digital converter (ADC).

The ADC captures a snapshot of the electric voltage on an audio line and represents it as a digital number.

Capturing the voltage thousands of times per second creates a good approximation of the original audio.
Digital/Analog Sound
Digital Audio Playback

Digital to analog

All computers must give us analog signals to be useful.

The screen converts digital information to light.

The digital-to-analog converter (DAC) takes the sample and sets a certain voltage on the analog outputs to recreate the signal.

This voltage is conveyed to the speakers which create pressure waves in the air.
Audacity
Open-source sound editing software

Free, open-source software that can be altered and redistributed
Multilingual
Easy to use
Records live audio
Cuts, copies, splices and mixes sounds together
Exports to different formats (with appropriate plugin)
HTML5 Audio and Video

HTML5 now supports audio and video natively in the web browser.

For years, it was necessary to rely on a third party to deliver this kind of content.

Now we can use the `<audio>` and `<video>` tags.
jQuery
JavaScript Framework
Interaction

During the semester we have learned to use HTML to build web pages and CSS to style them.

The third layer of front-end web development is interaction.

JavaScript is a programming language for creating interactivity and functionality in web browsers.
Introduction to Web Design & Computer Principles
CSCI-UA 4
jQuery
JavaScript Framework
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 manipulation
- CSS manipulation
- HTML events
- Effects and animation
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

With an introduction to jQuery, you will begin to get a sense of what can be done with JavaScript in general

JavaScript takes time to learn but it’s well worth it if you want to go further with web development
Forms
Gathering Information on a Web Page

Name

Email

Website

Submit
Forms

Web pages are good not just for providing information to visitors, but also gathering information from them.

The HTML `<form>` element is used to define a form for getting user input.

A variety of form elements are used to provide an interface for the input.

These form elements include text fields, checkboxes, drop-down menus, and buttons.
Forms
Gathering Information on a Web Page
Forms
Gathering Information on a Web Page

charity: water
100% funds water projects

Email

Name

Street

City

ZIP Code

United States

Give
<form action="my-script.php">

First name:
<input type="text" name="firstname">

Last name:
<input type="text" name="lastname">

<input type="submit" value="Submit">

</form>
Forms always begin with the `<form>` element.

The `<form>` element’s action attribute specifies how the form will be processed.

The `<input>` element is used for various kinds of user input.

The `<input>` element’s type attribute determines what kind of input is received from users.

Each `<input>` element must also have a name attribute and value in order for the data to be sent.
Forms
Validation

Before form data gets sent, it’s important to validate the input.

• You may want to make certain form fields required.

• You probably want to make sure that certain fields are completed properly.

• You should also verify that malicious code is not sent along with form input.

Form validation can be done client-side, server-side, or both.

We will use a jQuery validation plugin for simple client-side form validation.
Forms

Processing

Normally, forms are sent to the server to be processed.

This requires a server-side application written in a back-end language.

Since server-side coding is beyond the scope of this class, we will use a free service that receives form data and emails it to you.

Formspree is a project that allows us to easily add forms to otherwise static HTML pages.
Domain Names

Domain names serve as a more memorable reference to Internet resources.

Domain names are used to identify Internet Protocol (IP) addresses.

An IP address is an identifier for a node—a computer or device on a network.
Domain Names

TLD

Every domain name has a suffix that indicates which top level domain (TLD) it belongs to.

Top-level domains today are grouped as follows:

• Generic top-level domains
• Country-code top-level domains
• Infrastructure top-level domain
• Sponsored top-level domain
Domain Names

Generic TLDs

Generic top-level domains initially consisted of:

- GOV  Government agencies
- EDU  Educational institutions
- ORG  Nonprofit organizations
- MIL  Military
- COM  Commercial business
- NET  Network organizations

Some of these, such as .com and .net, are no longer restricted to their original intended usage.

More generic TLDs have since been added and are being added today.
Domain Names

Selection

When you register a domain name, you are not its owner, rather you have the exclusive right to use it.

Some factors to consider when selecting a domain name:

• Relevance to site
• Communicability
• Availability

Here is a list of all domain name registrars: [www.internic.net/alpha.html](http://www.internic.net/alpha.html)
**Web Hosting**

A Web hosting service allows individuals and organizations to make their website accessible to others.

The host usually provides storage space on a server as well as Internet connectivity.

Theoretically, any computer can serve as a Web host, but it needs to always be on and implement measures for security and stability.
Web Hosting
Selection

Web hosting costs anywhere from $5 per year to $40 per month, depending on a variety of factors:

- Disk space (more is better, but you often don’t need more than a few GB)
- Bandwidth (data transfer)
- Up time (reliability)
- Overage: Would you rather be charged extra or have a hard cap if you reach your data limits?
Web Hosting

Extras

Optional extras

• Databases (for CMS, blog, etc.)

• Mailboxes (if you want an email address with your domain)

• Customer support (email only or phone also?)
Search engine optimization is the process of making your site easy for others to locate.

The more thoughtfully and selectively you add keywords to your pages, the better your search rankings.

There are several factors that help your website to rise in search results.
On-page techniques are the methods you can use to improve search results for your site.

This involves identifying and implementing keywords in seven particular places in your page:

1. Page title
2. URL
3. Headings
4. Text
5. Link text
6. Image alt text
7. Page descriptions
SEO
Off-Page Techniques

Search engines also look at the number of other sites that link to yours to determine search ranking.

This is especially so when the content of a referring site is similar to yours.

It’s ideal when the words that appear in links to your site also appear in the text of the page that the site links to.

Finally, as more people visit your site, the search ranking will also improve.
Analytics

Once people start visiting your site, it's helpful to know!

Analytics tools allow you to observe data about the traffic your site receives.

This can include the following information:

- Number of visits
- Geographic location of visitors
- Time spent on pages
- Referring web page
- Browser information
- Real-time activity
Final Exam
Monday, December 19, 10:00–11:50 a.m.
Room 201, Warren Weaver Hall