CMSC110
Introduction to Computing
Deepak Kumar

Administrivia

CMSC110: Introduction to Computing
Fall 2019

Course Website: https://cs.brynmawr.edu/Courses/cs110/fall2019/
Instructor:
   Deepak Kumar, (dkumar@cs.brynmawr.edu)

Lectures
   TuTh 12:55p to 2:15p in Park 245

TA-Support
   >20 hrs/week in Park 230/231

Labs — Register and attend one of these
   • Section A: Tuesdays 2:15 p.m. to 3:15 p.m. (led by Prof. Kumar)
   • Thursdays 11:55 a.m. to 12:45 p.m. (led by Prof. Kumar)

Office Hours
   Wednesdays 2:00 to 4:00p

Grading

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>~7 Assignments</td>
<td>30%</td>
</tr>
<tr>
<td>Lab Attendance</td>
<td>10%</td>
</tr>
<tr>
<td>Exam 1</td>
<td>20%</td>
</tr>
<tr>
<td>Exam 2</td>
<td>20%</td>
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<tr>
<td>Exam 3</td>
<td>25%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>
Administrivia

Software

Processing 3.X
- Already installed in the CS Lab
- Also available for your own computer @ www.processing.org
- Processing == Java

Required


Dropbox Account: Please go to dropbox.com and register. You will be using dropbox to submit many of your assignments. You will need to have this set up by the end of Week#1.

Class Lottery

- Make sure to sign-in your name.

- If you are not on the class list, sign on the attached sheet. 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: Entertainment...
Computing: Entertainment...

Mapping the Epigenome

DNA is 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.

Reading the chart
The outer ring represents 36 million base pairs in the human genome. Orange marks highlight areas of the chromosome where CpG methylation is most common in a study by the Human Epigenome Project.

Measuring CpG
Bar charts in the outer ring show the amount of CpG in each region. The top chart covers a single chromosome. The chart on the right shows the distribution of CpG across all 22 chromosomes.
Self-driving (Autonomous) Cars

Some Areas in Computer Science

- Artificial Intelligence
- Robotics
- Human-Computer Interaction
- Computer Graphics
- Computer Vision
- Operating Systems
- Computer Networking
- Databases
- Computer Security
- Ubiquitous Computing
More trendy...

- Machine Learning (Deep Learning)
- Data Science (Big Data)
- Cybersecurity
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
- Archaeology
- Psychology
- Sociology
- Cognitive Science

- Medicine/Surgery
- Engineering
- Linguistics
- Art
- ...

Creative Introduction to Computing

Visualizations

Programming

Aesthetics & Art

Algorithms

Processing/Java

Computational Media
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.
A program

```c
int areaOfCircle(int radius){
    return PI*radius*radius;
}

r = 10;
area = areaOfCircle(r);
```

Programming Languages

<table>
<thead>
<tr>
<th>Processing/Java/C/C++</th>
<th>Python</th>
<th>Lisp</th>
</tr>
</thead>
</table>
| int areaOfCircle(int radius){
    return PI*radius*radius;
} | def areaOfCircle(radius):
    return PI*radius*radius;
 | (defun areaOfCircle (radius)
    (return (* PI radius radius))) |
| r = 10; area = areaOfCircle(r); | r = 10
area = areaOfCircle(r) | (setq r 10)
(setq area (areaOfCircle r)) |
Programming Languages

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| \begin{verbatim}
int areaOfCircle(int radius) {
    return PI*radius*radius;
}
\end{verbatim} | \begin{verbatim}
def areaOfCircle(radius):
    return PI*radius*radius;
\end{verbatim} | \begin{verbatim}
defareaOfCircle (radius) {
    return (* PI radius radius))
\end{verbatim} |

\textit{FORTRAN, BASIC, Pascal, C, Ada, C++, C#, Java, Javascript, Perl, Ruby, Swift, R…}

There are over 3000 of them!

A more interesting program...

\begin{verbatim}
for e1, e2, e3, e4, e5:
    setup()
    size(200, 200);
    smooth();
    no-stroke();
    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);

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();
\end{verbatim}
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 Introduction to ^ Computing
Let’s get started…

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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)
Anatomy of a Function Call

Function name

Parentheses

Arguments

Statement terminator

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 );

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

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()

```java
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

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

rectMode

```java
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
256 Shades of Gray