Game of Pong

Overview and starting development

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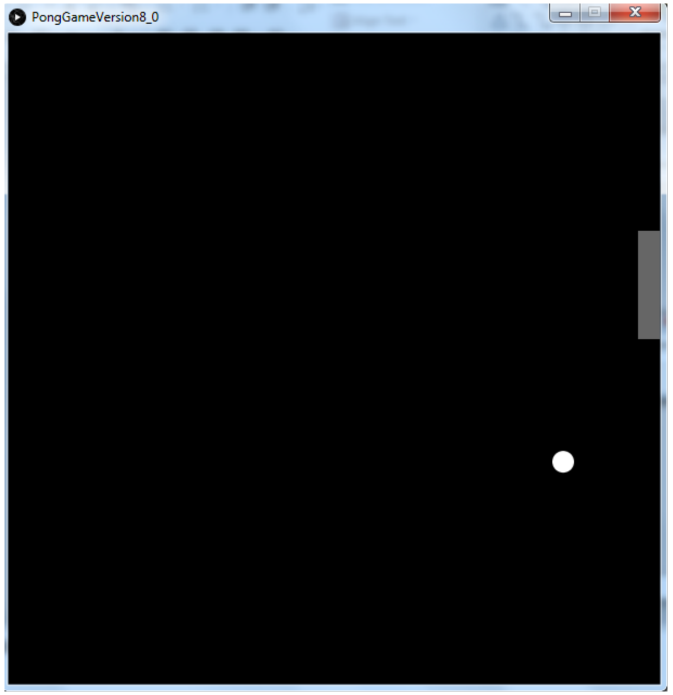
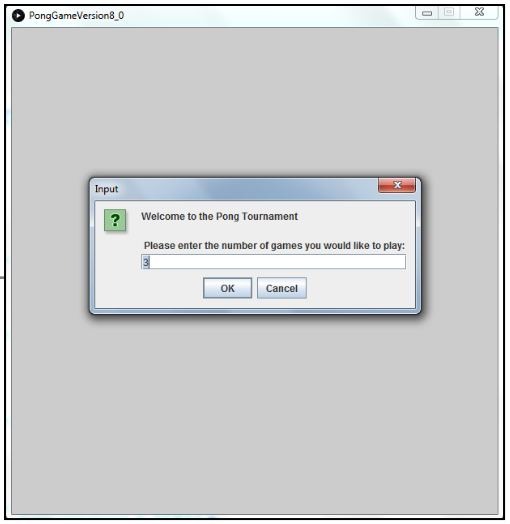
Topics list - **PONG**

- **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 (JOptionPane for I/O)



Idea is based on Reas and Fry (2014) example

PongGame - Overview


PongGameVersion8_0

Input

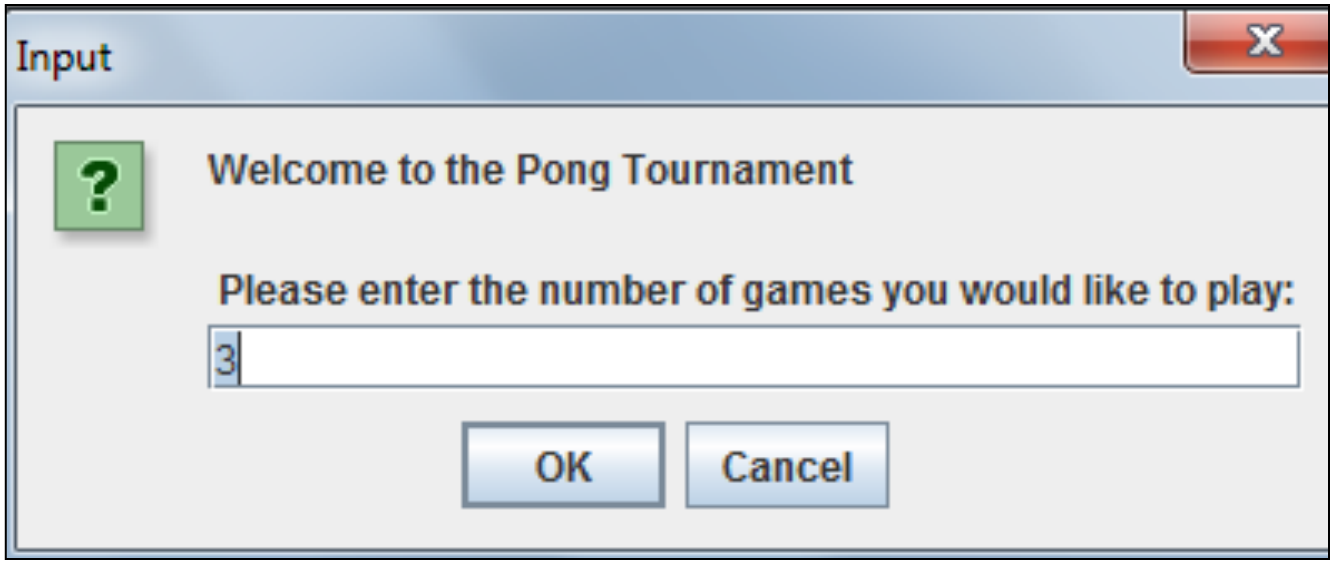
Welcome to the Pong Tournament

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**.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Please enter the number of games you would like to play:

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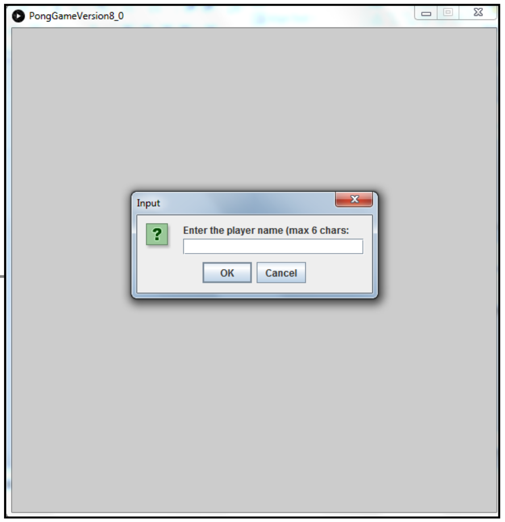
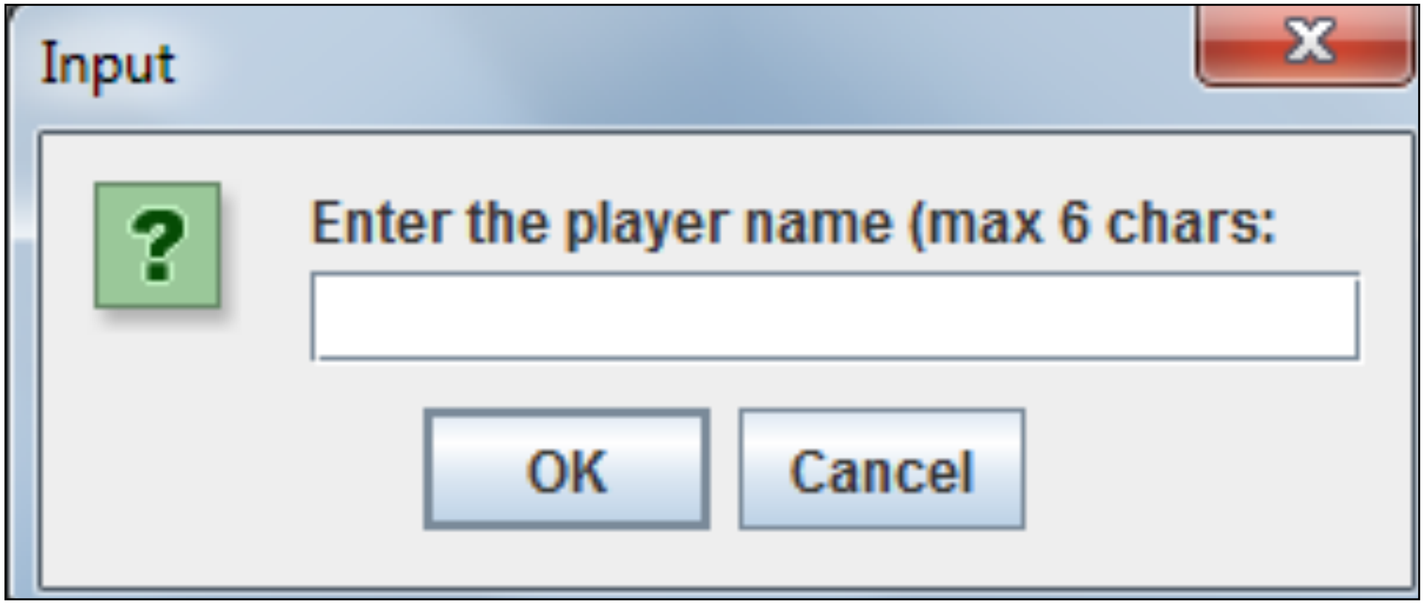
OK Cancel

PongGame - Overview



Enter PLAYER NAME

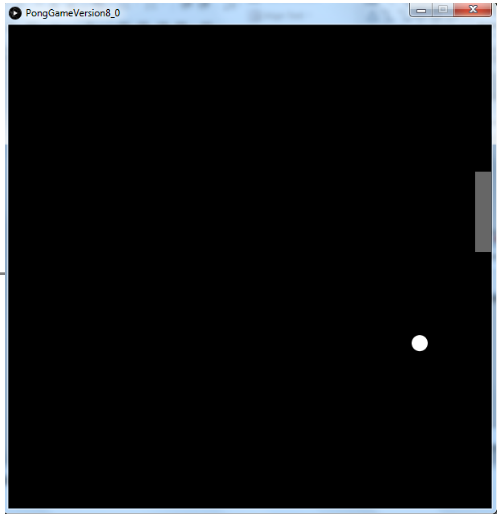
<= 6 chars, pong **truncates** the String



Input

Enter the player name (max 6 chars:

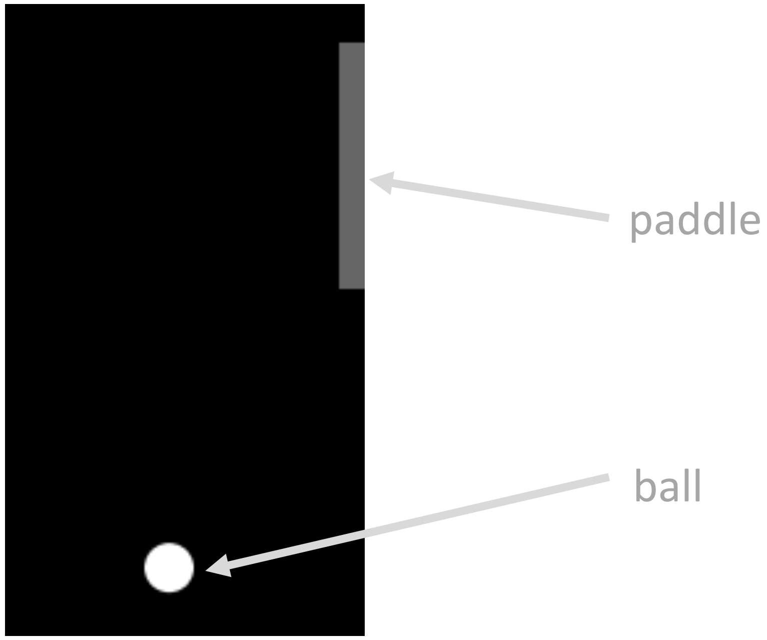
PongGame - Overview



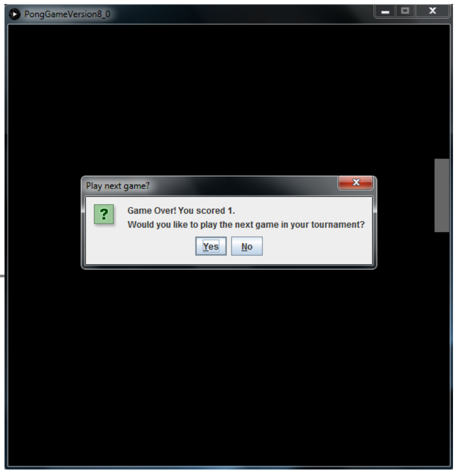
When the ball is **hit** by the paddle
→ **score increased by 1**.

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

Number of lives in a game
→ **3**



PongGame - Overview



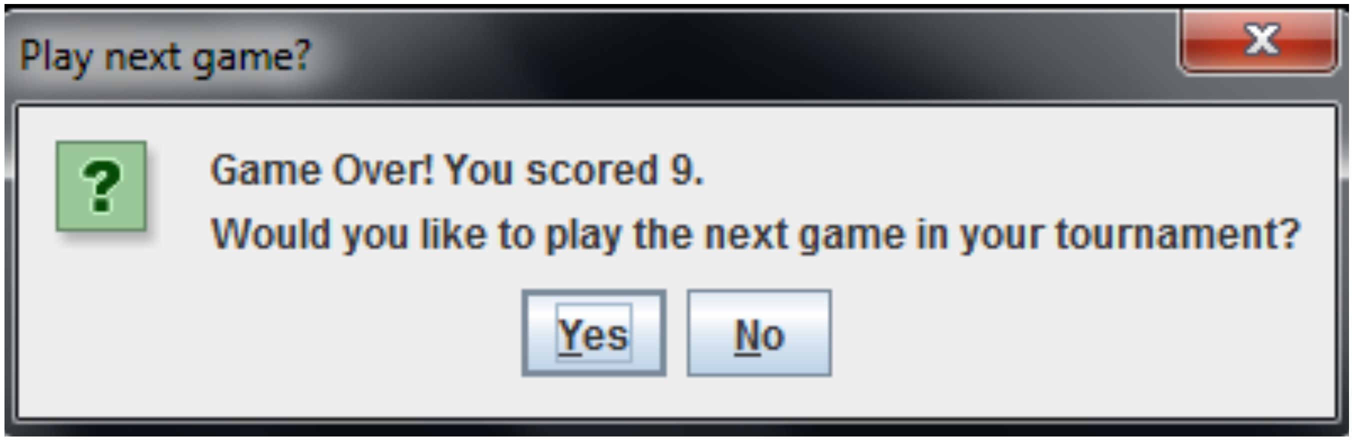
PongGameVersion8_0

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**:

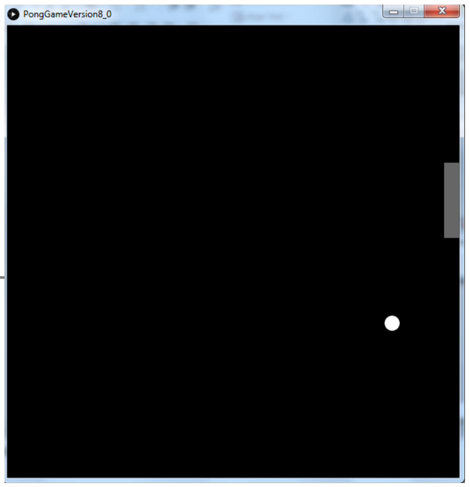
- **Score is displayed**.
- Player is **asked** if they want to **continue with the tournament**



Play next game?

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

PongGame - Overview



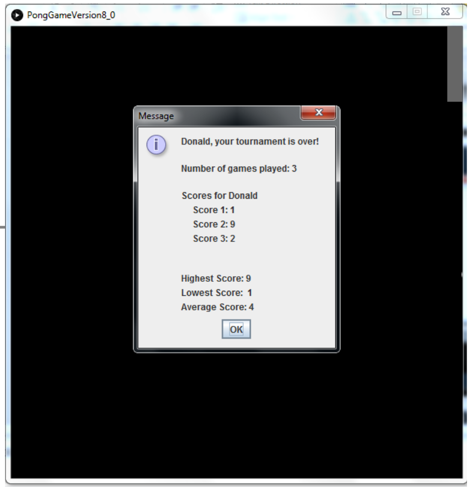
If the player **continues** with the tournament:

- 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

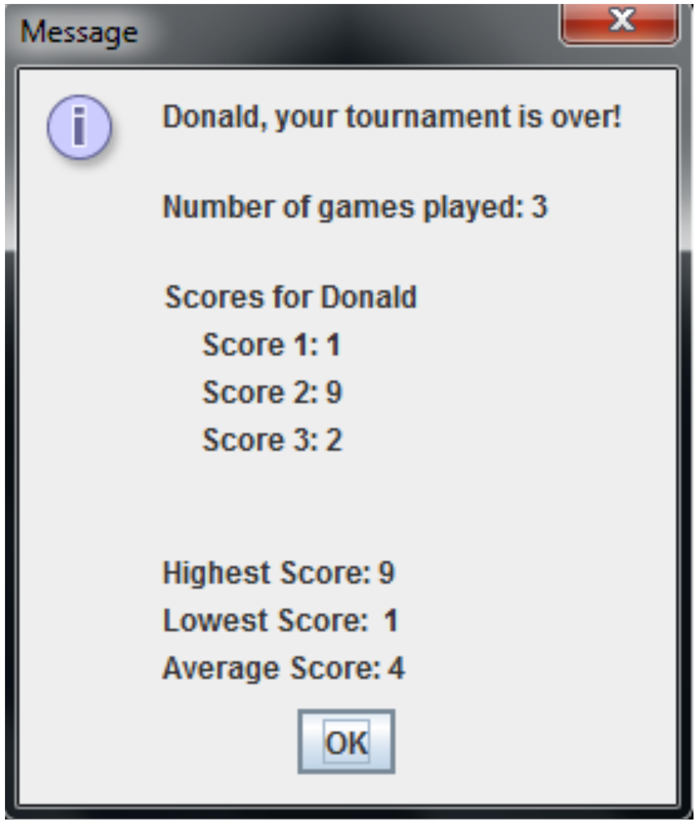
Scores for Donald
Score 1: 1
Score 2: 9
Score 3: 2

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

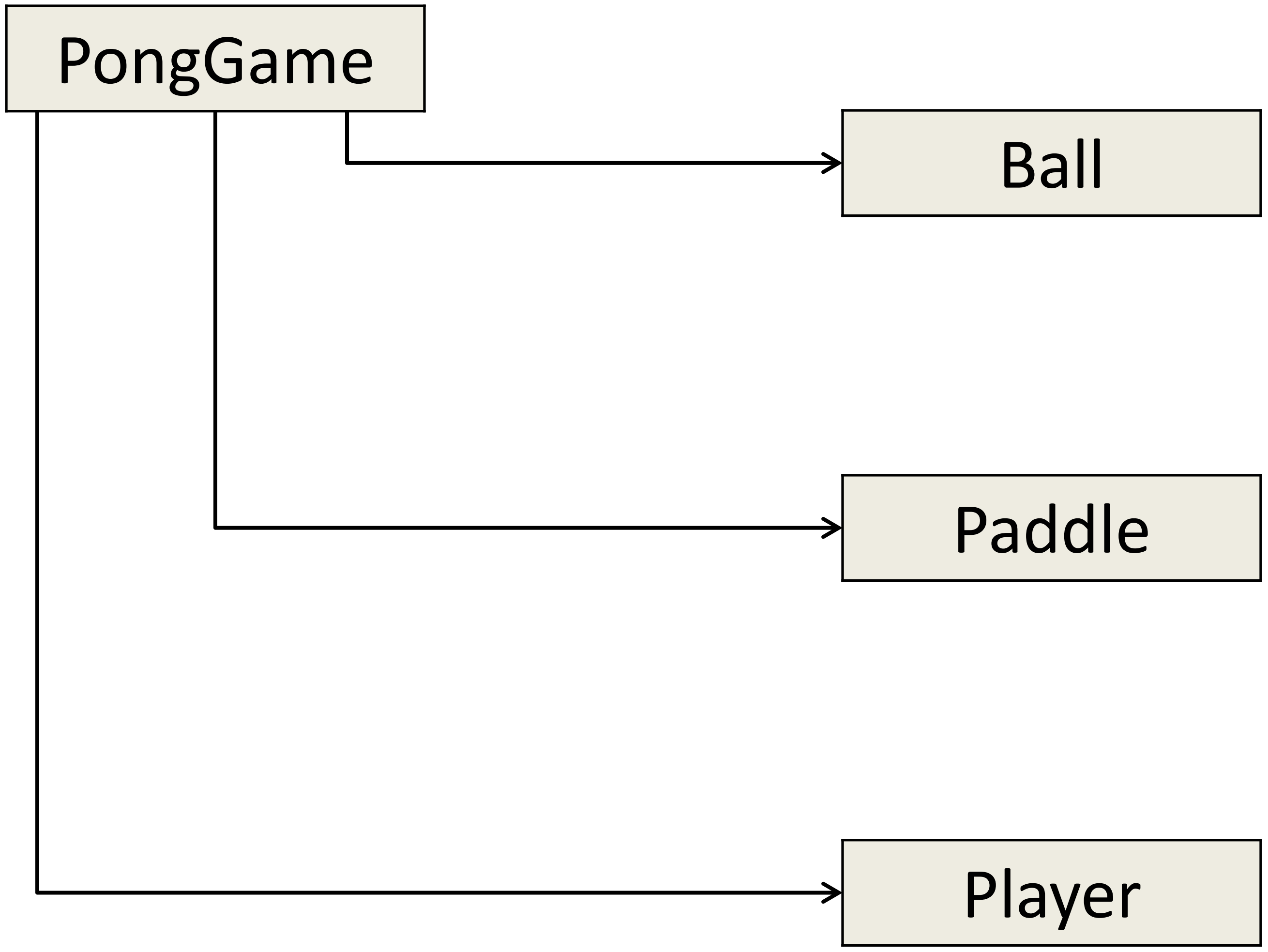
OK

- **For each game in the tournament**
  Display player name and score

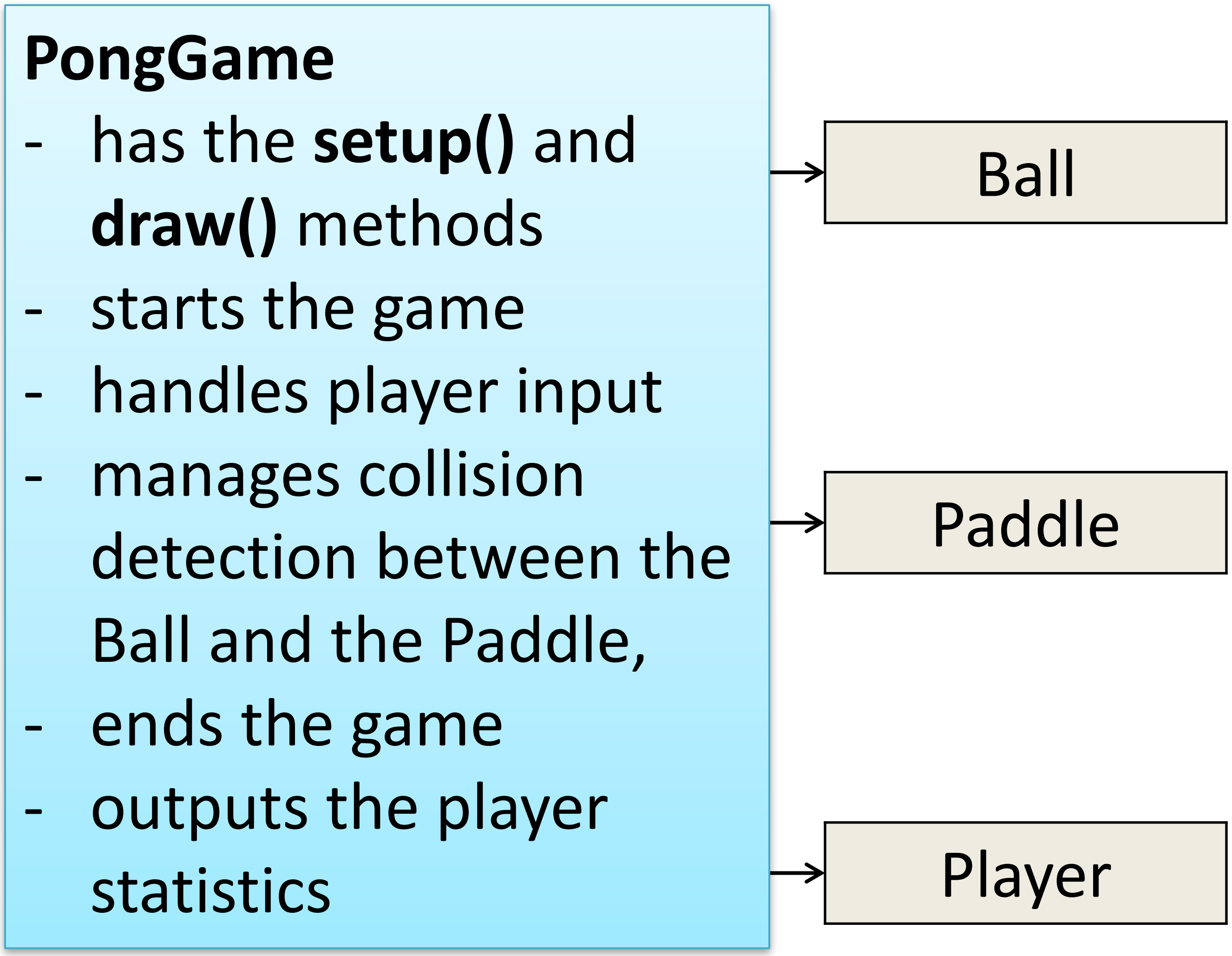
- **Display tournament statistics**
  (i.e. highest, lowest and average score).


```
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
```

PongGame - Overview CLASSES



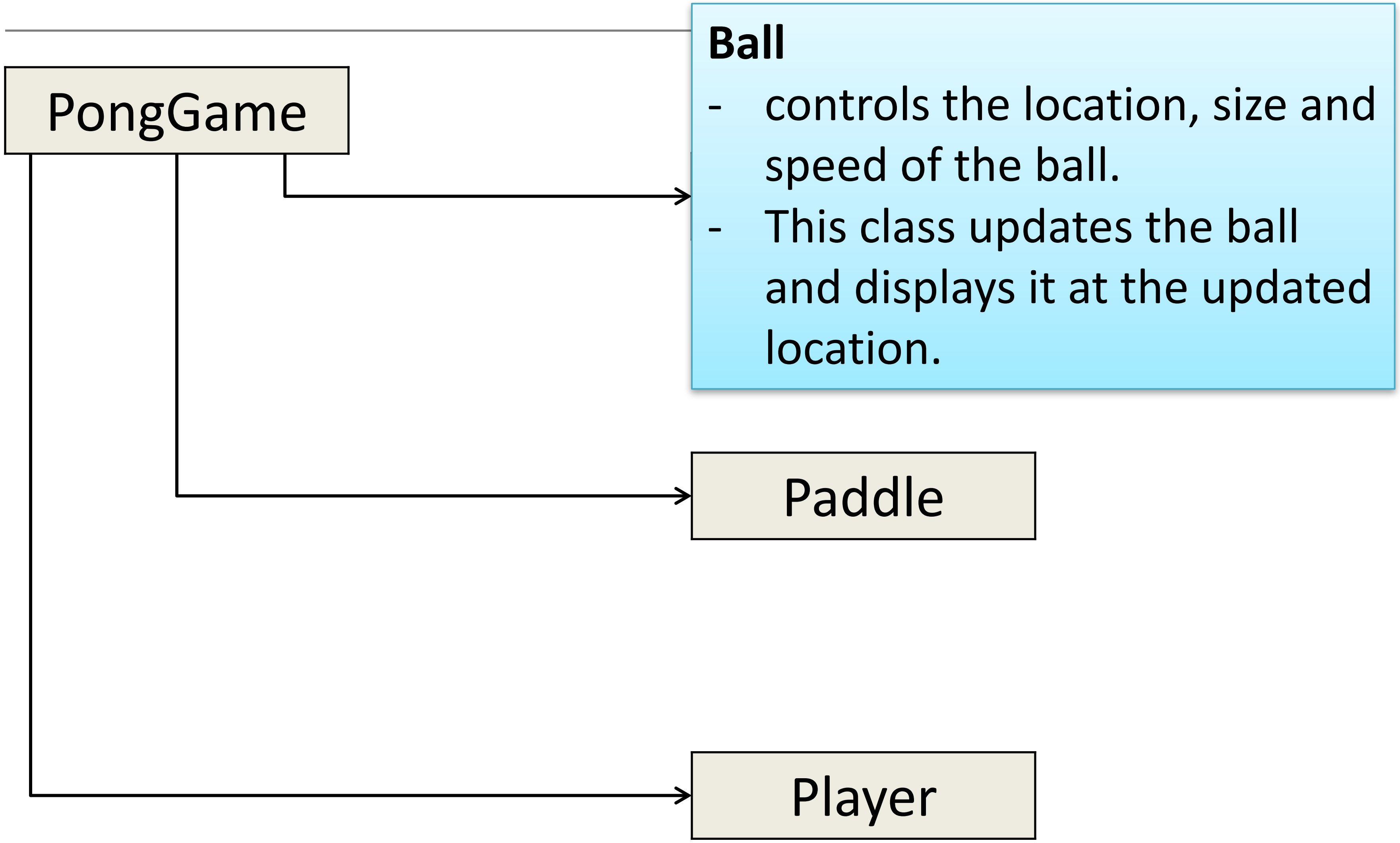
PongGame - Overview



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

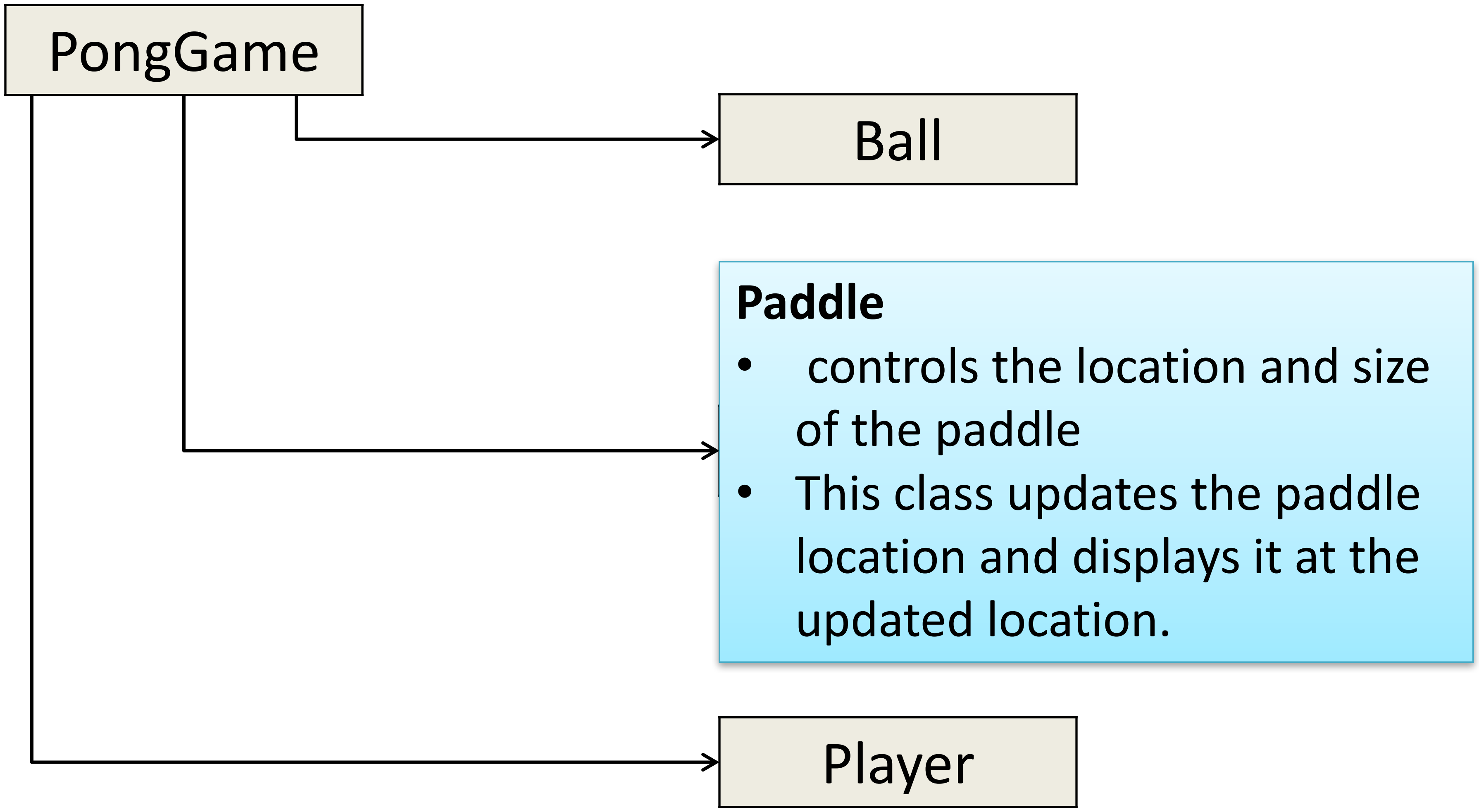
PongGame - Overview



Ball

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

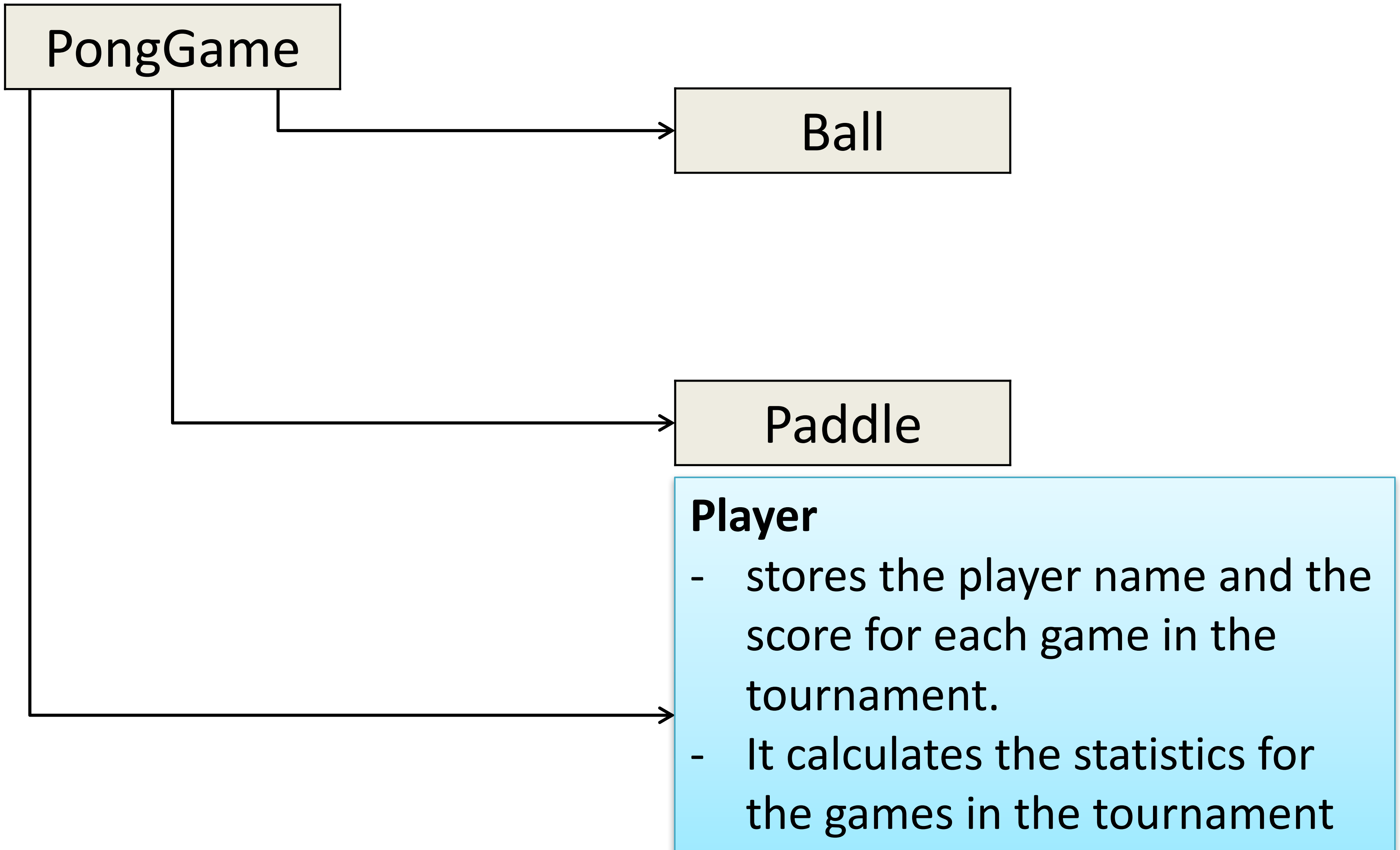
PongGame - Overview



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

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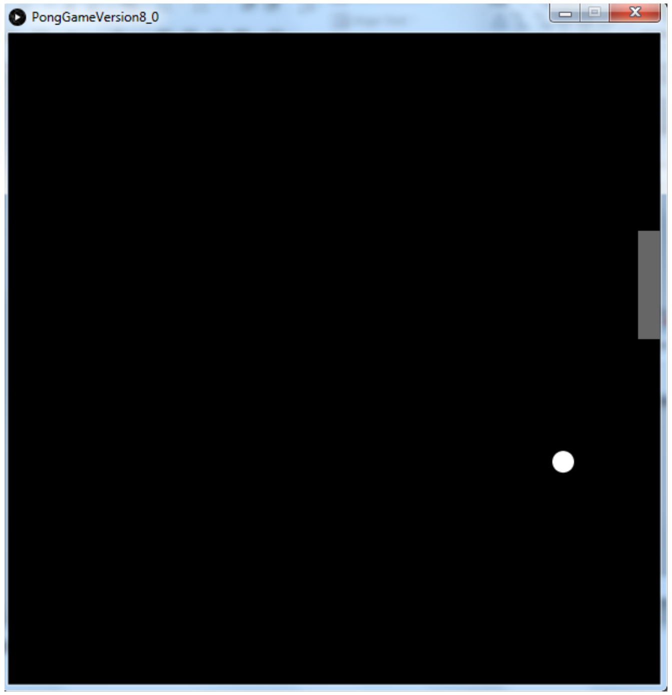
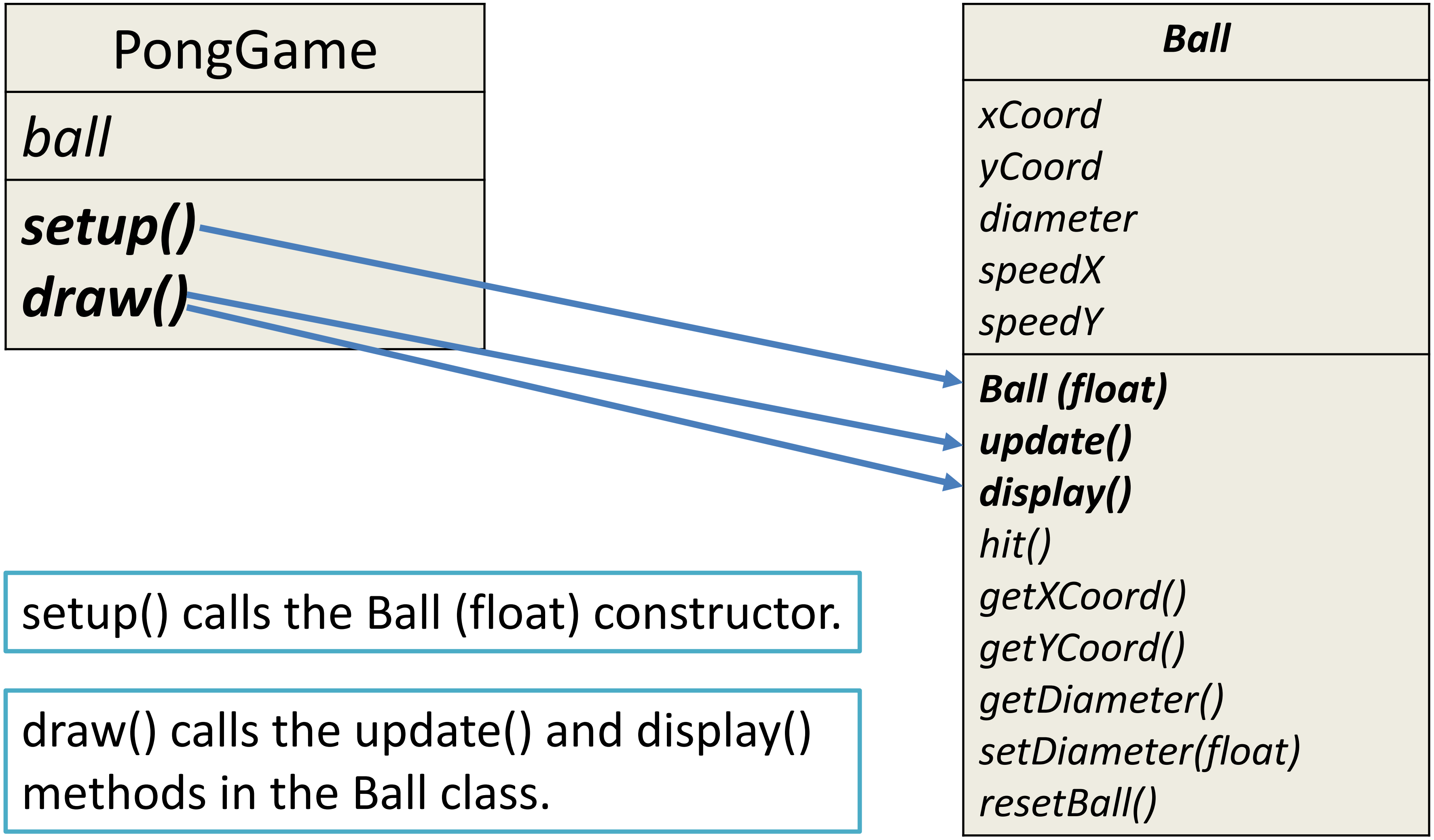


Idea is based on Reas and Fry (2014) example

Demo of
Pong Game V1.0

Classes in the PongGameV1.0



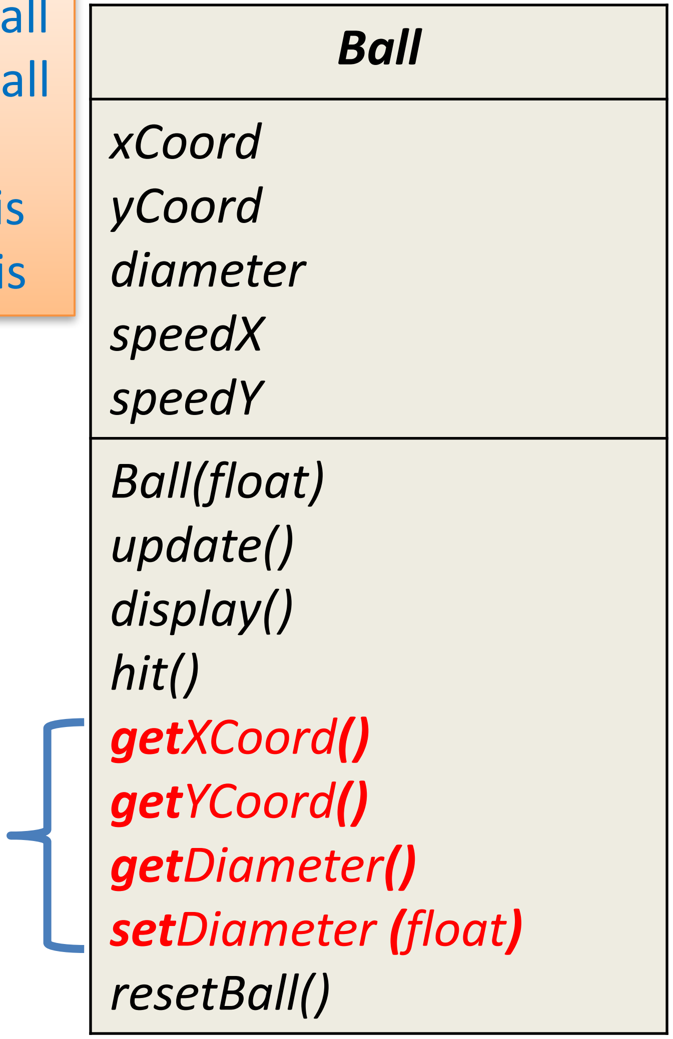
setup() calls the Ball (float) constructor.

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

Ball Class – instance **fields**

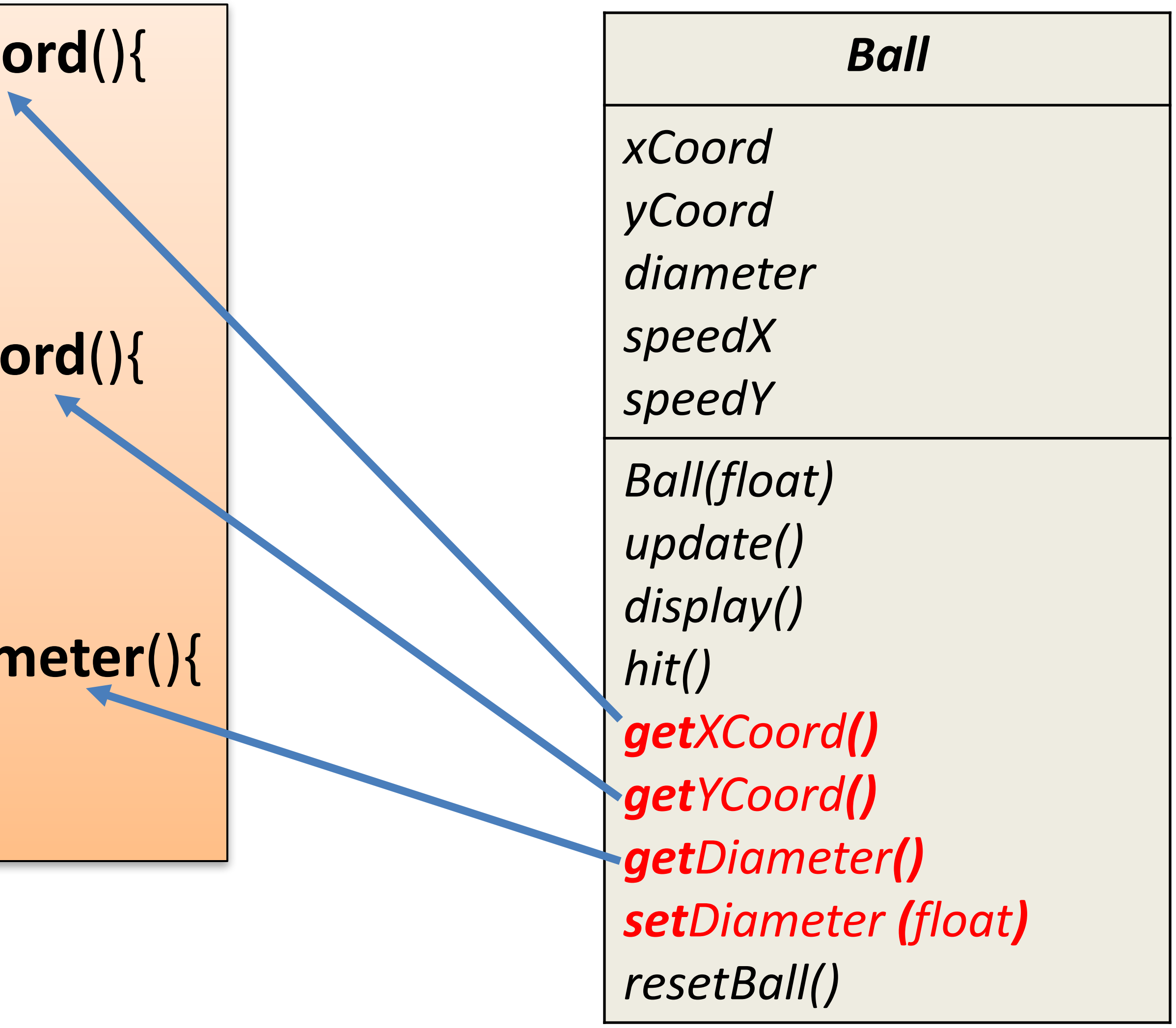
```
private float xCoord;       //x coordinate of the ball
private float yCoord;       //y coordinate of the ball
private float diameter;     //diameter of the ball
private float speedX;       //speed along the x-axis
private float speedY;       //speed along the y-axis
```

getters and **set**ters for the **fields**



Ball Class – **getters**

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

public float getYCoord(){
   return yCoord;
}

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



Ball Class – **setter**

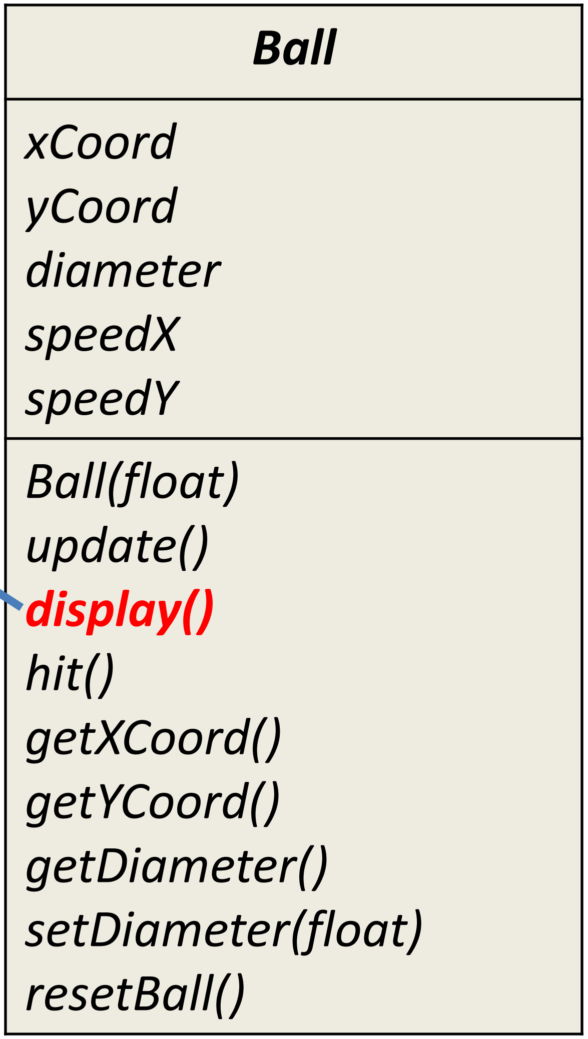
```
public void setDiameter (float diameter){

  //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

display() method

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



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

private helper method – resetBall()

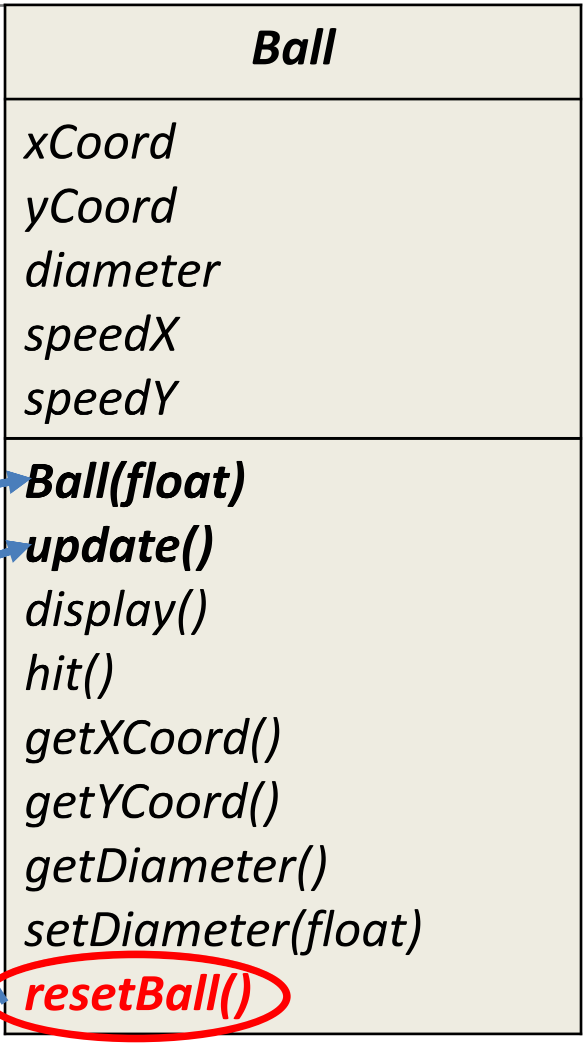
```
private void resetBall(){
    xCoord = 0;
    yCoord = random(height);
    speedX = random(3, 5);
    speedY = random(-2, 2);
}
```

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
yCoord
diameter
speedX
speedY

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

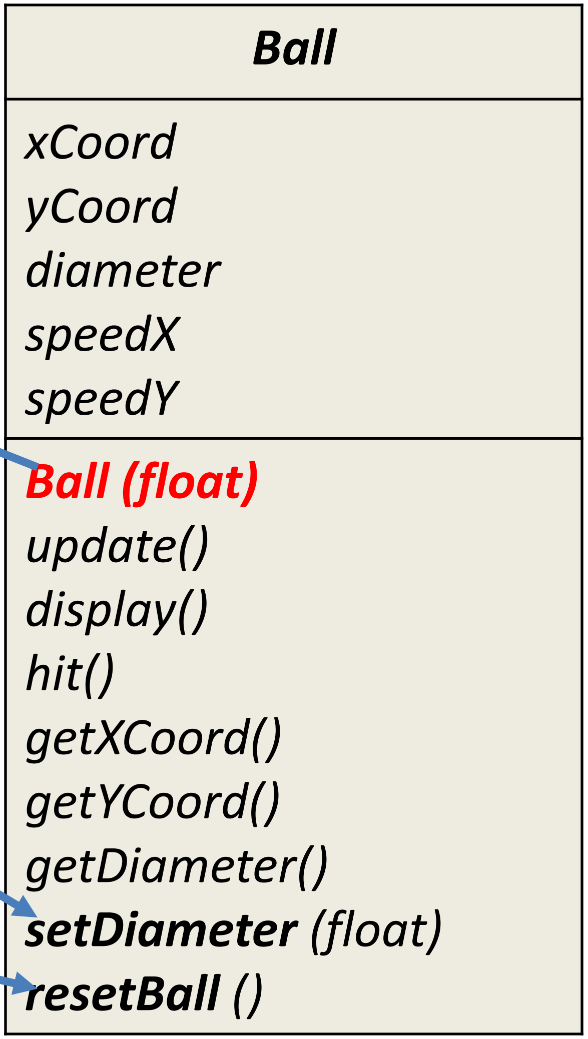
returns a random float between **low** (inclusive) and high (exclusive).

Ball 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



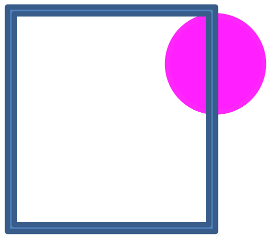
Ball

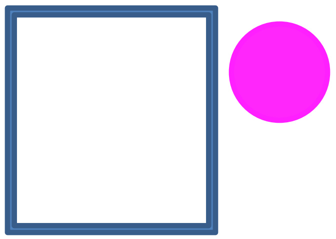
xCoord
yCoord
diameter
speedX
speedY

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…

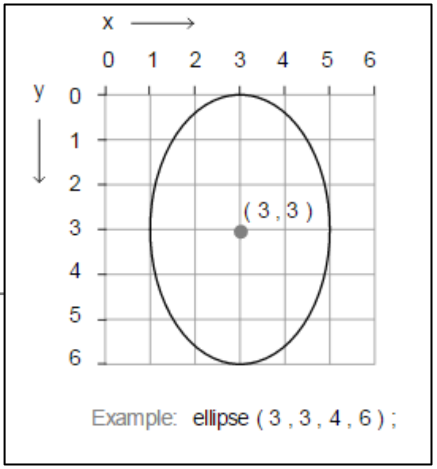
goes **off the screen**
return *true* (i.e. a life was lost)

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

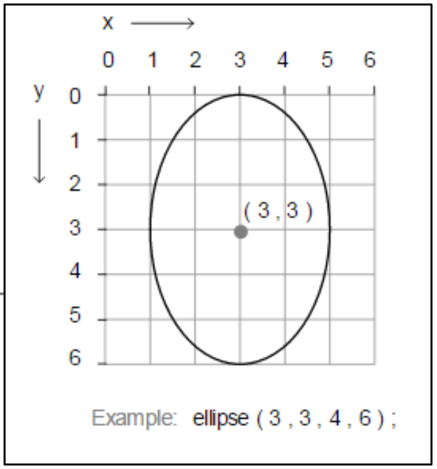


```
//reset position if ball leaves the screen
if (xCoord > width + diameter/2){
  resetBall();
  lifeLost = true;
}
```

(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

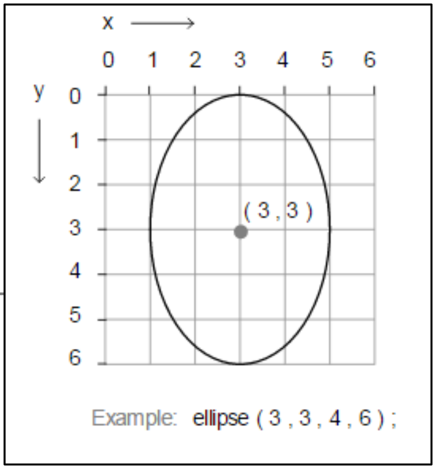


```
// If ball hits the left edge of the display
// window, change direction of xCoord
if (xCoord < diameter/2)
  xCoord = diameter/2;
  speedX = speedX * -1;
}
```

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)

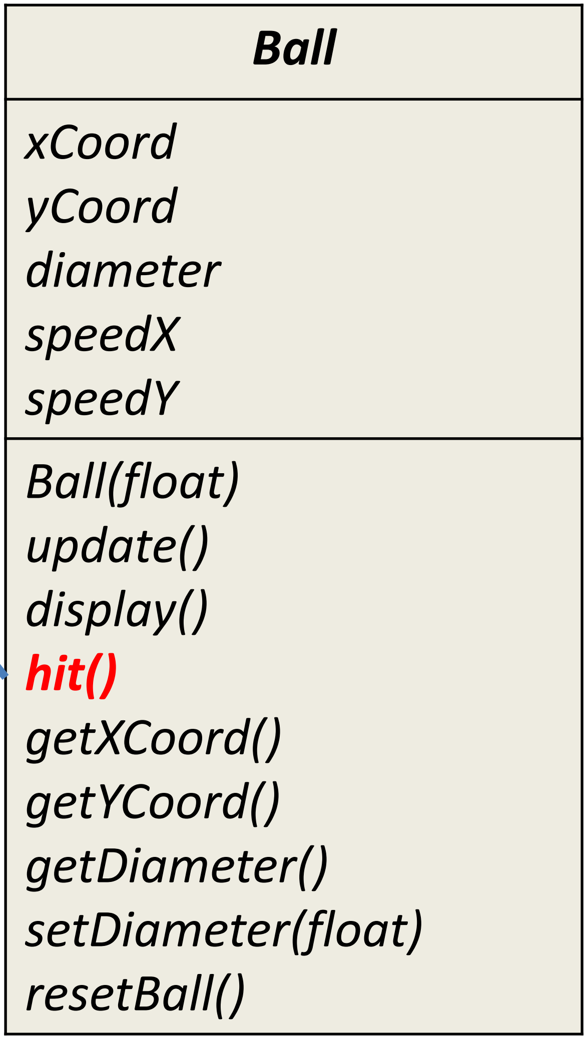
hit() method

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

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

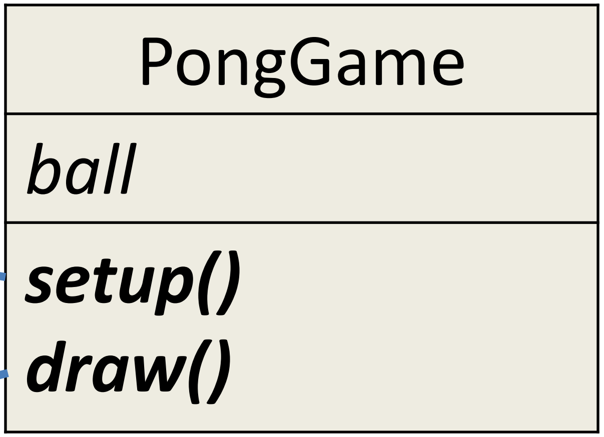
We’re preparing our class for **collision detection** in V3.0.

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



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();
}
```



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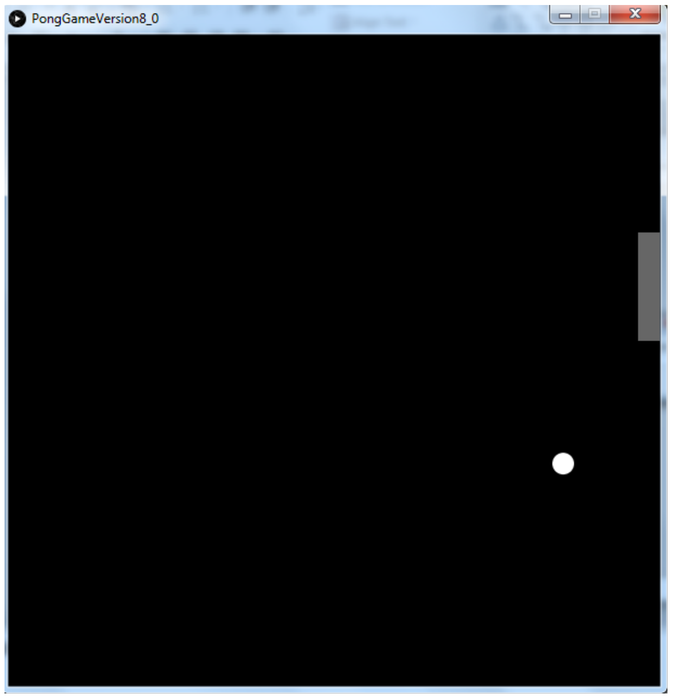

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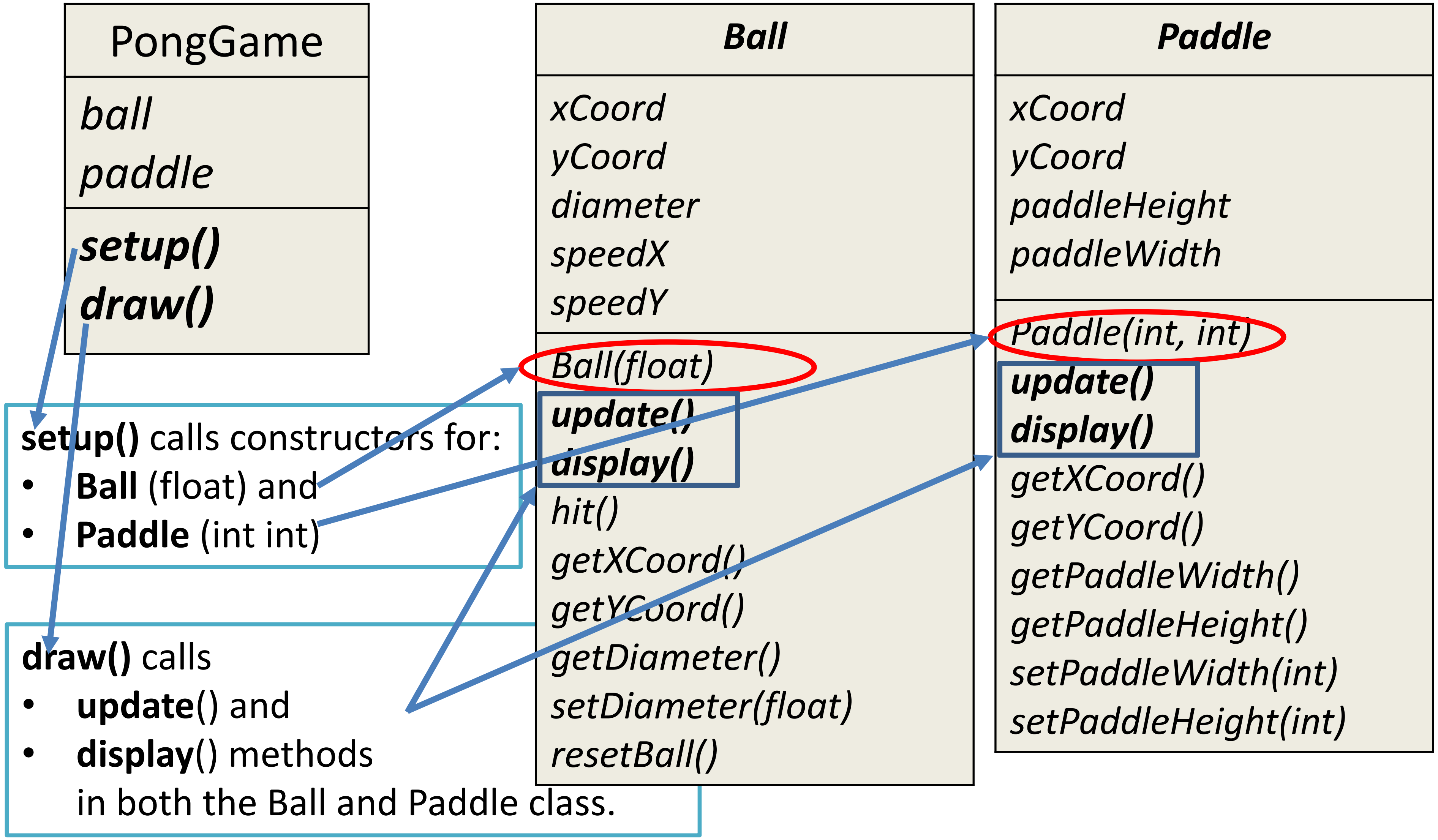
Demo of
Pong Game V2.0

Classes in the PongGameV2.0



setup() calls constructors for:

- **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

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

Paddle
xCoord ***yCoord*** ***paddleHeight*** ***paddleWidth***

Paddle(int, int)
update()
display()
getXCoord()
getYCoord()
getPaddleWidth()
getPaddleHeight()
setPaddleWidth(int)
setPaddleHeight(int)

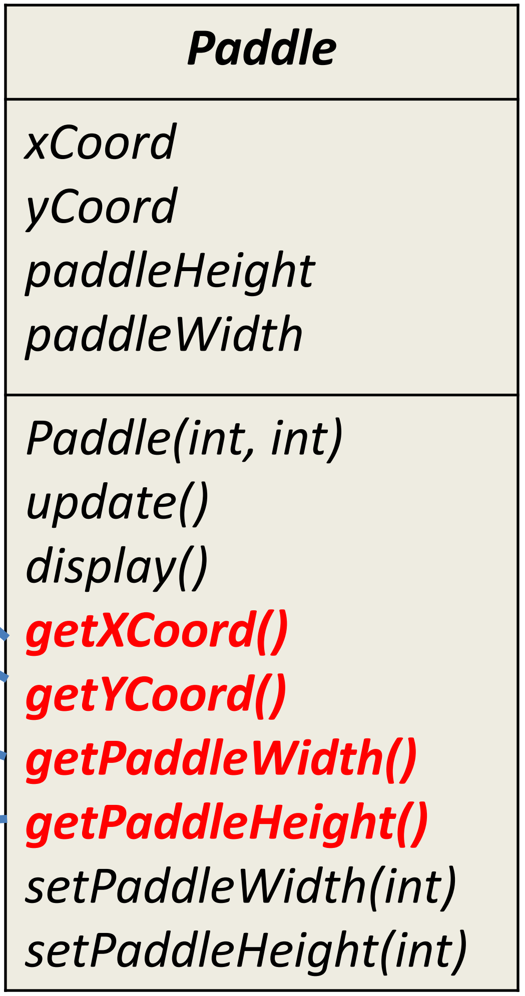
Paddle Class – **getters**

```
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 *yCoord* *paddleHeight* *paddleWidth*

Paddle(int, int)
update()
display()
getXCoord()
getYCoord()
getPaddleWidth()
getPaddleHeight()
setPaddleWidth(int)
setPaddleHeight(int)

Paddle Class – **setters**

setPaddleHeight(int)

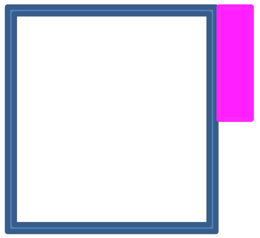
```
public void setPaddleHeight (int paddleHeight){
    // The paddle height must be
    // between 50 and height/2 (inclusive)
    if ((paddleHeight >= 50) && (paddleHeight <= height/2)){
       this.paddleHeight = paddleHeight;
    }
    else{
    // If an invalid height is passed as a parameter, a 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 *yCoord* *paddleHeight* *paddleWidth*

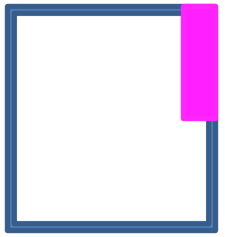
Paddle(int, int)
update()
display()
getXCoord()
getYCoord()
getPaddleWidth()
getPaddleHeight()
setPaddleWidth(int)
setPaddleHeight(int)

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 *yCoord* *paddleHeight* *paddleWidth*

Paddle(int, int)
update()
display()
getXCoord()
getYCoord()
getPaddleWidth()
getPaddleHeight()
setPaddleWidth(int)
setPaddleHeight(int)

display() method

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

Paddle

xCoord
yCoord
paddleHeight
paddleWidth

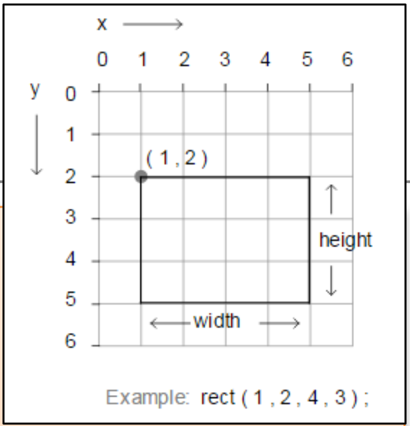
Paddle(int, int)
update()
display()
getXCoord()
getYCoord()
getPaddleWidth()
getPaddleHeight()
setPaddleWidth(int)
setPaddleHeight(int)

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;
   }
}
```



Paddle
xCoord *yCoord* *paddleHeight* *paddleWidth*

Paddle(int, int)
update()
display()
getXCoord()
getYCoord()
getPaddleWidth()
getPaddleHeight()
setPaddleWidth(int)
setPaddleHeight(int)

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

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 *paddle*

setup()
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.