

SDES3607
DESIGN AND COMPUTERS 4

INTRODUCTIONTOPROCESSING

WEEK 1

WHAT IS PROCESSING?

An open source programming language

An extension of Java, made for visual designers and artists

Focusing on visual, instant 'sketch' programming (with capabilities for sound and animation)

This course uses Processing 2.07b



USEFUL RESOURCES

PROCESSING A Programming Handbook for Visual Designers and Artists
by Casey Reas and Ben Fry

PROCESSING.ORG/REFERENCE Your coding cheatsheet

PROCESSING.ORG/EXHIBITION Various creative projects made with Processing

OPENPROCESSING.ORG Processing community site for learning and sharing

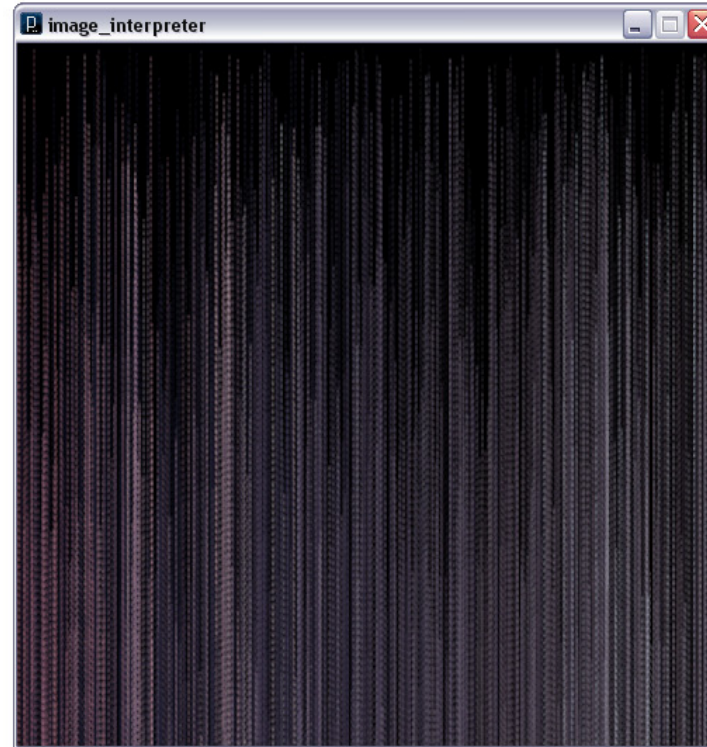
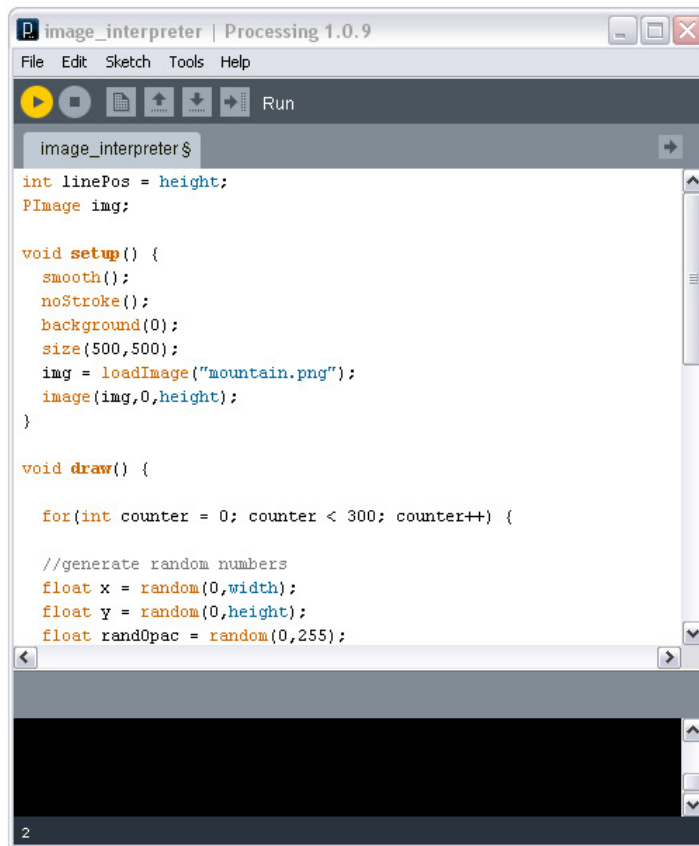
THE PROCESSING IDE

(INTERACTIVE DEVELOPMENT ENVIRONMENT)

controls

coding
window

console



sketch window

WHAT IS A PROGRAM?

A procedural set of instructions that tell the computer what to do

Often likened to a recipe

Instructions are always carried out top to bottom

Method:

1. Process the biscuits in the bowl of a food processor until crumbs form.
2. Add the butter and process until combined.
3. Press the crumbs evenly over the base and sides of a 20cm springform pan using the back of a metal spoon.
4. Chill in the refrigerator for 20 minutes.
5. Meanwhile, preheat oven to 160°C.
6. Clean the food processor bowl.....

EXAMPLE PROGRAM

```
//This program draws a square 100 pixel window,  
//gives it a black background, draws two  
//ellipses, and prints words to the console.
```

```
size(100,100);  
background(0);  
ellipse(0,0,60,60);  
ellipse(50,50,30,30);  
print("This is some test text!");  
println("This is some more test text!");  
println("This is even more test text!");
```

EXAMPLE PROGRAM

comment



```
//This program draws a square 100 pixel window,  
//gives it a black background, draws two  
//ellipses, and prints words to the console.
```

```
size(100,100);  
background(0);  
ellipse(0,0,60,60);  
ellipse(50,50,30,30);  
print("This is some test text!");  
println("This is some more test text!");  
println("This is even more test text!");
```

COMMENTS

p.17

```
//This program draws a square 100 pixel window,  
//gives it a black background, draws two  
//ellipses, and prints words to the console.
```

Comments are ignored by the computer. They let you write notes to yourself and to others who read your programs.

Two forward slashes **//** are used to denote a comment.

A forward slash followed by an asterisk **/*** allows the comment to continue until the opposite ***/**

EXAMPLE PROGRAM

comment



```
//This program draws a square 100 pixel window,  
//gives it a black background, draws two  
//ellipses, and prints words to the console.
```

parameters



function



```
size(100,100);
```

← statement terminator

```
background(0);
```

```
ellipse(0,0,60,60);
```

```
ellipse(50,50,30,30);
```

```
print("This is some test text!");
```

```
println("This is some more test text!");
```

```
println("This is even more test text!");
```

FUNCTIONS

p.18

parameters
↓
function → size(100,100); ← **statement terminator**

Functions allow you to execute many types of actions. A function's name is usually a lowercase word followed by parentheses.

The comma-separated elements between the parentheses are called **parameters**, and they affect the way the function works.

Statement terminators are semicolons. They tell the computer where the end of a statement is (like a full stop in a sentence).

EXAMPLE PROGRAM

comment



```
//This program draws a square 100 pixel window,  
//gives it a black background, draws two  
//ellipses, and prints words to the console.
```

function

parameters



```
size(100,100);
```

← statement terminator

```
background(0);
```

```
ellipse(0,0,60,60);
```

```
ellipse(50,50,30,30);
```

```
print("This is some test text!");
```

```
println("This is some more test text!");
```

```
println("This is even more test text!");
```

← prints to console



PRINTING TO THE CONSOLE

p.20

```
print("This is some test text!");
```

← prints to console

```
println("This is some more test text!");
```

↑ prints to console, then moves to new line

The functions `print()` and `println()` can be used to display data while a program is running.

Place the desired output in quotes.

COORDINATES (p.23)

Most drawing elements in Processing use a coordinate system to define their position. This is measured in **pixels**.

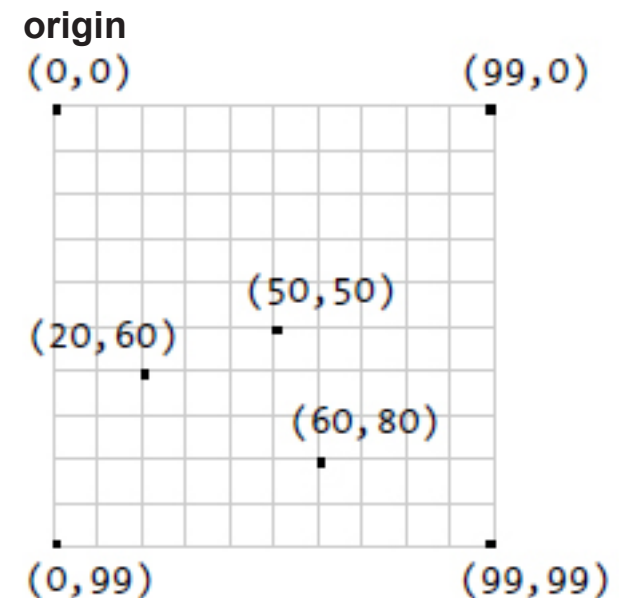
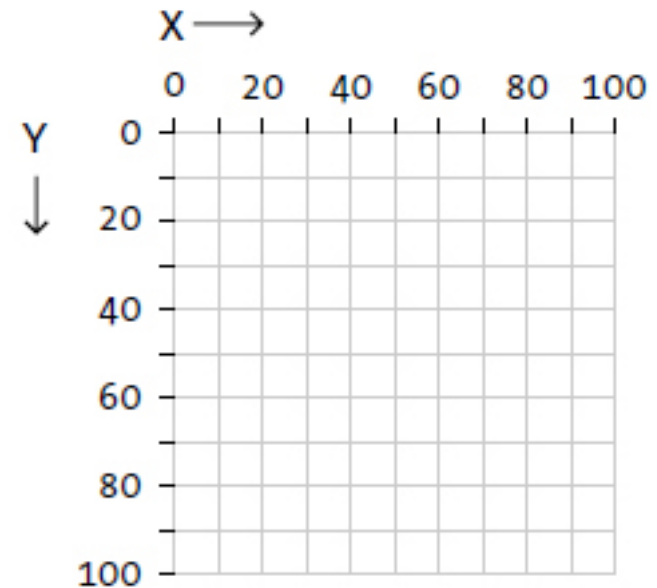
e.g. `size(100,100);`

↑ ↑
x(width) **y(length)**

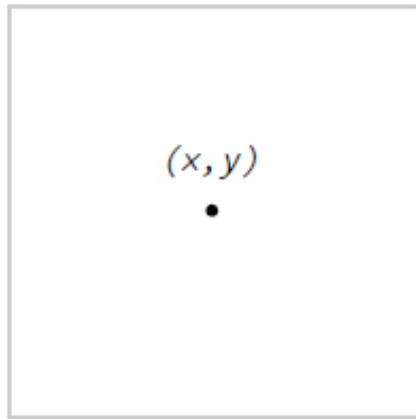
x(horizontal position) **y(vertical position)**

e.g. `rect(10,10,50,50);`

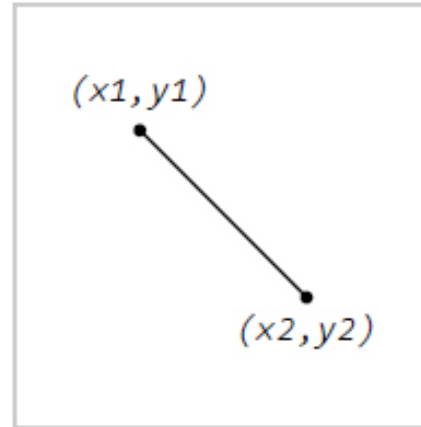
↑ ↑
x(width) **y(length)**



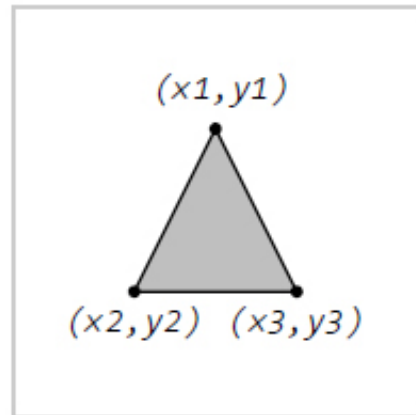
PRIMITIVE SHAPES (p.25)



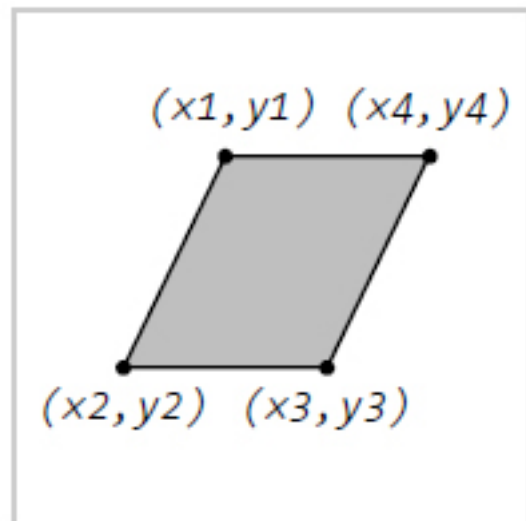
point(x , y)



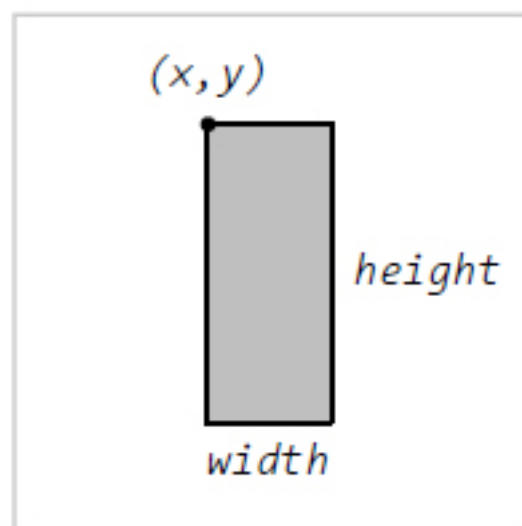
line(x_1 , y_1 , x_2 , y_2)



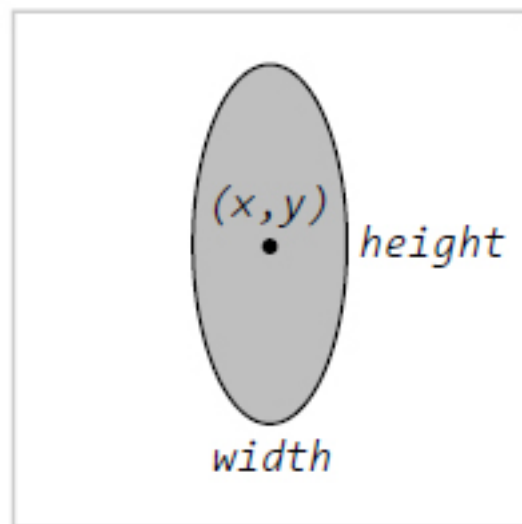
triangle(x_1 , y_1 , x_2 , y_2 , x_3 , y_3)



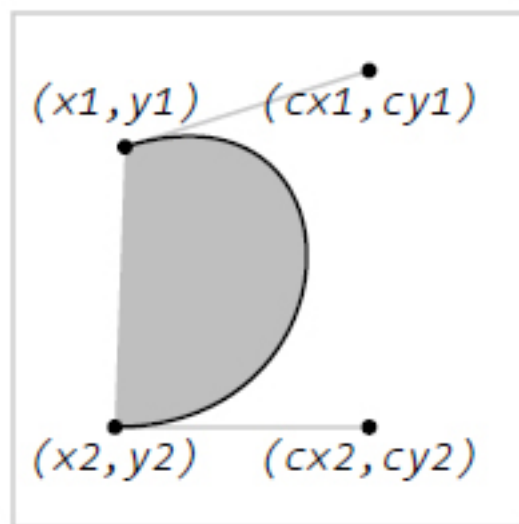
`quad(x1, y1, x2, y2, x3, y3, x4, y4)`



`rect(x, y, width, height)`



`ellipse(x, y, width, height)`



`bezier(x1, y1, cx1, cy1, cx2, cy2, x2, y2)`

EXERCISE

2.1. Create a composition by carefully positioning one line and one ellipse.

(p.35)

STROKE, FILL, GREY VALUES (p.31)

The **fill** of a drawn element can be set to a **grey value** between **0 (black) and 255 (white)**.

The same applies to `background()`.

The **stroke** of an element may also be set to a grey value.

Once a fill or stroke value is defined, it applies to all shapes drawn afterward until the `fill()` or `stroke()` function is used again.

Try `noStroke()` and `noFill()`.



`background(0);`



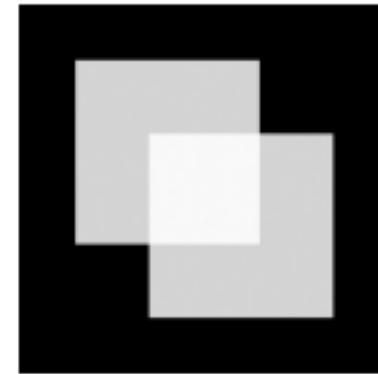
`background(124);`



`background(230);`

EXTRA CONTROL

For more control over these elements, such as transparency, stroke weight, and other features, see pages 32-35 in the Processing handbook.



```
background(0);  
fill(255, 220);  
rect(15, 15, 50, 50);  
rect(35, 35, 50, 50);
```

EXERCISE

2.2. Modify the code for exercise 1 to change the fill, stroke, and background values.

(p.35)

DATA TYPES(p.37)

When writing a program, it is often necessary to store various types of data. Processing has specific ways of referring to that data.

The most basic types of data are called **primitive** types.

boolean
true or false

int
a whole number (integer)
e.g. 5

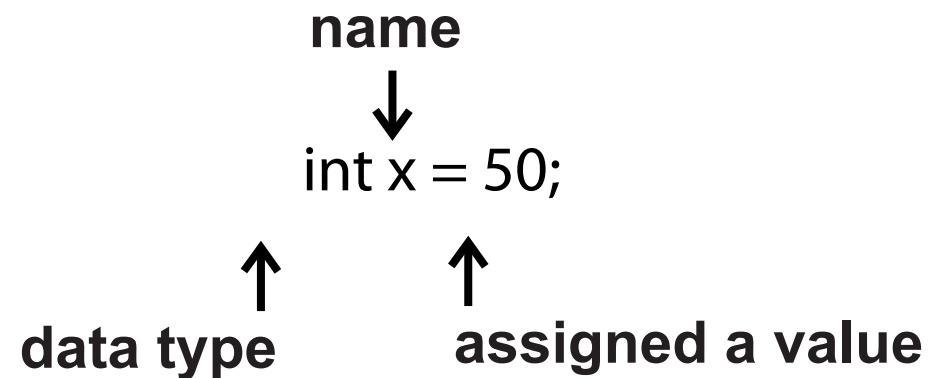
float
a decimal (floating point) number
e.g. 5.3

char
a single letter (character)
e.g. a

VARIABLES (p.38)

Variables are **containers for storing data**.

They must be given a **data type**, a **name**, and **assigned a value**:



You can now use the name of the variable to refer to that piece of data.

e.g. `int x = 50;`
`println(x);`

WHY VARIABLES?

Variables make programs easier to read and write.

Make sure your variable names make sense!

```
ellipse(10,10,10,30);  
ellipse(40,50,10,30);  
ellipse(30,20,10,30);
```

vs

```
int ellipseWidth = 10;  
int ellipseHeight = 30;
```

```
ellipse(10,10,  
ellipseWidth,ellipseHeight);  
ellipse(40,50,  
ellipseWidth,ellipseHeight);  
ellipse(30,20,  
ellipseWidth,ellipseHeight);
```

PRE-DEFINED VARIABLES

Pre-defined variables are designated variable names that are already defined by the Processing core library.

These variables are contextual:

`mouseX` is a variable that is dependent upon the current x position of the mouse according to the coordinate system

`width` is a variable that is dependent upon the parameter placed in the `size()` function

`size(100,100);`
 ↑ ↑
(width) **(height)**

EXERCISES

3.2. Make a few int and float variables. Try assigning them in different ways. Write the values to the console with `println()`.

3.3. Create a composition that scales proportionally with different window sizes. Put different values into `size()` to test.

(p.41)

ARITHMETIC (p.43-47)

Programs can be controlled mathematically using **operators** (right) in expressions.

e.g. `int a = 1;`
`a = a + 10;`
(a is now 11)

Remember your **order of operations**?

+ (add)

- (subtract)

* (multiply)

/ (divide)

% (modulus - read
page 45)

EXAMPLES



```
int a = 30;  
line(a, 0, a, height);  
a = a + 40; // Assign 70 to a  
strokeWeight(4);  
line(a, 0, a, height);
```



```
int a = 30;  
int b = 40;  
line(a, 0, a, height);  
line(b, 0, b, height);  
strokeWeight(4);  
// A calculation can be used as an input to a function  
line(b-a, 0, b-a, height);
```

SHORTCUTS_(p.48)

Some expressions are used so frequently that Processing includes shortcuts you can use to save time.

x += 5;
is the same as
x = x + 5;

x -= 5;
x = x - 5;

x++;
x = x + 1;

x *= 5;
x = x * 5;

x--;
x = x - 1;

x /= 5;
x = x / 5;

x = -x;
x = x * -1;

EXERCISES

4.1. Use one variable to set the position and size for three ellipses.

4.2. Use multiplication to create a series of lines with increasing space between each.

(p.50)

DECISIONS (p.51)

So far, we have been writing code that simply runs top to bottom.

To add further control, we can use **relational expressions** to decide **if** a section of a program should be run.

DECISIONS (p.52)

Operators used in relational expressions allow us to test if something is true or false by **comparing values**.

e.g. `println(3 > 5)` prints false

`println(3 < 5)` prints true

`println(3 >= 5)` prints false

`println(3 <= 5)` prints true

`println(3 == 5)` prints false

`println(3 != 5)` prints true

>
greater than

<
less than

>=
greater than or equal to

<=
less than or equal to

==
equal to

!=
not equal to

IF STRUCTURES (p.53)

When using relational expressions to make a decision in a program, we use what is called a **conditional** - an **if structure**.

If the conditional evaluates to true, the code inside the brackets will run. If it is false, the program ignores it.

```
if (test) {  
    statements  
}
```

e.g.

```
if(3 < 5) {  
    ellipse(50,50,10,10);  
}
```


EXTENSIONS (p.55-56)

We can extend an if structure by adding an **else**. The code inside the **else brackets** will only run if the conditional is **false**.

We can add layers of conditionals by nesting them within each other.

```
if(test) {  
    if(test) {  
        code;  
    }  
}
```

We can also add extra control to an else by adding an if.

e.g.

```
if(3 < 5)  
    ellipse(50,50,10,10);  
} else {  
    rect(50,50,10,10);  
}
```

LOGICAL OPERATORS (p.57-59)

Sometimes we need to combine two or more relational expressions. To do this, we need logical operators.

OR (||) makes the whole expression return true if only **one** part is true.

AND (&&) makes the whole expression return true only if **both** parts are true.

NOT (!) inverts the logical value and can only be applied to boolean variables. It is less used than OR or AND.

e.g.

```
if((3 < 5)&&(3 > 2)) {  
    ellipse(50,50,10,10);  
}
```

Both parts are true, so the code will run.

EXERCISE

5.2. Create a composition with a series of lines and ellipses. Use an if structure to select which lines of code to run and which to skip.

(p.59)

REPETITION (p.61)

Often we find ourselves writing the same code over and over. For example, to draw lots of ellipses.

To help cut down on lengthy code, we can use **iterative structures**, or **for structures**, that automatically repeat lines of code for us.

Like if structures, we can **nest** for structures inside each other to create complex patterns.

```
for (init; test; update) {  
    statements  
}
```

e.g.

```
for (int x = 20; x < 80; x += 5) {  
    line(20,x,80,x+15);  
}
```

EXERCISE

6.1. Draw a regular pattern with five lines. Rewrite the code using a for structure.

6.2. Draw a dense pattern by embedding two for structures.

(p.68)