

LECTURE 1: INTRO TO WEB PROGRAMMING: LAYERS OF ABSTRACTION

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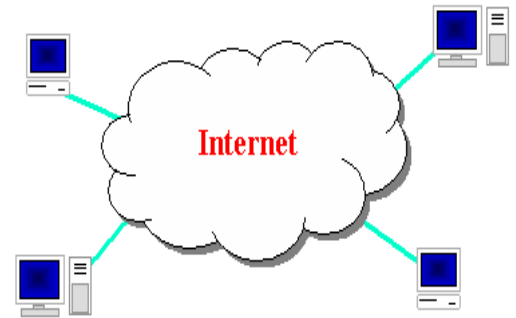
Wholeness Statement

In this lecture we introduce the basic technologies that make up the Internet, the World Wide Web and the Hyper Text Markup Language (HTML). We will see that many technologies are built on top of other technologies.

The universe is organized in layers. The most basic layer is the unified field of pure intelligence.

The Internet

- A connection of computer networks using the Internet Protocol (IP)
- layers of communication protocols: IP → TCP/UDP → HTTP/FTP/POP/“MTP/““H...
- What's the difference between the Internet and the World Wide Web (WWW)?
- The Web is the collection of web sites and pages around the world; the Internet is larger and also includes other services such as email, chat, online games, etc.

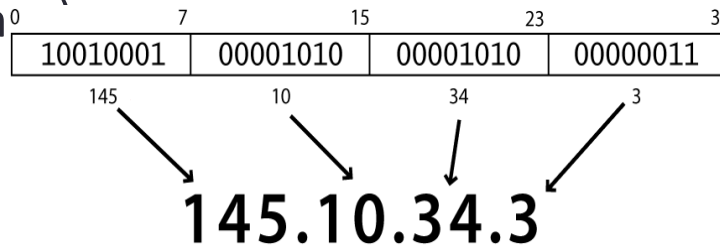


Brief history

- Began as a US Department of Defense network
 - called [ARPANET](#) (1960s-70s)
- Initial services: Electronic mail, File transfer
- Opened to commercial interests in late 80s
- WWW created in 1989-91 by [Tim Berners-Lee](#)
- Popular Web browsers released: Netscape 1994, IE 1995
- Amazon.com opens in 1995; Google January 1996; Facebook 2004; Uber 2009
- https://en.wikipedia.org/wiki/History_of_the_Internet

Internet Protocol (IP) IPv4

- The underlying system of communication for all data sent across the Internet.
- Each device has a 32-bit IP address written as four 8-bit numbers (0-255)
- There are two types of IP addresses, servers used to have static IP address while users usually get a dynamic IP address from their ISP.
- Find out your local IP address: in a terminal, type: ipconfig (Windows) or ifconfig (Mac/Lin)



- IPv6 addresses are 128-bit IP address written in hexadecimal and separated by colons. An example IPv6 address could be written like this: 3ffe:1900:4545:3:200:f8ff:fe21:67cf

Transmission Control Protocol (TCP)

- Adds multiplexing, guaranteed message delivery on top of IP
- **Multiplexing:** multiple programs using the same IP address
 - **port:** a number given to each program or service
 - port 80: web browser (port 443 for secure browsing)
 - port 25: email
 - port 22: ssh
 - Port 21: File transfer (FTP)
 - port 5190: AOL Instant Messenger
 - [more common ports](#)
- Some programs (games, streaming media programs) use simpler [UDP](#) protocol instead of TCP

Web servers and Browsers

- **Web server:** software that listens for web page requests
 - [Apache](#)
 - Microsoft Internet Information Server (IIS)
- **Web browser:** fetches/displays documents from web servers
 - [Mozilla Firefox](#)
 - Microsoft [Internet Explorer](#) (IE)
 - Apple [Safari](#)
 - [Google Chrome](#)
 - [Opera](#)

Domain Name System (DNS)

- A set of servers that map written names to IP addresses
 - Example: www.cs.mum.edu → 69.18.50.54

Uniform Resource Locator (URL)

An identifier for the location of a document on a web site
a basic

URL: `http://www.abc.com/info/index.html`

~~~ ~~~~~ ~~~~~

protocol      host                  path

- Upon entering this URL into the browser, it would:
- Ask the DNS server for the IP address of `www.abc.com`
- Connect to that IP address at port 80
- Ask the server to GET `/info/index.html`
- Display the result page on the screen

# More advanced URLs

- **Anchor:** jumps to a given section of a web page
  - <http://www.textpad.com/download/index.html#downloads>
  - fetches `index.html` then jumps down to part of the page labeled downloads
- **Port:** for web servers on ports other than the default 80
  - <http://www.cs.mum.edu:8080/secret/money.txt>
- **Query string:** a set of parameters passed to a web program
  - <http://www.google.com/search?q=miserable+failure&start=10>
  - parameter q is set to "miserable+failure"
  - parameter start is set to 10

# Hypertext Transport Protocol (HTTP)

- a set of commands that a computer can send to a server to request files
- Some HTTP commands (your browser sends these internally):
  - **GET**: Requests a specific file or resource from the server
  - **POST**: Submits form information to the server
  - **PUT**: Uploads a file to the server
  - **HEAD**: Requests information about a file from the server, but not the file's entire contents.

# HTTP request and response messages

- Request

GET /index.html HTTP/1.1

HOST: mumstudents.org

- Response

HTTP/1.1 200 OK

Date: Sun, 30 Aug 2015 16:08:38 GMT

Server: Apache/2.4.7 (Ubuntu)

Last-Modified: Fri, 12 Dec 2014 20:23:01 GMT

Accept-Ranges: bytes

Content-Length: 942

Content-Type: text/html

<!DOCTYPE html>

<html>

...

# Request and Response

The screenshot shows a web browser window with the address bar displaying `mumstudents.org/cs472/`. The page title is "CS472: Web Programming". The Chrome DevTools Network tab is open, showing a list of requests. The table below summarizes the data from the Network tab.

| Name Path                                                                         | Method | Status Text      | Type            | Initiator                       | Size Content      | Time Latency | Timeline | 107ms | 161ms | 214ms | 268ms | 322ms |
|-----------------------------------------------------------------------------------|--------|------------------|-----------------|---------------------------------|-------------------|--------------|----------|-------|-------|-------|-------|-------|
| <b>mumstudents.org</b><br>/cs472                                                  | GET    | 200 OK           | text/html       | Other                           | 3.03KB<br>58.97KB | 16ms<br>12ms |          |       |       |       |       |       |
| <b>style.css</b><br>/cs472                                                        | GET    | 304 Not Modified | text/css        | <u>mumstudents.org</u> : Parser | 210B<br>889B      | 11ms<br>7ms  |          |       |       |       |       |       |
| <b>jquery.min.js</b><br>ajax.googleapis.com/ajax/libs/jquery/1.11.1/jquery.min.js | GET    | 304 Not Modified | text/javascript | <u>mumstudents.org</u> : Parser | 136B<br>90.89KB   | 49ms<br>48ms |          |       |       |       |       |       |
| <b>MUM_Logo_Blue_Small.png</b><br>/cs472/images                                   | GET    | 304 Not Modified | image/png       | <u>mumstudents.org</u> : Parser | 188B<br>16.44KB   | 29ms<br>3ms  |          |       |       |       |       |       |

4 requests | 3.55KB transferred | 320ms (onload: 322ms, DOMContentLoaded: 319ms)

Documents Stylesheets Images Scripts XHR Fonts WebSockets Other

# HTTP status code

- When you request a document from a web server, it sends this document back to you, along with a number called HTTP status code.

| Number                        | Meaning                                     |
|-------------------------------|---------------------------------------------|
| 200                           | OK                                          |
| 301-303                       | page has moved (permanently or temporarily) |
| 403                           | you are forbidden to access this page       |
| 404                           | page not found                              |
| 500                           | internal server error                       |
| <a href="#">complete list</a> |                                             |



# MIME Types (Multi-Purpose Internet Mail Extension)

- A two-part identifier which many web protocols use to categorize each type of data.      broad type/subtype

| MIME Type                        | File extension(s) | Description           |
|----------------------------------|-------------------|-----------------------|
| application/octet-stream         | .exe              | Executable programs   |
| audio/mpeg                       | .mp3, .mpg        | MPEG or MP3 music     |
| image/gif, image/jpeg, image/png | .gif, .jpg, .png  | GIF, JPEG, PNG images |
| text/css                         | .css              | Style sheets          |
| text/html                        | .html, .htm, .php | Web pages             |
| <a href="#">MIME Type list</a>   |                   |                       |

# Web languages / technologies

- Hypertext Markup Language ([HTML](#)): used for writing web pages
- Cascading Style Sheets ([CSS](#)): stylistic info for web pages
- PHP Hypertext Processor ([PHP](#)): dynamically create pages on a web server
- [JavaScript](#): interactive and programmable web pages
- Asynchronous JavaScript and XML ([Ajax](#)): accessing data for web applications
- Extensible Markup Language ([XML](#)): metalanguage for organizing data
- JavaScript Object Notation ([JSON](#)): lightweight data-interchange format that is largely replacing XML in modern web apps

# How browsers display a webpage

1. User machines have IP address on the Internet
2. Server machines have IP address and Domain Name
3. Domain names and IP addresses are registered at global DNS Server
4. When the user opens a browser window and asks for [www.test.com](http://www.test.com)
5. First, the browser will check the local DNS (host file) for the IP address of that domain
6. If not found, it will connect to ISP and ask it for the DNS
7. Once retrieved, the browser will send another request to that server
8. Requests are carried by the IP protocol, sent by the TCP protocol, and represented by HTTP or HTTPS protocol
9. The server will send the browser a response with HTML code.
10. The browser will interpret the HTML code line by line and start building the web page.
11. For every resource not found in the browser cache, the browser will send a new request to the server again asking for that resource and so on.

# Main Point

The internet is a global computer network that uses IP addresses to uniquely identify computers on the network. Through the TCP protocol each IP address can work with multiple services at the same time. One of these services is the HTTP protocol which is used by the World Wide Web to transport HTML pages. These are many layers of the internet.

*During the TM technique, the mind experiences the most fundamental layer of the universe, the field of pure intelligence.*

# Hypertext Markup Language (HTML)

- Describes the content and structure of information on a web page
- Surrounds text content with opening and closing tags
- Each tag's name is called an element
  - Syntax: `<element>content</element>`
  - Example: `<p>This is a paragraph</p>`
- Most whitespace is insignificant in HTML (ignored or collapsed to a single space)
- The newest version is HTML5

# Structure of an HTML5 page

- The **header** describes the page and the **body** contains the page's contents
  - An HTML page is saved into a file ending with extension **.html**
- **DOCTYPE** tag tells browser the HTML version.
  - In this case, HTML5.

```
<!DOCTYPE html>
```

```
<html>
```

```
<head>
```

```
<meta charset="utf-8"/>
```

```
<title></title>
```

```
</head>
```

```
<body>
```

**Page contents**

```
</body>
```

```
</html>
```

# Web Page Metadata

- Data about data - Information describes the page itself

```
<meta charset="utf-8" />
<meta name="description" content="Learn HTML" />
<meta name="keywords" content="HTML,CSS" />
<meta name="viewport" content="width=device-width,
initial-scale=1.0" />
```

- Placed in the **head** section of your HTML page
- **meta** tags often have both the **name** and **content** attributes
- HTML5 introduced a method to let web designers take control over the viewport (the user's visible area of a web page), through the <meta> tag

# Metadata

| Attribute                         | Value                                                                          | Description                                                                |
|-----------------------------------|--------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| <a href="#"><u>charset</u></a>    | character_set                                                                  | Specifies the character encoding for the HTML document                     |
| <a href="#"><u>name</u></a>       | application-name<br>author<br>description<br>generator<br>keywords<br>viewport | Specifies a name for the metadata                                          |
| <a href="#"><u>content</u></a>    | text                                                                           | Gives the value associated with the http-equiv or name attribute           |
| <a href="#"><u>http-equiv</u></a> | content-type<br>default-style<br>refresh                                       | Provides an HTTP header for the information/value of the content attribute |



# Favorites icon ("favicon")

```
<link href="filename" type="MIME type" rel="relationship"/>  
<link href="yahoo.gif" type="image/gif" rel="shortcut icon"/>
```

- The link tag, placed in the head section, attaches another file to the page
- In this case, an icon to be placed in the browser title bar and bookmarks
- E.g. [https://www.w3schools.com/tags/tryit.asp?filename=tryhtml5\\_link\\_sizes](https://www.w3schools.com/tags/tryit.asp?filename=tryhtml5_link_sizes)



# Relative vs Absolute URL

- **Relative URL**

- index.html (path relative)
- graphics/image.png
- ../about.html (directory relative)
- ../../stories/stories.html
- /image.png (root relative)

- **Absolute URL**

- <http://www.mysite.com>
  - C:\website\images\image.png
- Why won't the last example work when we move our code to production?

# Common Error on Relative URL

- Placing a leading “/” on a relative URL

<http://www.myexample.com/mysite/files/index.html>

<http://www.myexample.com/mysite/files/images/smiley.gif>

```

```

Looking for URL:

<http://www.myexample.com/images/smiley.gif>

```

```



# Block-level Elements

- A block-level element always starts on a new line and takes up the full width available (stretches out to the left and right as far as it can).
- Examples of block-level elements:
  - `<div>`
  - `<h1>` - `<h6>`
  - `<p>`
  - `<form>`



# Paragraph: <p>

- Paragraphs of text (block)

<p>

**Lorem quis lorem. Pellentesque ultrices  
nunc id mauris posuere pulvinar.**

</p>

Placed within the body of the page

- [More paragraph examples](#)

# Headings: <h1>, <h2>, ..., <h6>

- Headings to separate major areas of the page (block)

<h1>Maharishi University</h1>

<h2>Department of Computer Science</h2>

<h3>WAP Course</h3>

Maharishi University

Department of Computer Science

WAP Course



# Horizontal Rule: `<hr />`

- A line to separate sections (block)

```
<h1>CS472 Web Programming</h1>
```

```
<p>Very good, fun course - HTML, CSS, JavaScript,  
JSP, Servlets</p>
```

```
<hr />
```

```
<h1>CS421 Modern Programming Practices</h1>
```

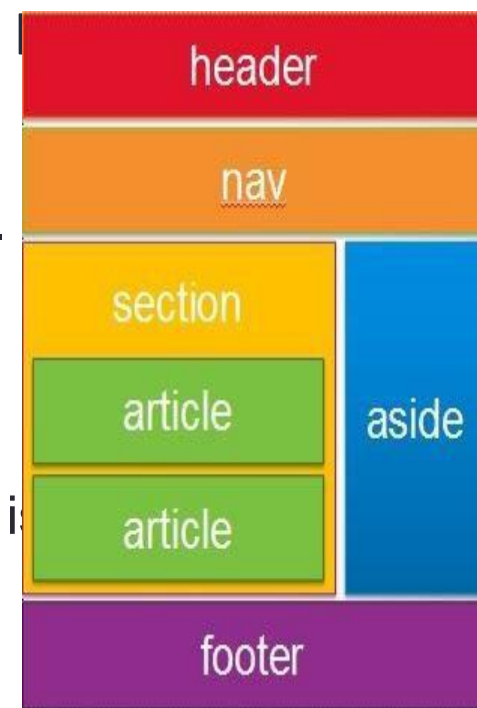
```
<p>Profound course - OOAD, Java8 features</p>
```



# New Semantic Elements

They generally have no default outward appearance on the page, instead they give insight into the structure of the page.

- **section**: defines a section in a document.
- **header**: specifies a header for a document or section.
- **footer**: specifies a footer for a document or section.
- **nav**: defines a set of navigation links.
- **aside**: defines some content aside from the content it is in (e.g., a sidebar).
- **article**: specifies independent, self-contained content.



[More Semantic Tags](#)



# Main point

The Hyper Text Markup Language uses tags to demarcate different sections of a text. An HTML page always starts with a `<html>` tag, inside of which it has a `<head>` tag to describe the page, and a `<body>` tag of the contents that will actually be displayed. These are the tags you will use for every HTML page.

*The most powerful language is the language of nature, which is the impulses of pure intelligence vibrating within itself.*



# Inline Elements

- An inline element does not start on a new line and only takes up as much width as necessary.
- Examples of inline elements:
  - `<span>`
  - `<a>`
  - `<img>`

# Images: `<img>`

- Inserts a graphical image into the page (inline)
  - Another get request
- The src attribute specifies the image URL
- HTML5 also requires an alt attribute describing the image
- title attribute is an optional tooltip (on ANY element)

```




# Links: <a>

- Links, or "anchors", to other pages (inline)
- href can be absolute or relative URL
- Anchors are inline elements

```
<p>  
  <a href="story1.html">Bruce Wayne, the richest man  
    in Gotham City, is the alter ego of Batman.  Bam!  
  </a>  
</p>
```

- NOTE: In HTML5, you can wrap links around “block-level” elements
- See example: [lecture01-examples/link-old.html](#), [lecture01-examples/link-html5.html](#)

# Line break: `<br />`

- Forces a line break in the middle of a block element (inline)

`<p>Teddy said it was a hat, <br /> So I put it on.</p>`

`<p>Now Daddy's saying, <br /> Where the heck's the toilet plunger gone?</p>`

- Warning: Don't over-use `br` (guideline:  $\geq 2$  in a row is bad)
- `<br />` should not be used to separate paragraphs or used multiple times in a row to create spacing



# Phrase elements : `<em>`, `<strong>`

- `em`: emphasized text (usually rendered in italic)
- `strong`: strongly emphasized text (usually rendered in bold)

```
<p>HTML is  
  <em>really</em>, <strong>REALLY</strong>  
  fun!  
</p>
```

HTML is *really***REALLY** fun!

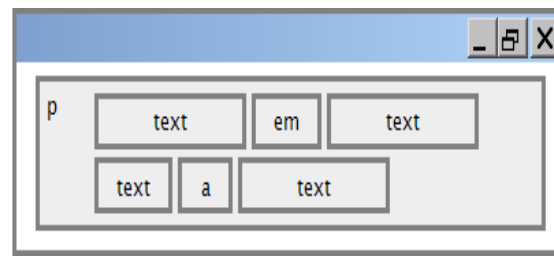
- As usual, the tags must be properly nested for a valid page.

# Nesting tags

- Tags must be correctly nested
  - a closing tag must match the most recently opened tag
- The browser may render it correctly anyway, but it is invalid HTML
- i.e., bad nesting
  - `<p> What a <em> lovely </p> day </em>`
- Good nesting
  - `<p> What a <em> lovely </em> day </p>`

# Review: Block elements VS Inline elements

- block elements contain an entire large region of content
  - Examples: paragraphs, lists, table cells
  - The browser places a margin of whitespace between block elements for separation
- inline elements affect a small amount of content
  - Examples: bold text, code fragments, images
  - The browser allows many inline elements to appear on the same line
  - Must be nested inside a block element





# Comments: `<!-- -->`

- Comments to document your HTML file or "comment out" text
- Many web pages are not thoroughly commented (or at all)
- Useful at the top of page and for disabling code

```
<!-- This is comment -->
```

```
<p>
```

```
WAP courses are<!-- NOT--> a lot
of fun!
```

```
</p>
```



# Unordered list: `<ul>`, `<li>`

- `ul` represents a bulleted list of items (block)
- `li` represents a single item within the list (block)

```
<ul>
```

```
  <li>No shoes</li>
```

```
  <li>No shirt</li>
```

```
  <li>No problem!</li>
```

```
</ul>
```

- No shoes
- No shirt
- No problem!



# Ordered list: `<ol>`

- `ol` represents a numbered list of items (block)
- We can make lists with letters or Roman numerals using CSS (later)

```
<p>RIAA business model:</p>
```

```
<ol>
```

```
<li>Sue customers</li>
```

```
<li>Profit!</li>
```

```
</ol>
```

RIAA business model:

1. Sue customers
2. Profit!



# Nested Lists

- A list can contain other lists

```
<ul>
  <li>Simpsons:
    <ul>
      <li>Homer</li>
      <li>Marge</li>
    </ul>
  </li>
  <li>Family Guy:
    <ul>
      <li>Peter</li>
      <li>Lois</li>
    </ul>
  </li>
</ul>
```

- Simpsons:
  - Homer
  - Marge
- Family Guy:
  - Peter
  - Lois



# Definition list: `<dl>`, `<dt>`, `<dd>`

- `dl` represents a list of definitions of terms (block)
- `dt` represents each term, and `dd` its

|        |                                  |
|--------|----------------------------------|
| newbie | one who does not have mad skills |
| own    | to soundly defeat                |
| frag   | a kill in a shooting game        |

`<dl>`

`<dt>newbie</dt>`

`<dd>one who does not have mad skills</dd>`

`<dt>own</dt>`

`<dd>to soundly defeat</dd>`

`<dt>frag</dt>`

`<dd>a kill in a shooting game</dd>`

`</dl>`



# Inline quotations: <q>

- A short quotation (inline)

<p>

Quoth the Raven, <q>Nevermore.</q>

Quoth the Raven, "Nevermore."

Why not just write the following?

<p>Quoth the Raven, "Nevermore."</p>

- Using <q> allows us to apply CSS styles to quotations



# Quotations: `<bblockquote>`

A lengthy quotation (block)

`<p>As Lincoln said in his famous Gettysburg Address:`

`</p>`

`<blockquote>`

`<p>Fourscore and seven years ago, our  
fathers brought forth on this continent a  
new nation, conceived in liberty, and dedicated  
to the proposition that all men are created  
equal.</p>`

`</blockquote>`

As Lincoln said in his famous Gettysburg Address:

Fourscore and seven years ago, our fathers brought forth on this continent a new nation, conceived in liberty, and dedicated to the proposition that all men are created equal.



# HTML Character Entities

- A way of representing any [Unicode](#) character within a web page
- [Complete list of HTML entities](#)
- How would you display the text & on a web page?

| character(s) | entity                     |
|--------------|----------------------------|
| < >          | &lt; &gt;                  |
| é è ñ        | &eacute; &egrave; &ntilde; |
| ™ ©          | &trade; &copy;             |
| π δ Δ        | &pi; &delta; &Delta;       |
| И            | &#1048;                    |
| " &          | &quot; &amp;               |





# HTML-encoding text

- To display the link text in a web page, its special characters must be encoded as shown below

&lt;p&gt;

&lt;a href=&quot;http://google.com/&quot;&gt; Google&lt;/a&gt;

&lt;/p&gt;

```
<p> <a href="http://google.com/"> Google</a> </p>
```



# Computer code: `<code>`

- A short section of computer code (usually shown in a fixed-width font) (inline)

`<p>`

**The `<code>ul</code>`** and  
**`<code>ol</code>`** tags make lists.

`</p>`

The `ul` and `ol` tags make lists.



# Preformatted text: `<pre>`

- A large section of pre-formatted text (block)
- a fixed-width font (usually Courier), and it preserves both spaces and line breaks.

`<pre>`

**Steve Jobs speaks loudly reality**

```
Steve Jobs speaks loudly reality  
distortion Apple fans bow down
```

**Apple fans bow down**

`</pre>`



# Abbreviations: <abbr>

- An abbreviation, acronym, or slang term (inline)

```
<p> Safe divers always remember to check their  
  <abbr title="Self-Contained Underwater Breathing  
    Apparatus">SCUBA</abbr> gear.  
</p>
```

Safe divers always remember to check their SCUBA gear.

Self-Contained Underwater Breathing Apparatus



# HTML tables: `<table>`, `<tr>`, `<td>`

- A 2D table of rows and columns of data (block element)

```
<table>
  <tr>
    <td>1,1</td>
    <td>1,2 okay</td>
  </tr>
  <tr>
    <td>2,1 real wide</td>
    <td>2,2</td>
  </tr>
</table>
```

|               |          |
|---------------|----------|
| 1,1           | 1,2 okay |
| 2,1 real wide | 2,2      |

- **table** defines the overall table, **tr** each row, and **td** each cell's data
- tables are useful for displaying large row/column data sets



# Table headers, captions:

## `<th>`, `<caption>`

```
<table>
  <caption>My important data</caption>
  <tr>
    <th>Column 1</th>
    <th>Column 2</th>
  </tr>
  <tr>
    <td>1,1</td>
    <td>1,2 okay</td>
  </tr>
  <tr>
    <td>2,1 real wide</td>
    <td>2,2</td>
  </tr>
</table>
```

| My important data |          |
|-------------------|----------|
| Column 1          | Column 2 |
| 1,1               | 1,2 okay |
| 2,1 real wide     | 2,2      |

- **th** cells in a row are considered headers; by default, they appear bold
- a **caption** at the start of the table labels its meaning



# The `rowspan` and `colspan` attributes

- `colspan`** makes a cell occupy multiple columns; **`rowspan`** multiple rows

```
<table>
  <tr>
    <th>Column 1</th>
    <th>Column 2</th>
    <th>Column 3</th>
  </tr>
  <tr>
    <td colspan="2">1,1-1,2</td>
    <td rowspan="3">1,3-3,3</td>
  </tr>
  <tr>
    <td>2,1</td>
    <td>2,2</td>
  </tr>
  <tr>
    <td>3,1</td>
    <td>3,2</td>
  </tr>
</table>
```

| Column 1 | Column 2 | Column 3 |
|----------|----------|----------|
| 1,1-1,2  |          | 1,3-3,3  |
| 2,1      | 2,2      |          |
| 3,1      | 3,2      |          |

# Don't use tables for layout!

- (borderless) tables appear to be an easy way to achieve grid-like page layouts
- Many "newbie" web pages do this
- But, a table has semantics; it should be used only to represent an actual table of data
- Instead of tables, use divs, widths/margins, floats, etc. to perform layout



# Web Standards

- It is important to write proper HTML code and follow proper syntax.
- Why use valid HTML and web standards?
  - More interoperable across different web browsers
  - More likely that our pages will display correctly in the future



# W3C HTML Validator

- Checks your HTML code to make sure it follows the official HTML syntax
- More picky than the browser, which may render bad HTML correctly

<p>

```
<a href="http://validator.w3.org/check/referer">
```

```
  
```

```
</a>
```

</p>

Note that the validation website expects requests to come from a page that was served by a web server. Will not work with an html page opened from a file. E.g., mumstudents.org web server.



# Main Point

We discussed some of the most common tags. The most important concept is to use tags based on their semantics (meaning), not based on their visual effect (which can easily be changed).

*Through the TM technique, the individual gains access to the language of nature to effortlessly fulfill any desire.*

# CONNECTING THE PARTS OF KNOWLEDGE WITH THE WHOLENESS OF KNOWLEDGE

## *The Web Programming Environment*

1. HTML is the basis of Web Programming, every web page is made of HTML.
  2. To be an effective web programmer you also have to understand the deeper underlying realities of HTTP, TCP, and DNS.
- 

3. **Transcendental consciousness** is the experience of the deepest underlying reality, the unified field.
4. **Impulses within the Transcendental field:** the infinite dynamism of the unified field expresses itself into the universe.
5. **Wholeness moving within itself:** In Unity Consciousness, one experiences that this infinite dynamism is the Self.

