# Game of Pong

Overview and starting development

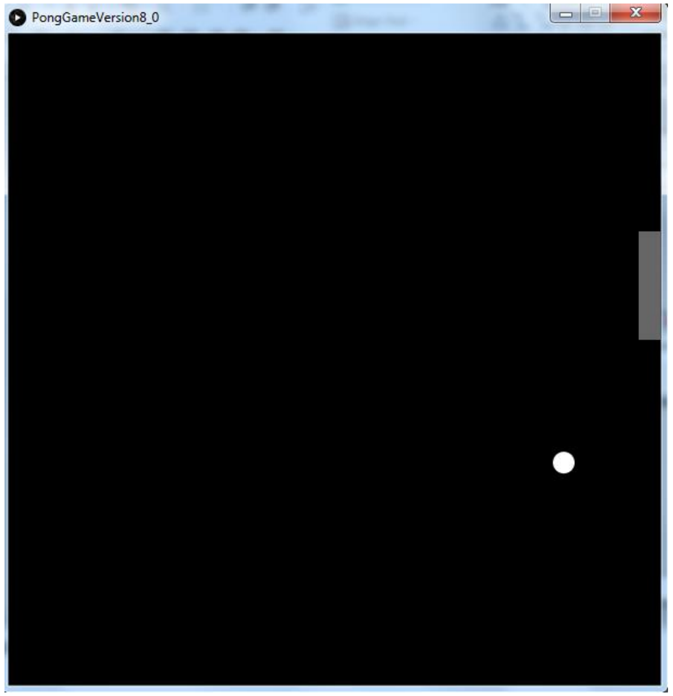
Produced by: Dr. Siobhán Drohan
Ms. Mairead Meagher

Waterford Institute of Technology
INSTITIÚID TEICNEOLAÍOCHTA PHORT LÁIRGE

Department of Computing and Mathematics
http://www.wit.ie/

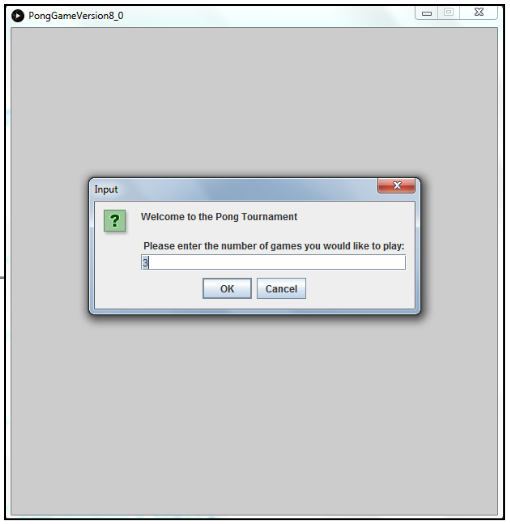
# Topics list - **PONG**

- **Overview** of **PongGame**
- Developing PongGame
  - 9 versions (iterations) described with 4 sets of slides:
  - Set 1
    - V1.0 (Ball class)
    - V2.0 (Paddle class)
  - Set 2
    - V3.0 (Collision detection)
    - V4.0 (Lives lost, lives per game, score)
    - V5.0 (Tournament functionality)
  - Set 3
    - V6.0 (Player class – array, no statistics)
    - V7.0 (Player class – array, with statistics)
    - V8.0 (JOptionPane for I/O)
  - Set 4
    - V9.0 (Advanced Collision Detection)

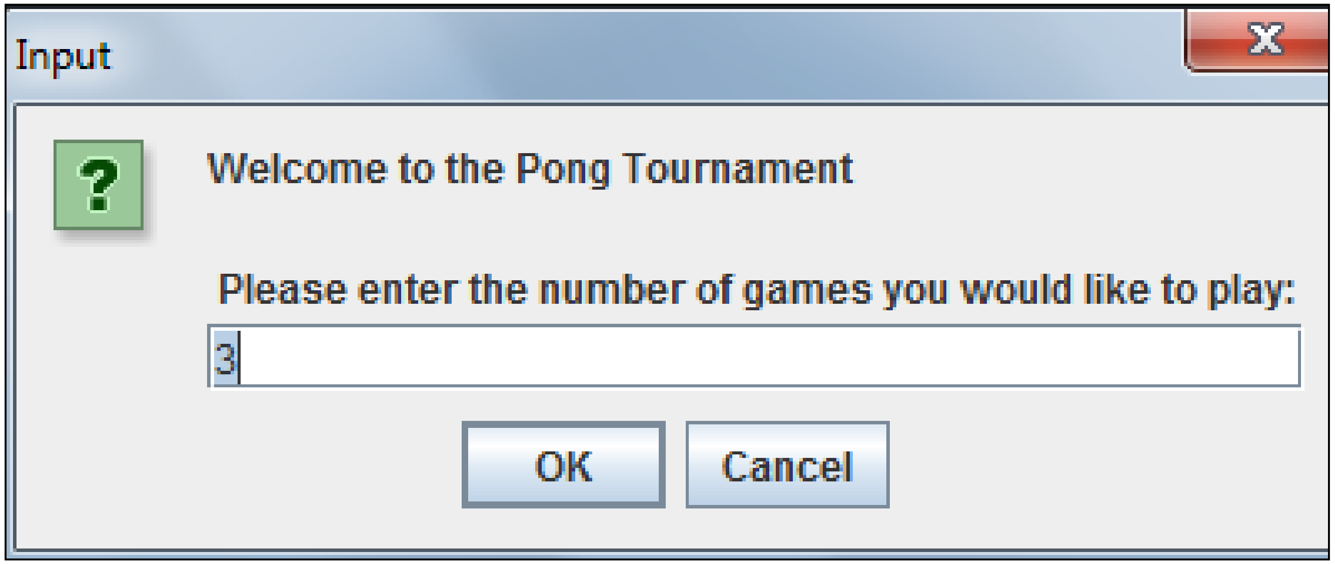


Idea is based on Reas and Fry (2014) example

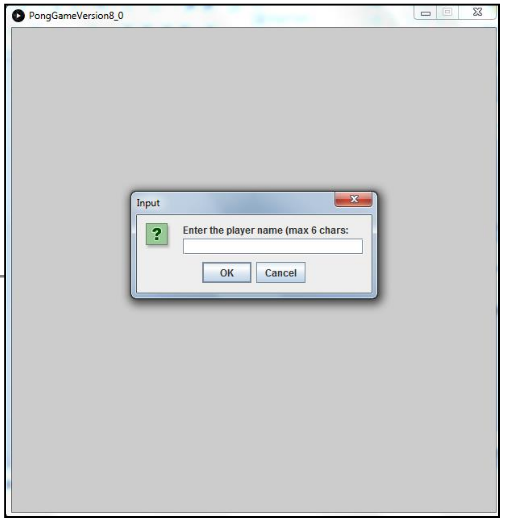
# PongGame - Overview


PongGameVersion8_0
Input
Welcome to the Pong Tournament
Please enter the number of games you would like to play:
3
OK
Cancel

Player decides **the NUMBER OF GAMES** of Pong they would like to play in their **tournament**.


Input
Welcome to the Pong Tournament
Please enter the number of games you would like to play:
3
OK
Cancel

# PongGame - Overview

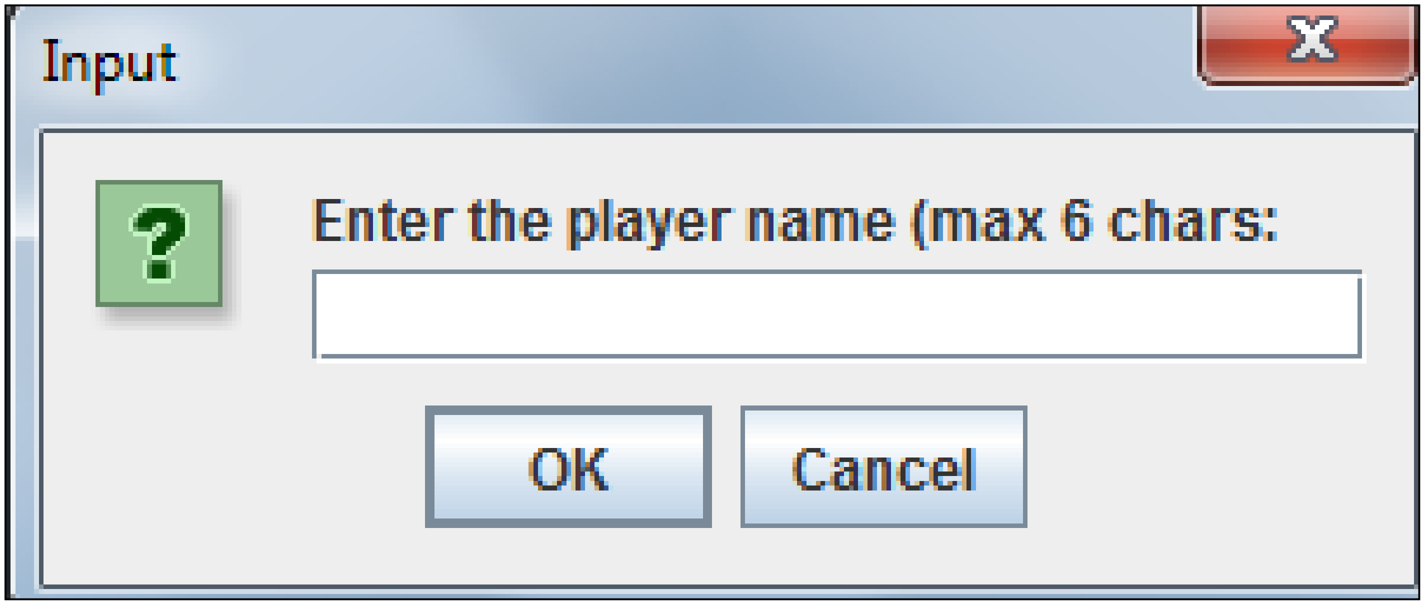

PongGameVersion8_0

Input

Enter the player name (max 6 chars:

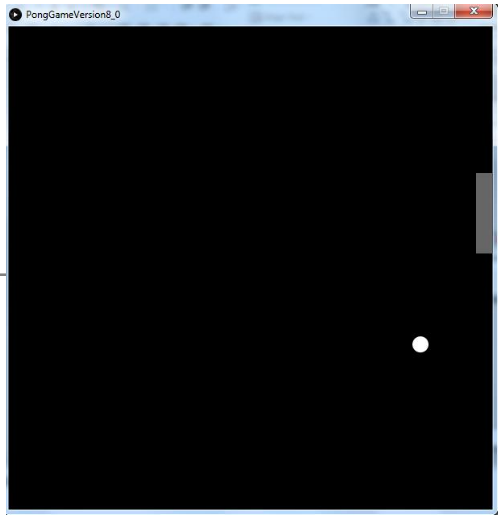
**Enter PLAYER NAME**

**<= 6 chars**, pong **truncates** the String


Input

Enter the player name (max 6 chars:

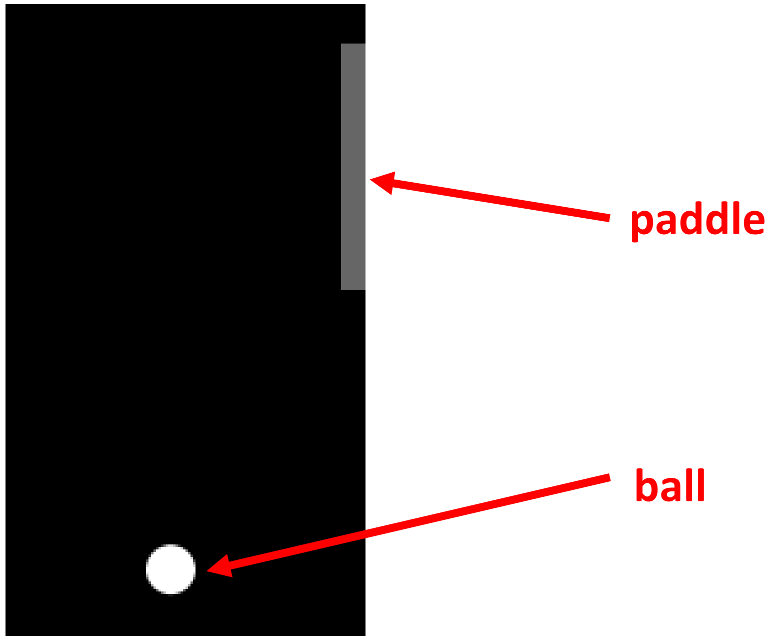
# PongGame - Overview



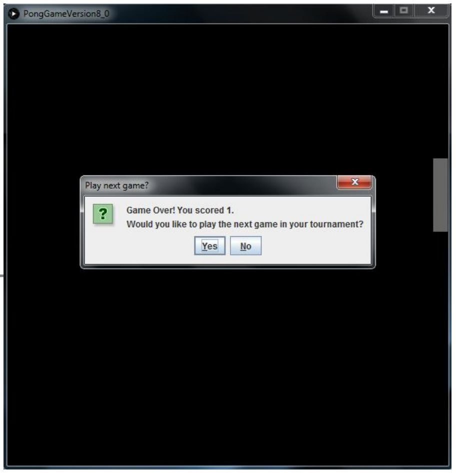
When the ball is **hit** by the paddle
→ **score increased by 1**.

When the paddle **misses** the ball
→ **a life is lost**.

**Number of lives in a game**
→ **3**



# PongGame - Overview

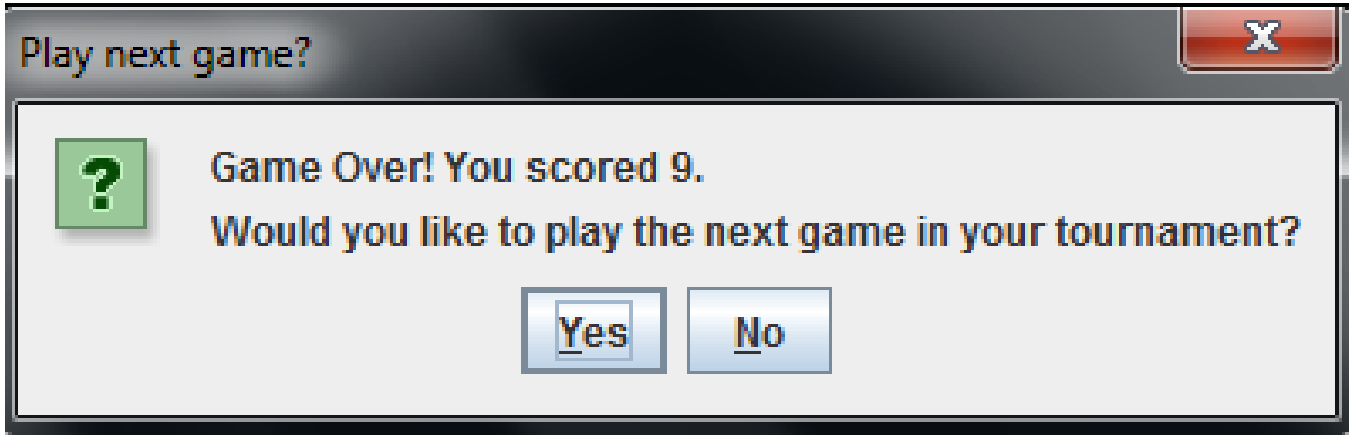

PongGameVersion8_0

Play next game?

Game Over! You scored 1.
Would you like to play the next game in your tournament?

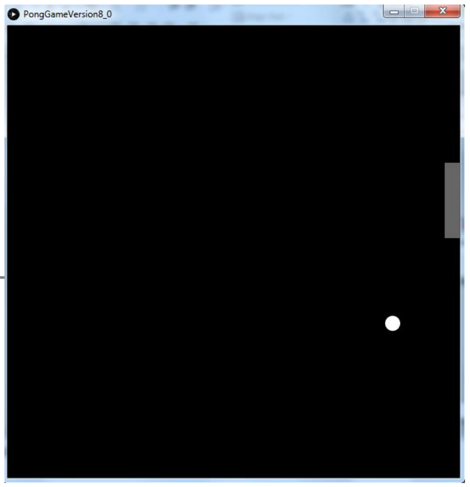
When a **game ends**
and there are more games left to play in the **tournament**:

- **Score is displayed**.
- Player is **asked** if they want to **continue with the tournament**


Play next game?

Game Over! You scored 9.
Would you like to play the next game in your tournament?

# PongGame - Overview



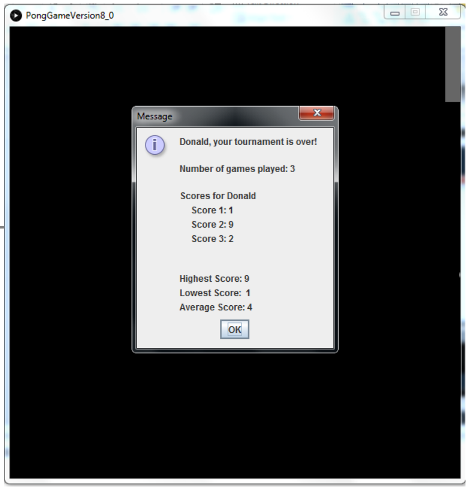
If the player **continues** with the tournament:

- Game **score is stored in an array**.
- A **new game** is started

> - **number of lives lost → 0**
> - **Score → 0**

# PongGame - Overview

When a game ends
and **NO more games are left** in the tournament:


PongGameVersion8_0

Message

Donald, your tournament is over!

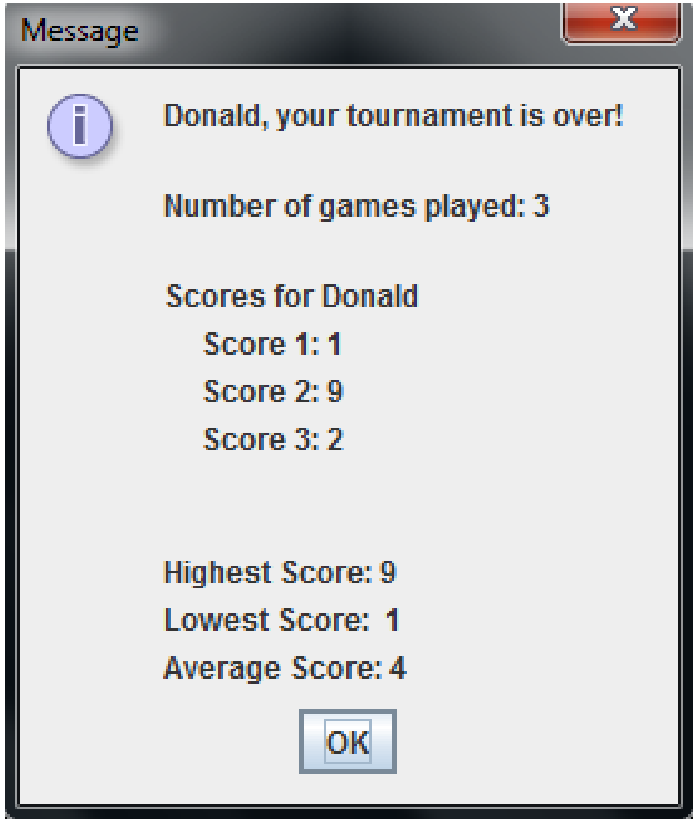
Number of games played: 3

Scores for Donald
Score 1: 1
Score 2: 9
Score 3: 2

Highest Score: 9
Lowest Score: 1
Average Score: 4

OK

- **Display the player name and the number of games played.**
- **For each game in the tournament**
  **Display the score**
- **Display tournament statistics**
  (i.e. highest, lowest and average score).


Message

Donald, your tournament is over!

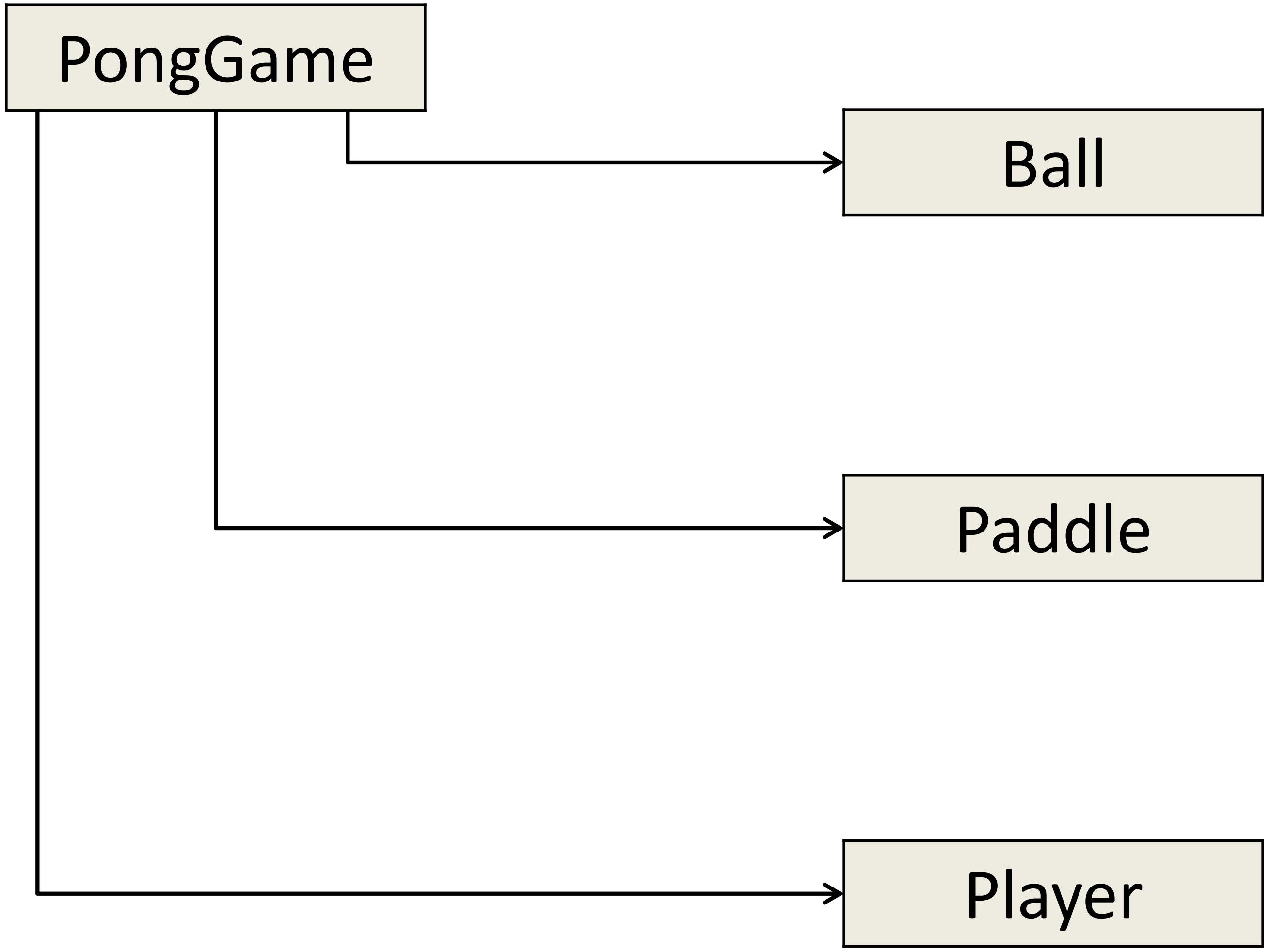
Number of games played: 3

Scores for Donald
Score 1: 1
Score 2: 9
Score 3: 2

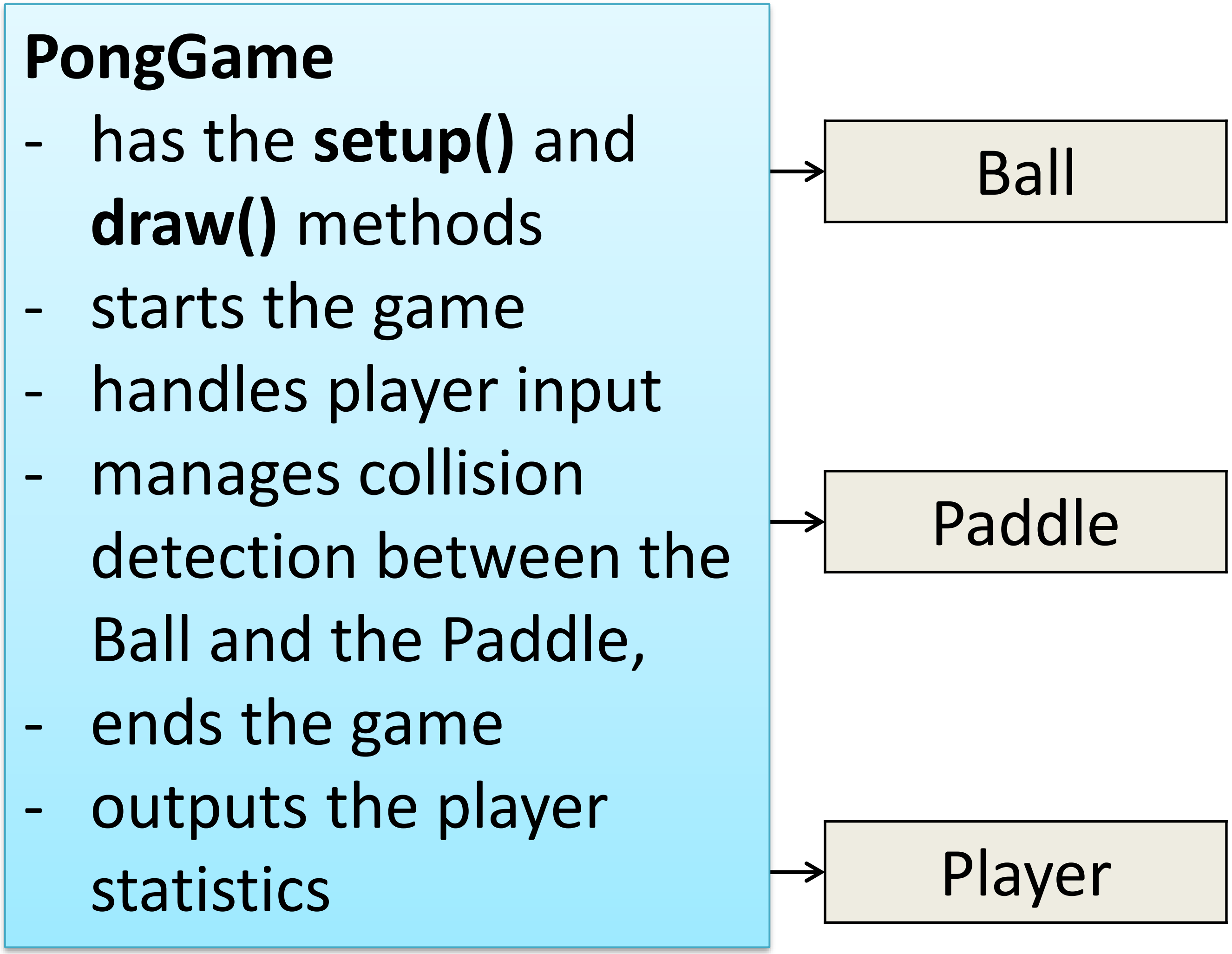
Highest Score: 9
Lowest Score: 1
Average Score: 4

OK

## PongGame - Overview CLASSES



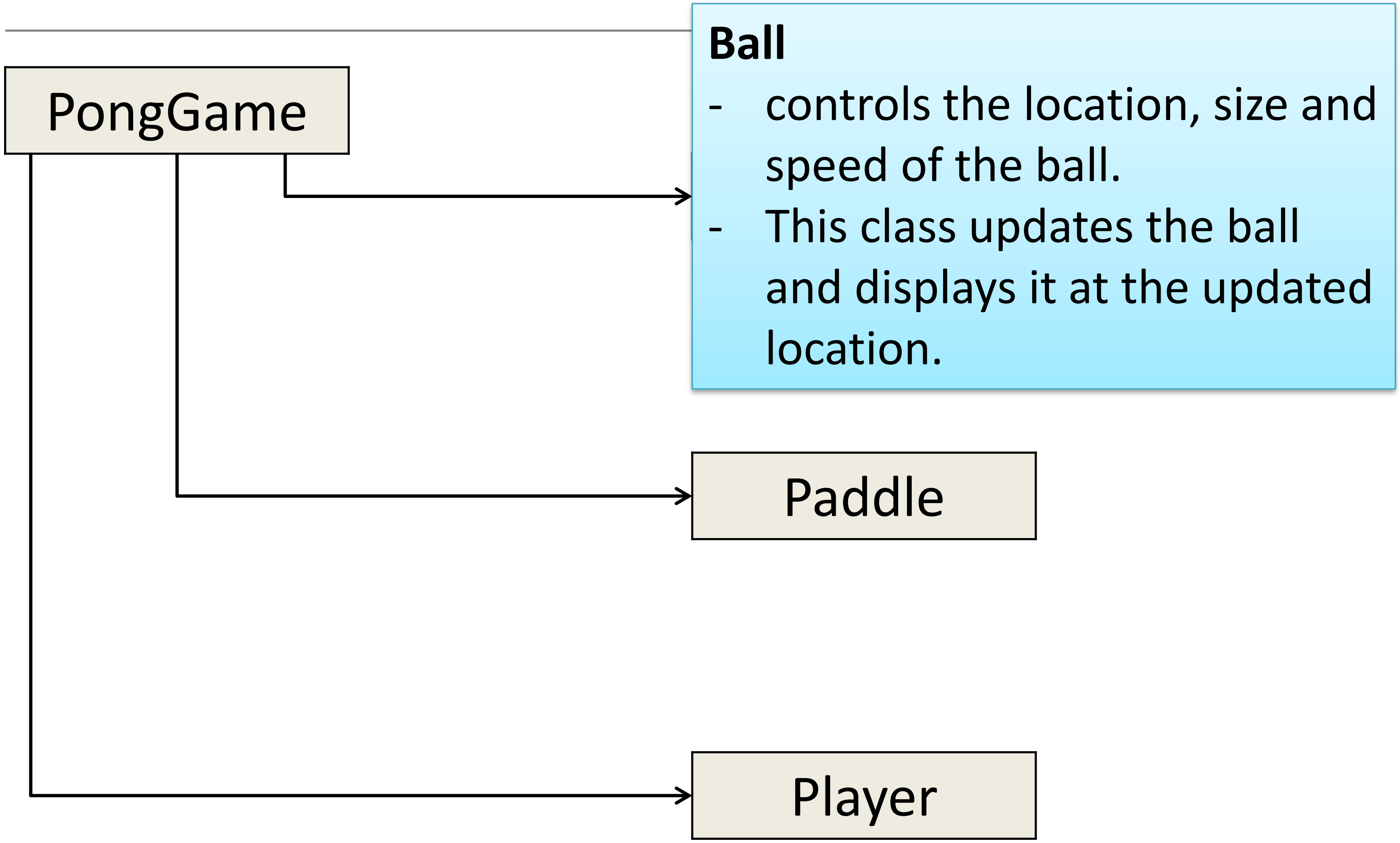
# PongGame - Overview



**PongGame**

- has the **setup()** and **draw()** methods
- starts the game
- handles player input
- manages collision detection between the Ball and the Paddle,
- ends the game
- outputs the player statistics

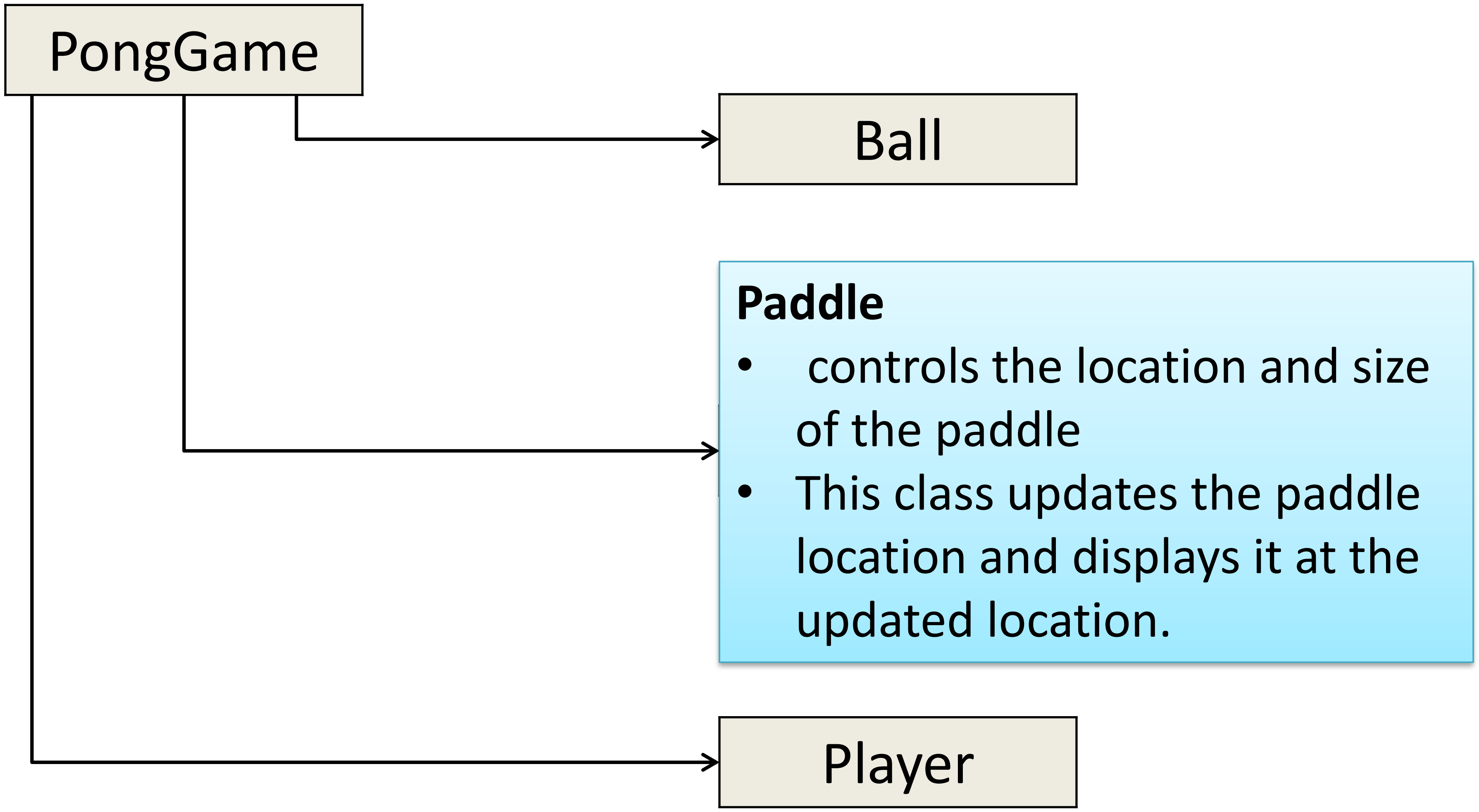
# PongGame - Overview



**Ball**

- controls the location, size and speed of the ball.
- This class updates the ball and displays it at the updated location.

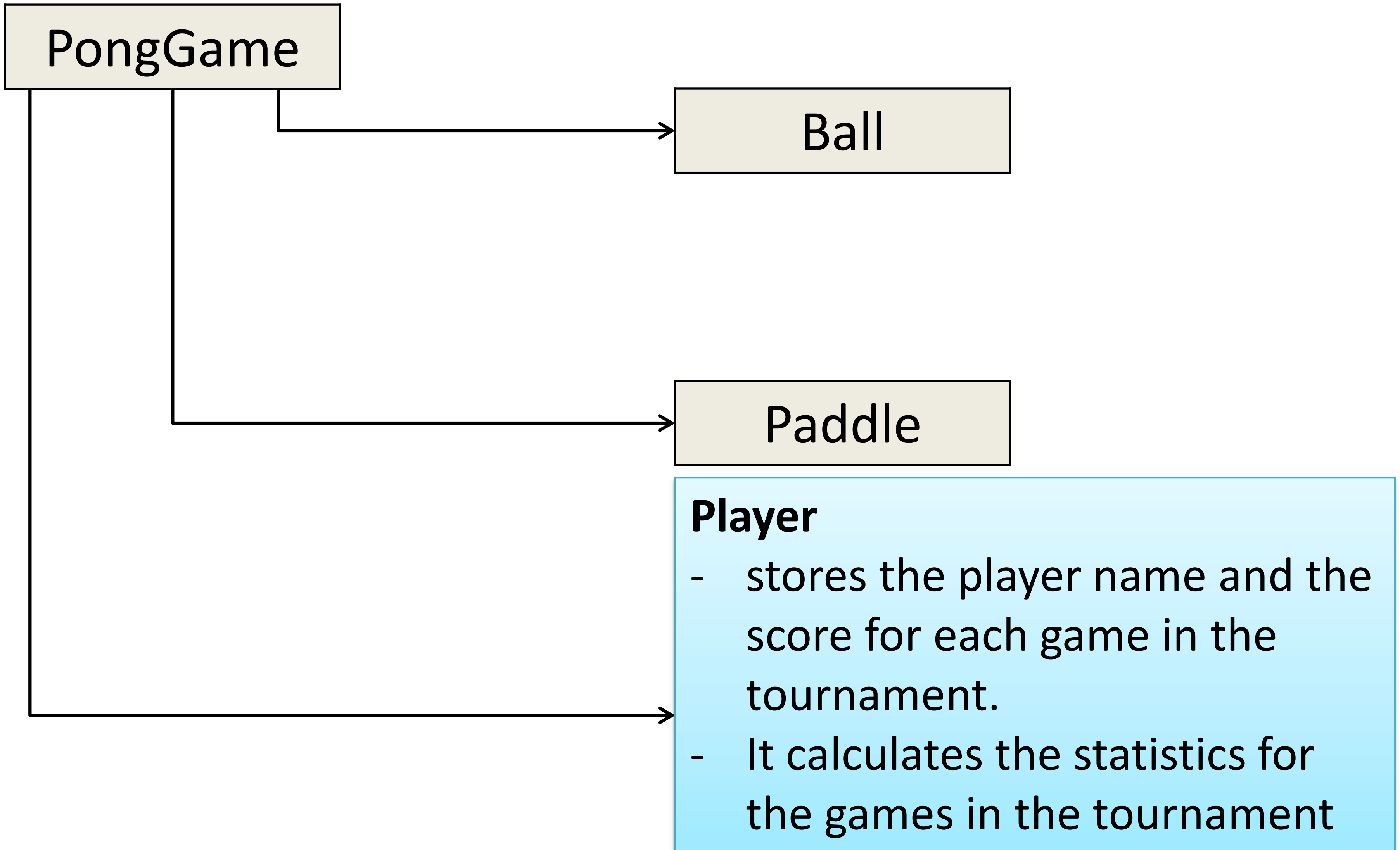
# PongGame - Overview



**Paddle**

- controls the location and size of the paddle
- This class updates the paddle location and displays it at the updated location.

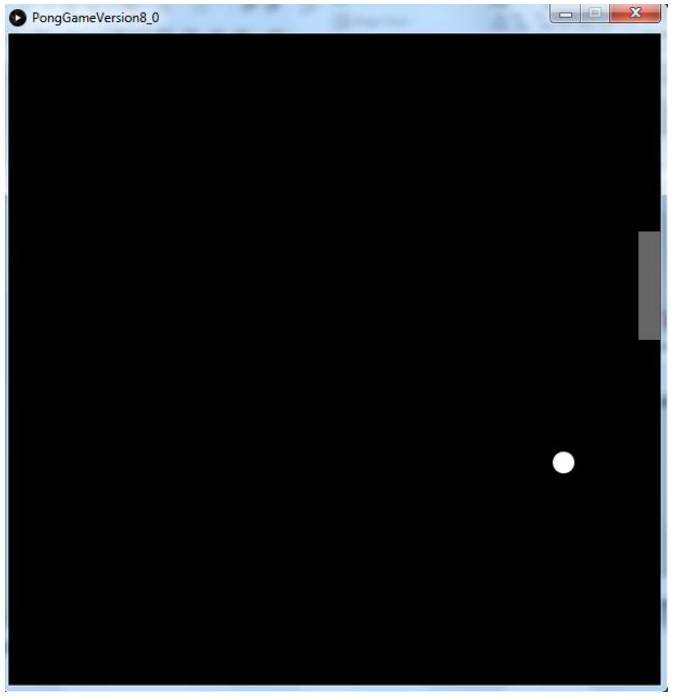
# PongGame - Overview



**Player**
- stores the player name and the score for each game in the tournament.
- It calculates the statistics for the games in the tournament

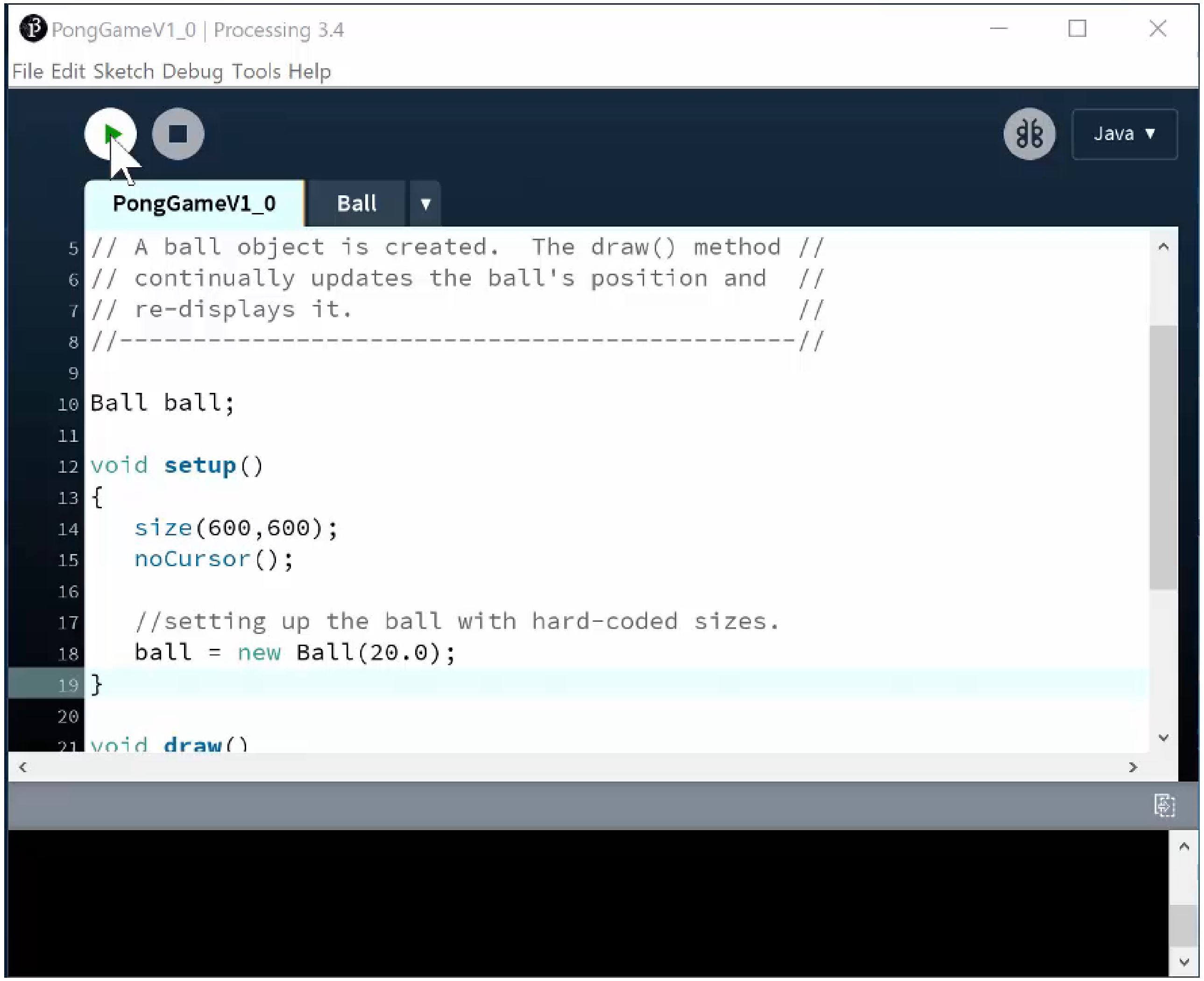
# Topics list - **PONG**

- **Overview** of **PongGame**
- Developing PongGame
  - 9 versions (iterations) described with 4 sets of slides:
  - Set 1
    - V1.0 **(Ball class)**
    - V2.0 (Paddle class)
  - Set 2
    - V3.0 (Collision detection)
    - V4.0 (Lives lost, lives per game, score)
    - V5.0 (Tournament functionality)
  - Set 3
    - V6.0 (Player class – array, no statistics)
    - V7.0 (Player class – array, with statistics)
    - V8.0 (JOptionPane for I/O)
  - Set 4
    - V9.0 (Advanced Collision Detection)



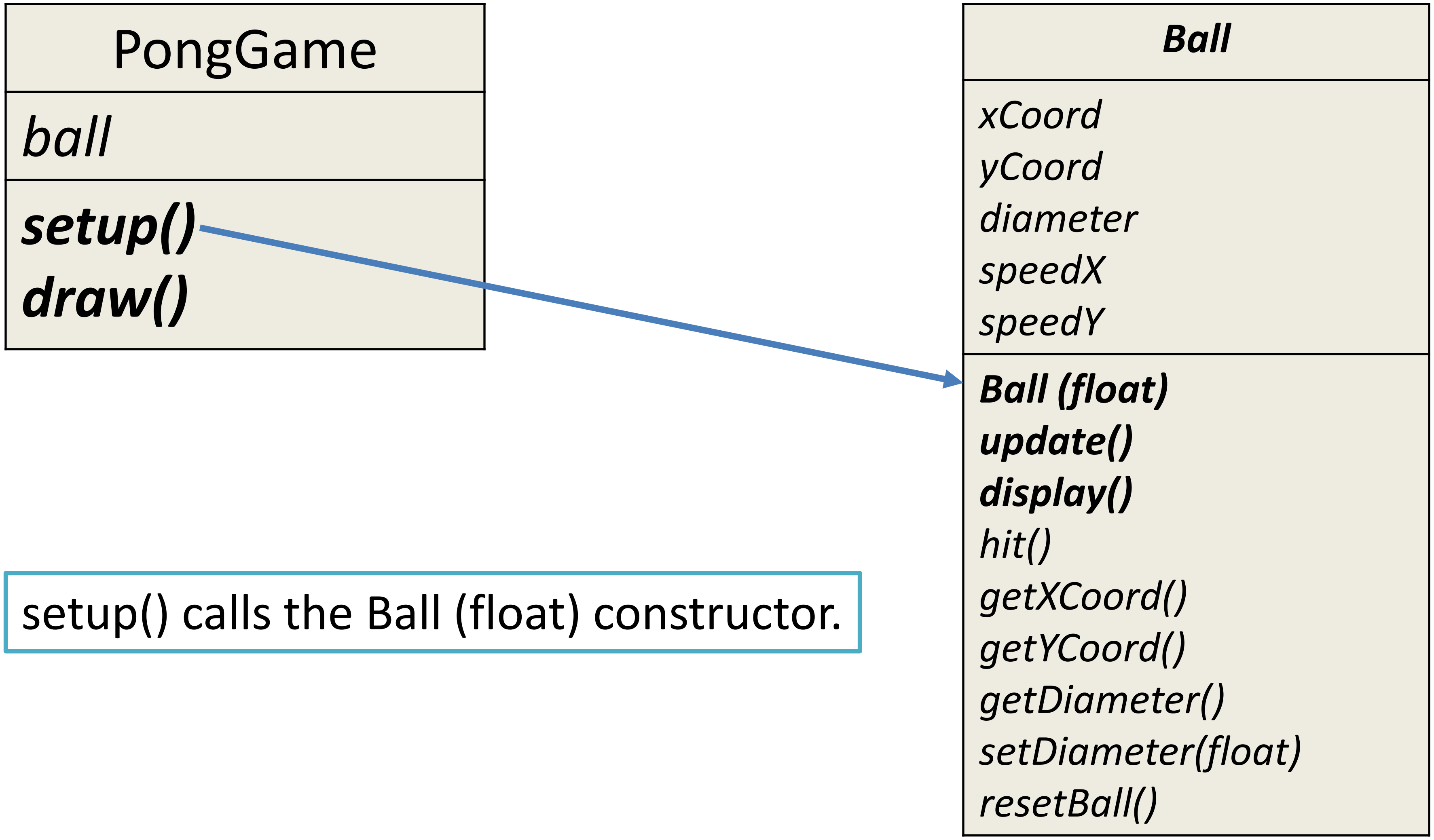
Idea is based on Reas and Fry (2014) example

# Demo of
# Pong Game V1.0


PongGameV1_0 | Processing 3.4
File Edit Sketch Debug Tools Help
Java
PongGameV1_0
Ball

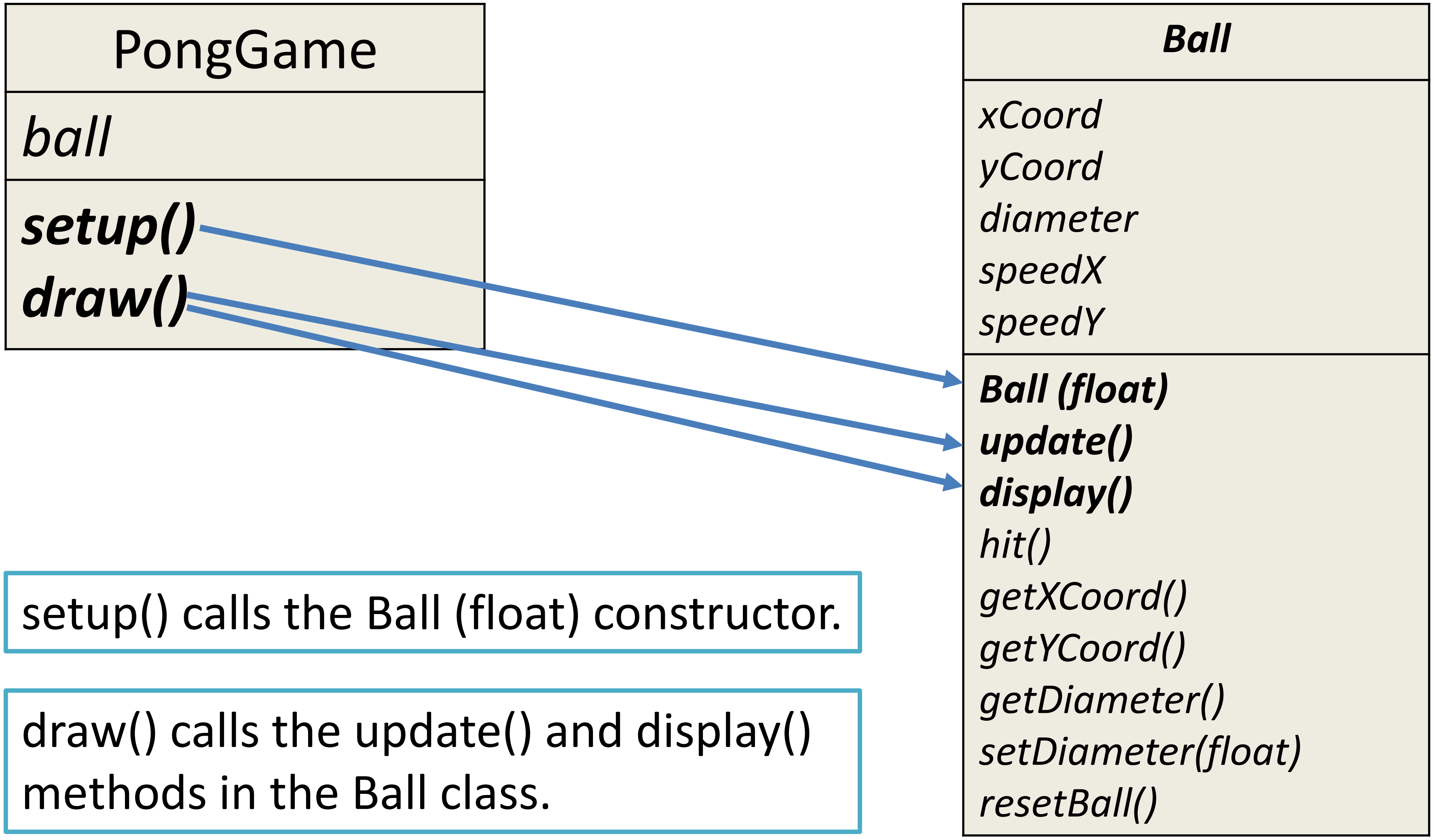
```
// A ball object is created.  The draw() method //
// continually updates the ball's position and  //
// re-displays it.                              //
//----------------------------------------------//

Ball ball;

void setup()
{
   size(600,600);
   noCursor();

   //setting up the ball with hard-coded sizes.
   ball = new Ball(20.0);
}

void draw()
```

## Classes in the PongGameV1.0



setup() calls the Ball (float) constructor.

# Classes in the PongGameV1.0



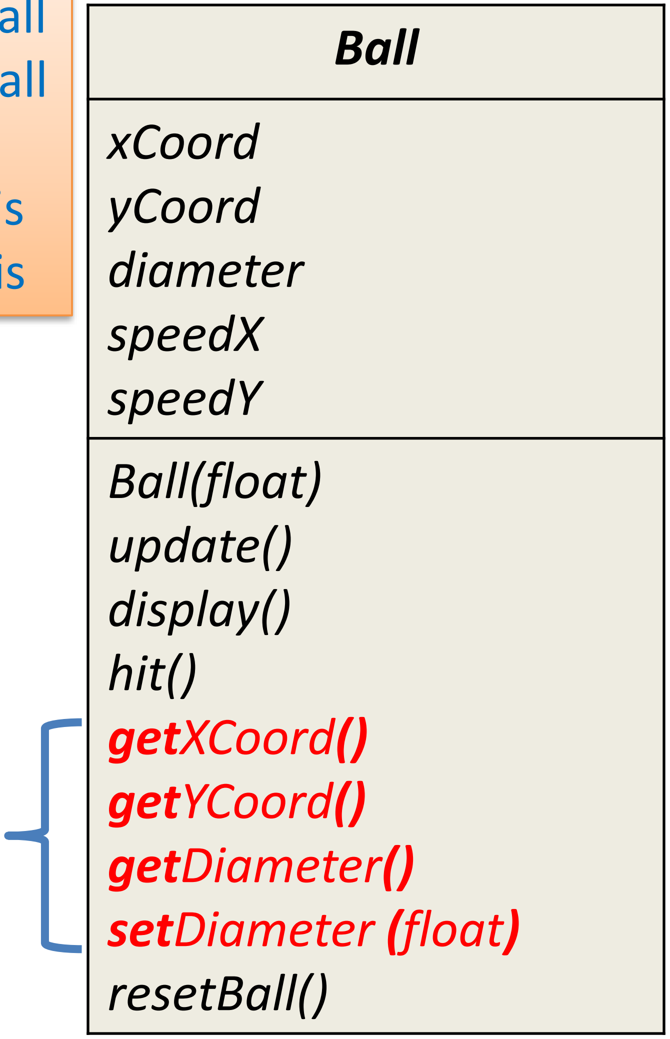
setup() calls the Ball (float) constructor.

draw() calls the update() and display() methods in the Ball class.

# Ball Class – instance **fields**

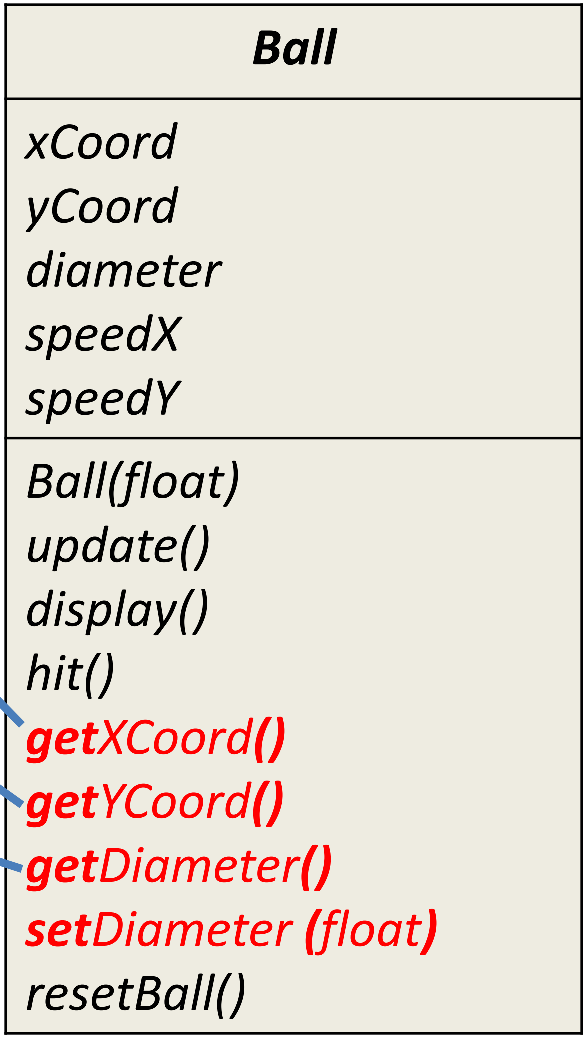
```
private float xCoord;        //x coordinate of the ball
private float yCoord;        //y coordinate of the ball
private float diameter;      //diameter of the ball
private float speedX;        //speed along the x-axis
private float speedY;        //speed along the y-axis
```

**get**ters and **set**ters for the **fields**



## Ball Class – **get**ters

```
public float getXCoord(){
   return xCoord;
}

public float getYCoord(){
   return yCoord;
}

public float getDiameter(){
   return diameter;
}
```



## Ball Class – **setter**

```
public void setDiameter (float diameter){

   //The ball diameter must be between 20 and height/6 (inclusive)
   if ((diameter >= 20) && (diameter <= height/6)){
     this.diameter = diameter;
   }
   else {
    // If an invalid diameter is passed as a parameter, a default of 20 is imposed.
    // With this animation, if we do not supply a default value for the diameter,
    // a ball may not be drawn on the display window.
    // Important note:
    // it is not always appropriate to provide a default value at setter) level;
    // this will depend on your design.
     this.diameter = 20;
   }
 }
```

**VALIDATION**

**INITIALISATION**

# Ball Class – **display()** method

```
public void display(){
  fill(255);
  noStroke();
  ellipse(xCoord, yCoord, diameter, diameter);
}
```

| ***Ball*** |
|---|
| *xCoord*<br>*yCoord*<br>*diameter*<br>*speedX*<br>*speedY* |
| *Ball(float)*<br>*update()*<br>***display()***<br>*hit()*<br>*getXCoord()*<br>*getYCoord()*<br>*getDiameter()*<br>*setDiameter(float)*<br>*resetBall()* |

Draws a white ball,
with no outline
on the display window.

# private helper method – resetBall()

```
private void resetBall(){
   xCoord = 0;
   yCoord = random(height);
   speedX = random(3, 5);
   speedY = random(-2, 2);
}
```

The **resetBall** method is used by
the **Ball** constructor and the **update** method.

private helper method
→ **private** to the class you are in

i.e. can't use it outside of the current class.

| ***Ball*** |
|---|
| *xCoord*<br>*yCoord*<br>*diameter*<br>*speedX*<br>*speedY* |
| ***Ball(float)***<br>***update()***<br>*display()*<br>*hit()*<br>*getXCoord()*<br>*getYCoord()*<br>*getDiameter()*<br>*setDiameter(float)*<br>***resetBall()*** |

# A note on **random()**

```
private void resetBall(){
  xCoord = 0;
  yCoord = random (height);
  speedX = random (3, 5);
  speedY = random (-2, 2);
}
```

**random (high)**

returns a random float between **zero** (inclusive) and high (exclusive).

**random (low, high)**

returns a random float between **low** (inclusive) and high (exclusive).

# Ball Class – Ball constructor

```
public Ball (float diameter){
    setDiameter(diameter);
    resetBall();
}
```

Constructor takes in the diameter of the ball and uses the **setDiameter** *setter method* to update the diameter instance field.

*private helper method* **resetBall** is called to set up the xCoord with zero and yCoord, speedX and speedY with random values

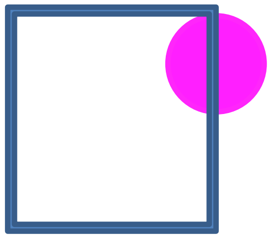
***Ball***

*xCoord*
*yCoord*
*diameter*
*speedX*
*speedY*

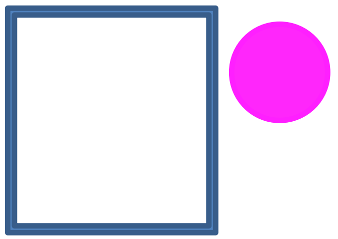
***Ball (float)***
*update()*
*display()*
*hit()*
*getXCoord()*
*getYCoord()*
*getDiameter()*
***setDiameter** (float)*
***resetBall** ()*

# Recap – Drawing Modes: **ellipse**

- The default ellipse mode is CENTER
  - This means x & y positions for ellipse() specify the **center** of the ellipse
  - At the max width of the window, half the ellipse is seen



  - If we specify an x value > width + radius of the circle the circle has left the screen



# **update()** method

**update()** changes the ball position.

if the ball…

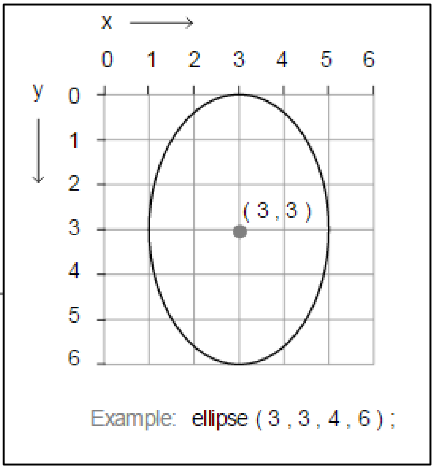
goes **off the screen**
return *true* (i.e. a life was lost)

hits the **left edge**
Change **xCoord** direction

hits the **top or bottom**
Change **yCoord** direction

```
public boolean update(){

  boolean lifeLost = false;

  //update ball coordinates
  xCoord = xCoord + speedX;
  yCoord = yCoord + speedY;

  //reset position if ball leaves the screen
  if (xCoord > width + diameter/2){
    resetBall();
    lifeLost = true;
  }
  // If ball hits the left edge of the display
  // window, change direction of xCoord
  if (xCoord < diameter/2)
    xCoord = diameter/2;
    speedX = speedX * -1;
  }

  // If ball hits top or bottom of the display
  //  window, change direction of yCoord
  if (yCoord > height - diameter/2){
    yCoord = height - diameter/2;
    speedY = speedY * -1;
  }
  else if (yCoord < diameter/2){
    yCoord = diameter/2;
    speedY = speedY * -1;
  }
  return lifeLost;
}
```

# **update()** – explained 1

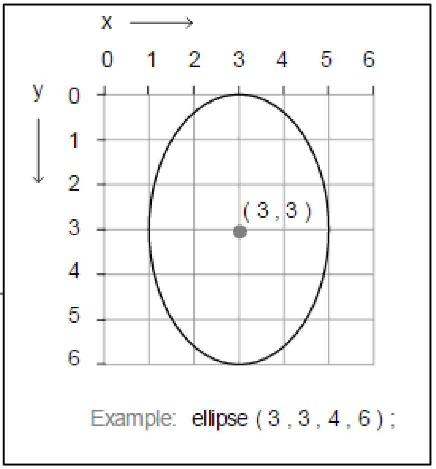


```
//reset position if ball leaves the screen
if (xCoord > width + diameter/2){
   resetBall();
   lifeLost = true;
}
```

**(width + diameter/2)**

In this check, we add diameter/2 *(i.e. the radius)*
onto the width of the window
so that the ball is completely off the screen
because the x,y values specify the CENTER of the circle

## **update()** – explained 2

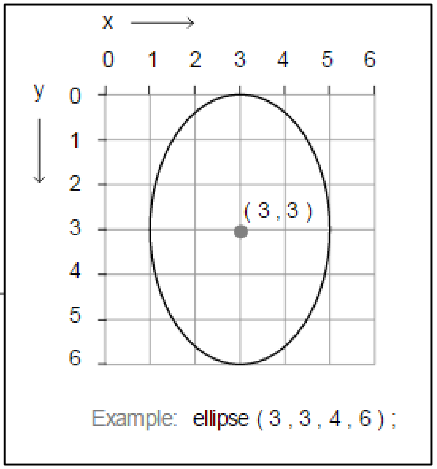


```
// If ball hits the left edge of the display
// window, change direction of xCoord
if (xCoord < diameter/2)
   xCoord = diameter/2;
   speedX = speedX * -1;
}
```

If the **xCoord** is less than the radius of the circle,
the circle has hit the left side

→ reset the xCoord to the radius of the circle
and reverse the speedX variable by multiplying by -1.

# **update()** – explained 3



```
// If ball hits top or bottom of the display
//  window, change direction of yCoord
if (yCoord > height - diameter/2){
   yCoord = height - diameter/2;
   speedY = speedY * -1;
}
else if (yCoord < diameter/2){
   yCoord = diameter/2;
   speedY = speedY * -1;
}
```

The **yCoord** is investigated to see if the ***top*** or ***bottom*** of the screen was hit.

(yCoord < diameter/2)

(yCoord > height - diameter/2)

# **hit()** method

```
public void hit (){
    speedX = speedX * -1;
    xCoord = xCoord + speedX;
}
```

We're not using this method in this version of Pong.

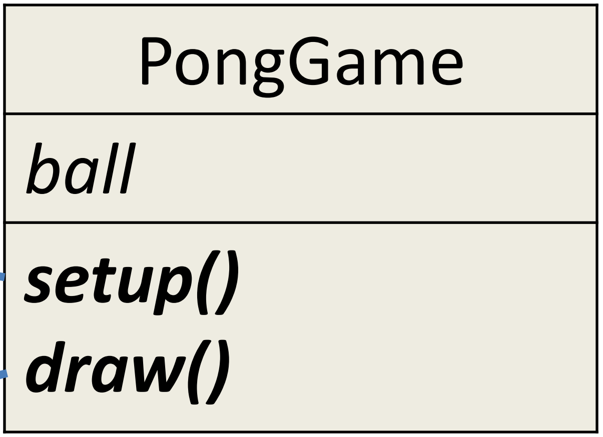
We're preparing our class for **collision detection** in V3.0.

This method **changes the ball direction** when it hits the paddle.
It **bumps it back to the edge of the paddle.**

| ***Ball*** |
|---|
| *xCoord*<br>*yCoord*<br>*diameter*<br>*speedX*<br>*speedY* |
| *Ball(float)*<br>*update()*<br>*display()*<br>***hit()***<br>*getXCoord()*<br>*getYCoord()*<br>*getDiameter()*<br>*setDiameter(float)*<br>*resetBall()* |

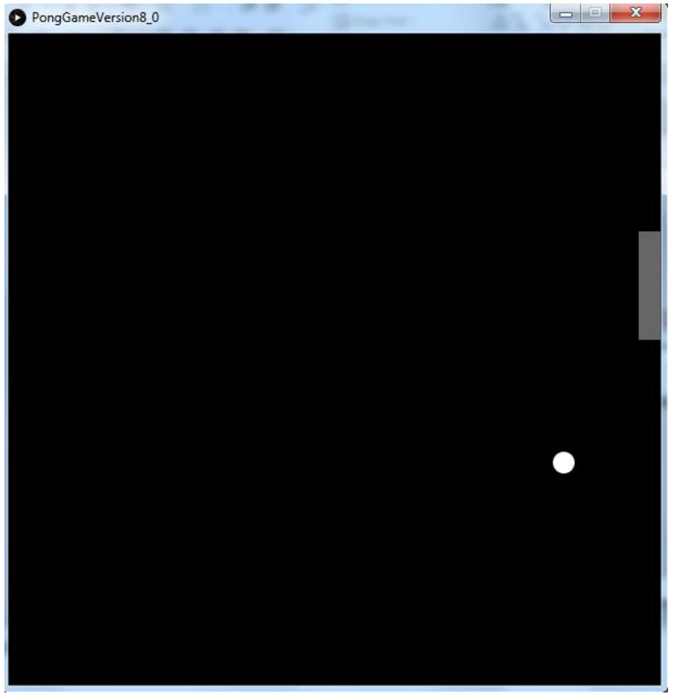
# PongGame **V1.0**

```
Ball ball;

void setup() {
  size(600,600);
  noCursor();
  //setting up the ball with hard-coded sizes.
  ball = new Ball(20.0);
}

void draw() {
  background(0);
  //Update the ball position and display it.
  ball.update();
  ball.display();
}
```



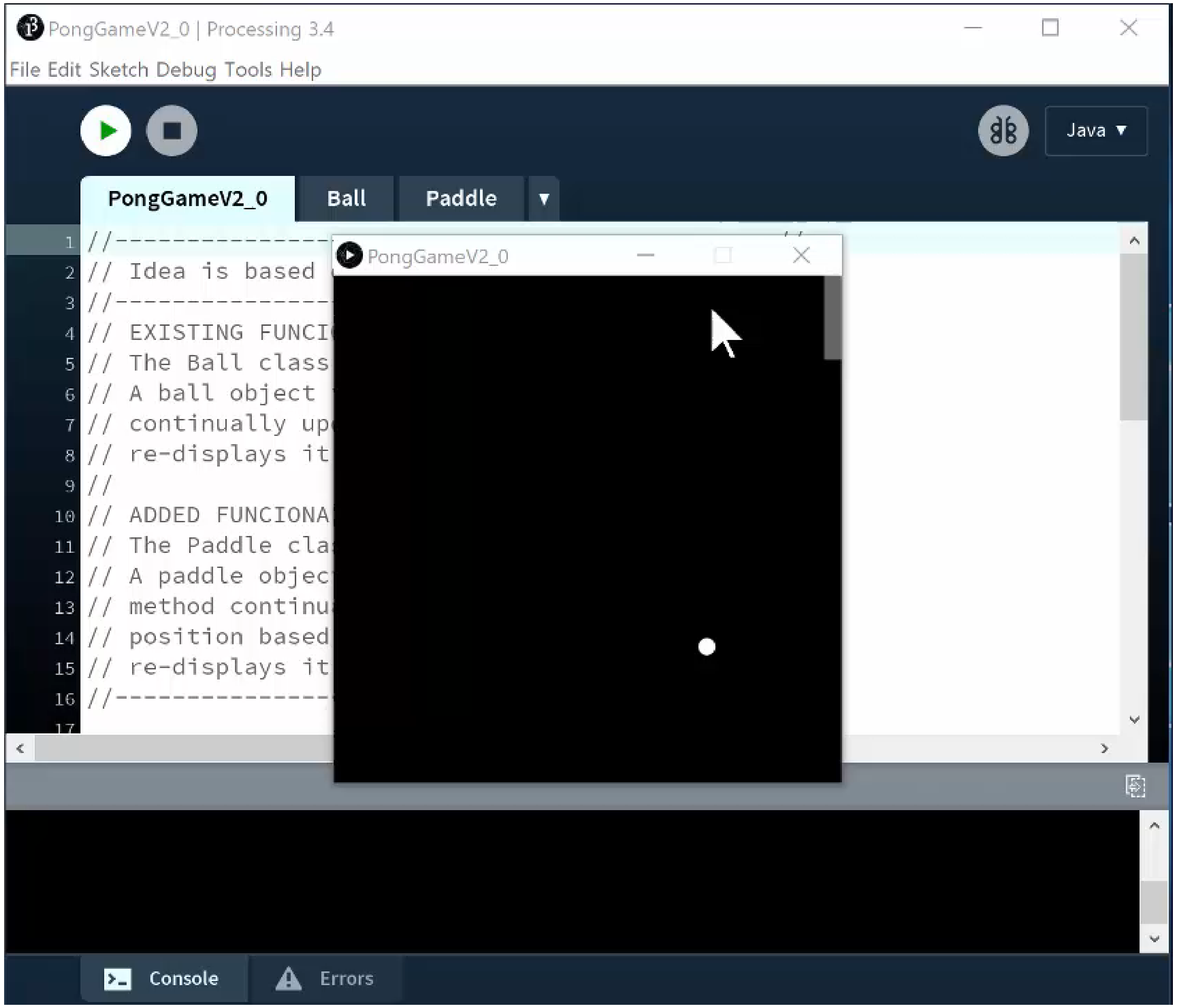
## Topics list - **PONG**

- **Overview** of **PongGame**
- Developing PongGame
  - 9 versions (iterations) described with 4 sets of slides:
  - Set 1
    - V1.0 (Ball class)
    - V2.0 (Paddle class)
  - Set 2
    - V3.0 (Collision detection)
    - V4.0 (Lives lost, lives per game, score)
    - V5.0 (Tournament functionality)
  - Set 3
    - V6.0 (Player class – array, no statistics)
    - V7.0 (Player class – array, with statistics)
    - V8.0 (JOptionPane for I/O)
  - Set 4
    - V9.0 (Advanced Collision Detection)



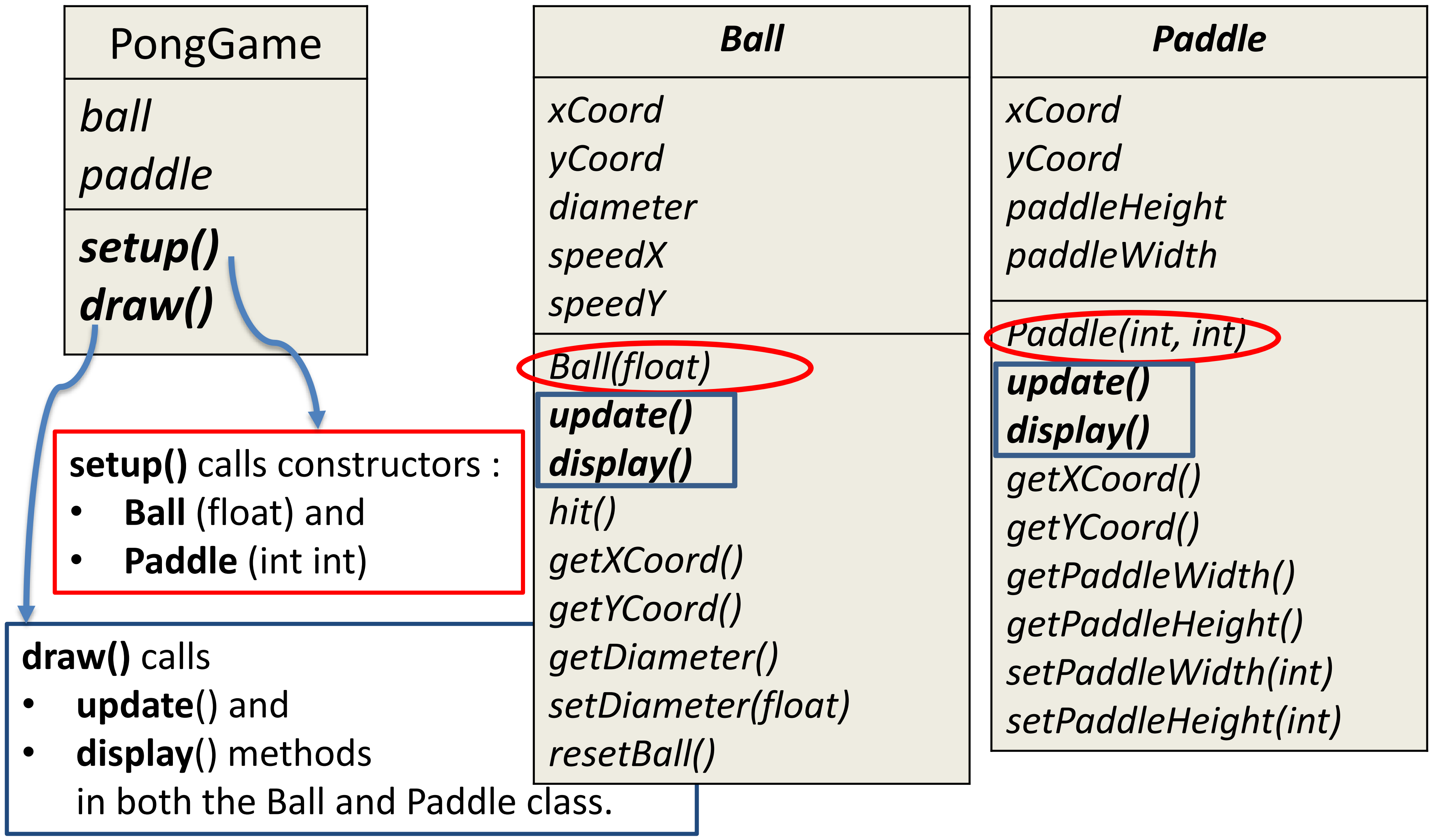
Idea is based on Reas and Fry (2014) example

# Demo of
# Pong Game V2.0


PongGameV2_0 | Processing 3.4
File Edit Sketch Debug Tools Help
Java
PongGameV2_0
Ball
Paddle
PongGameV2_0
Console
Errors

```
//---------------
// Idea is based
//---------------
// EXISTING FUNCI
// The Ball class
// A ball object
// continually up
// re-displays it
//
// ADDED FUNCIONA
// The Paddle cla
// A paddle objec
// method continu
// position based
// re-displays it
//---------------
```

# Classes in the PongGameV2.0



**setup()** calls constructors :
- **Ball** (float) and
- **Paddle** (int int)

**draw()** calls
- **update**() and
- **display**() methods

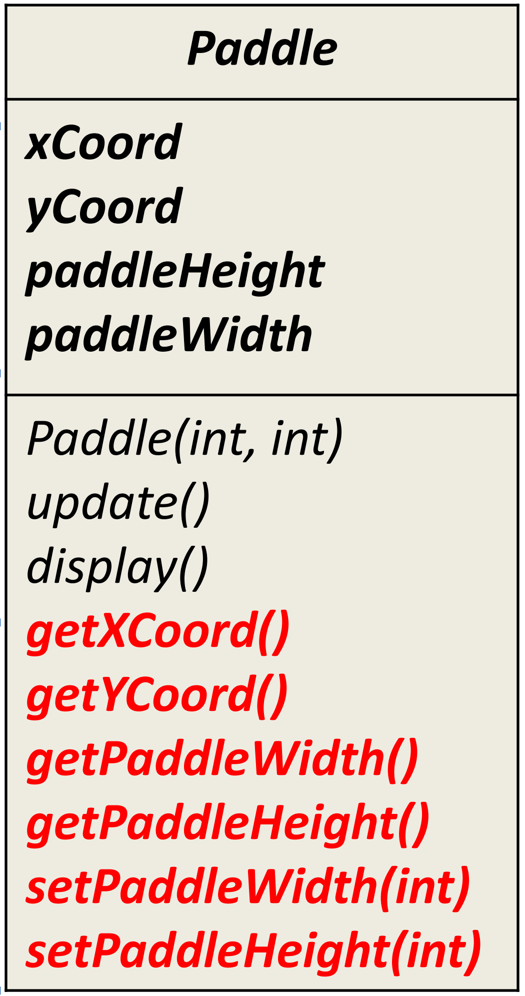
in both the Ball and Paddle class.

## **Paddle** Class – instance **fields**

```
private int xCoord;          // X coordinate of the paddle
private int yCoord;          // Y coordinate of the paddle
private int paddleWidth;     // width of the paddle
private int paddleHeight;    // height of the paddle
```

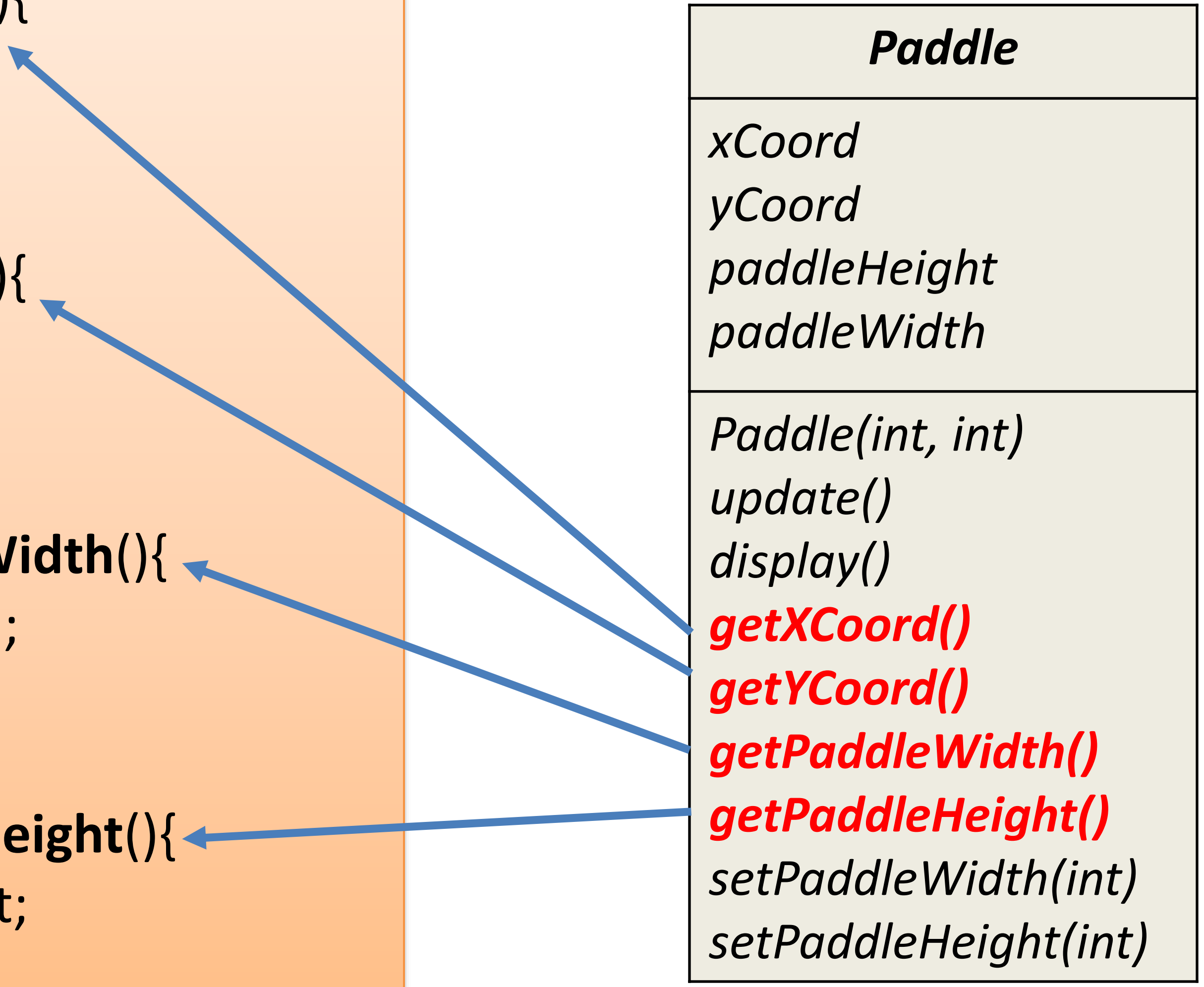
**Fields** – made private

**get**ters and **set**ters for the private **fields**



# Paddle Class – **getters**

```java
public int getXCoord(){
   return xCoord;
}

public int getYCoord(){
   return yCoord;
}

public int getPaddleWidth(){
   return paddleWidth;
}

public int getPaddleHeight(){
   return paddleHeight;
}
```



# Paddle Class – **setters**

## **setPaddleWidth**(int)

```
public void setPaddleWidth (int paddleWidth){
   //The paddle width must be
   // between 10 and width/2 (inclusive)
   if ((paddleWidth >= 20) && (paddleWidth <= width/2)){
      this.paddleWidth = paddleWidth;
   }
   else{
   // If an invalid width is passed as a parameter, a default
   // width of 20 is imposed.  With this animation, if we do
   // not supply a default value for the width, a paddle
   //may not be drawn on the display window.  Important
   // note: it is not always appropriate to provide a default
   // value at setter level; this will depend on your
   //design.
      this.paddleWidth = 20;
   }
}
```

| ***Paddle*** |
|---|
| *xCoord*<br>*yCoord*<br>*paddleHeight*<br>*paddleWidth* |
| *Paddle(int, int)*<br>*update()*<br>*display()*<br>*getXCoord()*<br>*getYCoord()*<br>*getPaddleWidth()*<br>*getPaddleHeight()*<br>***setPaddleWidth(int)***<br>*setPaddleHeight(int)* |

## Paddle Class – **setters**

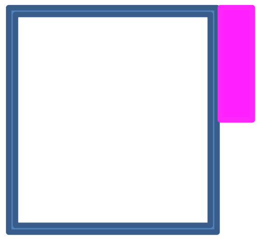
## **setPaddleHeight**(int)

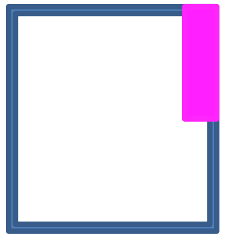
```
public void setPaddleHeight (int paddleHeight){
    // The paddle height must be
    // between 50 and height/2 (inclusive)
    if ((paddleHeight >= 50) && (paddleHeight <= height/2)){
        this.paddleHeight = paddleHeight;
    }
    else{
    // If an invalid height is passed as a parameter, a default
    // height of 50 is imposed.  With this animation, if we do
    // not supply a default value for the height, a paddle
    // may not be drawn on the display window.  Important
    // note: it is not always appropriate to provide a default
    // value at setter level; this will depend on your design.
        this.paddleHeight = 50;
    }
  }
```

| ***Paddle*** |
|---|
| *xCoord*<br>*yCoord*<br>*paddleHeight*<br>*paddleWidth* |
| *Paddle(int, int)*<br>*update()*<br>*display()*<br>*getXCoord()*<br>*getYCoord()*<br>*getPaddleWidth()*<br>*getPaddleHeight()*<br>*setPaddleWidth(int)*<br>***setPaddleHeight(int)*** |

# Recap – Drawing Modes: **rect**

- The default rect mode is CORNER
  - This means x & y positions for rect() specify the **top left CORNER** of the rectangle
  - At the max width of the window, the rectangle would be invisible
  - If we specify an x value which is the width of the screen – width of the rectangle it will be seen





# Paddle constructor

```
public Paddle (int paddleWidth, int paddleHeight)
{
    setPaddleWidth (paddleWidth);
    setPaddleHeight (paddleHeight);

    // the xCoordinate variable is set here and it stays
    // this value for duration of the program.
    xCoord = width - this.paddleWidth;

    // the yCoordinate variable is set here and changes
    // later in the program as the mouse moves on the
    // vertical plane.
    yCoord = height/2;
 }
```

| ***Paddle*** |
|---|
| *xCoord*<br>*yCoord*<br>*paddleHeight*<br>*paddleWidth* |
| ***Paddle(int, int)***<br>*update()*<br>*display()*<br>*getXCoord()*<br>*getYCoord()*<br>*getPaddleWidth()*<br>*getPaddleHeight()*<br>*setPaddleWidth(int)*<br>*setPaddleHeight(int)* |

## **display()** method

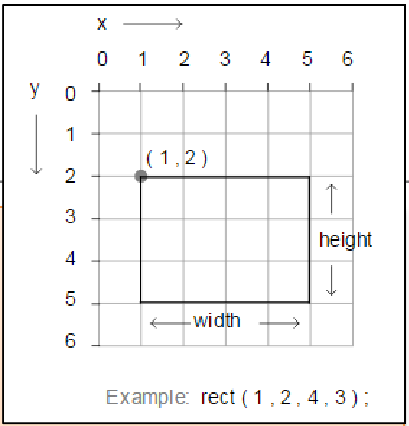
```
public void display() {
  fill(102);
  noStroke();
  rect(xCoord, yCoord, paddleWidth, paddleHeight);
}
```

| ***Paddle*** |
|---|
| *xCoord*<br>*yCoord*<br>*paddleHeight*<br>*paddleWidth* |
| *Paddle(int, int)*<br>*update()*<br>***display()***<br>*getXCoord()*<br>*getYCoord()*<br>*getPaddleWidth()*<br>*getPaddleHeight()*<br>*setPaddleWidth(int)*<br>*setPaddleHeight(int)* |

Draws a gray paddle,
with no outline on the display window.

## update() method

```
public void update()
{
  yCoord = mouseY - paddleHeight/2;

  //Reset yCoord if it's outside the window coordinates.
  if (yCoord < 0){
      yCoord = 0;
   }
   if (yCoord > (height - paddleHeight)){
      yCoord = height - paddleHeight;
   }
}
```



changes the vertical position of the paddle in line with the cursor.

| ***Paddle*** |
|---|
| *xCoord*<br>*yCoord*<br>*paddleHeight*<br>*paddleWidth* |
| *Paddle(int, int)*<br>***update()***<br>*display()*<br>*getXCoord()*<br>*getYCoord()*<br>*getPaddleWidth()*<br>*getPaddleHeight()*<br>*setPaddleWidth(int)*<br>*setPaddleHeight(int)* |

# PongGame V2.0

```
Ball ball;
Paddle paddle;

void setup(){
  size(600,600);
  noCursor();
  //setting up ball and paddle with hard-coded sizes.
  ball = new Ball(20.0);
  paddle = new Paddle(20,100);
}

void draw(){
  background(0);
  //Update the paddle location in line with the cursor
  paddle.update();
  paddle.display();
  //Update the ball position and display it.
  ball.update();
  ball.display();
}
```

| PongGame |
|---|
| *Ball* <br> *paddle* |
| ***setup()*** <br> ***draw()*** |

Create Ball & Paddle objects.

Call their update() & display() methods in draw()

# Questions?

## References

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