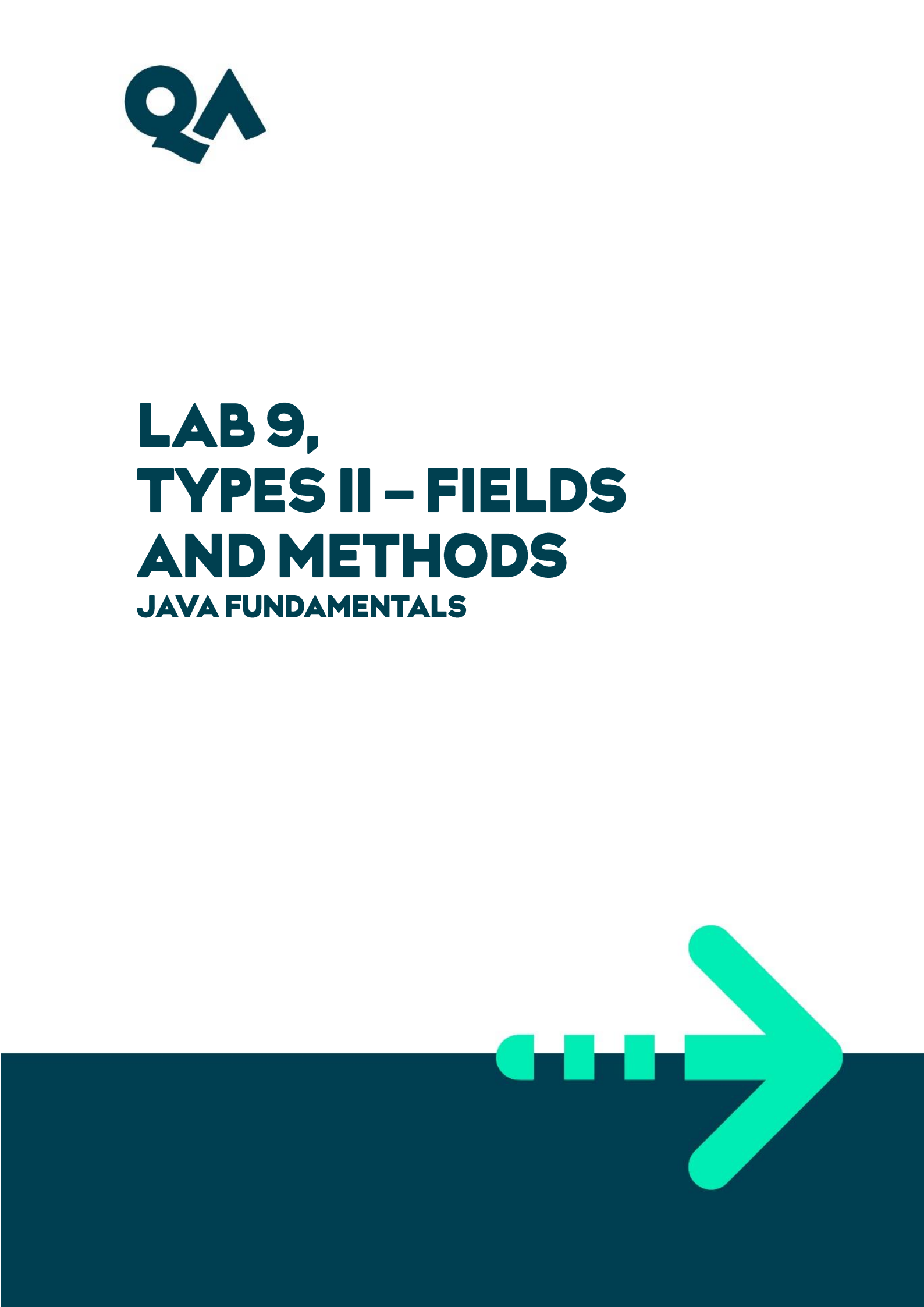


LAB 9, TYPES II – FIELDS AND METHODS

JAVA FUNDAMENTALS

Lab 9, Types II – Fields and Methods

Objective

You will further your understanding of object oriented programming.
In this lab you'll create a graphical application instead of a Console app.

Part 1 - Step by step.

You'll soon be creating a graphical application which is new. You'll copy and paste many lines of code. You are not required to understand how the graphics code works but it is not too complex to investigate by yourself.

1. Back in the labs project which you created in *Lab1*, add a new package called lab09.

   Please refer to lab1's instructions if you need help.

2. Create a class called Game in this package

3. Create an instance of Game in the main() method. This will kick start the game using its constructor.

4. You need a canvas upon which you can draw and show your animation. In this case you'll create a number of ball objects bouncing around a rectangle (the world).

   You can get creative later and do something else but for now please follow the steps. The aim is to investigate OO not concentrate on animation and graphics.

   Delete any code in the Game class and copy the following code.

   There a few comments in this code which are placeholders for code which you'll write later on.

```
import java.awt.*;
import java.awt.event.*;
import java.util.*;
import java.util.Timer;
import javax.swing.*;

public class Game extends Canvas {
	// create an array of 3 balls
	// call this array balls

Game() {
		JFrame frame = new JFrame();
		this.setSize(400, 400);
		frame.add(this);
		frame.pack();
		frame.setVisible(true);

		Timer t = new Timer();
		TimerTask tt = new TimerTask() {
			@Override
			public void run() {
				draw();
			}
		};

		t.schedule(tt, 0, 50);


		frame.addWindowListener(new WindowAdapter() {
			@Override
			public void windowClosing(WindowEvent e) {
				t.cancel();
				tt.cancel();
			}
		});
	}

	public void draw() {
		// call the move() method of each balls
		// Tip: use an enhanced for loop to pick
		//      each ball in the balls array.
		this.repaint();
	}

	public void paint(Graphics g) {
		g.drawRect(0, 0, 300, 300);
		// move and draw each ball in balls array
		// Tip: use an enhanced for loop to pick
		//      each ball in the balls array.

	}
}
```

Creates a form

Creates a timer to call the draw() method every 50ms (1/20 sec)

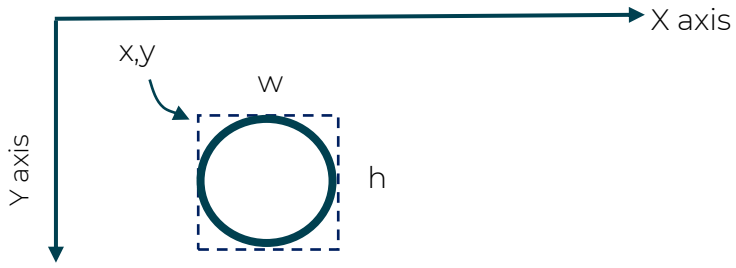
Runs when the window is closed

Invokes a repaint which will run the paint() method

5. Run the application to see if your code works as expected.

6. Create a class called Ball with the following fields

```
public int x, y, w, h;
private int dirX, dirY;
```



A ball's dimension is represented as a rectangle. X and y are the top coordinate and w and h are the width and height of the ball's rectangle. dirX and dirY are the amount by which each ball moves in the x and y direction.

The coordinate system is perhaps unlike what you're familiar with as it is upside-down! X increases to the right and Y increases towards the bottom.

7. Create a constructor to set every field (x,y,w,h,dirX,dirY).

8. To practice using constructor chaining, create another constructor to set just x,y,w,h but not the dirX and dirY.

   Use constructor chaining to call the first constructor with dirX=1 and dirY=1.

9. Create a method called move() in the Ball class.
   In this method, increase x by dirX and y by dirY and then follow a series of tests to make sure each ball stay within the world which is set in the paint event as 300px wide, 300px high and starts at x=0,y=0.

   if (x < 0) then set x=0 and change the sign of dirX
   Tip: dirX = -dirX
   do the same for the y coordinate (when it goes below zero) but this time changing dirY.

   if (x > 300-width of the ball) then set
   x=300-width of the ball and reverse the sign of dirY.

   do the same for the y coordinate (taking the height of the ball into account).

10. Back in the Game class view the comments and perform those tasks (create 3 balls, call move()... and draw each ball).
    Tip: paint method can draw a circle using this code:

```
g.drawOval( b.x, b.y, b.w, b.h );
// where b is a ball reference
```

11. If everything works, you should see 3 objects bouncing on your screen. If you have a need for speed then increase the dirX and dirY values!

Part 2 - Step by step.

In this part you'll make use of static keyword.
Clearly setting the world dimension to 300px (height and width) is not a good idea. All balls share the same world coordinates. This is a perfect place to use the static keyword.

1. Create a static int field in Ball called worldW and another called worldH to represent the width and height of the world. You should see three balls bouncing!
2. Create static method as
   public static void setWorld(int w, int h)
   to set the static *worldW* and *worldH* values.
3. In the Game() constructor just before the line `Timer t = new Timer();`
   Invoke the setWorld() method of the Ball class to set the world's width and height for every Ball.
4. Change the move() method in the Ball class to use the Ball.worldH and Ball.worldW values instead of 300px. You'll also need to change the paint() method to use the new static values (to draw the world's rectangle).
5. Run and test your code.

** End **