Week 10

Quiz 1 Review
# Base Number Systems

<table>
<thead>
<tr>
<th></th>
<th>Base</th>
<th>‘42’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binary</td>
<td>2</td>
<td>101010</td>
</tr>
<tr>
<td>Octal</td>
<td>8</td>
<td>52</td>
</tr>
<tr>
<td>Decimal</td>
<td>10</td>
<td>42</td>
</tr>
<tr>
<td>Hexadecimal</td>
<td>16</td>
<td>0x2a</td>
</tr>
</tbody>
</table>
Bitwise Operators

& - AND

1100
&1010
\underline{1000}

| - OR

0011
|1010
\underline{1011}

^ - XOR

1010
^1100
\underline{0110}

~ - NOT

\sim(1010) = 0101
Asymptotic Runtime

• Big O – Upper bound on runtime.
  – ‘Worst Case’

• Omega – Lower bound on runtime.
  – ‘Best Case’

• If a program takes $6n^2 + 4n + 57$ steps...
  – $O(n^2)$, we ignore constants, lower-order terms.
Stacks

- First in, last out data structure.
- Can ‘pop’ or ‘push’ things to the top of the stack.
Queues

- First in, first out data structure.
- “Insert” and “Remove” operations.

Head    Tail
Trees

- Trees consist of ‘branches’.

```c
struct branch
{
    struct branch* left;
    int val;
    struct branch* right;
}
```
A BST is a special tree such that:
1) Left ‘sub-tree’ of each node contains only lesser nodes.
2) Right ‘sub-tree’ of each node contains only greater nodes.
3) Left and right ‘sub-trees’ of each node are also binary search trees.
Binary Search Tree

Lower bound on depth of tree is $\log(n)$. 
Hash Tables

• Consists of an array and a hash function.

• Hash function maps input to an index in the associated array.

• Allows us to check whether something is contained in a data structure without checking through the entire thing.
Hash Tables

Good Hash Functions are:
• Deterministic
• Well-distributed

```c
int xkcd_hash(char* word) {
    return 4;
}
```

THIS IS BAD
Tries

• Tree of Arrays
• Fast Lookup, High Memory Use

struct trie_node
{
  struct trie_node* array[N];
  bool checkbox;
}

Tries
First two elements are in an array. First represents the letter ‘a’. Second represents the letter ‘b’.

Checkbox indicates whether what we’ve looked at so far is in the data structure.

“a”, “bb” are in this structure.
HTML

• Hypertext Markup Language
• Arranges and formats webpage content
• ‘Tags’ enclose regions of page.
  – Each beginning tag has an ending tag.
  – In general, close most recently opened first.
• ‘Tags’ may have ‘attributes’.
  – Attributes are like parameters for a tag.
CSS

• Cascading Style Sheets
• Specifically used to format the appearance of elements of a webpage
• May be included in a tag’s ‘style’ attribute, or included in a separate .css file
CSS

• ‘style’ attributes allow for formatting of tag contents using CSS.

• Examples:
  align: center
  font-size: small
  color: blue
  display: block
CSS

• Can also define formatting in an external .css file which is linked in.

    Format

Selector (name of tag)
{
    declarations;
}

PHP

- PHP: PHP Hypertext Preprocessor

- When accessed, dynamically generates a webpage which it then outputs to browser.

## PHP

<table>
<thead>
<tr>
<th>C</th>
<th>PHP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compiled</td>
<td>Interpreted</td>
</tr>
<tr>
<td>Strongly-typed</td>
<td>Loosely-typed</td>
</tr>
</tbody>
</table>
mySQL

• SQL – Structured Query Language

• Database software which allows us to store a collection of data as ‘entries’ containing a set of distinct ‘fields’ containing values.

• Databases contains tables, which contain rows, which contain fields.
mySQL

- **INSERT**
  - Insert a new entry.

- **DELETE**
  - Remove an existing entry.

- **SELECT**
  - Select one or more entries.

- **UPDATE**
  - Update the fields of an existing entry.
mySQL

Don’t forget to escape user input inserted into query strings!

“INSERT INTO students VALUE (‘<user string>’);”
Development of Interactivity

- HTML – static web pages
- PHP – dynamically generated web pages
- Javascript – web pages with dynamic content
Javascript

• Programming Language used in web design

• Unlike PHP, executed client-side!

• Javascript code is included in HTML passed to browser.
Javascript

• Like CSS, may be included either within the HTML page or linked in from external .js file.

• Linking in:

```html
<head>
  <script src="file.js">
  </script>
</head>
```
# Javascript

<table>
<thead>
<tr>
<th>PHP</th>
<th>Javascript</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interpreted</td>
<td>Interpreted</td>
</tr>
<tr>
<td>Loosely-typed</td>
<td>Loosely-typed</td>
</tr>
<tr>
<td>Server-side execution</td>
<td>Client-side execution</td>
</tr>
</tbody>
</table>
Document Object Model

• Contents of web page represented in a structure called the Document Object Model.

• We can access individual elements by Id in Javascript and get their contents!

• Example:
  – name = document.getElementById(‘name’).value;
Development of Interactivity

• HTML – static web pages

• PHP – dynamically generated web pages

• Javascript – web pages with dynamic content

• Ajax – dynamically load content from other pages
Ajax

- Asynchronous Javascript and XML
- Allows us to send requests to other pages for new content without reloading page!
Questions
This Was Section

Good luck and thanks for a great year.