CMSC 110
Introduction to Computing

Paul Ruvolo  Deepak Kumar
Administrivia
CMSC 110: Introduction to Computing
Spring 2013

Course Website: http://www.cs.brynmawr.edu

Co-Instructors:
Paul Ruvolo, Ph.D. (pruvolo@cs.brynmawr.edu)
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Lectures
TuTh 2:15p to 3:45p in Park 338

TA-Support
>20 hrs/week in Park 231

Open Labs (Optional)
Wed 1:30p to 3:30p in Park 231

Office Hours
Available by appointment. Walk-ins are welcome!

Grading
• 7 Assignments 56%
• In-class Quizzes 4%
• Exam 1 18%
• Exam 2 22%
Total 100%
Class Lottery

• Make sure to sign-in your name.

• If you are not “in” the lottery, indicate that. We will contact you by e-mail as soon as we have confirmation from other students.
What is Computing?
Computing: Your Parent’s View
Computing: internet, e-mail, network...
Computing: Digital Photography

Computing: Entertainment...
Computing: Entertainment...
Cutting Edge Computer Science
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 2
Google’s Autonomous Car

- Nevada made it legal for autonomous cars to drive on roads in June 2011
- California introduced a similar bill in Aug 2012
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
Robot Soccer

RoboCup International Robotics Competition
http://www.robocup.org/

Bryn Mawr Robot Soccer Team
Areas in Computer Science

- Artificial Intelligence
- Robotics
- Human-Computer Interaction
- Computer Graphics
- Computer Vision
- Operating Systems
- Computer Networking
- Databases
- Computer Security
- Ubiquitous Computing
What is Computer Science?

Computer science is the study of solving problems using computation

- Computers are part of it, but the emphasis is on the problem solving aspect

Computer scientists work across disciplines:

- Mathematics
- Biology (bioinformatics)
- Chemistry
- Physics
- Geology
- Geoscience
- Archeology
- Psychology
- Sociology
- Cognitive Science
- Medicine/Surgery
- Engineering
- Linguistics
- Art
- ...
“Computer science is no more about computers than astronomy is about telescopes”

- Edsger Dijkstra
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   TuTh 2:15p to 3:45p in Park 338

Hands-On Sessions
   Meet in computer labs (Park 231)

Open Labs (Optional)
   Wed 1:30p to 3:30p in Park 231

Grading
   • 7 Assignments 56%
   • In-class Quizzes 4%
   • Exam 1 18%
   • Exam 2 22%
   Total 100%

Office Hours
   Paul Ruvolo: Tues/Wed 1:30-2:30 pm and by appointment in Park 246-D
   Deepak Kumar: Mondays 1:30-2:30p in Park 246-B
Algorithms

An **algorithm** is an effective method for solving a problem expressed as a finite sequence of instructions. For example,

**Put on shoes**
- left sock
- right sock
- left shoe
- right shoe
Programming = Writing Apps

**Programming** is the process of designing, writing, testing, debugging / troubleshooting, and maintaining the source code of computer programs. This source code is written in a programming language.
int areaOfCircle(int radius) {
    return PI*radius*radius;
}

r = 10;
area = areaOfCircle(r);
Programming Languages

<table>
<thead>
<tr>
<th>Processing</th>
<th>Python</th>
<th>Lisp</th>
</tr>
</thead>
<tbody>
<tr>
<td>int areaOfCircle(int radius){</td>
<td>def areaOfCircle(radius):</td>
<td>(defun areaOfCircle (radius)</td>
</tr>
<tr>
<td>return PI<em>radius</em>radius;</td>
<td>return PI<em>radius</em>radius;</td>
<td>(return (* PI radius radius))</td>
</tr>
<tr>
<td>r = 10;</td>
<td>r = 10</td>
<td>(setq r 10)</td>
</tr>
<tr>
<td>area = areaOfCircle(r);</td>
<td>area = areaOfCircle(r)</td>
<td>(setq area (areaOfCircle r))</td>
</tr>
</tbody>
</table>
A more interesting program...

```java
Eye e1, e2, e3, e4, e5;

void setup()
{
    size(200, 200);
    smooth();
    noStroke();
    e1 = new Eye(50, 16, 80);
    e2 = new Eye(64, 85, 40);
    e3 = new Eye(90, 200, 120);
    e4 = new Eye(150, 44, 40);
    e5 = new Eye(175, 120, 80);
}

void draw()
{
    background(102);
    e1.update(mouseX, mouseY);
    e2.update(mouseX, mouseY);
    e3.update(mouseX, mouseY);
    e4.update(mouseX, mouseY);
    e5.update(mouseX, mouseY);
    e1.display();
    e2.display();
    e3.display();
    e4.display();
    e5.display();
}

class Eye
{
    int ex, ey;
    int size;
    float angle = 0.0;

    Eye(int x, int y, int s) {
        ex = x;
        ey = y;
        size = s;
    }

    void update(int mx, int my) {
        angle = atan2(my-ey, mx-ex);
    }

    void display() {
        pushMatrix();
        translate(ex, ey);
        fill(255);
        ellipse(0, 0, size, size);
        rotate(angle);
        fill(153);
        ellipse(size/4, 0, size/2, size/2);
        popMatrix();
    }
}
```
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!
Creative Computing

Introduction to Computing

- Visualizations
- Programming
- Aesthetics & Art
- Algorithms
- Processing/Java
- Computational Media
Examples
Shepard Fairey
Abstract

Art
Summertime

Summertime,
And the livin' is easy
Fish are jumpin'
And the cotton is high

Your daddy's rich
And your mamma's good lookin'
So hush little baby
Don't you cry

One of these mornings
You're going to rise up singing
Then you'll spread your wings
And you'll take to the sky

But till that morning
There's a'nothing can harm you
With daddy and mamma standing by

Summertime,
And the livin' is easy
Fish are jumpin'
And the cotton is high

Your daddy's rich
And your mamma's good lookin'
So hush little baby
Don't you cry

Lyrics by George Gershwin
World Cloud

war
peace
human
President’s Inaugural Addresses
Map-based
Box Office Earnings

nytimes.com
February 23, 2008
Let’s get started...
Software

Processing
- Already installed in the CS Lab
- Also available for your own computer @ www.processing.org
- Processing == Java

Book

http://www.learningprocessing.com/
Primitive 2D Shapes

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

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

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

- **Color**
  - Setting
    - background()
    - colorMode()
    - fill()
    - noFill()
    - noStroke()
    - stroke()

http://processing.org/reference/
Anatomy of a Function Call

Function name
Parentheses
Arguments
Statement terminator

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

(0, 0)  +x

+y
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);

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/strokeCap_.html
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