Using Methods

More on writing methods

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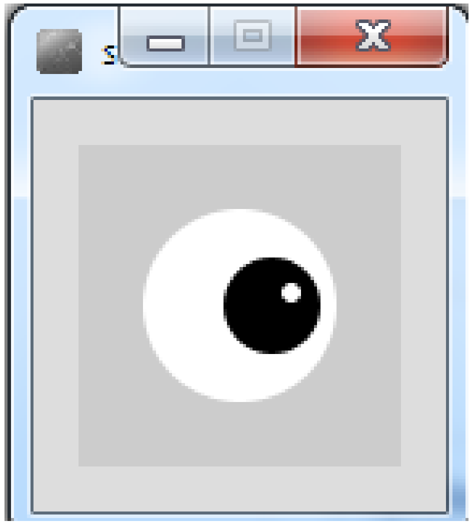
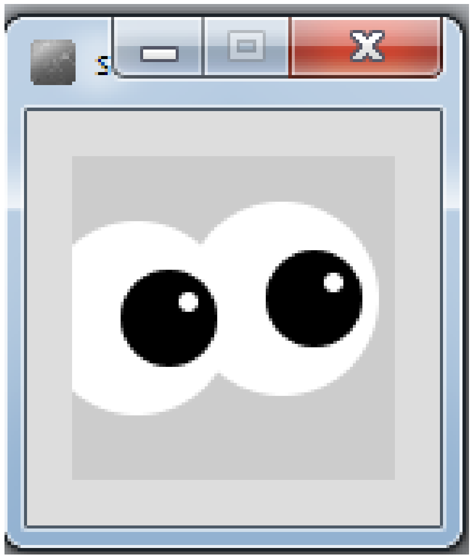
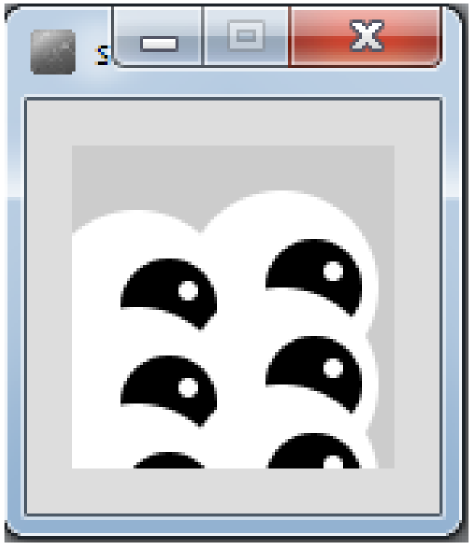
Topics list

1. Method example: **Eyes**
2. Method example: **X’s**
3. **Overloading** methods.
4. Method example: Celcius / Farenheit **Converter**.
5. **Recursion**.





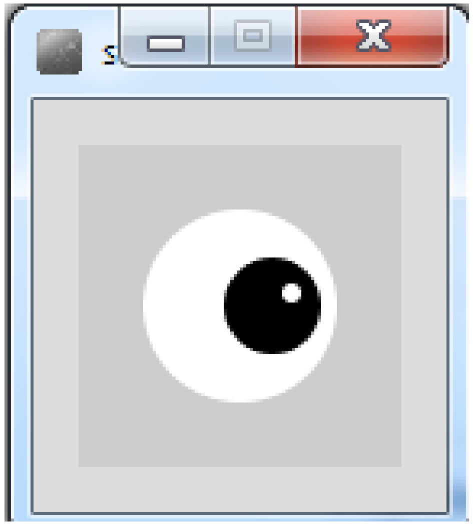


Source: Reas & Fry (2014)

Example 3.7 – Drawing a single eye

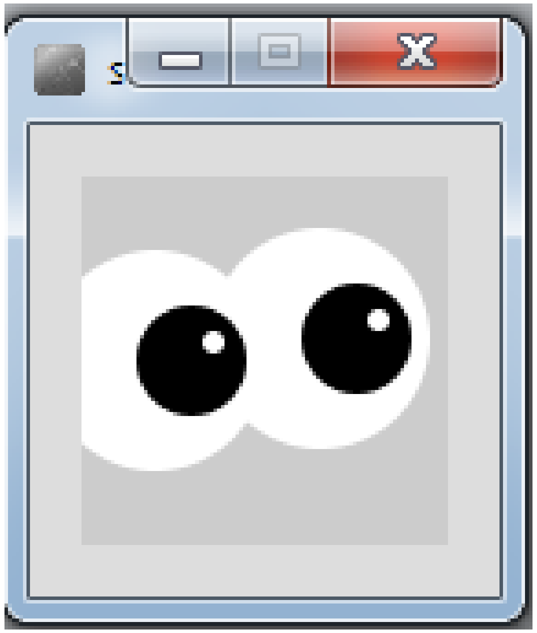
```
void setup()
{
  size(100,100);
  noStroke();
}
```

```
void draw()
{
  background(204);
  fill(255);
  ellipse(50,50,60,60);             //outer white circle
  fill(0);
  ellipse(50+10, 50, 30, 30);       //black circle
  fill(255);
  ellipse(50+16, 46, 6, 6);         //small, white circle
}
```



Source: Reas & Fry (2014)

What if we wanted to draw two eyes?

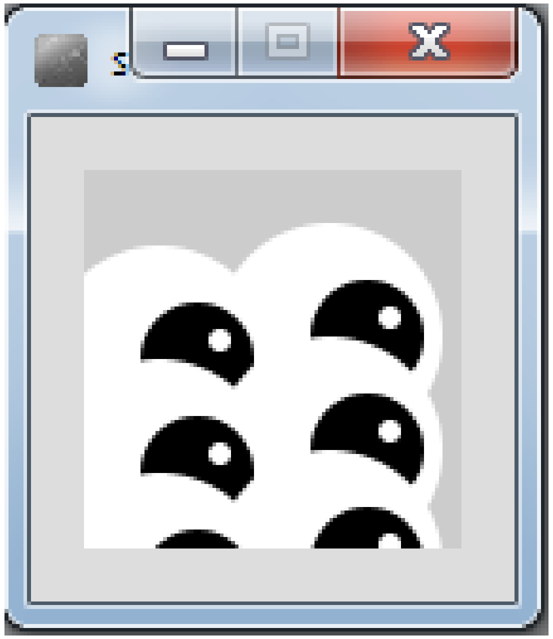


Each eye takes a six lines of code to draw.

```
void draw()
{
  background(204);
  //Right eye
  fill(255);
  ellipse(65,44,60,60);             //outer white circle
  fill(0);
  ellipse(65+10, 44, 30, 30);       //black circle
  fill(255);
  ellipse(65+16, 44-5, 6, 6);       //small, white circle
  //Left eye
  fill(255);
  ellipse(20,50,60,60);             //outer white circle
  fill(0);
  ellipse(20+10, 50, 30, 30);       //black circle
  fill(255);
  ellipse(20+16, 50-5, 6, 6);       //small, white circle
}
```

Source: Reas & Fry (2014)

What if we wanted to draw six eyes?



Are we going to repeat the six lines of code SIX times?

What if we wanted to draw 100 eyes → 600 lines of code!

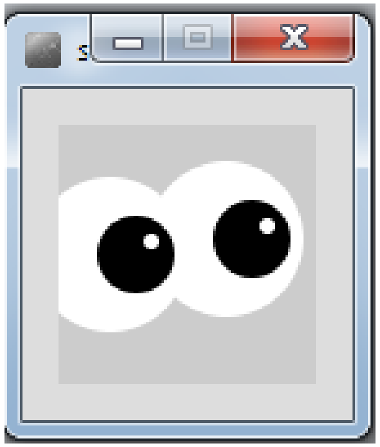
Source: Reas & Fry (2014)

Example 3.8 – Drawing two eyes

```
void setup()
{
  size(100,100);
  noStroke();
}
```

```
void draw()
{
  background(204);
  eye(65,44);
  eye(20,50);
}
```

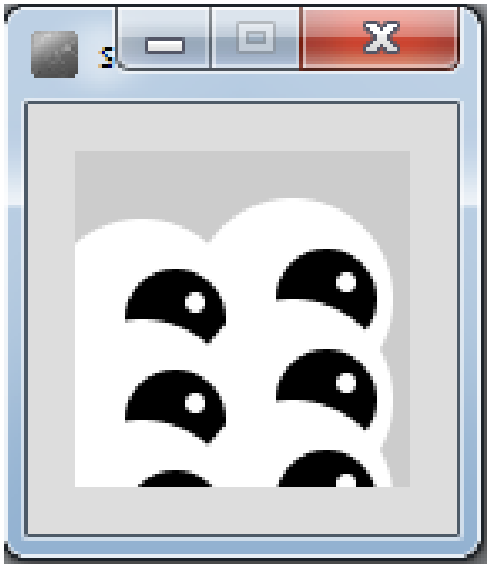
```
void eye (int x, int y)
{
  fill(255);
  ellipse(x,y,60,60);          //outer white circle
  fill(0);
  ellipse(x+10, y, 30, 30);   //black circle
  fill(255);
  ellipse(x+16, y-5, 6, 6);   //small, white circle
}
```



Source: Reas & Fry (2014)

Example 3.9 – Drawing six eyes

```
void setup()
{
  size(100,100);
  noStroke();
}
```



```
void eye (int x, int y)
{
  fill(255);
  ellipse(x,y,60,60);
  fill(0);
  ellipse(x+10, y, 30, 30);
  fill(255);
  ellipse(x+16, y-5, 6, 6);
}
```

```
void draw()
{
  background(204);
  eye(65,44);
  eye(20,50);
  eye(65,74);
  eye(20,80);
  eye(65,104);
  eye(20,110);
}
```

Source: Reas & Fry (2014)

Topics list

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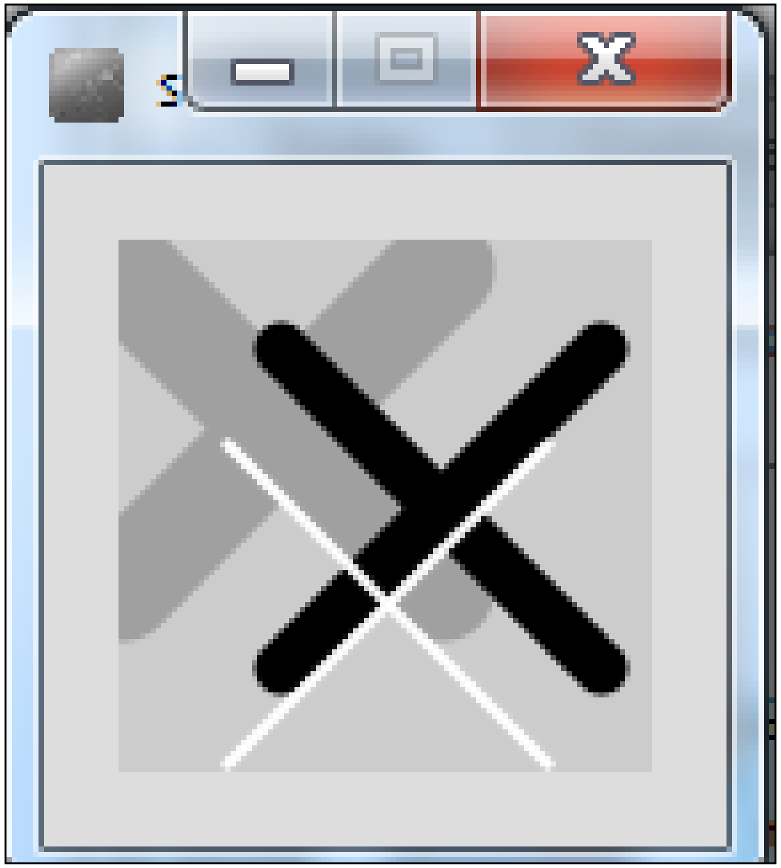
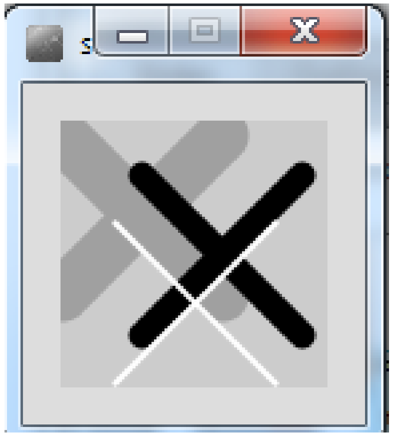


Source: Reas & Fry (2014)

How about this solution?

```
void setup() {
   size(100,100);
}
```



```
void draw(){
  background(204);
  //draw thick, light gray x
  stroke(160);
  strokeWeight(20);
  line(0,5,60,65);
  line(60,5,0,65);
  //draw medium, black x
  stroke(0);
  strokeWeight(10);
  line(30,20,90,80);
  line(90,20,30,80);
  //draw thin, white x
  stroke(255);
  strokeWeight(2);
  line(20,38,80,98);
  line(80,38,20,98);
}
```

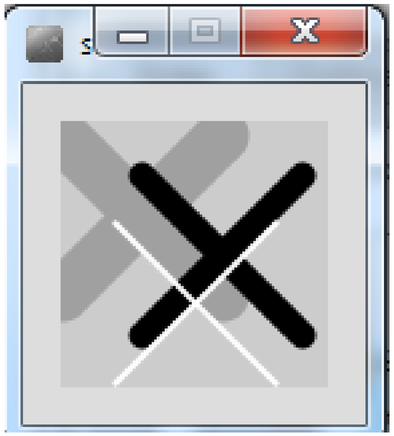
Source: Reas & Fry (2014)

Code duplication

```
//draw thick, light gray x
 stroke(160);
strokeWeight(20);
line(0,5,60,65);
line(60,5,0,65);
```

```
//draw medium, black x
stroke(0);
strokeWeight(10);
line(30,20,90,80);
line(90,20,30,80);
```

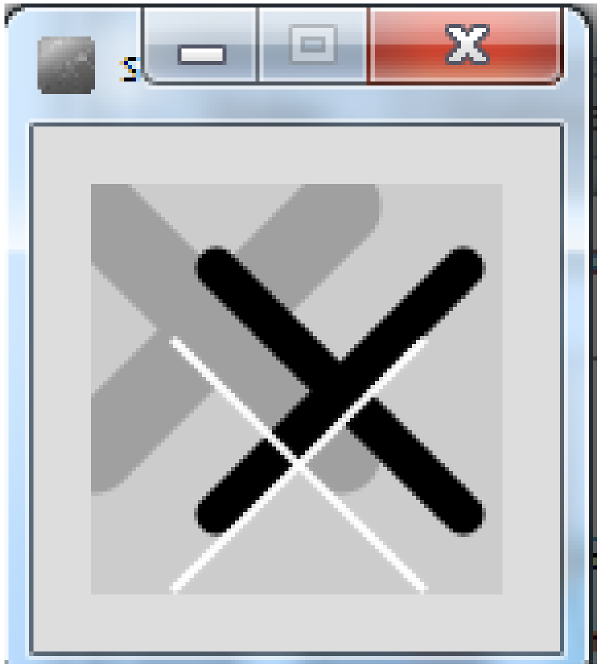
```
//draw thin, white x
stroke(255);
strokeWeight(2);
line(20,38,80,98);
line(80,38,20,98);
```



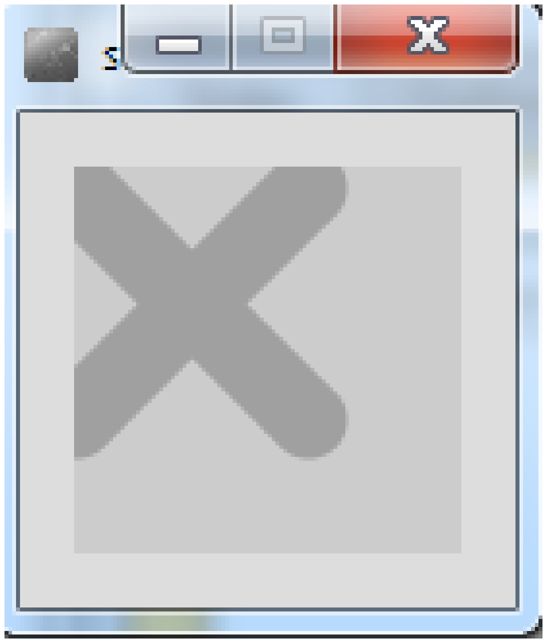
Source: Reas & Fry (2014)

A solution with methods

- We will incrementally build a solution that uses methods to produce this output…



Example 3.10 – using a method to draw a thick, light gray X



```
void draw()
{
   background(204);
   drawX();
}
```

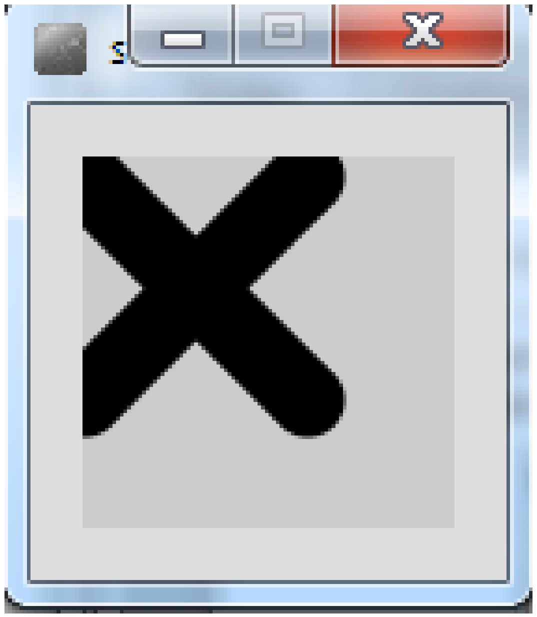
```
void drawX()
{
  //draw thick, light gray x
  stroke(160);
  strokeWeight(20);
  line(0,5,60,65);
  line(60,5,0,65);
}
```

Source: Reas & Fry (2014)

Example 3.11 – drawing a thick X, passing **colour as a parameter.**

```
void draw()
{
   background(204);
  drawX(0);
}
```

```
void drawX (int gray)
{
  stroke(gray);
  strokeWeight(20);
  line(0,5,60,65);
  line(60,5,0,65);
}
```

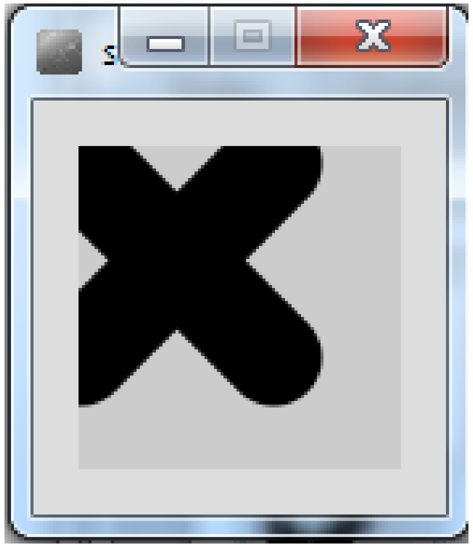


Source: Reas & Fry (2014)

Example 3.12 – drawing X, **passing colour and weight**.

```
void draw()
{
   background(204);
  drawX(0, 30);
}
```

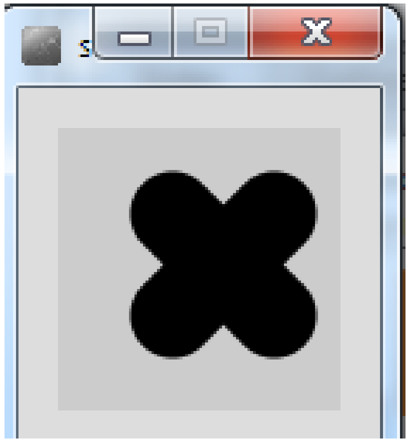
```
void drawX (int gray, int weight)
{
 stroke (gray);
 strokeWeight (weight);
 line(0,5,60,65);
 line(60,5,0,65);
}
```



Source: Reas & Fry (2014)

Example 3.13 – drawing X, passing **colour, weight, position, size**

```
void draw()
{
   background(204);
  drawX(0, 30, 40, 30, 36);
}
```

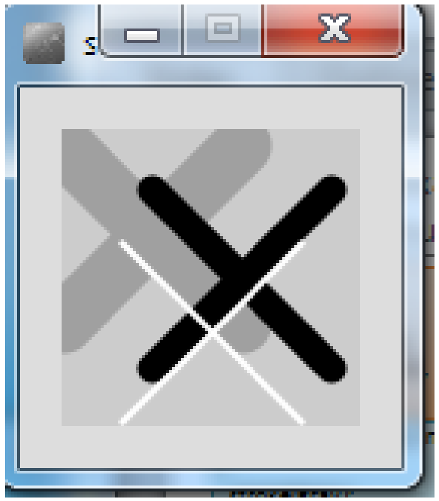


```
void drawX (int gray, int weight, int x, int y, int size)
{
 stroke (gray);
 strokeWeight (weight);
 line(x, y, x+size, y+size);
 line(x+size, y, x, y+size);
}
```

Source: Reas & Fry (2014)

Example 3.14 – drawing multiple Xs

```
void draw()
{
    background(204);
    drawX(160, 20, 0, 5, 60);
    drawX(0, 10, 30, 20, 60);
    drawX(255, 2, 20, 38, 60);
}
```

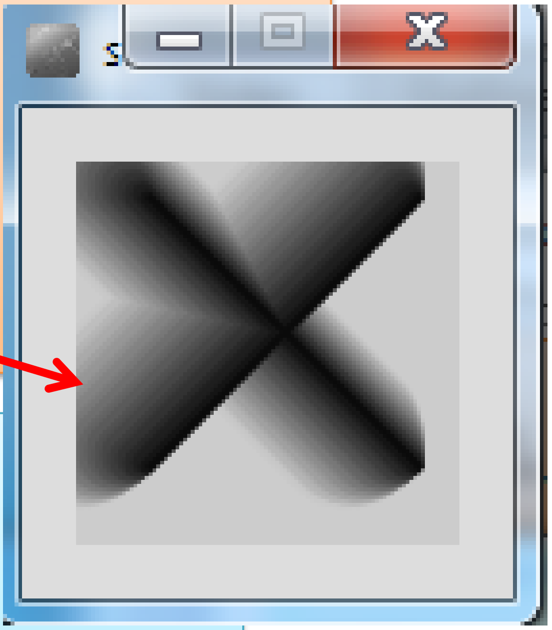


```
void drawX (int gray, int weight, int x, int y, int size)
{
  stroke(gray);
  strokeWeight(weight);
  line(x, y, x+size, y+size);
  line(x+size, y, x, y+size);
}
```

Source: Reas & Fry (2014)

Example 3.15 – drawing **multiple Xs using a for loop**

```
void draw()
{
    background(204);
    for (int i = 0; i < 20; i++){
        drawX(200-i*10, (20-i)*2, i, i/2, 70);
    }
}
```



```
void drawX(int gray, int weight, int x, int y, int size)
{
  stroke(gray);
  strokeWeight(weight);
  line(x, y, x+size, y+size);
  line(x+size, y, x, y+size);
}
```

Source: Reas & Fry (2014)

Topics list

1. Method example: **Eyes**
2. Method example: **X’s**
3. **Overloading** methods.
4. Method example: Celcius / Farenheit **Converter**.
5. **Recursion**.

Overloaded methods

- Multiple methods can have the **same name**, once they have a **<u>different parameter list</u>**.
- In the previous examples, we wrote the following methods:
  - void drawX ()
  - void drawX (int gray)
  - void drawX (int gray, int weight)
  - void drawX (int gray, int weight, int x, int y, int size)

Same Name Different Parameter List

Source: Reas & Fry (2014)

Overloaded methods

Method signature	**Parameter List**
void drawX ()	no parameter
void drawX (int gray)	int
void drawX (int gray, int weight)	int, int
void drawX (int gray, int weight, int x, int y, int size)	int, int, int, int, int

Source: Reas & Fry (2014)

Overloaded methods

- A program can have two or more methods with the same name, only if their parameter list is different.

- When Java is checking that a parameter list is different, it is not checking the name of the variables, it is **checking the data type** of the variables
  e.g. this is permitted as the **data type is different**:
  - void drawX ($\boxed{\text{int}}$ gray)
  - void drawX ($\boxed{\text{float}}$ gray)

Data types must be different

Source: Reas & Fry (2014)

Overloaded methods

```
void draw()
{
   background(204);
  drawX(0);
}
```

Which drawX method is called and why?

```
void drawX(int gray){
  stroke(gray);
  strokeWeight(5);
  line(0,5,60,65);
  line(60,5,0,65);
}

void drawX(float gray){
  stroke(gray);
  strokeWeight(20);
  line(0,5,60,65);
  line(60,5,0,65);
}
```

Source: Reas & Fry (2014)

Overloaded methods

- When you call a method, Java **matches** the **number and type of the arguments** you passed to the method with all the declared methods.
- When a match is found, Java invokes that method e.g.

drawX (0)	calls	void drawX (int gray)
drawX (0.0)	calls	void drawX (float gray)

Source: Reas & Fry (2014)

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1. Method example: **Eyes**
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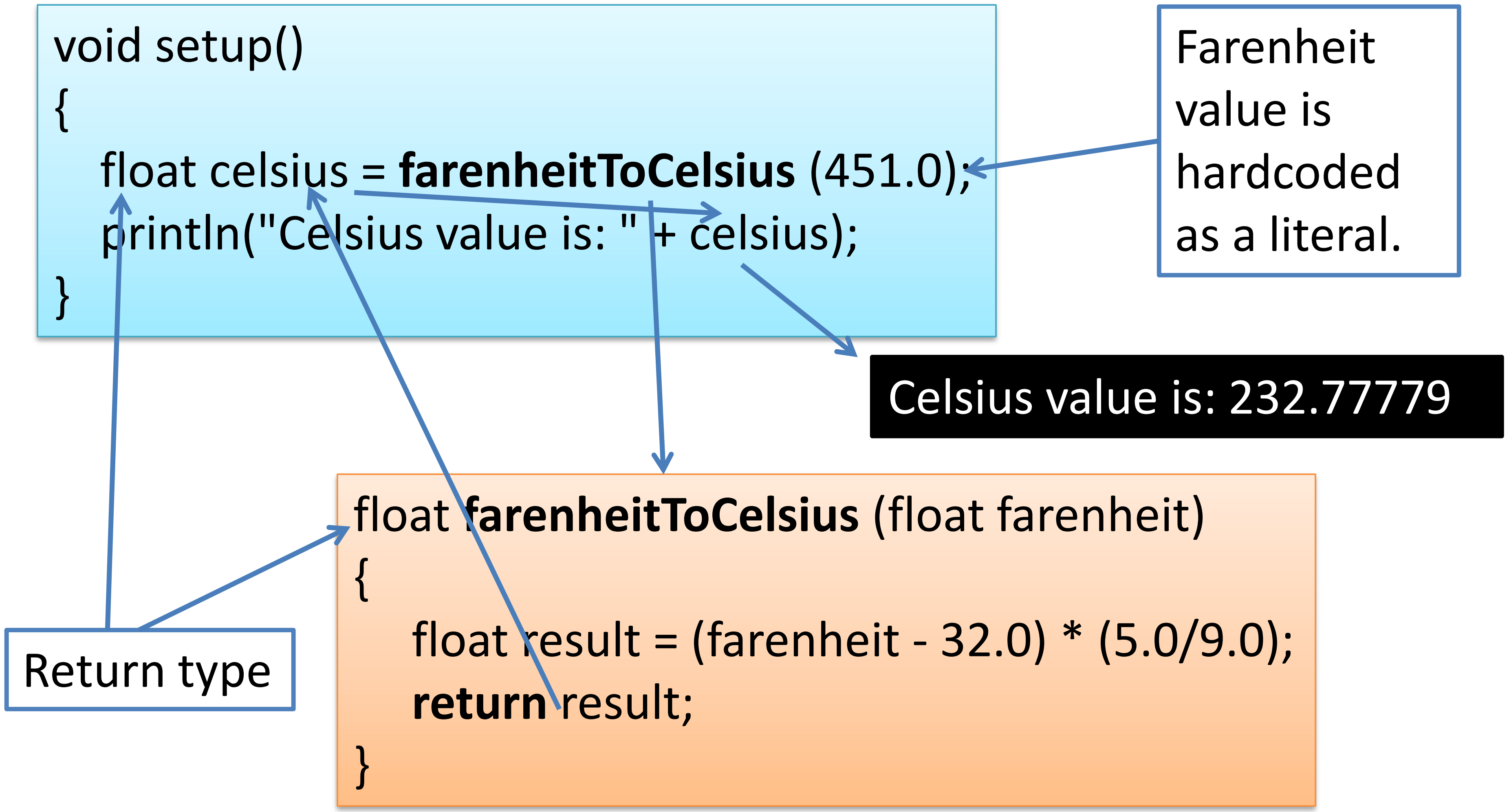
Example 3.16 – Farenheit to Celsius



```
void setup()
{
    float celsius = farenheitToCelsius (451.0);
    println("Celsius value is: " + celsius);
}
```

Farenheit value is hardcoded as a literal.

```
Celsius value is: 232.77779
```

```
float farenheitToCelsius (float farenheit)
{
    float result = (farenheit - 32.0) * (5.0/9.0);
    return result;
}
```

Return type

Source: Reas & Fry (2014)

Example 3.16 – Updated

both methods are exactly the same

```
float farenheitToCelsius (float farenheit)
{
    float result = (farenheit - 32.0) * (5.0/9.0);
    return result;
}
```

```
float farenheitToCelsius (float farenheit)
{
     return (farenheit - 32.0) * (5.0/9.0);
}
```

Source: Reas & Fry (2014)

Topics list

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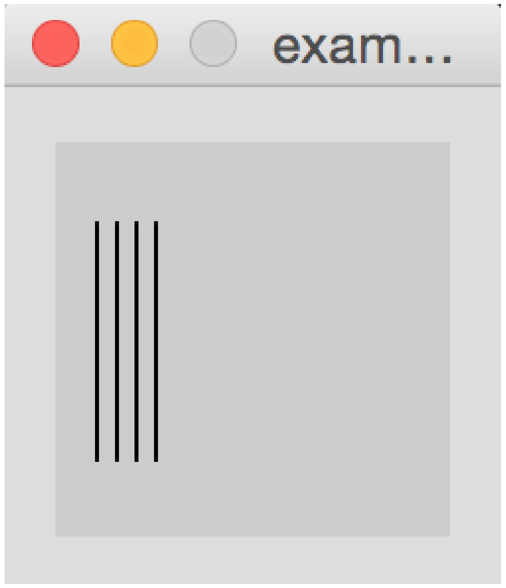
Example 3.17 – drawLines – for loop



```
void setup()
{
  size(100,100);
  drawLines(10,4);
}
```

```
void drawLines (int xStart, int numLines)
{
    for (int i = 0; i < numLines; numLines--)
    {
        line (xStart, 20, xStart, 80);
        xStart += 5;
    }
}
```

NOTE
instead of incrementing the loop control variable i as normal (e.g. i++)
the condition is being reduced back to 0 (by decrementing numLines)

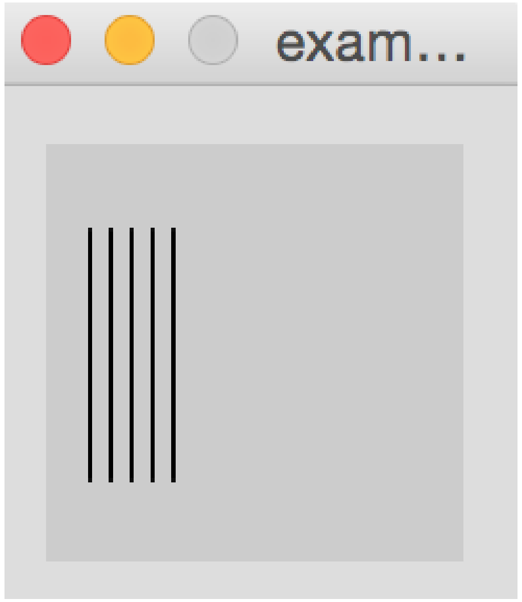
Source: Reas & Fry (2014)

Recursion

- A method can contain a **line of code that calls itself**.
  - This is called recursion.
- To stop the infinite calling of the method, it is necessary to have some way for the method to exit.
  - This is called the ***base case***.
  - You continually work towards the base case.

Source: Reas & Fry (2014)

Example 3.17 – drawLines – **recursion**



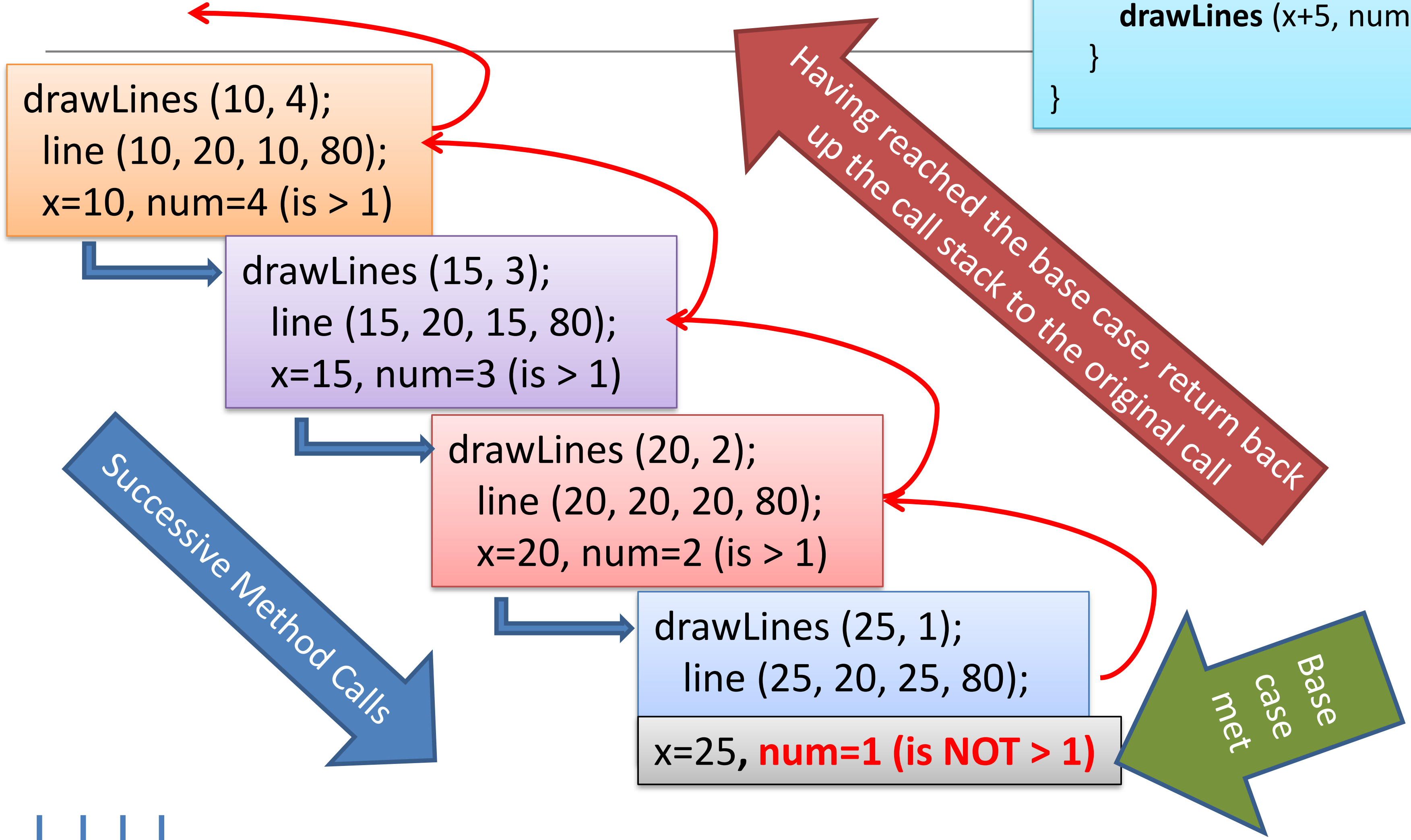
```
void setup()
{
  size(100,100);
  drawLines(10,4);
}
```

```
void drawLines (int x, int num)
{
    line (x, 20, x, 80);
    if (num > 1)
    {
       drawLines (x+5, num-1);
    }
}
```

Source: Reas & Fry (2014)

Example 3.17

```
void drawLines (int x, int num){
    line (x, 20, x, 80);
    if (num > 1)
    {
        drawLines (x+5, num-1);
    }
}
```



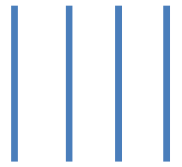
```
drawLines (10, 4);
  line (10, 20, 10, 80);
  x=10, num=4 (is > 1)

drawLines (15, 3);
  line (15, 20, 15, 80);
  x=15, num=3 (is > 1)

drawLines (20, 2);
  line (20, 20, 20, 80);
  x=20, num=2 (is > 1)

drawLines (25, 1);
  line (25, 20, 25, 80);
x=25, num=1 (is NOT > 1)
```

Successive Method Calls
Having reached the base case, return back up the call stack to the original call
Base case met



Source: Reas & Fry (2014)

Summary

1. Method example: **Eyes**
2. Method example: **X's**
3. **Overloading** methods.
4. Method example: Celcius / Farenheit **Converter**.
5. **Recursion**.

Questions?

References

- Reas, C. & Fry, B. (2014) Processing – A Programming Handbook for Visual Designers and Artists, 2nd Edition, MIT Press, London.