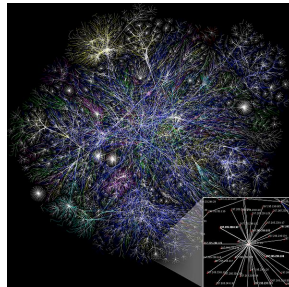# EECS 1012: Introduction to Computer Science

December 2, 2016

This is an introductory course in computer science. Rather than providing a broad overview of the discipline it takes a single aspect of computer science -- web-based programming -- and uses that to introduce a number of concepts related to data organization and retrieval, procedural programming and networking. Along the way it will introduce you to a number of representation schemes HTML, CSS, JSON and the like, as well as the JavaScript programming language and AJAX.

Network protocols - TCP/IP

- TCP/IP routes packets across the network to make it seem as though there was a direct connection between machines.

- Given an address (machine name) you can talk to any machine connected to the internet.

Connectivity of the internet

Network protocols -TCP/IP

- Built upon this network is a number of services

  - Name services (you can have a name turned into a network address)

  - Standard services (IMAP, POP3, SMTP, FTP, SCP, HTTP) for networking services such as email and the web.

The Web

- Fundamental concepts
  - Uniform Resource Locator
    - scheme:://domain:port/path?query#fragment
      - e.g. http://www.eecs.yorku.ca
  - Standard content
    - Hypertext markup language (HTML)
  - Standard protocol
    - Standard network protocol (HTTP)

This course

- Software development (programming if you like) in a web-based/cloud-based/netcentric environment.

- HTML, JavaScript, CSS

- Client-server programming

- Databases, JSON, XML

HTML

- Text file that provides structure to the document

  - Hypertext Markup Language

- Provides links to style (Cascading Style Sheets) and

- Provides links to actions (JavaScript)

HTML structure

- Organizes in terms of tags

- Tags have

  - Elements

  - Attributes

- Large numbers of tags

- Tag attributes and class

CSS Selector

```
pattern {
property : value;
property : value;
…
}

p {
  color : red;
}
```

What to match against

match paragraphs

CSS Selector

```
pattern {
property : value;
property : value;
…
}

p {
  color : red;
}
```

this property,
that value

do things in red

Selectors

- .foo   all elements with class="foo"

- #bar   the element with id="bar"

- tree   all <tree> elements

- tree,wheel   all <tree> and <wheel> elements

- tree wheel   all <wheel> within <tree>

- and many more

JavaScript

- JavaScript enables us to make web pages 'dynamic' and 'responsive'.

- Much JavaScript in web pages is 'event driven'

  - You assign a callback (a function) to an event, and when the event happens your code is executed.

  - When your callback ends, your code is quiescent until another event occurs.

Variables

- Are used to hold values

- Must have a name

  - Unique

  - Case sensitive

  - Names cannot be one of a set of reserved words

  - Letters, digits, _ and $, cannot start with a digit

Variables have values

- var x;
  - x has a special value *undefined*
- var x = "this";
  - x is a string and has the value "this"
- var x = 2;
  - x is a number and has the value 2
- var x = true;
  - x is a boolean and has the value true
- var x = [1, 2, 3];
  - x is an array value [1,2,3]
- var x = {blue : 1, red: 2};
  - x is an objective le {blue: 1, red: 2}

Assignment

- LHS = RHS;

- Arithmetic, Boolean and String operations

- Precedence

Selection

- if() { … }

- if() {…} else { ….}

- if() {…} else if () {…} …. else {…}

Iteration

- while(condition) { …. }

- do { …..} while(condition);

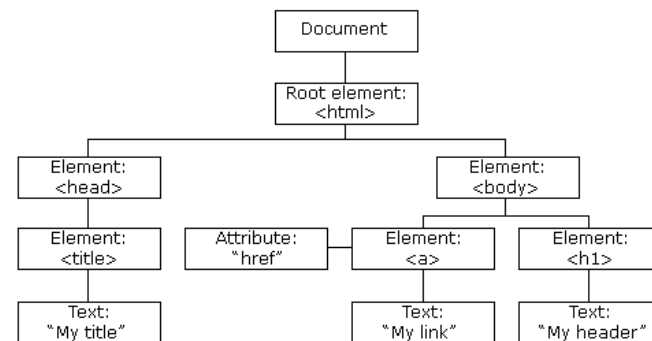- for(statement;boolean;statement) { … }

Functions

- Arguments

- Optional return value

- Allow data to be encapsulated into organized groupings

Objects

- methods and attributes (fields)

- Creating new (new Object())

DOM
(Document Object Model)

DOM

- Traversing the DOM tree

- Manipulating the DOM tree

Assorted HTML input widgets

- Text (done this already)

- Drop-down widgets

- Form (mechanism to group together input widgets)

  - NB: And submit (critical for buttons)

- Radio button

- Checkbox

- Textarea

- Range

JSON

- Written as collection of (name, value) pairs.

- Pairs separated by commas

- Objects defined as { … }

- Arrays defined as []

- JSON names & strings must appear in double quotes

XML

- Extensible markup language

- Provides a verbose but human readable structured document

- DTD - document type definition

```
1   var ajax;
2   function go()
3   {
4     ajax = new XMLHttpRequest();
5     ajax.onreadystatechange = ajaxProcess;
6     ajax.open("GET", "http://127.0.0.1:8000/sql?query=select * from collection");
7     ajax.send(null);
8   }
9
10  function ajaxProcess() {
11    if((ajax.readyState == 4)&&(ajax.status == 200)){
12      ajaxCompleted(ajax.responseText)
13    }
14  }
```

AJAX

XMLHttpRequest (XHR) is an API available to web browser scripting languages such as JavaScript. It is used to send HTTP or HTTPS requests to a web server and load the server response data back into the script.[1] Development versions of all major browsers support URI schemes beyond http and https, in particular, blob URLs are supported.[2]

Data from the response can be used to alter the current document in the browser window without loading a new web page, and despite the name of the API, this data can be in the form of not only XML,[3] but also JSON,[4] HTML or plain text.[5] The response data can also be evaluated by client-side scripting. For example, if it was formatted as JSON by the web server, it can be converted into a client-side data object for further use.
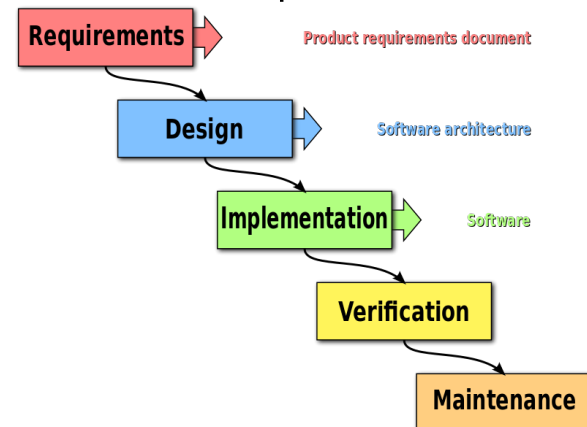

Event-driven programming

- Register a callback to service some event

  - Timer

  - Input event

  - User input

  - Database query

  - ….

Relational database

- Standard model of databases (from the 1970's)

- Data can be thought of as belonging to a collection of tables

- Rows correspond to records (or tuples).

- Columns are attributes

- Each row has a unique key

Waterfall model of Software Development

Requirements → Product requirements document

Design → Software architecture

Implementation → Software

Verification

Maintenance

Unit Testing

- Develop software in small testable units

- Test each unit in isolation

- Can develop test harnesses to exercise each module (unit) separately.

- Design by contract

Cookies

- One 'problem' with web pages is that they lack persistent data

- Can use some central server for data, but what about less persistent, local storage?

  Cookies are the answer.

Final test

- Monday is the test

  - 40 minutes, 40 questions, closed book, no calculator

  - Enter from 1st floor

  - Bring your ID