Computer Programming Fundamentals

CS 152
Professor: Leah Buechley
TAs: Melody Horn, Noah Garcia, Andrew Geyko, Juan Ormaza
Time: MWF 10:00-10:50am
https://handandmachine.cs.unm.edu/classes/CS152_Fall2021/

QUIZ 2 POSTED ON LEARN

- 50 points
- Due tomorrow by 11am
- You have 2 hours to complete the quiz.
- Can start anytime between 11am today and the deadline
- No late submissions accepted
- Only one submission
- Use course slides
- Use IntelliJ

ASSIGNMENT 4

- Classes and objects
- Can work in a 2 person team if you wish
- Email me team member names by Monday
- Due Friday 10/8

WEBSITE ISSUE

RETURNING TO OUR BALL CODE

I WANT TO CREATE A BALL WITH A RANDOM: COLOR, SIZE, AND POSITION

RANDOMIZING POSITION: FIRST TRY

```
Ball (int windowWidth, int windowHeight) {
    int minSize = 10;
    int maxSize = 100;
    size = minSize+(int)(Math.random()*(maxSize-minSize));
    int red = (int)(Math.random()*256);
    int green = (int)(Math.random()*256);
    int blue = (int)(Math.random()*256);
    color = new Color (red, green, blue);
    xPosition = (int)(Math.random()*windowWidth+1);
    yPosition = (int)(Math.random()*windowHeight+1);
    xSpeed = 1;
    ySpeed = 1;
}
```

BEFORE YOU RUN THE CODE

DELETE THE ENTIRE main() METHOD FROM THE BALL CLASS

```
public static void main(String[] args) {
    Ball ball;
    ball = new Ball();
    ball.move();

    Ball ball2;
    ball2 = new Ball(Color.BLUE, 100, 10, 500);
    System.out.println("ball2 xPosition: " +ball2.xPosition);
    ball2.setSpeed(100,100);
    ball2.move();
    System.out.println("ball2 xPosition after move: " +ball2.xPosition);
}
```

RUN YOUR PROGRAM WITH THE NEW CONSTRUCTOR

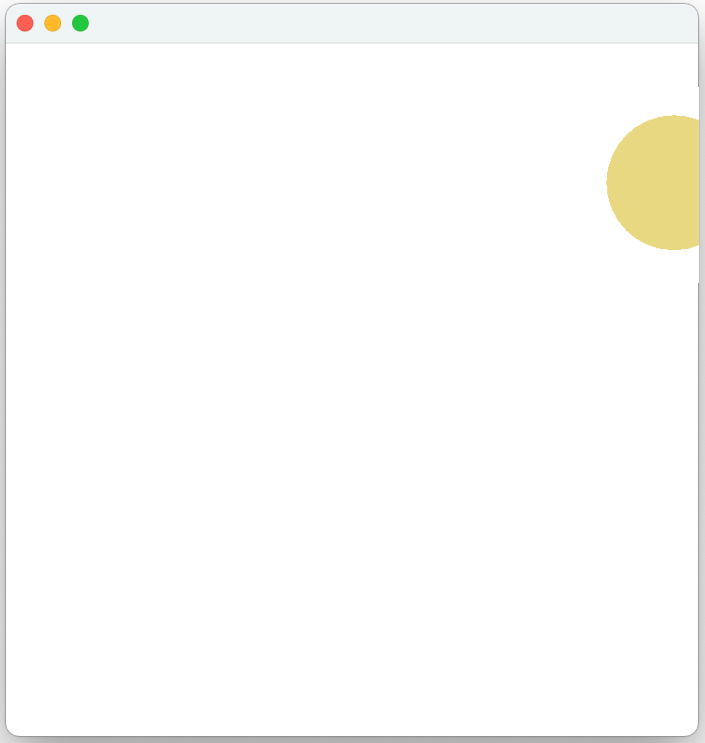
```
MyPanel () {
    width = 800;
    height = 500;
    ball = new Ball(width,height);
    ball.setSpeed(10,3);
    Dimension d = new Dimension(width,height);
    setPreferredSize(d);
    setVisible(true);
}
```

questions?

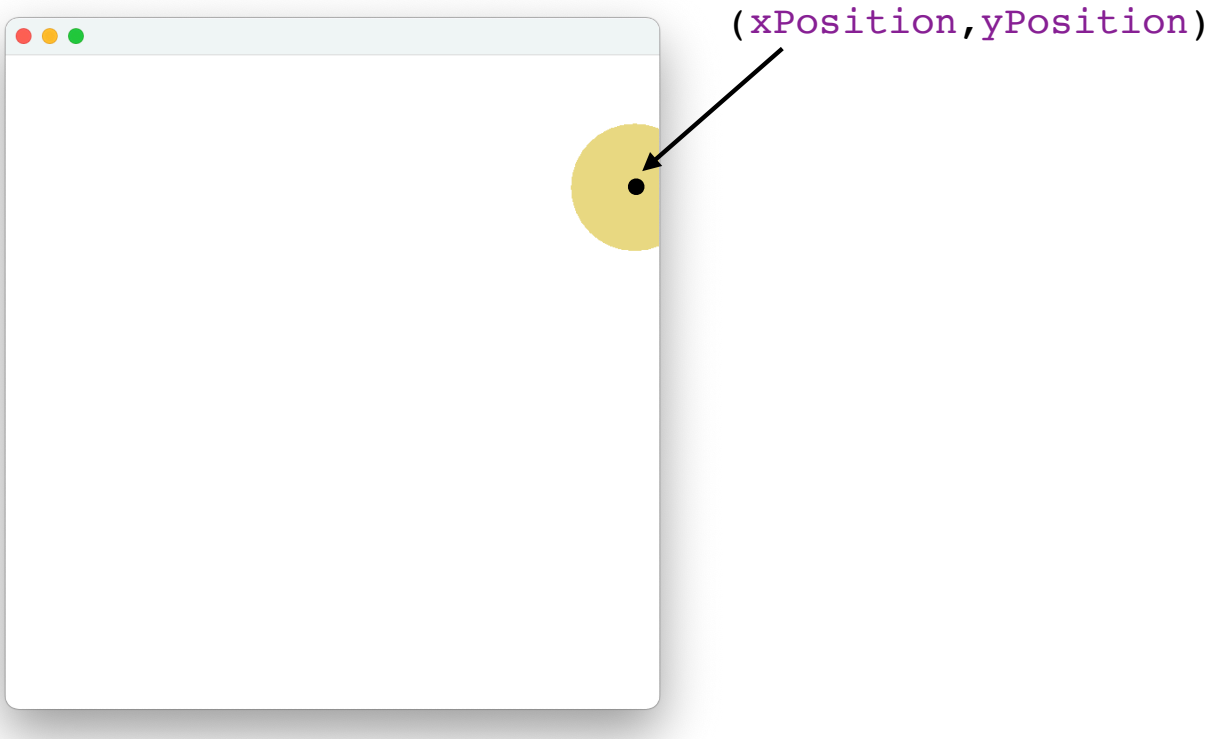
ANYONE HAVE A WEIRD ANIMATION?

THE TWITCHING BALL PROBLEM

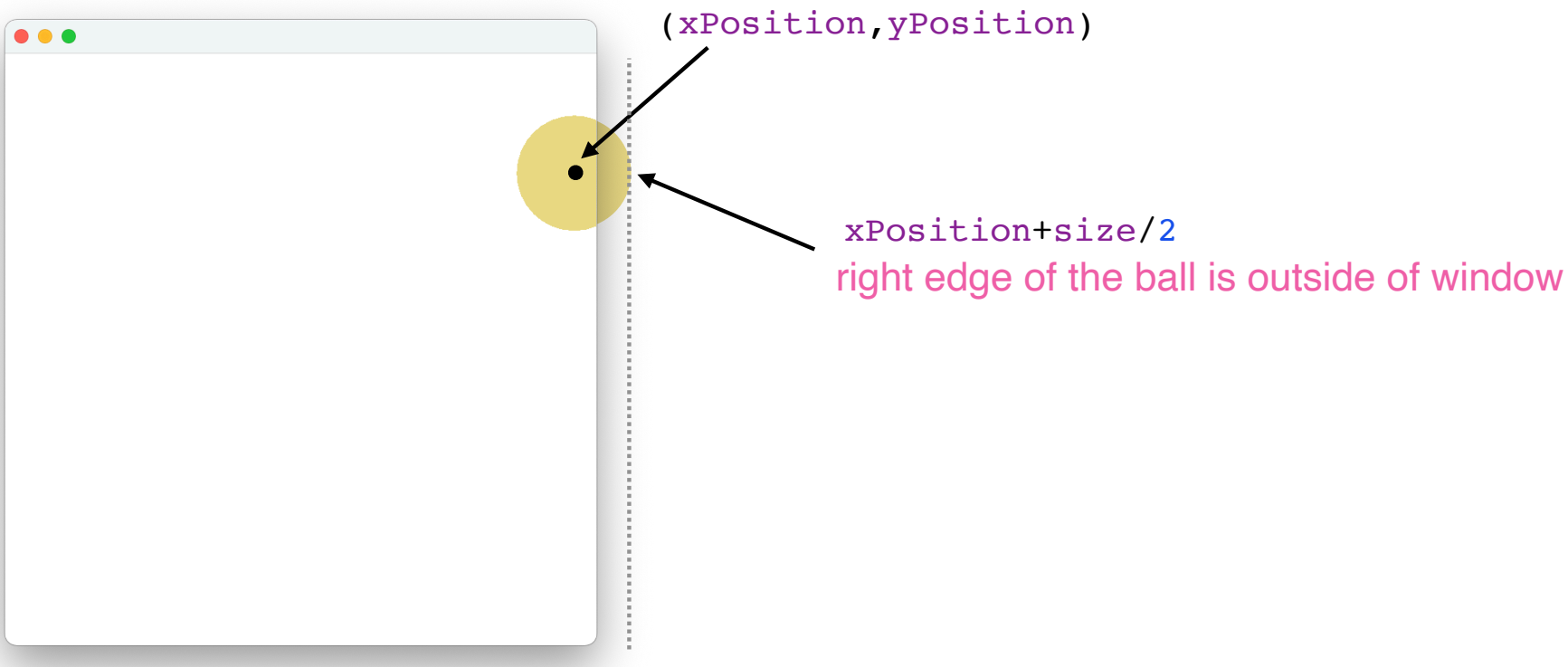
Ball is stuck on one of the edges of the screen twitching back and forth.



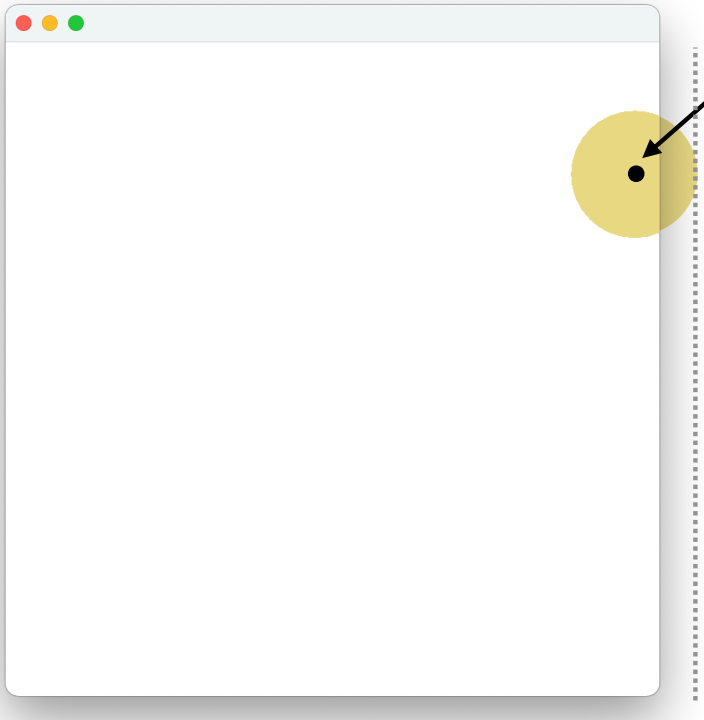
WHAT'S HAPPENING?



WHAT'S HAPPENING?



WHAT'S HAPPENING?



`(xPosition,yPosition)`

`xPosition+size/2`

right edge of the ball is outside of window

`xPosition+size/2 > windowWidth`

This statement is always true.

WHAT'S HAPPENING?

```
void bounce (int windowWidth, int windowHeight) {
    //right and left edges
    if (xPosition+size/2 > windowWidth || xPosition-size/2 < 0) {
        xSpeed = -xSpeed;   //change direction in x
    }
    //bottom and top edges
    if (yPosition+size/2 > windowHeight || yPosition-size/2 < 0 ) {
        ySpeed = -ySpeed;   //change direction in y
    }
}
```

This statement is always true. So, the ball just moves back and forth in x. It keeps changing direction. It's stuck on the edge.

WHAT'S HAPPENING?

```
void bounce (int windowWidth, int windowHeight) {
    //right and left edges
    if (xPosition+size/2 > windowWidth || xPosition-size/2 < 0) {
        xSpeed = -xSpeed;   //change direction in x
    }
    //bottom and top edges
    if (yPosition+size/2 > windowHeight || yPosition-size/2 < 0 ) {
        ySpeed = -ySpeed;   //change direction in y
    }
}
```

In general, if the ball starts outside of the window, one of these statements is always true. The ball just keeps changing direction, twitching.

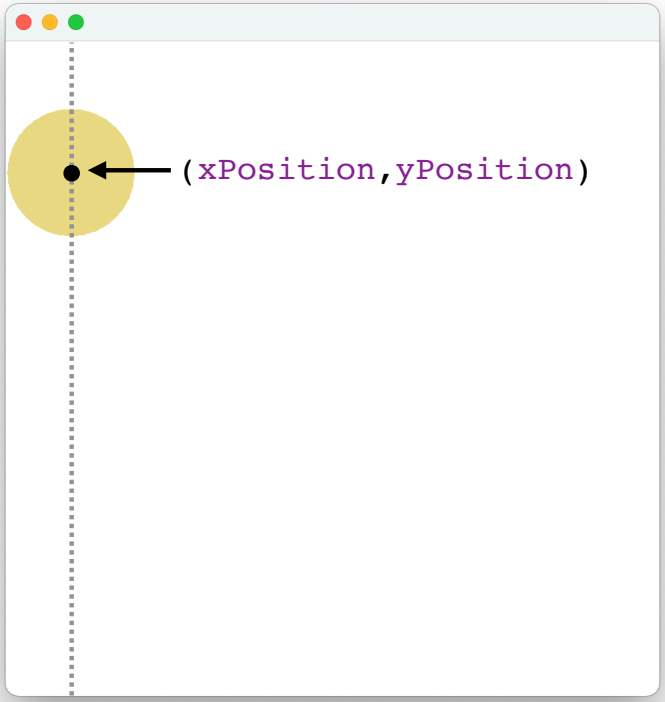
A SOLUTION

MAKE SURE THE BALL
IS NEVER CREATED
OUTSIDE OF THE WINDOW

KEEPING THE BALL IN THE WINDOW

- What is the smallest acceptable xPosition value for the Ball?

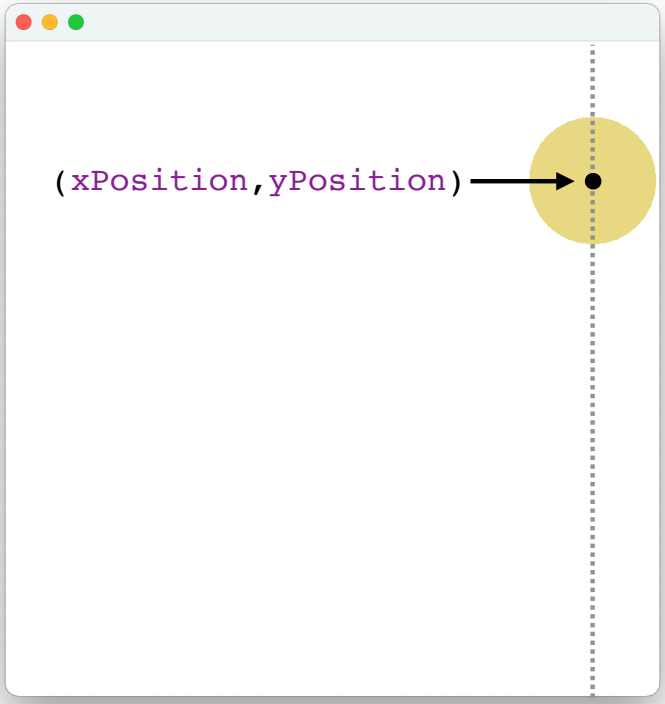
  size/2



KEEPING THE BALL IN THE WINDOW

- What is the largest acceptable xPosition value for the Ball?

  windowWidth-size/2



RANDOMIZING POSITION IN X

```
xPosition = (int)(size/2 + Math.random()*(windowWidth+1-size));
```

minimum

maximum - minimum + 1

```
(windowWidth-size/2)-size/2+1
```

SAME FOR yPosition & windowHeight

RANDOMIZING POSITION: TRY 2

```
Ball (int windowWidth, int windowHeight) {
    int minSize = 10;
    int maxSize = 100;
    size = minSize+(int)(Math.random()*(maxSize-minSize));
    int red = (int)(Math.random()*256);
    int green = (int)(Math.random()*256);
    int blue = (int)(Math.random()*256);
    color = new Color (red, green, blue);
    xPosition = (int)(size/2 + Math.random()*(windowWidth+1-size));
    yPosition = (int)(size/2 + Math.random()*(windowHeight+1-size));
    xSpeed = 1;
    ySpeed = 1;
}
```

minimum

RANDOMIZING POSITION: TRY 2

```
Ball (int windowWidth, int windowHeight) {
    int minSize = 10;
    int maxSize = 100;
    size = minSize+(int)(Math.random()*(maxSize-minSize));
    int red = (int)(Math.random()*256);
    int green = (int)(Math.random()*256);
    int blue = (int)(Math.random()*256);
    color = new Color (red, green, blue);
    xPosition = (int)(size/2 + Math.random()*(windowWidth+1-size));
    yPosition = (int)(size/2 + Math.random()*(windowHeight+1-size));
    xSpeed = 1;
    ySpeed = 1;
}
```

maximum - minimum + 1

questions?

LET’S RANDOMIZE THE SPEED

RANDOMIZING SPEED

```
Ball (int windowWidth, int windowHeight) {
    int minSize = 10;
    int maxSize = 100;
    size = minSize+(int)(Math.random()*(maxSize-minSize));
    int red = (int)(Math.random()*256);
    int green = (int)(Math.random()*256);
    int blue = (int)(Math.random()*256);
    color = new Color (red, green, blue);
    xPosition = (int)(Math.random()*windowWidth+1);
    yPosition = (int)(Math.random()*windowHeight+1);
    xSpeed = 1+(int)(Math.random()*10);
    ySpeed = 1+(int)(Math.random()*10);
}
```

WHAT ARE MIN AND MAX SPEEDS?

```
Ball (int windowWidth, int windowHeight) {
    int minSize = 10;
    int maxSize = 100;
    size = minSize+(int)(Math.random()*(maxSize-minSize));
    int red = (int)(Math.random()*256);
    int green = (int)(Math.random()*256);
    int blue = (int)(Math.random()*256);
    color = new Color (red, green, blue);
    xPosition = (int)(Math.random()*windowWidth+1);
    yPosition = (int)(Math.random()*windowHeight+1);
    xSpeed = 1+(int)(Math.random()*10);
    ySpeed = 1+(int)(Math.random()*10);
}
```

minimum = 1

maximum = 10

questions?

MORE THAN ONE BALL

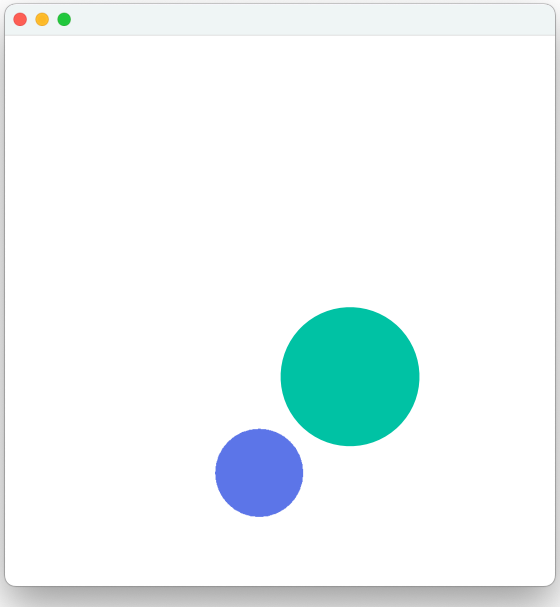
ADD A SECOND BALL TO YOUR PROGRAM

IN MyPanel

```
int width;
int height;
Ball ball;
Ball ball1;

MyPanel () {
    width = 500;
    height = 500;
    ball = new Ball(width,height);
    ball1 = new Ball(width,height);
    Dimension d = new Dimension(width,height);
    setPreferredSize(d);
    setVisible(true);
}
```

IN MyPanel

```
@Override
protected void paintComponent(Graphics g) {
    super.paintComponent(g);
    setBackground(Color.WHITE);

    ball.draw(g);
    ball.move();
    ball.bounce(width, height);

    ball1.draw(g);
    ball1.move();
    ball1.bounce(width, height);
}
```



WHAT IF WE WANT 3 BALLS?
10?
100?

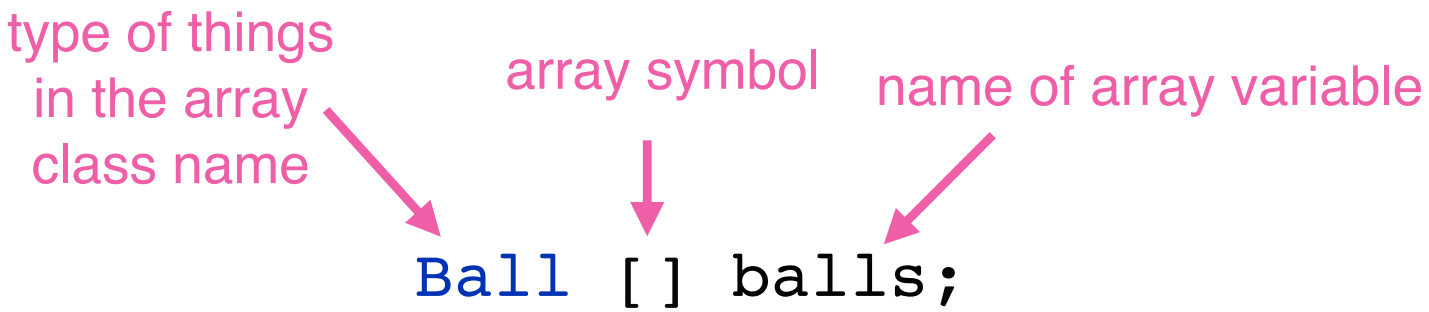
WHAT IS A SIMPLE WAY TO ADD MANY BALLS?

ARRAYS

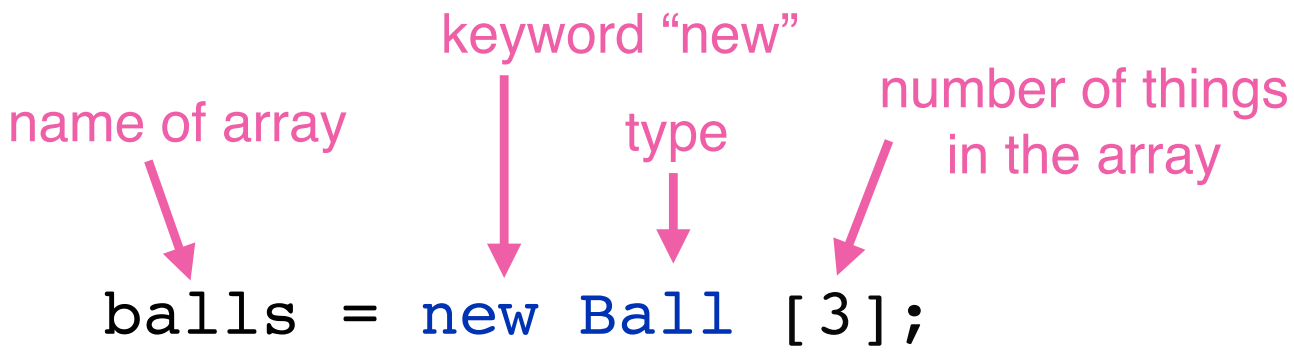
ARRAYS OF OBJECTS

- Define the array variable
- Create the array
- Create all of the objects

DEFINE THE ARRAY VARIABLE



CREATE THE ARRAY



CREATE ALL THE OBJECTS

number of items

```
for (int i=0; i<3; i++) {
    balls[i] = new Ball(width,height);
}
```

this will create a new object for each element in the array

questions?

ARRAYS OF OBJECTS

- Define the array variables

```
Ball[] balls;
int numberOfBalls;
```

- Create the array

```
numberOfBalls = 20;
balls = new Ball[numberOfBalls];
```

- Create all of the objects

```
for (int i=0;i<numberOfBalls; i++) {
    balls[i] = new Ball(width,height);
}
```

IN MyPanel

```
int width;
int height;
Ball ball;
Ball ball1;

MyPanel () {
    width = 800;
    height = 500;
    ball = new Ball(width,height);
    ball.setSpeed(10,3);
    ball1 = new Ball(width,height);
    ball1.setSpeed(7,8);
    Dimension d = new Dimension(width,height);
    setPreferredSize(d);
    setVisible(true);
}
```

IN MyPanel

```
int width;
int height;
Ball[] balls;
int numberOfBalls;

MyPanel () {
    width = 500;
    height = 500;
    numberOfBalls = 20;
    balls = new Ball[numberOfBalls];
    for (int i=0;i<numberOfBalls; i++) {
        balls[i] = new Ball(width,height);
    }
    Dimension d = new Dimension(width,height);
    setPreferredSize(d);
    setVisible(true);
}
```

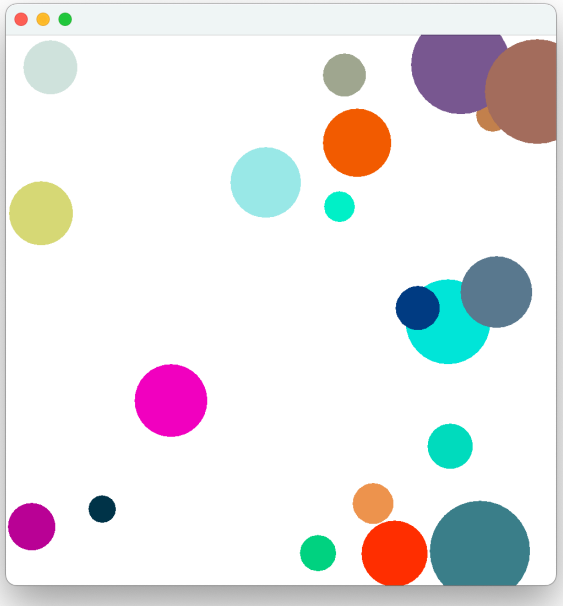
questions?

USING THE ARRAY

```
@Override
protected void paintComponent(Graphics g) {
    super.paintComponent(g);
    setBackground(Color.WHITE);

    ball.draw(g);
    ball.move();
    ball.bounce(width, height);

    ball1.draw(g);
    ball1.move();
    ball1.bounce(width, height);
}
```

USING THE ARRAY

```
@Override
protected void paintComponent(Graphics g) {
    super.paintComponent(g);
    setBackground(Color.WHITE);

    for (int i=0;i<numberOfBalls;i++) {
        balls[i].draw(g);
        balls[i].move();
        balls[i].bounce(width, height);
    }

}
```



questions?