CMSC B110: Introduction to Computing

Fall 2011 – Section 3

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Lectures
Tues/Thurs 4-5:30 pm in Park 349

Labs
Tues/Thurs 5:30-6:30 pm in Park 231

Grading
• 7 Assignments 56%
• Exam 1 20%
• Exam 2 24%
Total 100%

Office Hours
Tues/Thurs 1-4 pm by arrangement in Park 250
What is Computing?
Computing: Web, e-mail, social...
Computing: Productivity...
Computing: Entertainment...
Computing: Gaming...
2011 Jeopardy!

- In February 2011, IBM Watson bested Brad Rutter (biggest all-time money winner) and Ken Jennings (longest winning streak)
- IBM is currently applying Watson’s technology to medical diagnosis and legal research
Finding Life-Supporting Planets

Doppler Shift due to Stellar Wobble

<table>
<thead>
<tr>
<th>Velocity (meters per second)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>-10</td>
</tr>
<tr>
<td>-20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-52</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>52</td>
</tr>
<tr>
<td>104</td>
</tr>
<tr>
<td>156</td>
</tr>
<tr>
<td>208</td>
</tr>
<tr>
<td>260</td>
</tr>
<tr>
<td>312</td>
</tr>
</tbody>
</table>
Mapping the Epigenome

DNA contains the genetic blueprint for all human cells, but the reading and execution of the blueprint inside each cell is controlled in part by chemical markers attached to the DNA. Scientists have begun to map some of these epigenetic markers, including CpG methylation.

CpG methylation

DNA is a code written with four letters: A, T, C and G, each standing for one nucleotide. In CpG methylation, a small marker called a methyl group attaches to the DNA at a CpG site, where a C and a G nucleotide sit next to each other.

Chromosome 22

Of the 23 pairs of chromosomes in the human genome, 22 is the second smallest, containing only about 25% of the DNA. Gray and white bands on the circular chart correspond to chromosomal bands.
“Computer science is no more about computers than astronomy is about telescopes”

- Edsger Dijkstra
Computing is important.
# Fastest Growing Occupations

## Table 1.3 Fastest growing occupations, 2008 and projected 2018
(Numbers in thousands)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2008</td>
<td>2018</td>
<td>Number</td>
</tr>
<tr>
<td>Network systems and data communications analysts</td>
<td>292.0</td>
<td>447.8</td>
<td>155.8</td>
</tr>
<tr>
<td>Computer software engineers, applications</td>
<td>514.8</td>
<td>689.9</td>
<td>175.1</td>
</tr>
<tr>
<td>Computer software engineers, systems software</td>
<td>394.8</td>
<td>515.0</td>
<td>120.2</td>
</tr>
</tbody>
</table>

The Best and Worst Jobs

CareerCast rated 200 jobs based on income, working environment, stress, physical demands and job outlook, using data from the Labor Dept. and U.S. Census researchers’ own expertise. See which jobs were ranked highest and lowest, and their midlevel income. The highest-ranked jobs are highlighted in yellow. Click on headers to sort. See full rankings on CareerCast.com. (More: The Best and Worst Jobs.)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Title</th>
<th>Midlevel Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>software engineer</td>
<td>$87,000</td>
</tr>
<tr>
<td>2</td>
<td>mathematician</td>
<td>$94,000</td>
</tr>
<tr>
<td>3</td>
<td>actuary</td>
<td>$87,000</td>
</tr>
<tr>
<td>4</td>
<td>statistician</td>
<td>$73,000</td>
</tr>
<tr>
<td>5</td>
<td>computer systems analyst</td>
<td>$77,000</td>
</tr>
<tr>
<td>6</td>
<td>meteorologist</td>
<td>$85,000</td>
</tr>
<tr>
<td>7</td>
<td>biologist</td>
<td>$74,000</td>
</tr>
<tr>
<td>8</td>
<td>historian</td>
<td>$63,000</td>
</tr>
<tr>
<td>9</td>
<td>audiologist</td>
<td>$63,000</td>
</tr>
</tbody>
</table>

...many different companies ... need to hire computer scientists. They aren't tied to one particular industry.
How many of us are studying CS?
United States and Canada

Figure 7. Newly Declared CS/CE Undergraduate Majors

Figure 6. BS Production (CS & CE)

Computing Research News, CRA May 2010

CS=Computer Science, CE=Computer Engineering
http://www.cra.org/resources/taulbee/
### Secondary Schools

**TABLE 1**

Secondary schools offering introductory (or pre-AP) Computer Science courses, change from 2005 baseline

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>-6%</td>
<td>-17%</td>
</tr>
</tbody>
</table>

Secondary offering AP Computer Science courses, change from 2005 baseline

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>-20%</td>
<td>-35%</td>
</tr>
</tbody>
</table>

*Source: Computer Science Teachers Association survey data of high schools*
We've turned a corner...

• "Stanford University enrollment for in CS106A (CS1) [in 2010/2011] is 1087, which represents a year-on-year growth of 51%"

• Why?
  1. I'm just curious
  2. Increase my potential to land a good job
  3. I love computing
  4. Need to fill a requirement
  5. Other...

What can be programmed?
http://www.videophoneinsider.com/video-phone-history/
Google’s Autonomous Car

- Nevada made it legal for autonomous cars to drive on roads in June 2011
LEARNING COMPUTING WITH ROBOTS

Edited By
Deepak Kumar

Institute For Personal Robots in Education
www.roboteducation.org
Fall 2008, Revised June 2009
How do you program?
What is a Computer Program?

A collection of human and machine readable statements that can be translated to instructions executable by a computing device.
Creative Computing

Introduction to Creative Computing

- Visualizations
- Aesthetics & Art
- Processing/Java
- Programming
- Algorithms
- Computational Media
Our Goal

• Use computing to realize works of art

• Explore new metaphors from computing: images, animation, interactivity, visualizations

• Learn the basics of computing

• Have fun doing all of the above!
Software

**Processing**
- Already installed in the CS Lab
- Also available for your own computer @ [www.processing.org](http://www.processing.org)
- Processing == Java

Book

Primitive 2D Shapes

- point
- line
- triangle
- rect (rectangle)
- quad (quadrilateral, four-sided polygon)
- ellipse
- arc (section of an ellipse)
- curve (Catmull-Rom spline)
- bezier (Bezier curve)
Language (API). The Processing Language has been designed to facilitate the creation of sophisticated visual and conceptual structures.

Structure
[] (array access)
= (assign)
catch
class
, (comma)
// (comment)
{} (curly braces)
delay()
/*** */ (doc comment)
, (dot)
draw()

Shape
PShape
2D Primitives
arc()
ellipse()
line()
point()
quad()
rect()
triangle()

Color
Setting
background()
colorMode()
fill()
noFill()
noStroke()
stroke()
Anatomy of a Function Call

Function name

Parentheses

Arguments

Statement terminator

`line( 10, 10, 50, 80 );`
Coordinate System

(0, 0)
Pixels
Processing Canvas

`size( width, height );`
Set the size of the canvas.

`background( [0..255] );`
Set the background grayscale color.
Drawing Primitives

point( x, y );

line( x1, y1, x2, y2 );

triangle( x1, y1, x2, y2, x3, y3 );

quad( x1, y1, x2, y2, x3, y3, x4, y4 );

rect( x, y width, height );

ellipse( x, y, width, height );
smooth() vs. noSmooth()
Colors

Composed of four elements:

1. Red
2. Green
3. Blue
4. Alpha (Transparency)
Why 0 .. 255?
Shape Formatting

1. Fill color
2. Line thickness
3. Line color

*These are properties of your paintbrush, not of the object you are painting.*
Fill Color

```javascript
fill(gray);
fill(gray, alpha);
fill(red, green, blue);
fill(red, green, blue, alpha);

noFill();
```
Stroke (Line) Color

stroke(gray);
stroke(gray, alpha);
stroke(red, green, blue);
stroke(red, green, blue, alpha);

noStroke();
strokeCap()

smooth();
strokeWeight(12.0);
strokeCap(ROUND);
line(20, 30, 80, 30);
strokeCap(SQUARE);
line(20, 50, 80, 50);
strokeCap(PROJECT);
line(20, 70, 80, 70);

http://processing.org/reference/strokeCap_.html

strokeWeight()

smooth();
strokeWeight(1); // Default
line(20, 20, 80, 20);
strokeWeight(4); // Thicker
line(20, 40, 80, 40);
strokeWeight(10); // Beastly
line(20, 70, 80, 70);

http://processing.org/reference/strokeWeight_.html
**ellipseMode**

```javascript
ellipseMode(CENTER);
ellipse(35, 35, 50, 50);
ellipseMode(CORNER);
fill(102);
ellipse(35, 35, 50, 50);
```

**rectMode**

```javascript
rectMode(CENTER);
rect(35, 35, 50, 50);
rectMode(CORNER);
fill(102);
rect(35, 35, 50, 50);
```

http://processing.org/reference/ellipseMode_.html
http://processing.org/reference/rectMode_.html
Dropbox

- https://www.dropbox.com/
Processing.JS

• A Javascript implementation of Processing
• Runs in any modern web browser
  – Does not run well in IE8 and under
• Most of Processing is implemented
  – Images are processed slowly
  – No file IO
• http://processingjs.org
Studio Sketchpad

- Collaboratively edit, run and chat about a Processing.js program

- http://sketchpad.cc
- http://studio.sketchpad.cc