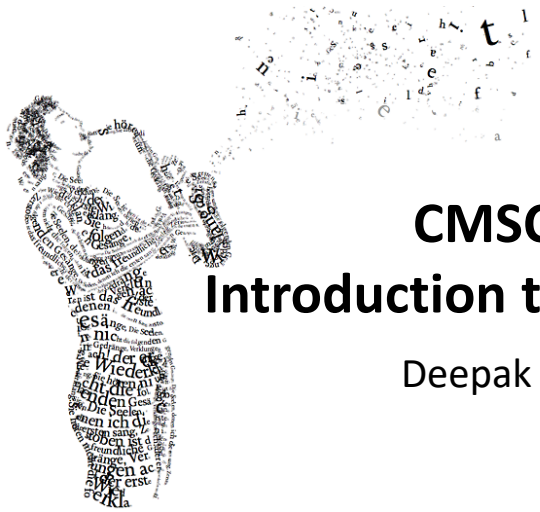
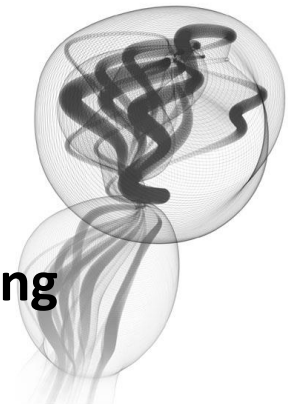


CMSC109
Introduction to Computing

Deepak Kumar



1

Administrivia

CMSC109: Introduction to Computing

Fall 2022

Course Website: https://cs.brynmawr.edu/Courses/cs109/fall2022/
Instructor:

Deepak Kumar, (dkumar@brynmawr.edu)

Lectures

MoWe 1:10p to 2:30p in Park 245

TA-Support

>20 hrs/week in Park 231

Labs – Attendance is required

- Mondays 2:40p to 4:00p in Park 231

Office Hours

TBA

Grading

• Assignments	25%
• Exam 1	20%
• Exam 2	20%
• Exam 3	25%
• Lab Attendance	10%
Total	100%

2

2

Administrivia

Software

Processing 4.X

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

Required

No text is required. We will provide online materials and handouts.

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.

3

3

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.

4

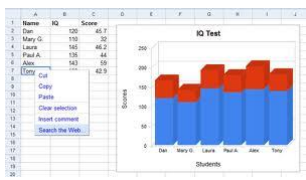
4

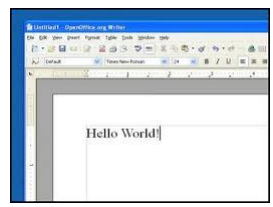
What is Computing?

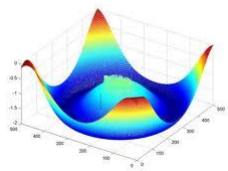
5

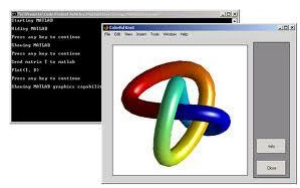
5

Computing: Your Parent's View









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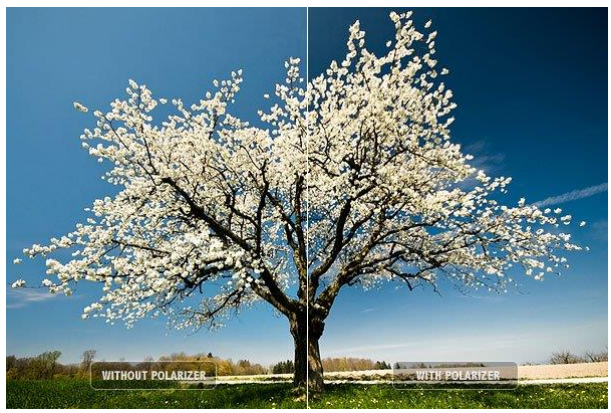
Computing: internet, e-mail, network…

7

7

Computing: Digital Photography



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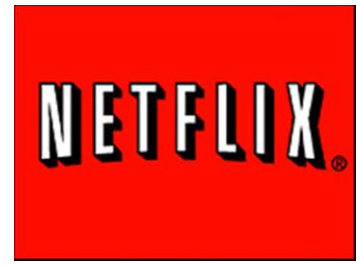
Computing: Entertainment…



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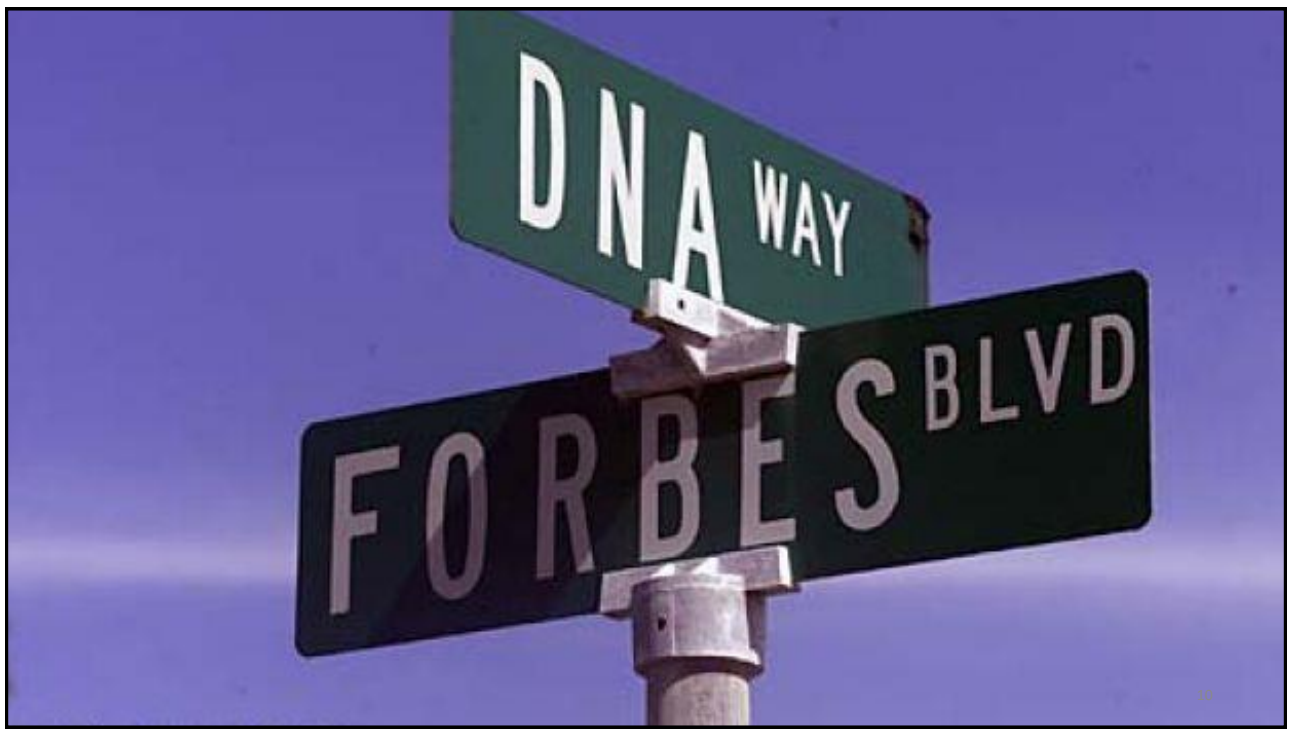

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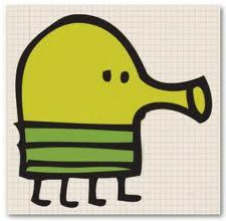
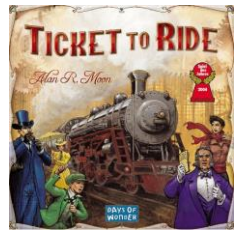
Computing: Entertainment…





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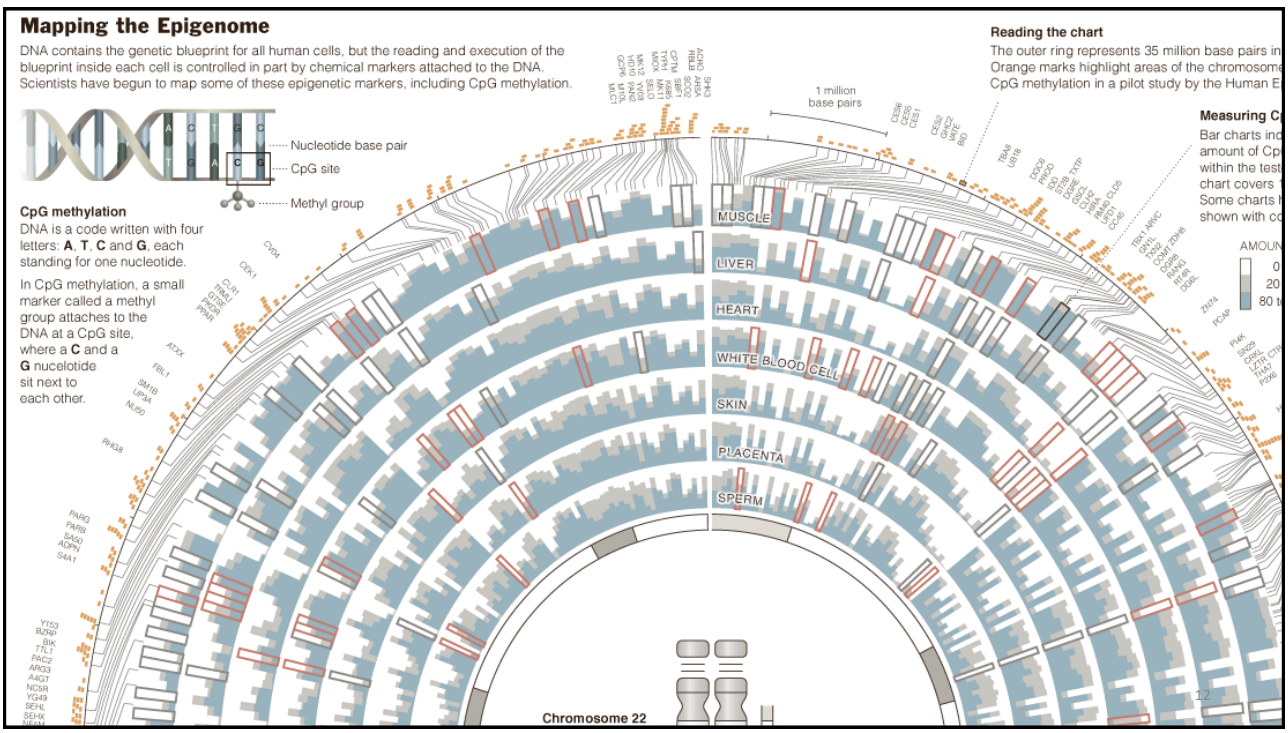

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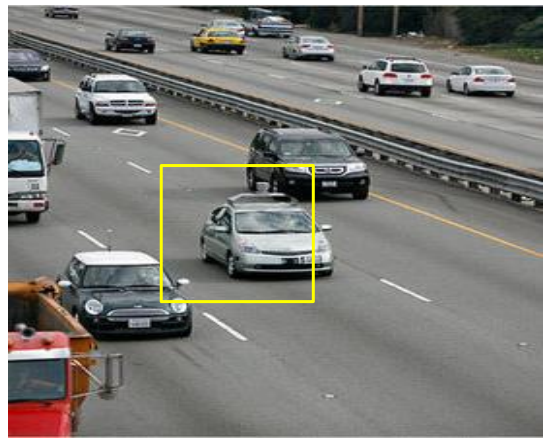
Self-driving (Autonomous) Cars



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Some Areas in Computer Science

Artificial Intelligence

Robotics

Human-Computer Interaction

Computer Graphics

Computer Vision

Operating Systems

Computer Networking

Databases

Computer Security

Ubiquitous Computing

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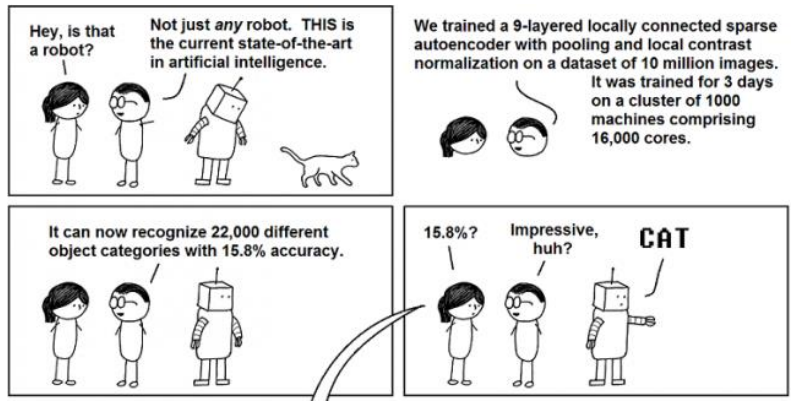
More trendy…

- Machine Learning (Deep Learning)
- Data Science (Big Data)
- Cybersecurity



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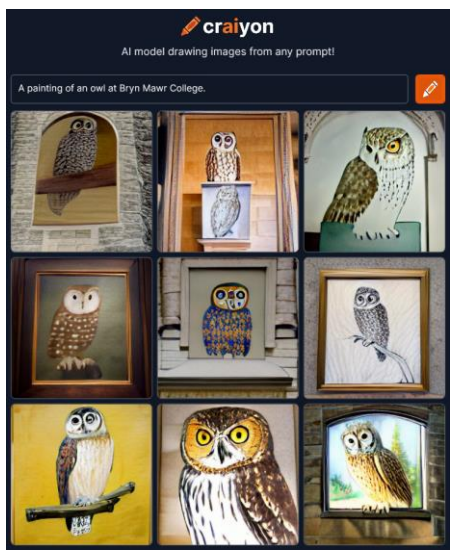
Dall-e: Hot off the presses…



Play here:
https://www.craiyon.com/

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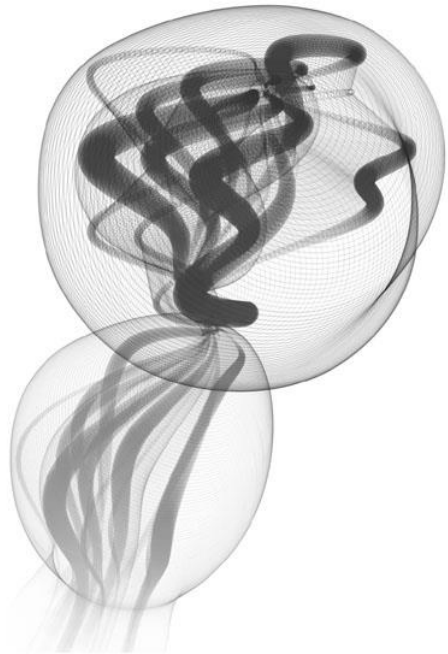
ART



Protobytes
By Ira Greenberg

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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	Geoscience	Medicine/Surgery
Biology (bioinformatics)	Archaeology	Engineering
Chemistry	Psychology	Linguistics
Physics	Sociology	Art
Geology	Cognitive Science	…

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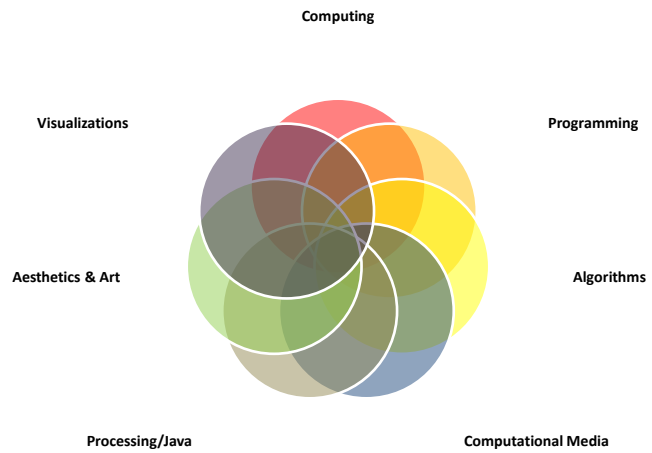
Creative
Introduction to ^ Computing



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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

20

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Exercise: How to draw an owl???

Exercise: How to draw an owl???

- What did we need?
- ***Primitive Shapes***: lines, circles, ovals, rectangles, squares, curves, etc. (also colors)
- Step-by-step Instructions (i.e. ***an algorithm***)
  do this
  then do this
  then this
  etc.

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 codes the steps of an **algorithm** using primitives.

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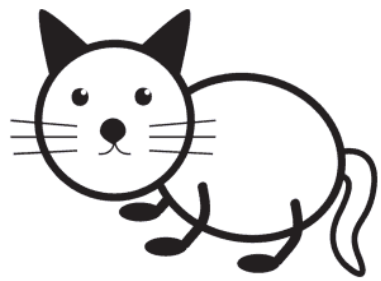
Algorithm to draw a cat?

Draw a face
Draw ears
Draw eyes
Draw nose and mouth
Draw whiskers
Draw body
Draw legs and feet
Draw tail



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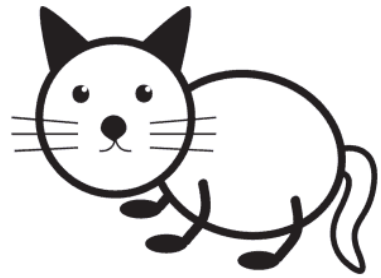
Algorithm to draw a cat? – Identify Primitives

Draw a face [circle]
Draw ears [triangle]
Draw eyes [circle]
Draw nose and mouth [circle, arc]
Draw whiskers [line]
Draw body [oval]
Draw legs and feet [line, oval]
Draw tail [curve??]



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From Algorithm to Program

- ***Programming Language***
  provides a formal language to write steps
  provides basic primitive operations
  Algorithm is coded into a ***program***

- There are over 3000 programming languages
  Python, C, Java, C++, C#, Visual Basic, JavaScript, PHP, Swift, Go, etc.

- In this class we will learn ***Processing*** (Java)

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A program

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

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

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Programming Languages

Processing/Java/C/C++	Python	Lisp

`int areaOfCircle(int radius){`
`  return PI*radius*radius;`
`}`
 	
`r = 10;`
`area = areaOfCircle(r);`
	`def areaOfCircle(radius):`
	`  return PI*radius*radius;`
	
	`r = 10`
	`area = areaOfCircle(r)`
		`(defun areaOfCircle (radius)`
		`  (return (* PI radius radius)))`
		
		`(setq r 10)`
		`(setq area (areaOfCircle r))`

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Programming Languages

Processing	Python	Lisp

`int areaOfCircle(int radius){`
`  return PI*radius*radius;`
`}`
 	
`r = 10;`
`area = areaOfCircle(r);`
	`def areaOfCircle(radius):`
	`  return PI*radius*radius;`
	
	`r = 10`
	`area = areaOfCircle(r)`
		`(defun areaOfCircle (radius)`
		`  (return (* PI radius radius)))`
		
		`(setq r 10)`
		`(setq area (areaOfCircle r))`

Python, C, Java, C++, C#, Visual Basic, JavaScript, PHP, Swift, Go, etc.

There are over 3000 of them!

29

29

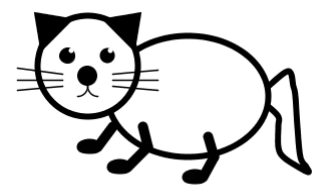
A Processing Program to Draw a Cat

```
void draw() {

  // Body
  strokeWeight(6);
  ellipse(200, 130, 160, 120);

  // Face
  strokeWeight(6);
  ellipse(100, 100, 100, 100);

  // Ears
  // left ear
  strokeWeight(6);
  fill(0);
  beginShape();
  vertex(55, 80);
  vertex(50, 50);
  vertex(80, 55);
  endShape(CLOSE);

  // right ear
  strokeWeight(6);
  fill(0);
  beginShape();
  vertex(120, 55);
  vertex(150, 50);
  vertex(145, 80);
  endShape(CLOSE);
```

```
  // Eyes
  strokeWeight(1);
  fill(0);
  // left eye
  ellipse(80, 90, 15, 15);
  fill(255);
  noStroke();
  ellipse(84, 85, 5, 5);

  // right eye
  strokeWeight(1);
  fill(0);
  ellipse(120, 90, 15, 15);
  fill(255);
  noStroke();
  ellipse(123, 85, 5, 5);

  // Nose and Mouth
  // nose
  fill(0);
  ellipse(100, 110, 20, 20);

  // Whiskers
  stroke(0);
  strokeWeight(1.5);

  //right
  line(125, 108, 170, 104);
  line(125, 114, 170, 114);
  line(125, 120, 170, 124);

  // left
  line(75, 108, 30, 102);
  line(75, 114, 30, 114);
  line(75, 120, 30, 124);
```

```
  // mouth
  stroke(1);
  noFill();
  //ellipse(90, 120, 20, 20);
  arc(90, 120, 20, 20, 0, PI/2);
  //ellipse(110, 120, 20, 20);
  arc(110, 120, 20, 20, PI/2, PI);


  // Legs and feet
  strokeWeight(10);
  line(125, 160, 110, 180);

  line(155, 160, 160, 180);
  line(160, 180, 140, 200);

  line(220, 170, 226, 190);
  line(226, 190, 215, 210);

  fill(0);
  stroke(1);
  ellipse(102, 180, 15, 5);
  ellipse(132, 200, 15, 5);
  ellipse(207, 210, 15, 5);
```

```
  // Legs and feet
  strokeWeight(10);
  line(125, 160, 110, 180);
  line(155, 160, 160, 180);
  line(160, 180, 140, 200);
  line(220, 170, 226, 190);
  line(226, 190, 215, 210);
  fill(0);
  stroke(1);
  ellipse(102, 180, 15, 5);
  ellipse(132, 200, 15, 5);
  ellipse(207, 210, 15, 5);

  // Tail
  noFill();
  strokeWeight(6);
  beginShape();
  curveVertex(280, 120);
  curveVertex(280, 120);
  curveVertex(300, 105);
  curveVertex(305, 120);
  curveVertex(307, 130);
  curveVertex(309, 160);
  curveVertex(312, 190);
  curveVertex(318, 200);
  curveVertex(320, 205);
  curveVertex(310, 200);
  curveVertex(295, 190);
  curveVertex(290, 180);
  curveVertex(290, 160);
  curveVertex(290, 150);
  curveVertex(280, 140);
  curveVertex(280, 140);
  endShape();
} // draw()
```



30

30

How to draw an owl…

```
void draw() {
  // Body
  fill(0);
  textSize(200);
  text("(    )", 100, 300);

  // Eyes
  ellipse(200, 200, 20, 20);
  ellipse(280, 200, 20, 20);

  // Nose/Beek
  strokeWeight(5);
  line(240, 220, 225, 235);
  line(240, 220, 255, 235);

  // Head/Hair
  pushMatrix();
  translate(300, 170);
  rotate(3*PI/2);
  text("{", 0, 0);
  popMatrix();

  // Bryn Mawr
  textSize(24);
  text("BRYN MAWR", 180, 340);
} // draw()
```

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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!

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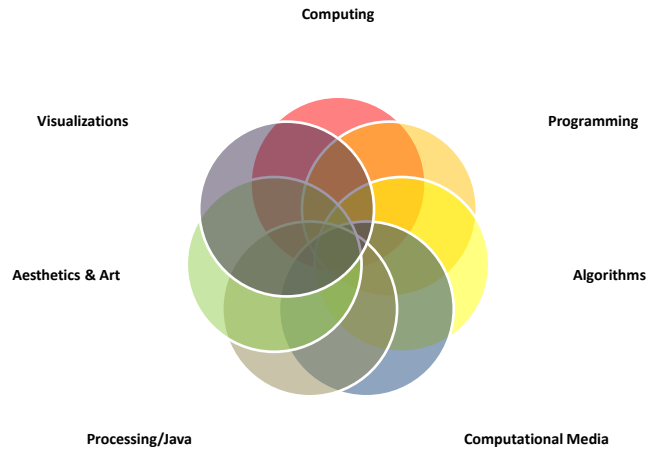
Creative
Introduction to ^ Computing



33

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Let's get started…

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Administrivia

Software

Processing 4.x

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

Required

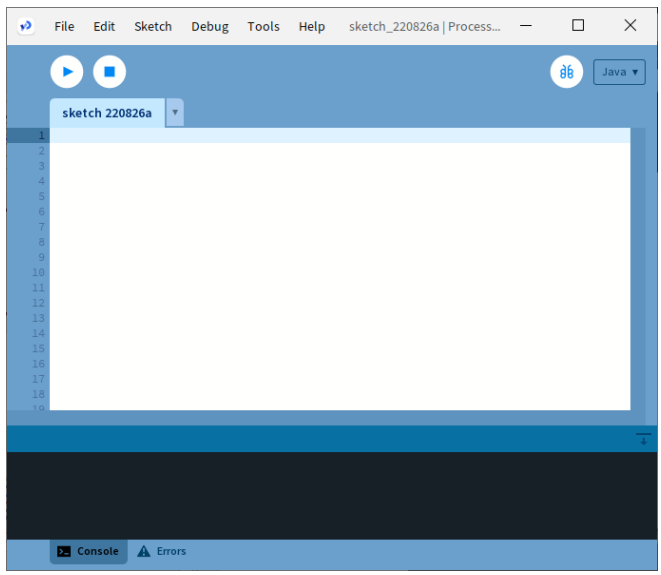
Text: No need to purchase a text.

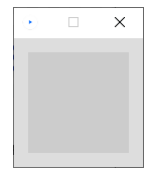
Dropbox Account: Please go to dropbox.com and register. You will be using dropbox to submit many of your assignments.

35

35

Processing 4 IDE





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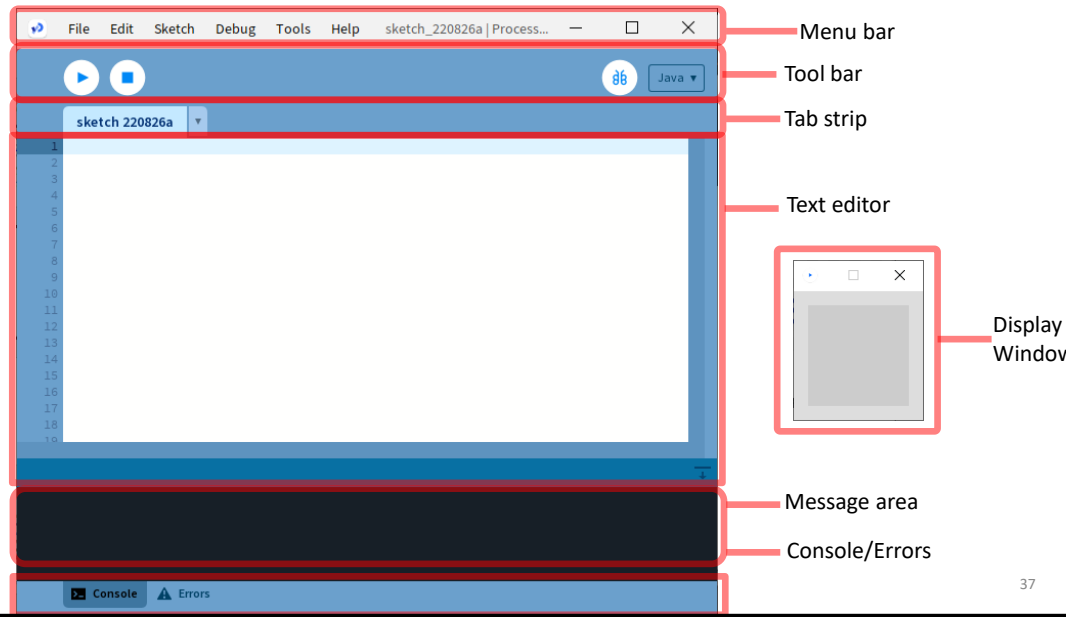
Processing 4 IDE



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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)

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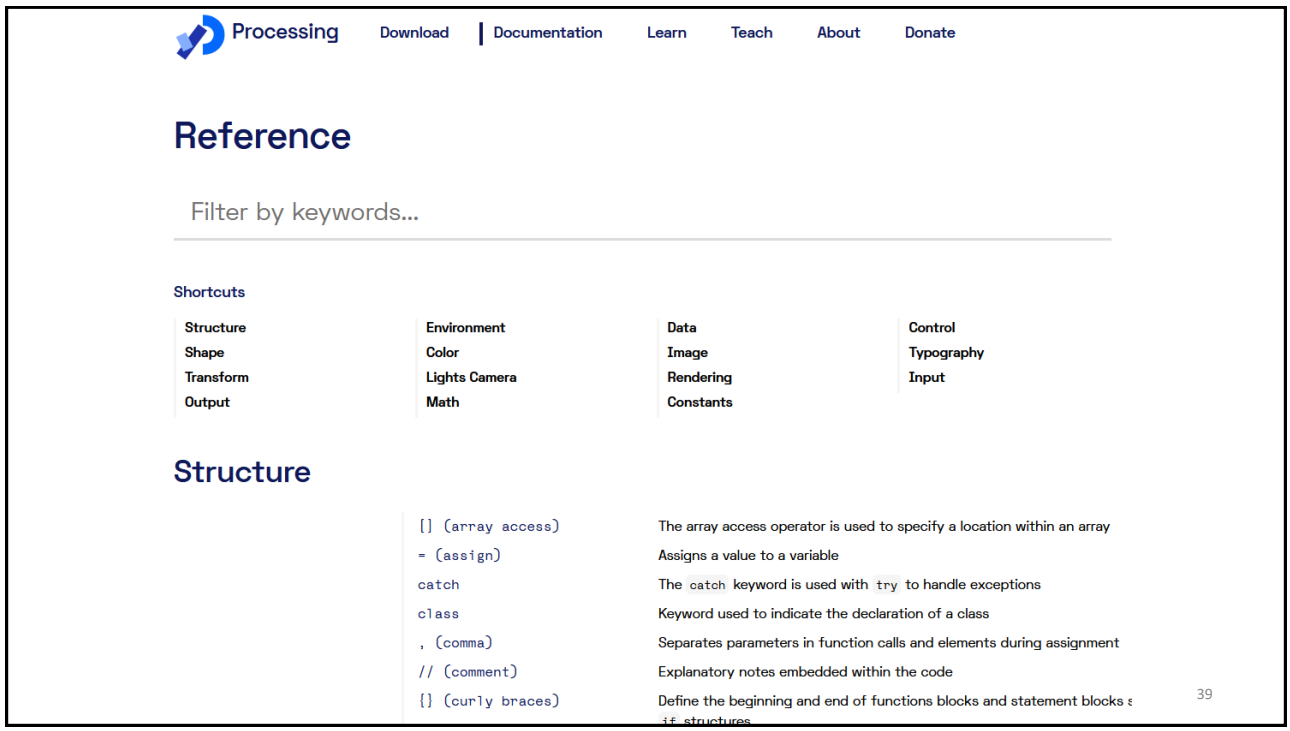
Processing
Download
Documentation
Learn
Teach
About
Donate
Reference
Filter by keywords...
Shortcuts
Structure
Shape
Transform
Output
Environment
Color
Lights Camera
Math
Data
Image
Rendering
Constants
Control
Typography
Input
Structure
[] (array access)
The array access operator is used to specify a location within an array
= (assign)
Assigns a value to a variable
catch
The catch keyword is used with try to handle exceptions
class
Keyword used to indicate the declaration of a class
, (comma)
Separates parameters in function calls and elements during assignment
// (comment)
Explanatory notes embedded within the code
{} (curly braces)
Define the beginning and end of functions blocks and statement blocks
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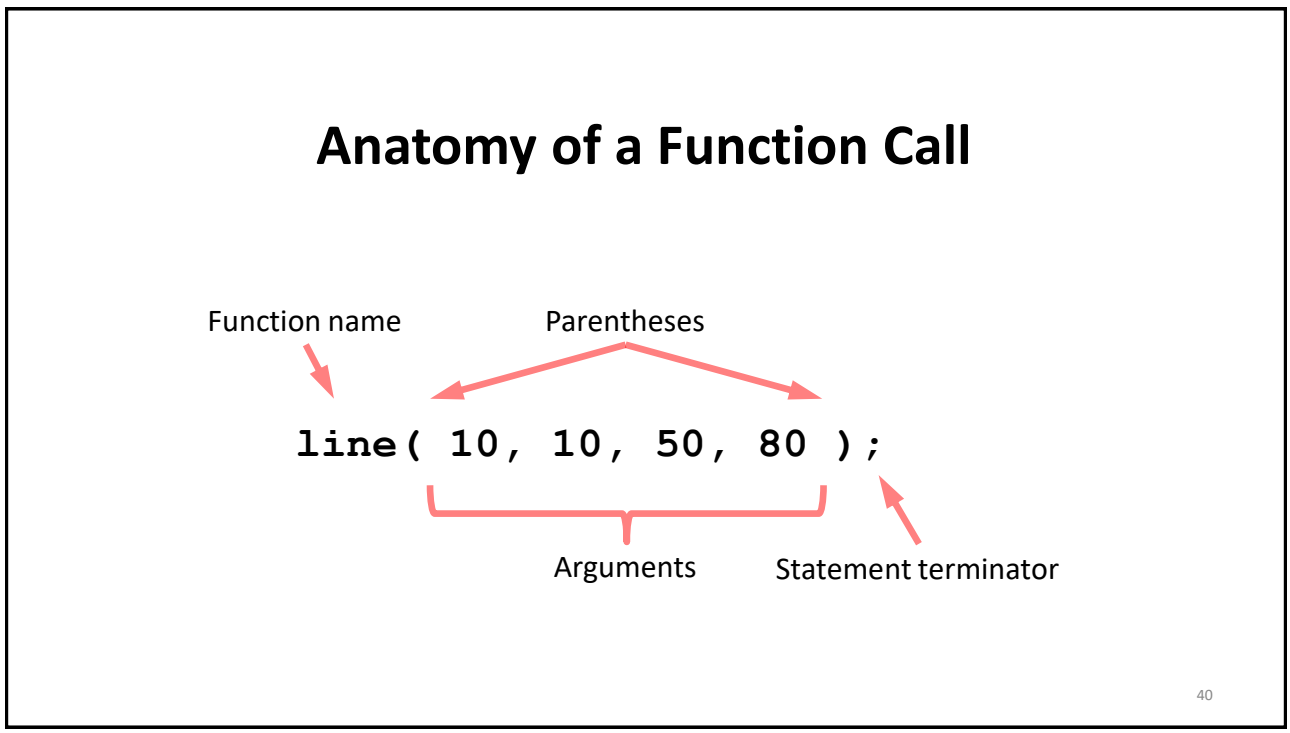
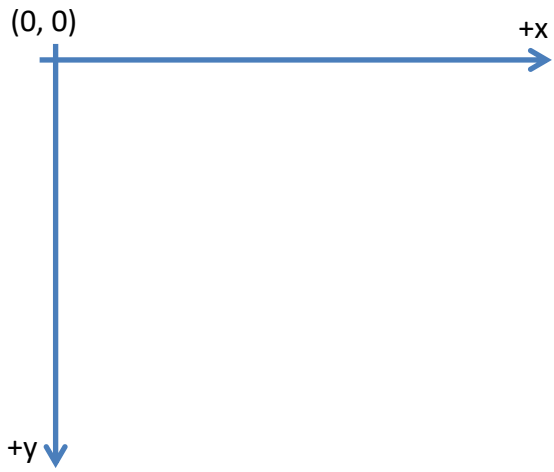

Anatomy of a Function Call
Function name
Parentheses
line(10, 10, 50, 80);
Arguments
Statement terminator
40

40

Coordinate System



41

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Pixels

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Processing Canvas

size(*width*, *height* **);**

Set the size of the canvas.

background(*[0..255]* **);**

Set the background grayscale color.

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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 );
```

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Colors

Composed of four elements:

1. Red
2. Green
3. Blue
4. Alpha (Transparency)

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Why 0 .. 255?

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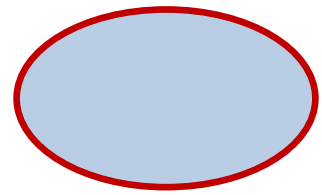
Shape Formatting

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



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

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Fill Color

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

noFill();
```

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Stroke (Line) Color

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

noStroke();
```

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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

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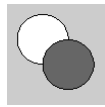
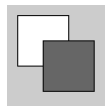
ellipseMode



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

rectMode

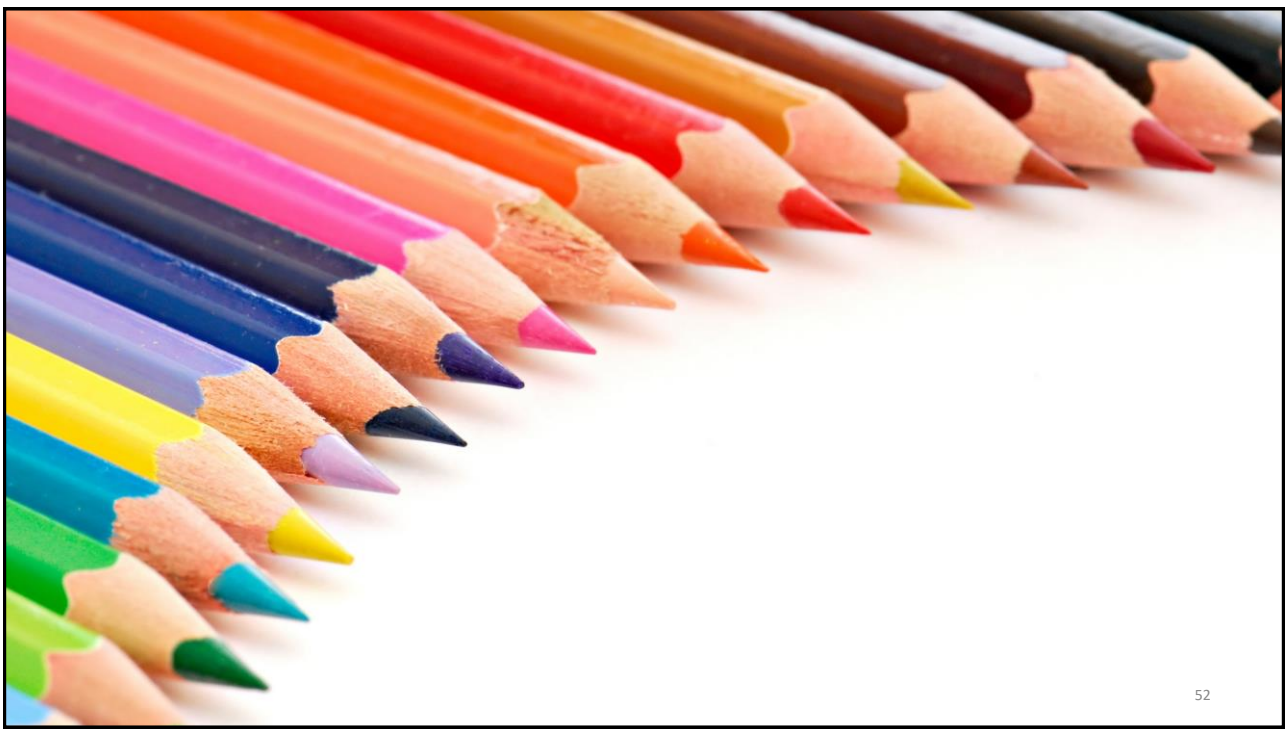


```
rectMode(CENTER);
rect(35, 35, 50, 50);
rectMode(CORNER);
fill(102);
rect(35, 35, 50, 50);
```

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

51

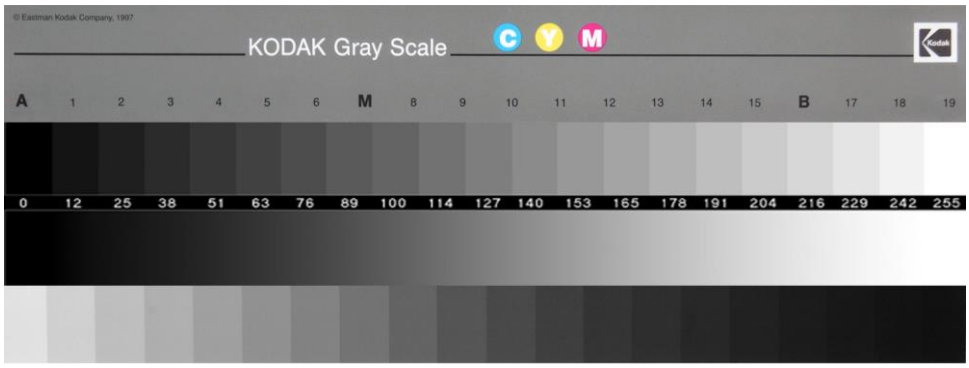
51



52

52

256 Shades of Gray



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