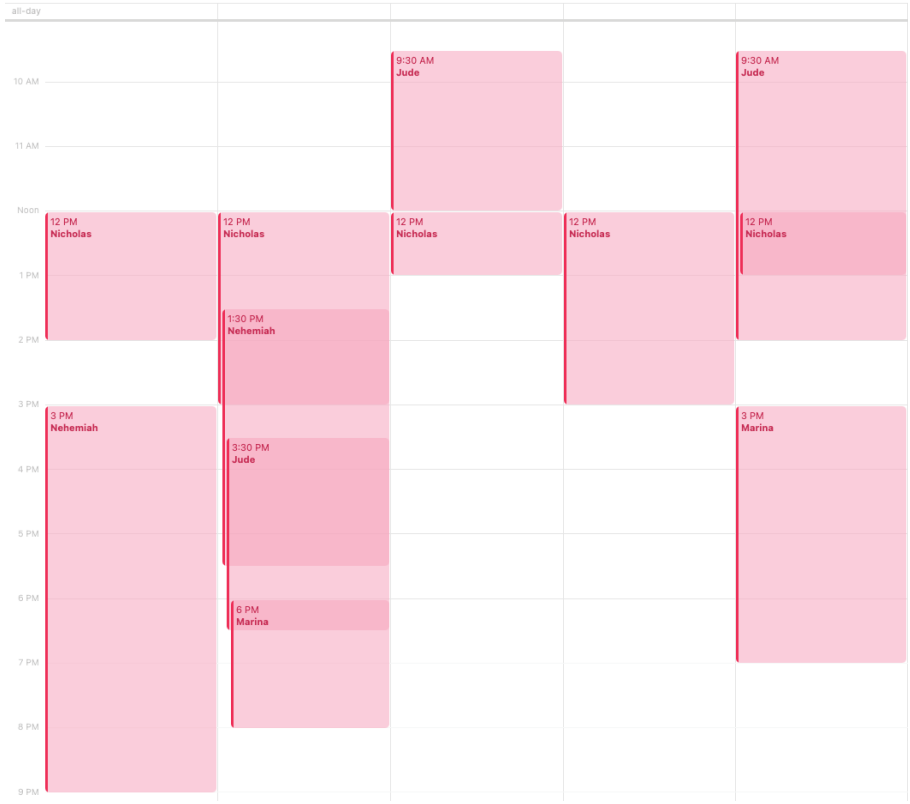
Computer Programming Fundamentals

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/

HEADS UP
QUIZ 2 ON FRIDAY

CS TUTORING NOW AVAILABLE
FARRIS ENGINEERING CENTER, 2065



Link to information
posted on our class homepage
& Piazza

TALK ON WEDNESDAY

TODAY: CLASSES AND OBJECTS cont.

PROGRAM WITH 3 CLASSES

MyFrame

```
import javax.swing.*;
import java.awt.*;

public class MyFrame {
    JFrame frame;
    JPanel panel;

    MyFrame(JPanel panel) {
        frame = new JFrame();
        this.panel = panel;
        frame.add(panel);
        frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        frame.pack();
        frame.setVisible(true);
    }
}
```

MyPanel

```
import javax.swing.*;
import java.awt.*;

public class MyPanel extends JPanel{
    int width;
    int height;
    Ball ball;

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

    public static void main(String[] args) {
        MyPanel panel = new MyPanel();
        MyFrame frame = new MyFrame(panel);
    }

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

        ball.draw(g);
    }
}
```

Ball

```
import java.awt.*;

public class Ball {
    Color color;
    int size;
    int xPosition;
    int yPosition;
    int xSpeed;
    int ySpeed;

    Ball () {
        color = Color.PINK;
        size = 50;
        xPosition = 100;
        yPosition = 100;
        xSpeed = 1;
        ySpeed = 1;
    }

    Ball (Color color, int size, int xPosition, int yPosition) {
        this.color = color;
        this.size = size;
        this.xPosition = xPosition;
        this.yPosition = yPosition;
        xSpeed = 0;
        ySpeed = 0;
    }

    void move() {
        xPosition = xPosition + xSpeed;
        yPosition = yPosition + ySpeed;
    }

    void setSpeed (int xSpeed, int ySpeed) {
        this.xSpeed = xSpeed;
        this.ySpeed = ySpeed;
    }

    void draw (Graphics g) {
        g.setColor(color);
        g.fillOval(xPosition,yPosition,size,size);
    }
}
```

PROJECT WITH MULTIPLE CLASSES

- Can use one class in another class as long as both are part of the same project
- Can use one class in another class as long as both are in the same folder
- More than one class can have a main() method
- You can choose which main() you run
- All classes in a project are compiled when you run your program

TODAY: CONTINUING TO WORK ON OUR BALL PROGRAM

HOW TO DRAW THE BALL?
WHERE TO DRAW THE BALL?

ADD A DRAW METHOD TO THE BALL CLASS

IN THE BALL CLASS

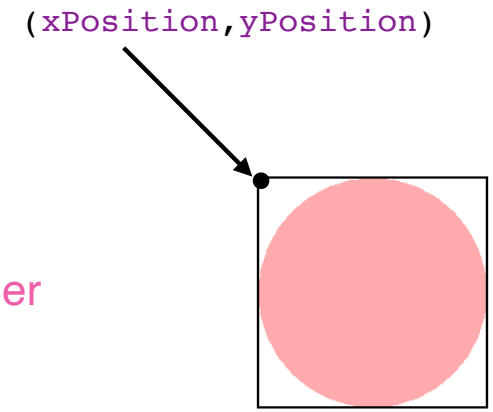
```
void draw (Graphics g) {
    g.setColor(color);
    g.fillOval(xPosition,yPosition,size,size);
}
```

GOOD CODING PRACTICE: ANYTHING THAT A BALL DOES OR THAT IS DONE TO A BALL SHOULD HAPPEN IN THE BALL CLASS

GOOD CODING PRACTICE: ANYTHING THAT AN OBJECT DOES OR THAT IS DONE TO AN OBJECT SHOULD HAPPEN IN THAT CLASS

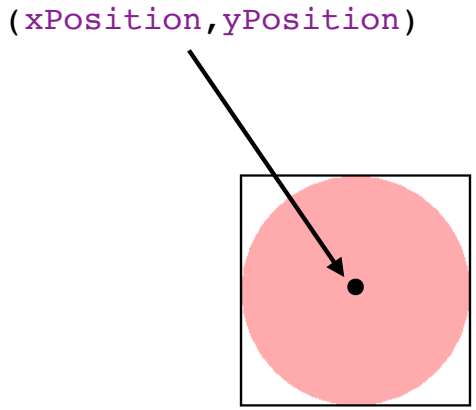
WHERE IS THE BALL DRAWN?

```
void draw (Graphics g) {
    g.setColor(color);
    g.fillOval(xPosition,yPosition,size,size);
}
```



relative to upper left hand corner

WE WANT xPosition & yPosition TO BE THE CENTER OF THE BALL

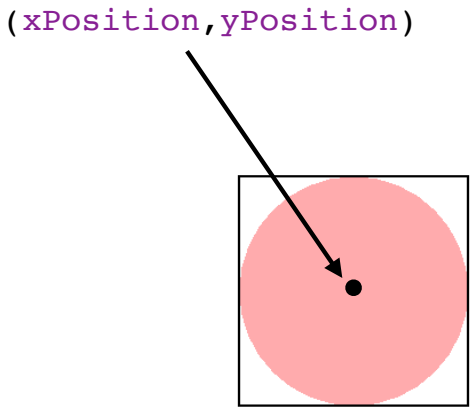


want to draw relative to center

HOW?

WE WANT xPosition & yPosition TO BE THE CENTER

```
void draw (Graphics g) {
    g.setColor(color);
    g.fillOval(xPosition-size/2,yPosition-size/2,size,size);
}
```



questions?

LET’S MOVE THE BALL

MyPanel CLASS

```
import javax.swing.*;
import java.awt.*;

public class MyPanel extends JPanel{
    int width;
    int height;
    Ball ball;

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

    public static void main(String[] args) {
        MyPanel panel = new MyPanel();
        MyFrame frame = new MyFrame(panel);
    }

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

        ball.draw(g);
    }
}
```

HOW TO MOVE THE BALL?
HOW TO ANIMATE OUR IMAGE?

A TRY

```
import javax.swing.*;
import java.awt.*;

public class MyPanel extends JPanel{
    int width;
    int height;
    Ball ball;

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

    public static void main(String[] args) {
        MyPanel panel = new MyPanel();
        MyFrame frame = new MyFrame(panel);
    }

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

        ball.draw(g);
        ball.move();
    }
}
```

A BETTER TRY

```
import javax.swing.*;
import java.awt.*;

public class MyPanel extends JPanel{
    int width;
    int height;
    Ball ball;

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

    public static void main(String[] args) {
        MyPanel panel = new MyPanel();
        MyFrame frame = new MyFrame(panel);
        while(true) {
            panel.repaint();
        }
    }

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

        ball.draw(g);
        ball.move();
    }
}
```

we want to keep drawing
our image over and over
to see the movement
use repaint()

BALL IS MOVING SO FAST!
HOW TO CONTROL THIS?

FRAME RATE

- Measurement used in movies/animations
- How many images we are shown per second
- Measured in frames (images) per second (FPS)
- Some standard frame rates:
  - 60 fps (TV)
  - 24 fps (most animation)
  - 12 fps (first silent movies)
- Right now, our program is showing frames as fast as java can generate them!
- We need a frame rate for our animation

A FRAME RATE FOR OUR PROGRAM

- Show the first image (paint)
- Pause for a certain amount of time
- Show the second image (repaint)
- loop…

ADD A DELAY METHOD TO MyPanel

```
void delay (int time) {

}
```

time = amount to delay

Thread.sleep()

```
Thread.sleep(time)
```

pauses the current thread for time in milliseconds
millisecond = 1/1000 second

Thread.sleep()

```
Thread.sleep(time)
```

might generate an error
might generate an “exception”

try AND catch

```
try {
    //some block of dangerous code
}
catch (Exception exc){
    //what to do if the block of code generates an error
}
```

won't be in tests or exams
you'll encounter it again
in more advanced CS
classes

More info: https://www.w3schools.com/java/java_try_catch.asp

HOW WE HAVE TO USE Thread.sleep()

```
try {
    Thread.sleep(time);
}
catch (Exception exc){
    System.out.println("I couldn't sleep!");
}
```

Java thinks Thread.sleep()
is so dangerous that it forces
you to take care of errors it
might generate.
You can only use it inside a
try/catch statement

A DELAY METHOD

```
void delay (int time) {
    try {
        Thread.sleep(time);
    }
    catch (Exception exc){
        System.out.println("I couldn't sleep!");
    }
}
```

USE DELAY IN MAIN

```
public static void main(String[] args) {
    MyPanel panel = new MyPanel();
    MyFrame frame = new MyFrame(panel);
    while (true) {
        panel.repaint();
        panel.delay(100);
    }
}
```

delay of 100ms = frame rate of ?

1000/100 = 10fps

questions?

HOW COULD WE IMPROVE THIS?

CREATE AN ANIMATE METHOD

- takes in frame rate as a parameter
- does the looping, repainting, and delaying based on frame rate

AN ANIMATE METHOD

```
void animate(int framerate) {
    int time = 1000/framerate;
    while (true) {
        repaint();
        delay(time);
    }
}
```

USE IN MAIN

```
public static void main(String[] args) {
    MyPanel panel = new MyPanel();
    MyFrame frame = new MyFrame(panel);
    panel.animate(60);
}
```

questions?

HOW COULD WE IMPROVE THE PROGRAM NOW?

KEEP THE BALL ON SCREEN
HAVE THE BALL BOUNCE

WHERE SHOULD WE WRITE THE BOUNCE CODE?

GOOD CODING PRACTICE: ANYTHING THAT A BALL DOES OR THAT IS DONE TO A BALL SHOULD HAPPEN IN THE BALL CLASS

A BOUNCE METHOD IN THE BALL CLASS

IN THE BALL CLASS

```
void bounce () {

}
```

what parameters should we use?

what do we need to know to bounce a ball around a particular window?

PARAMETERS: WINDOW SIZE

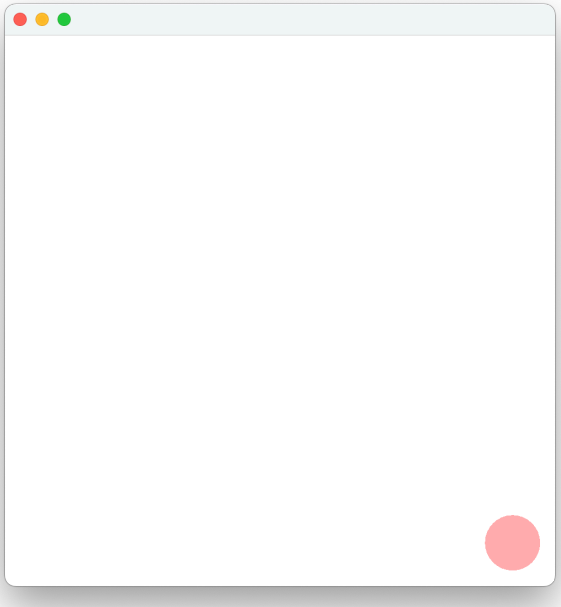
```
void bounce (int windowWidth, int windowHeight) {

}
```

size of the window!

when do I bounce?

when I hit an edge!

HITTING AN EDGE



how do I know when I'm hitting an edge?
or am past one?
how many edges do we need to think about?

CHECKING FOR EDGES

```
void bounce (int windowWidth, int windowHeight) {
    //right edge
    if (xPosition > windowWidth) {

    }
    //bottom edge
    if (yPosition > windowHeight) {

    }
}
```

what do I do when I hit an edge?

change direction!

how?

CHANGING DIRECTION

```
void bounce (int windowWidth, int windowHeight) {
    //right edge
    if (xPosition > windowWidth) {
        xSpeed = -xSpeed;
    }
    //bottom edge
    if (yPosition > windowHeight) {
        ySpeed = -ySpeed;
    }
}
```

ALL THE EDGES

```
void bounce (int windowWidth, int windowHeight) {
    //right and left edges
    if (xPosition > windowWidth | xPosition < 0) {
        xSpeed = -xSpeed;
    }
    //top and bottom edges
    if (yPosition > windowHeight | yPosition < 0) {
        ySpeed = -ySpeed;
    }
}
```

NOTE: ONLY WORKS IF BALL STARTS INSIDE WINDOW

```
void bounce (int windowWidth, int windowHeight) {
    //right and left edges
    if (xPosition > windowWidth | xPosition < 0) {
        xSpeed = -xSpeed;
    }
    //top and bottom edges
    if (yPosition > windowHeight | yPosition < 0) {
        ySpeed = -ySpeed;
    }
}
```

questions?

USE bounce IN MyPanel
WHERE?

USE bounce IN MyPanel

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

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

}
```

ISSUES WITH BOUNCE?

ISSUES WITH BOUNCE?
NOT ACCOUNTING FOR SIZE OF BALL
HOW TO FIX?

BOUNCE METHOD ACCOUNTING FOR BALL SIZE

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

questions?

PLAY WITH DIFFERENT BALL PARAMETERS: SPEED, SIZE, COLOR

IN MyPanel CONSTRUCTOR

```
MyPanel () {
    width = 500;
    height = 500;
    Color c = new Color(42, 186, 186);
    ball = new Ball(c, 80, 100,200);
    ball.setSpeed(5,7);
    Dimension d = new Dimension(width,height);
    setPreferredSize(d);
    setVisible(true);
}
```

questions?

Thank you!

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