Csci 4131 Internet Programming

Fall 2016
Lecture 1, Sept 6

Instructor: Dr. Dan Challou

Agenda

- Course Logistics – Intro and Overview
- History of the Internet
- How Computers represent text
- Overview of WWW
  - Hardware and Software Models of WWW function
  - Course Technologies - HTML, CSS, JavaScript, …
  - A brief look at HTML
  - A 5000 foot view of the URI's, URL's, HTTP & HTTPS Protocols

Course Logistics

Contact Info

- **Instructor:** Dan Challou
- email: challou@cs.umn.edu
- office phone: 612 625-8207.
- Office hours are in Shepherd Labs, Room 587:

  Monday from 2:30 pm to 3:30 pm

  Tuesday from 3:30 to 4:45pm

  and, by appointment

TA's

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• Nilanshu Sharma	sharm398@umn.edu
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Office hours will be posted ASAP, and will definitely be held on Thursday and Friday of this week!!!!!

Course Logistic, Wrap-up

The Syllabus and Schedule can be all found on Moodle.

The Schedule will be updated, so please check it regularly

All Homework assignments will be posted on moodle, and you will submit your homework assignments via through moodle as well

Course Syllabus and Schedule

- See Class Moodle Site

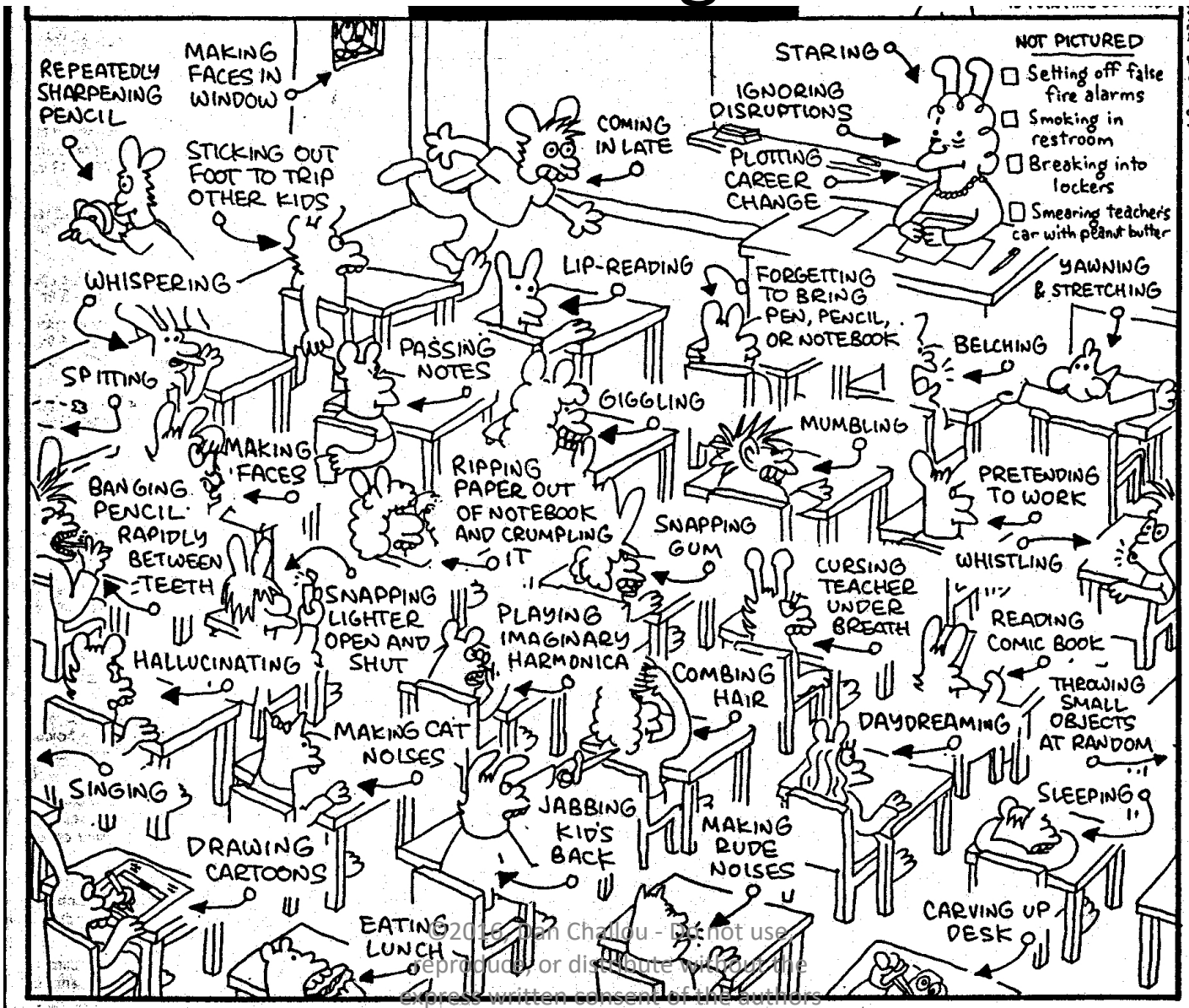
Homework 1 Has Been Posted

- And it is due this Friday, September 10th, at 11:55pm!!!!!

Technology Policy

- In class, from Students, Technology should not be heard - and seen as little as possible
- Cellphone volume off
- If you are using laptops, you should be using them to take notes or do a related class exercise
- If your technological device emits an audio distraction, you will be invited (i.e., required) to sing the first stanza of the rouser at the start of the next class. We will admit duets, or, if necessary a small chorus if there is more than one violator OR - I may just confiscate it for the duration of the class
- Exceptions
  - A device is required by the student to function in the world,
  - Get me (the instructor) and documentation from a health professional or official university source to support your use…

Positive Class Participation - Encouraged



Exercise 1: Raise Your Hand

Class Participation – Assignment #1

- Write your name on a piece of paper and student ID on a piece of paper
- Take 5 minutes to write down the following
  - 3 or four topics in the scope of this course that are of most interest to you
  - Your assessment of your expertise in

    HTML, CSS, JavaScript, DOM, jQuery, XML, JSON

    PhP, CGI, WSGI, Python, Perl, SQL, MySQL;

  - Experience, if any, Client Side

    Scripting and Server Side Scripting

Course Theme

- Teach you technologies you can use to build your own personal website

“Client” Side Technologies in Course Scope (Subject to Change)

- HTML /Forms
- CSS
- JavaScript / Forms
- JQuery
- DOM
- XML
- Ajax (Asynchonous Javascript and XML) / JSON

“Server” Side Technologies in Course Scope (Subject to Change)

- Webserver – (XAMMP is free Apache distribution)
- Database – MySQL
- PhP
- CGI / WSGI
- Perl
- Python

Applications we'll use

- Google Maps
- MySQL
- ?????

Reading

- Chapter 1 in Deitel
- Tutorials
  - http://www.w3schools.com/html/
  - http://www.w3schools.com/css/

What the heck is the Internet?

- http://www.businessinsider.com/what-is-the-internet-and-how-the-internet-works2011-6
- Jay and Silent Bob have a different view:
  - https://www.youtube.com/watch?v=nv_F3nAPjsI

History of the Internet

- Leonard Kleinrock – Packet Switching 1961
  - Showed the viability of Packet Switching vs. Circuit Switching (an actual unique connected path between two “terminals”)
  - ARPANET, funded by DARPA, up and working in October 1969 (UCLA connected with SRI)
  - First Transmission Protocol – Network Control Protocol - 1972
  - Transmission Control Protocol / **Internet Protocol** January 1, 1983

A Note on IP Addresses

- An Internet Protocol (IP) address is a numerical label assigned to each device (e.g., computer, printer) participating in a computer network that uses the Internet Protocol for communication.[1]

- IP address serves two principal functions:
  - host or network interface identification,
  - location addressing.

- Its role has been characterized as follows:
  - "A name indicates what we seek.
  - An address indicates where it is.
  - A route indicates how to get there."[2]

Format of an Internet Address

- Initially – Internet Protocol Version 4.
- Format - 172.16.254.1 (for IPv4) – 32 bits
- How many devices can be addressed using this format?
- $2^{32} = 4,294,967,296$

Exercise 2

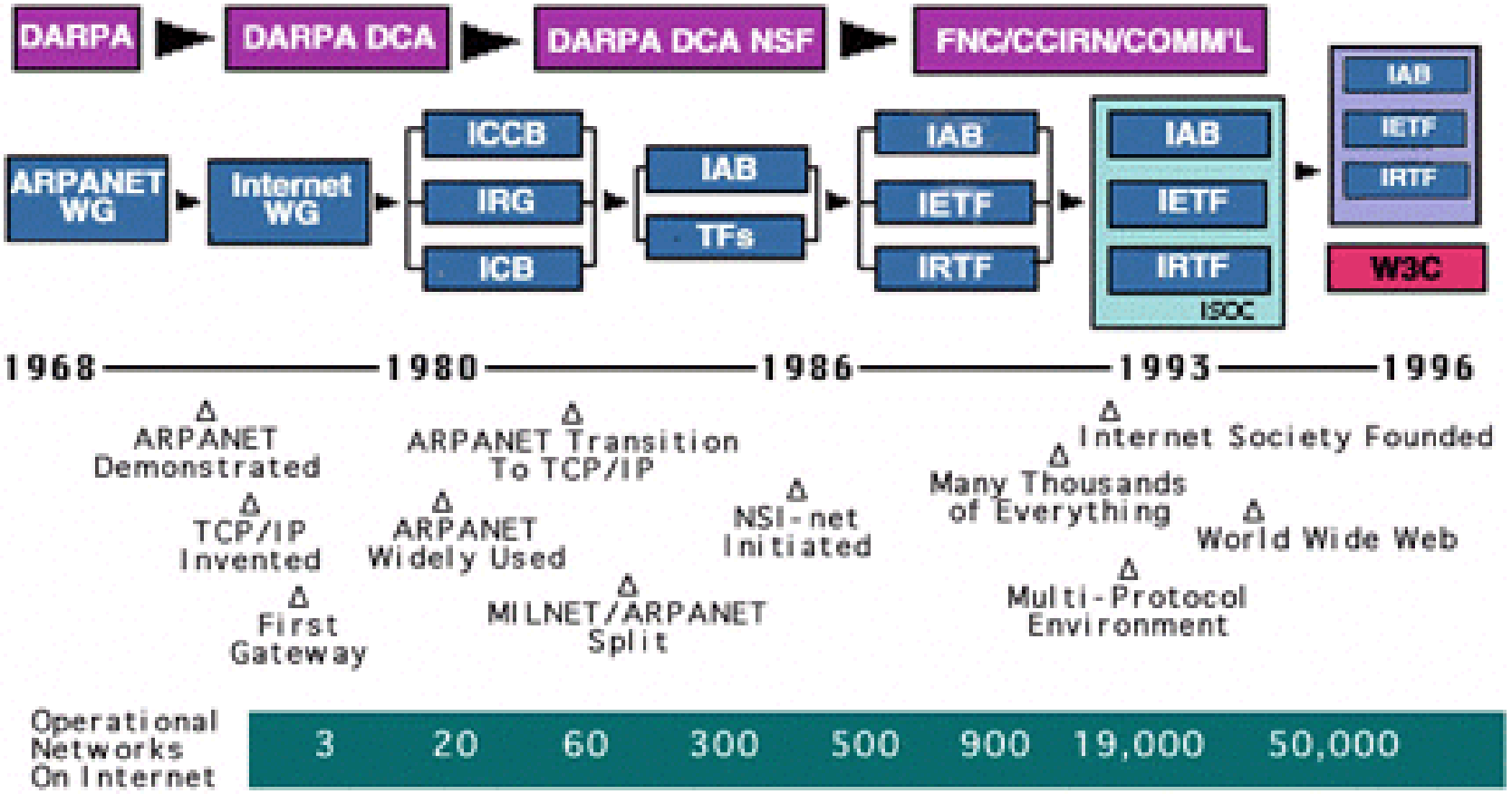
- Are 2^{32} = 4,294,967,296 IP addresses sufficient?
- Sites that might be helpful:
  - http://www.gartner.com/newsroom/id/3165317
  - http://www.internetlivestats.com/internet-users/

Introduce yourself to your neighbor and formulate an answer to the question.

Are 2^{32} = 4,294,967,296 addresses sufficient?

- Rhetorical Question – no, of course
- IPV6 - Format: 2001:db8:0:1234:0:567:8:1 - 128 bits
- 2^{128} = $3.4 * 10^{38}$ Addresses
- http://en.wikipedia.org/wiki/IP_address

Timeline – Evolution of The Internet



http://www.internetsociety.org/internet/what-internet/history-internet/brief-history-internet#LK64

The Internet as of

- According to The Motley Fool – Number of Devices Connected to the Internet
  - 15 billion

So, the internet today is a giant network of computerized devices (cell phones, tablets, PC's, Laptops, printers, etc)

World Population is: 7.189 Billion People (and Climbing)

http://www.census.gov/popclock/

http://www.fool.com/investing/general/2016/01/18/internet-of-things-in-2016-6-stats-everyone-should.aspx

Most Popular Browsers

- http://www.w3schools.com/browsers/browsers_stats.asp

Most Popular Uses of the Internet

- http://www.businessinsider.com/10-charts-reveal-stunning-facts-about-how-people-use-the-internet-2013-6

- http://www.pewinternet.org/Trend-Data-(Adults)/Online-Activites-Total.aspx

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So Let's Get Started Understanding the Elements that are used to make up the internet

- In order to Get To HTML (and beyond), let's look at how text was and is represented by computers

Evolution of How Computers Represent Text

- Before Digital Images, Digital Video, Digital Music, etc. :
  - Computers were used to manipulate numbers
  - Earliest machines were used in number crunching – computing artillery firing tables, decrypt codes used by opposing forces to transmit messages, etc

And then there was ASCII

- American Standard Code for Information Exchange (circa 1960)
- Numeric Scheme for encoding characters of the English Alphabet
- Created by Bell Telephone Laboratories (aka – "The Phone Company") to support their tele-printers

http://en.wikipedia.org/wiki/ASCII

USASCII code chart

b_4	b_3	b_2	b_1	Row ↓ / Column →	0 (0 0 0)	1 (0 0 1)	2 (0 1 0)	3 (0 1 1)	4 (1 0 0)	5 (1 0 1)	6 (1 1 0)	7 (1 1 1)
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

- Why would anyone ever need any other character encoding standard?

- So – what was the answer?

  – Unicode Transformation Format (UTF)

Unicode provides a unique number for every character,
no matter what the platform,
no matter what the program,
no matter what the language.

http://www.unicode.org/standard/WhatIsUnicode.html

But Different Unicode “Standards” Emerged

- Unicode 8 – works with Legacy ASCII Applications (C)
- Unicode 16 – Java, Windows
- Unicode 32

https://en.wikipedia.org/wiki/Comparison_of_Unicode_encodings

Unicode 8 seems to becoming the Defacto Standard

- Unicode 8 – not big or little endian (does not depend on how computer hardware is implemented)
  - Big Endian - most significant byte in smallest address
  - Little Endian – most signifcant byte in largest address
- Supports the legacy ASCII character set

Additional Supplemental Reading

- http://www.utf8everywhere.org/
- https://en.wikipedia.org/wiki/Code_point
- https://en.wikipedia.org/wiki/Unicode_equivalence

- Why should we care about Unicode transformation formats (UTF)?

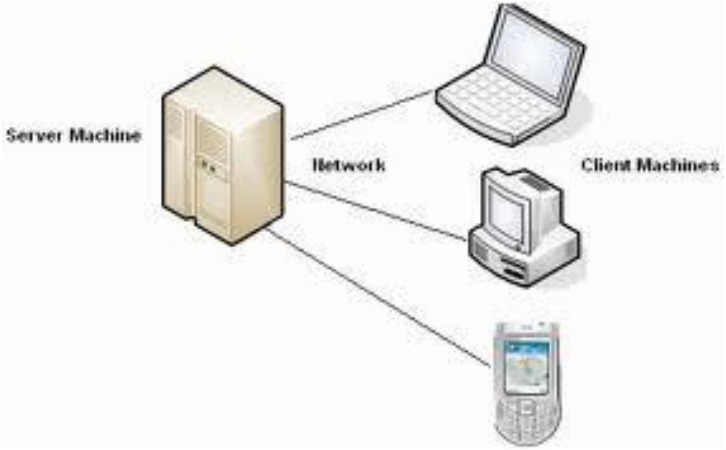
UTF Enables Web Browsers Know How to Display HTML

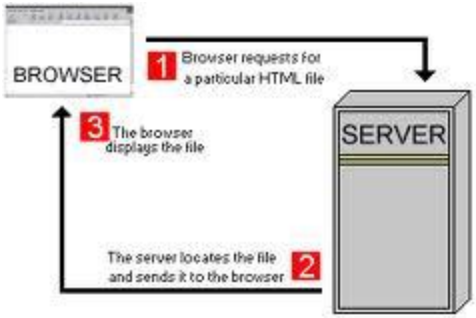
- Hyper-text Markup Language is used to mark up text, which is represented in Unicode
- To correctly process HTML, a web browser must ascertain which Unicode characters are represented by the encoded form of an HTML document. In order to do this, the web browser must know what encoding was used
- http://en.wikipedia.org/wiki/Unicode_and_HTML

The World Wide Web

- After the Internet was in place, the world wide web – which uses the Internet, emerged.
  - In 1989, Tim Berners-Lee of CERN (the European Organization for Nuclear Research) began to develop a technology for sharing information via hyperlinked text documents (aka web pages) called HyperText Markup Language (HTML).
  - Berners-Lee also wrote the Hypertext Transfer Protocol (HTTP)—a communications protocol used to send information over the web.
  - Each web page on the Internet is associated with a unique Uniform Resource Locator (URL).
  - The URL specifies the address (i.e., location) of the web page displayed in the browser window.
  - URLs usually begin with http://.
  - Web use increased dramatically with the availability in 1993 of the Mosaic browser, which featured a user-friendly graphical interface – its inventor, Marc Anderson, went on to found Netscape

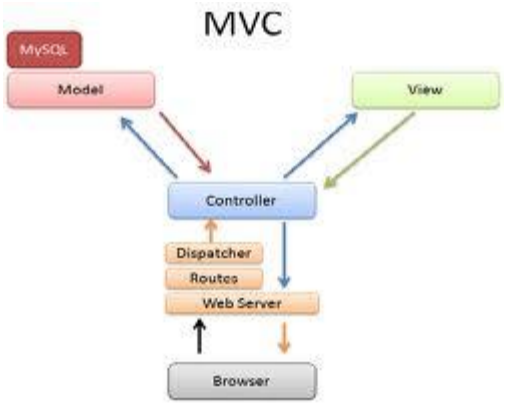
Client-Server – A Hardware Model to Describe How WWW Functions

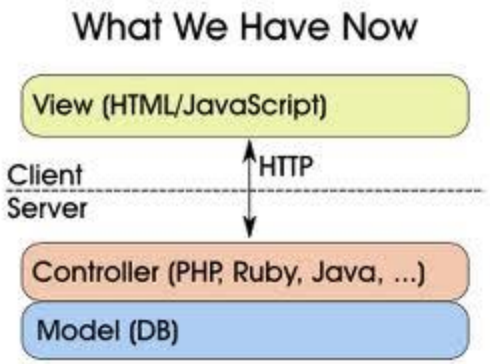




Model View Controller

- MVC – A Software Design Pattern useful for implementing Web Applications





“Client” Side Technologies in Course Scope (Subject to Change)

- HTML /Forms
- CSS
- JavaScript / Forms
- JQuery
- DOM
- XML
- Ajax (Asynchonous Javascript and XML) / Json
- Json

“Server” Side Technologies in Course Scope (Subject to Change)

- Webserver – Apache
- Database – MySQL
- PhP
- CGI
- Python

WWW Basics

- In its simplest form, a *web page* is an HTML (HyperText Markup Language) document (with the extension .html or .htm) that describes to a web browser the document's content and structure.
- HTML documents normally contain hyperlinks, which, when clicked, load a specified web document.
- Images and text may be hyperlinked. (What else??????)
- When the user clicks a hyperlink, a web server locates the requested web page and sends it to the user's web browser.
- Alternatively, a user can type the *address of a web page* into the browser's *address field* and press *Enter* to view the specified page.

WWW Basics (continued)

- Hyperlinks can reference other web pages, e-mail addresses, files and more.
- If a hyperlink's URL is in the form mailto:*emailAddress*, clicking the link loads your default e-mail program and opens a message window addressed to the specified e-mail address.
- If a hyperlink references a file that the browser is incapable of displaying, the browser prepares to download the file, and generally prompts the user for information about how the file should be stored.

Let's build a simple web-page

- Structure
  Version tag (if html 5)
  html tag
  head tag
  Meta tag, with information on the character set
  Tag closing head
  Tag opening body
  Other HTML elements
  Tag closing body
  Tag closing html page

  See Try2.html, posted on course moodle site

  And we will check it with the validator: https://validator.w3.org/

Let’s look at an another HTML5 Web Page

www.w3schools.com/html/tryit.asp?filename=tryhtml_basic_link

www.w3schools.com – excellent resource for a number of the course topics

To Recap

- HyperText Markup Language - A markup language, not a programming language!
- HTML is used to **structure** and add content to websites
- Web browsers parse HTML and render page

Reading /Tutorials

- Chapter 1 in Deitel
- Chapter 2 Deitel has most of what you need for HW1
- Go through the www3 schools tutorials on HTML, and HTML 5 (and CSS)
  - http://www.w3schools.com/html/
  - http://www.w3schools.com/css/