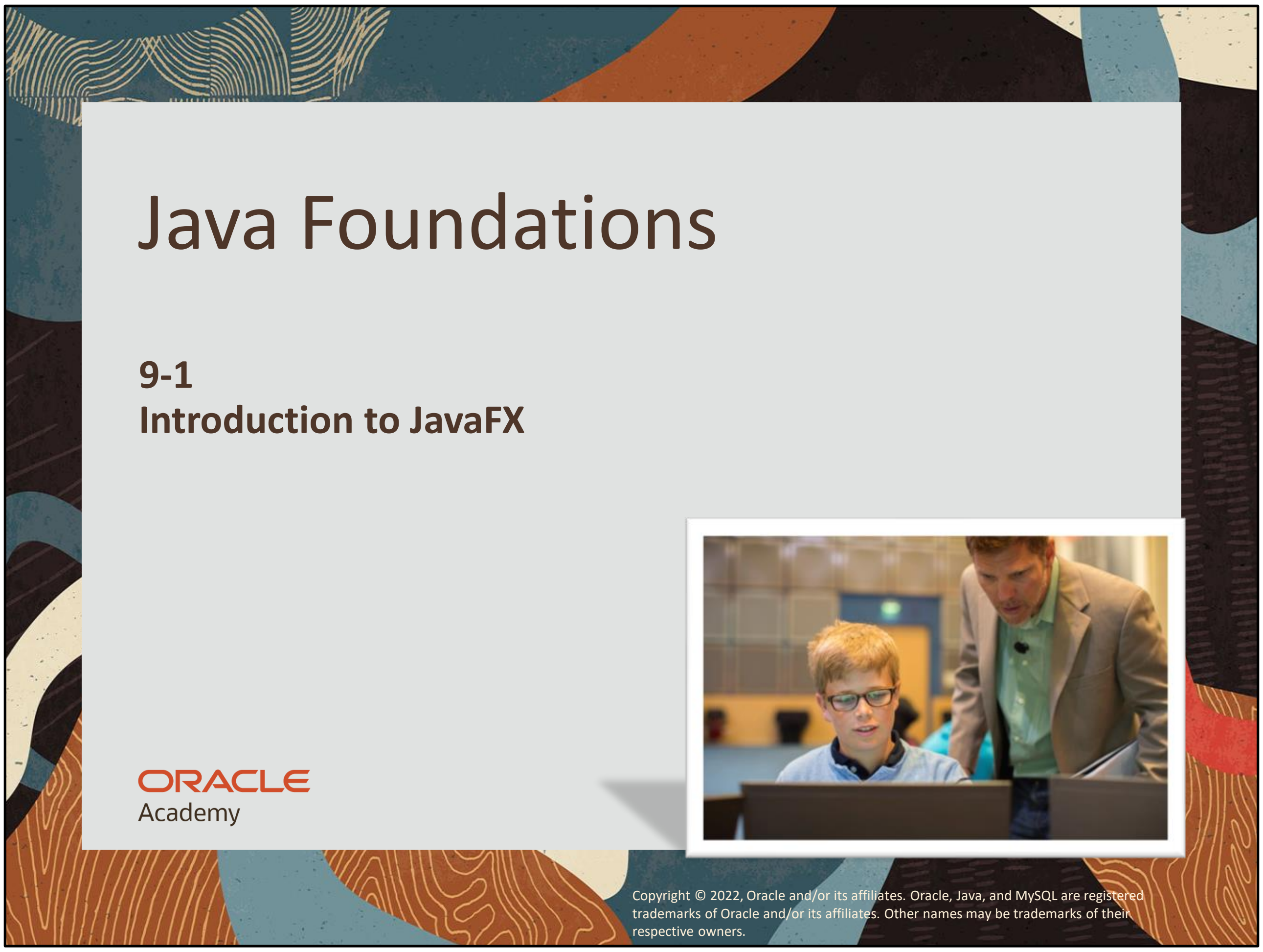
ORACLE
Academy



Java Foundations

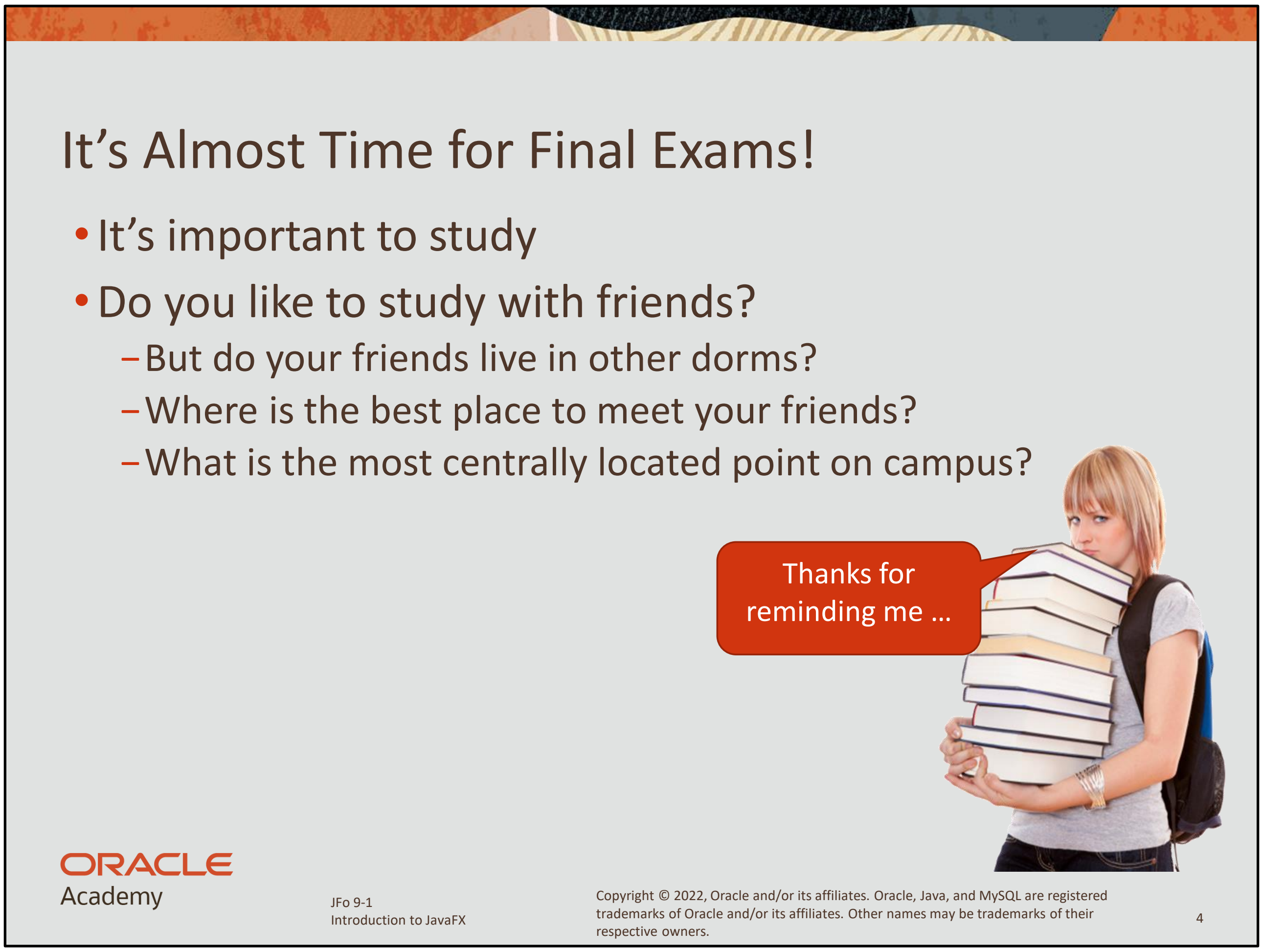
9-1 Introduction to JavaFX

ORACLE Academy

Objectives

- This lesson covers the following objectives:
  - Create a JavaFX project
  - Explain the components of the default JavaFX project
  - Describe different types of Nodes and Panes
  - Explain the Scene Graph, Root Node, Scenes, and Stages

ORACLE
Academy



It’s Almost Time for Final Exams!

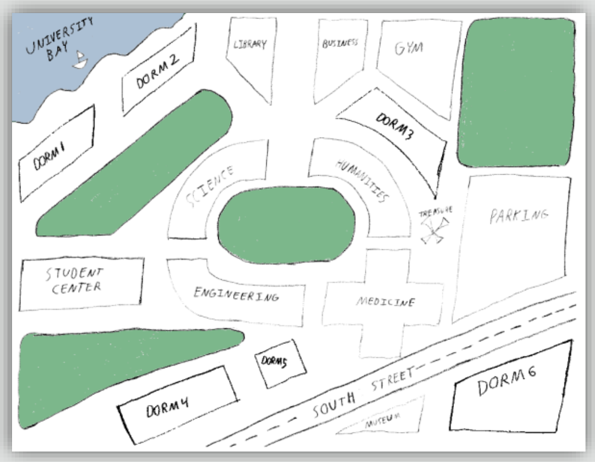
- It’s important to study
- Do you like to study with friends?
  - But do your friends live in other dorms?
  - Where is the best place to meet your friends?
  - What is the most centrally located point on campus?

ORACLE Academy

JFo 9-1
Introduction to JavaFX

JavaFX Can Help

- JavaFX is used to create GUI applications
- GUI: Graphical user interface
- A GUI application allows us to see the answer on a map



ORACLE Academy

Exercise 1

- The reference material for this slide `CampusMap.mp4` demonstrates a completed application written using JavaFX
- Play `CampusMap.mp4`
- Each square is aligned with the correct dorm on the map
- Each dorm's population is adjusted by clicking and dragging the text below each square
- Observe changes in the following center points:
  - All students in all dorms
  - A study group of three friends living in Dorms 1, 2, and 4

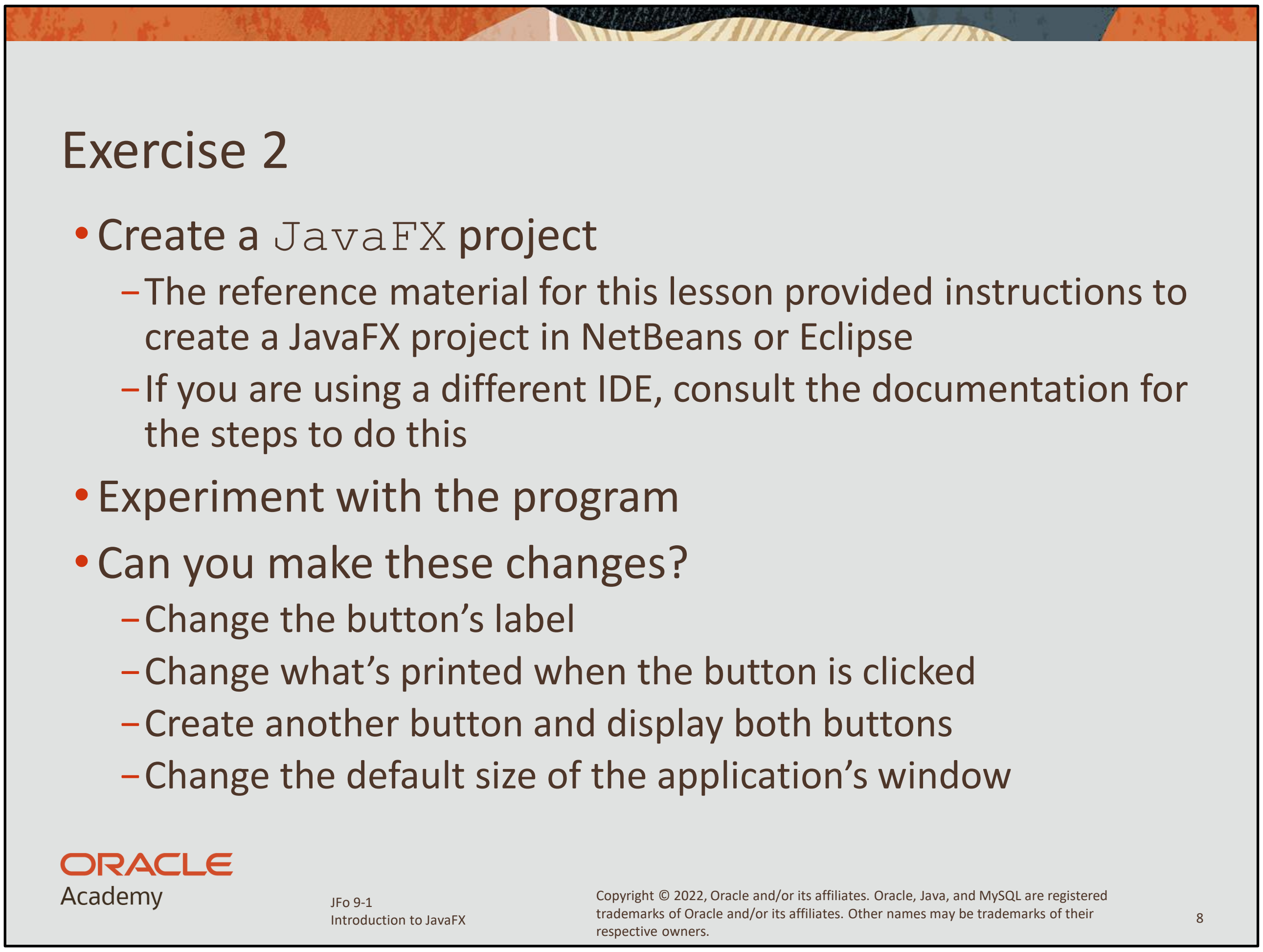
ORACLE Academy

But That's Not my Campus!

- You're right
- It would be better if the program used your school's …
  - Map of campus
  - Dorm names
  - Dorm populations
  - And your group of friends
- That's this section's problem set
- Section 9 discusses everything you'll need to re-create the program

ORACLE Academy

Java Puzzle Ball is also a JavaFX application, but it would take far too long to re-create.



Exercise 2

- Create a `JavaFX` project
  - The reference material for this lesson provided instructions to create a JavaFX project in NetBeans or Eclipse
  - If you are using a different IDE, consult the documentation for the steps to do this
- Experiment with the program
- Can you make these changes?
  - Change the button’s label
  - Change what’s printed when the button is clicked
  - Create another button and display both buttons
  - Change the default size of the application’s window

ORACLE Academy

The Default JavaFX Project

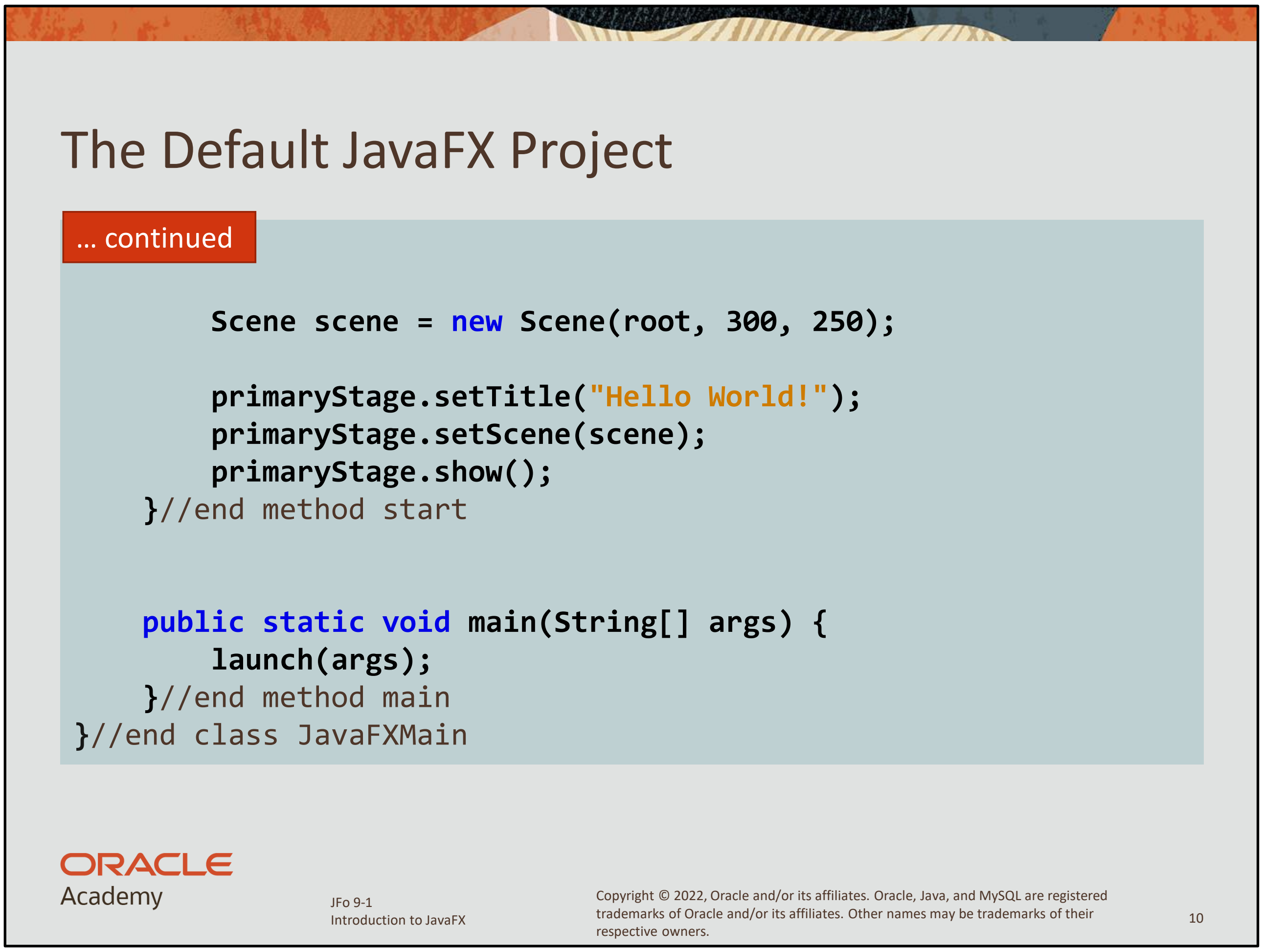
```java
public class JavaFXMain extends Application {

    @Override
    public void start(Stage primaryStage) {
        Button btn = new Button();
        btn.setText("Say 'Hello World'");
        btn.setOnAction(new EventHandler<ActionEvent>() {

            @Override
            public void handle(ActionEvent event) {
                System.out.println("Hello World!");
            }
        });

        StackPane root = new StackPane();
        root.getChildren().add(btn);
```

Continued on next slide..



The Default JavaFX Project

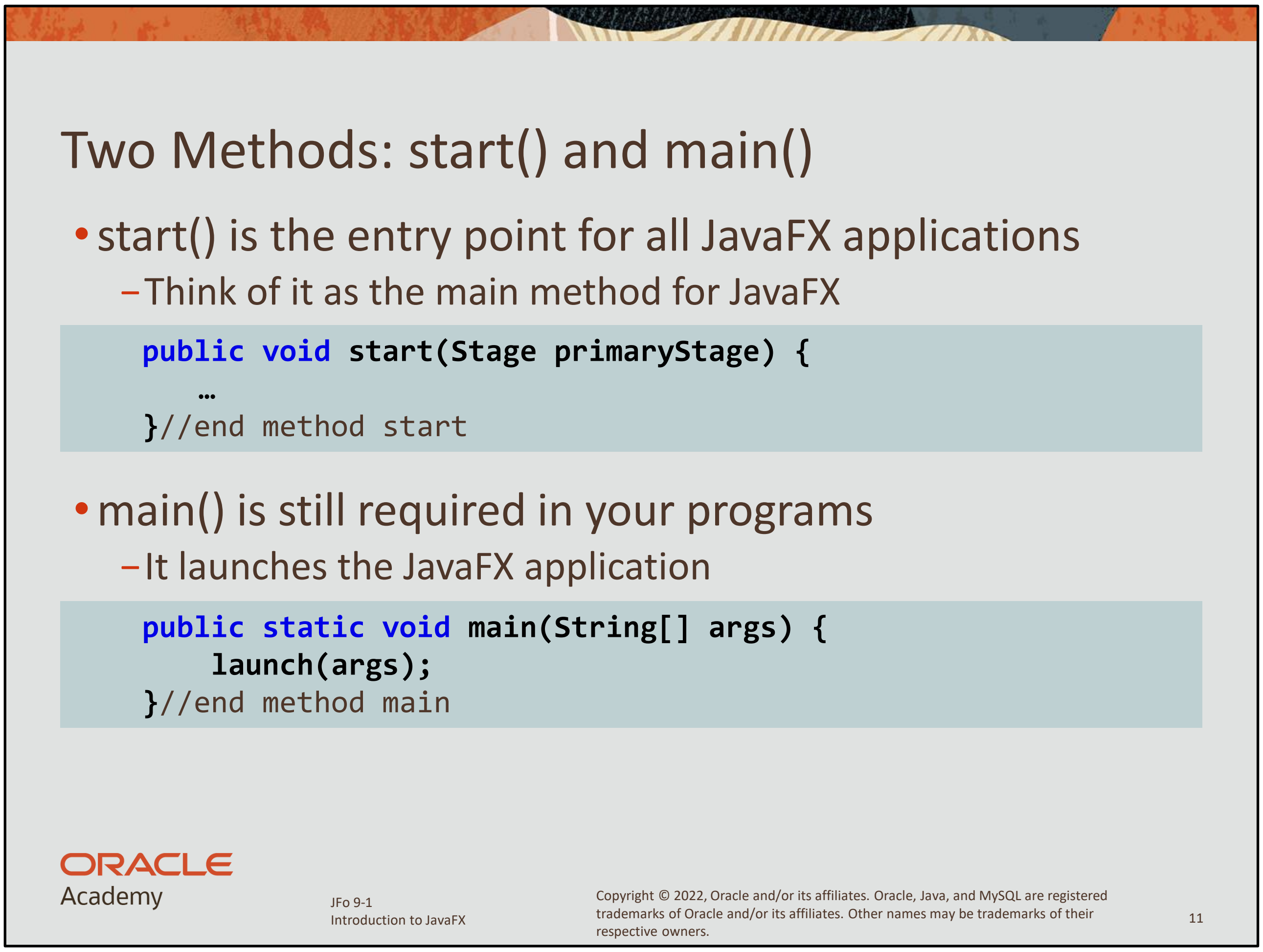
... continued

```
        Scene scene = new Scene(root, 300, 250);

        primaryStage.setTitle("Hello World!");
        primaryStage.setScene(scene);
        primaryStage.show();
    }//end method start


    public static void main(String[] args) {
        launch(args);
    }//end method main
}//end class JavaFXMain
```

ORACLE
Academy



Two Methods: start() and main()

- start() is the entry point for all JavaFX applications
  - Think of it as the main method for JavaFX

```
public void start(Stage primaryStage) {
    …
}//end method start
```

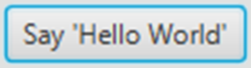
- main() is still required in your programs
  - It launches the JavaFX application

```
public static void main(String[] args) {
    launch(args);
}//end method main
```

ORACLE
Academy

Buttons Are Objects

- Buttons are like any other object
  - They can be instantiated
  - They contain fields
  - They contain methods



```
    public void start(Stage primaryStage) {
        Button btn = new Button();
        btn.setText("Say 'Hello World'");
       …
    }//end method start
```

- From this code, we can tell …
  - Buttons contain a text field
  - Buttons contain a method for changing the text field

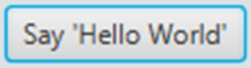
Buttons Are Nodes

- Some of these fields and methods are designed to store and manipulate visual properties:
  - btn.getText()
  - btn.setMinHeight()
  - btn.setLayoutX() **//set x position**
  - btn.setLayoutY() **//set y position**
  - btn.isPressed() **//is it pressed?**
- Objects like this are called JavaFX Nodes

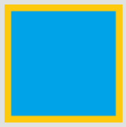
ORACLE
Academy

Nodes

- There are many types of JavaFX Nodes:



Button



Rectangle

PieChart

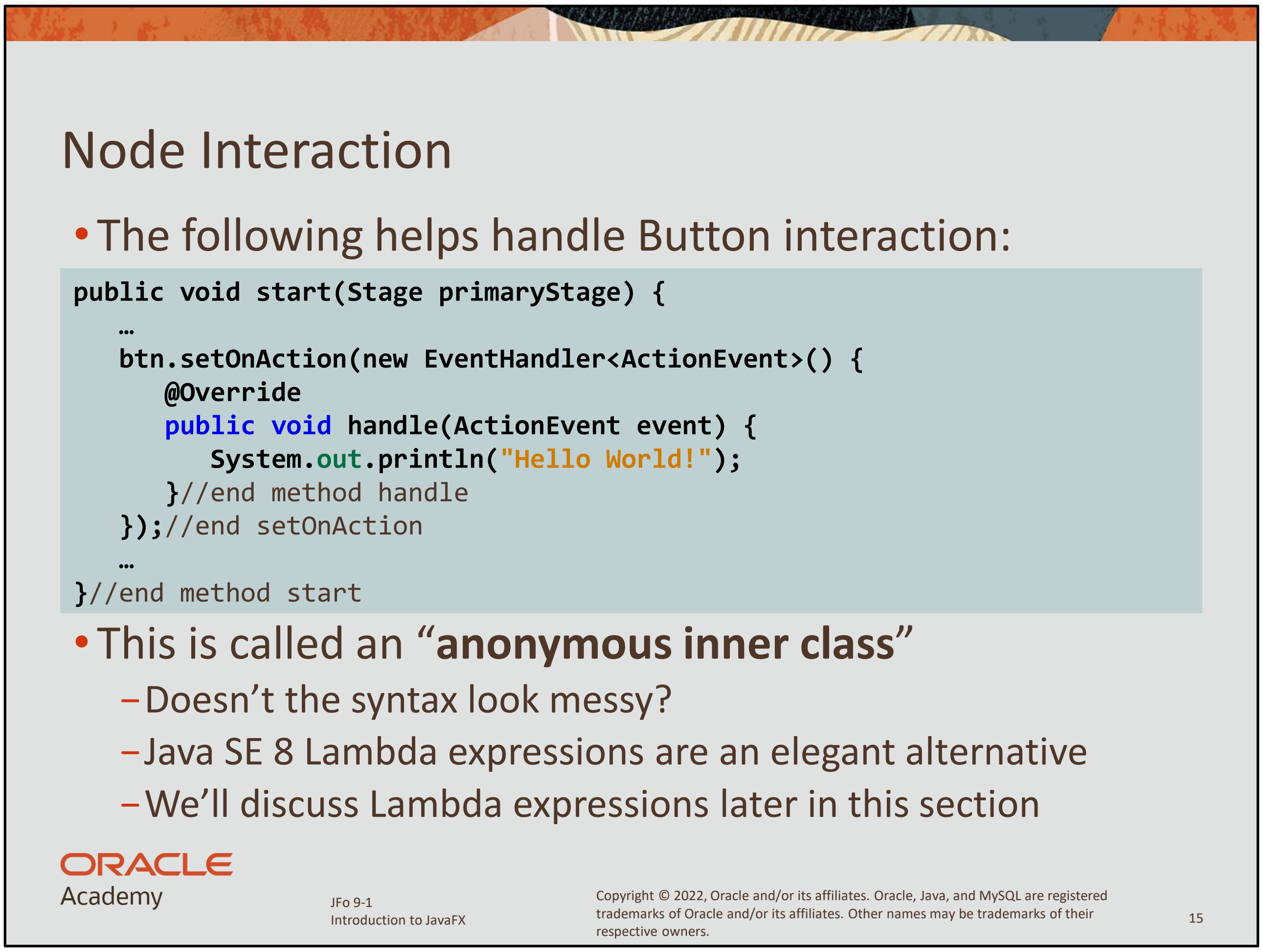
ScrollBar

Text

ImageView

- Visual objects you'll create will most likely …
  - Be a Node, or
  - Include a Node as a field

ORACLE
Academy



Node Interaction

- The following helps handle Button interaction:

```
public void start(Stage primaryStage) {
   …
   btn.setOnAction(new EventHandler<ActionEvent>() {
      @Override
      public void handle(ActionEvent event) {
         System.out.println("Hello World!");
      }//end method handle
   });//end setOnAction
   …
}//end method start
```

- This is called an “**anonymous inner class**”
  - Doesn’t the syntax look messy?
  - Java SE 8 Lambda expressions are an elegant alternative
  - We’ll discuss Lambda expressions later in this section

ORACLE
Academy

Creating Nodes

- Nodes are instantiated like any other Java object:

```
public void start(Stage primaryStage) {
   Button btn1 = new Button();
   Button btn2 = new Button();
   btn1.setText("Say 'Hello World'");
   btn2.setText("222");
   …
}//end method start
```

- After you instantiate a Node:
  - It exists and memory is allocated to store the object
  - Its fields can be manipulated, and methods can be called
  - But it might not be displayed …

At least not yet …

ORACLE
Academy

Displaying Nodes

- There are a few steps to displaying a node

```
public void start(Stage primaryStage) {
   Button btn1 = new Button();
   Button btn2 = new Button();
   btn.setText("Say 'Hello World'");
   btn.setText("222");
   StackPane root = new StackPane();
   root.getChildren().add(btn1);
   root.getChildren().add(btn2);
   …
}//end method start
```

- First, add each Node to the Root Node
  - It's usually named root
  - It's very much like an ArrayList of all Nodes

ORACLE Academy

Adding Nodes to the Root Node

- You could add each Node separately:

✓
```
root.getChildren().add(btn1);
root.getChildren().add(btn2);
root.getChildren().add(btn3);
```

- Or you could add many Nodes at once:

✓
```
root.getChildren().addAll(btn1, btn2, btn3);
```

Adding Nodes to the Root Node

- But don’t add the same Node more than once
  - This causes a compiler error:

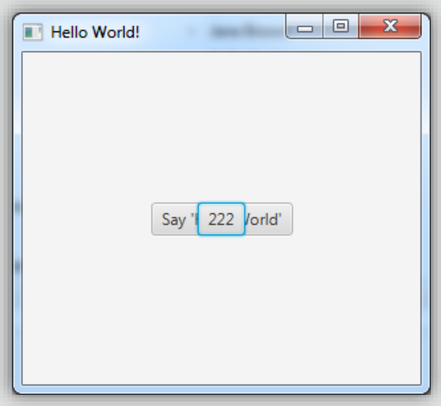
```
root.getChildren().add(btn1);
root.getChildren().add(btn1);
```

StackPane Root Node

- The Root Node in this example is a StackPane

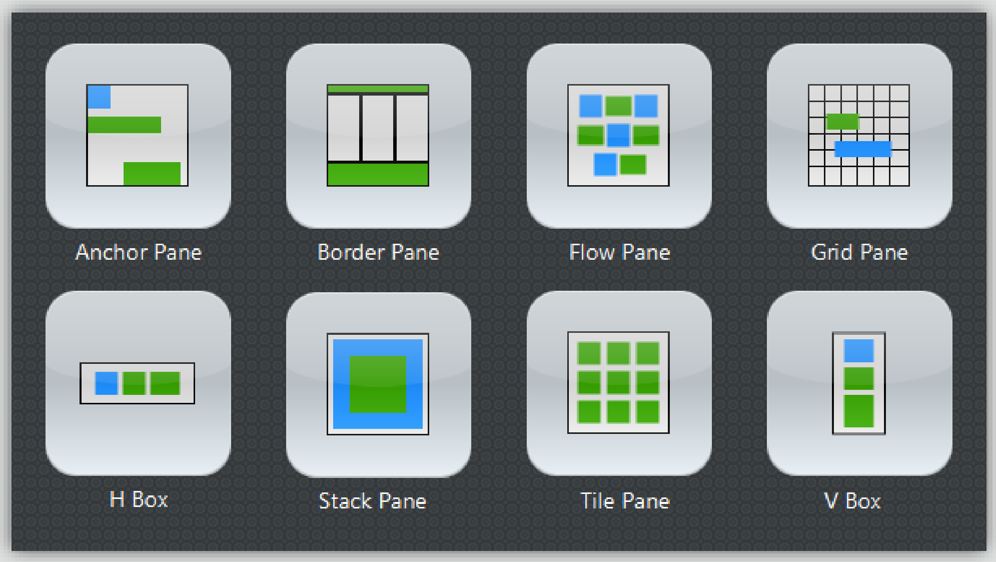
```
StackPane root = new StackPane();
root.getChildren().addAll(btn1, btn2);
```

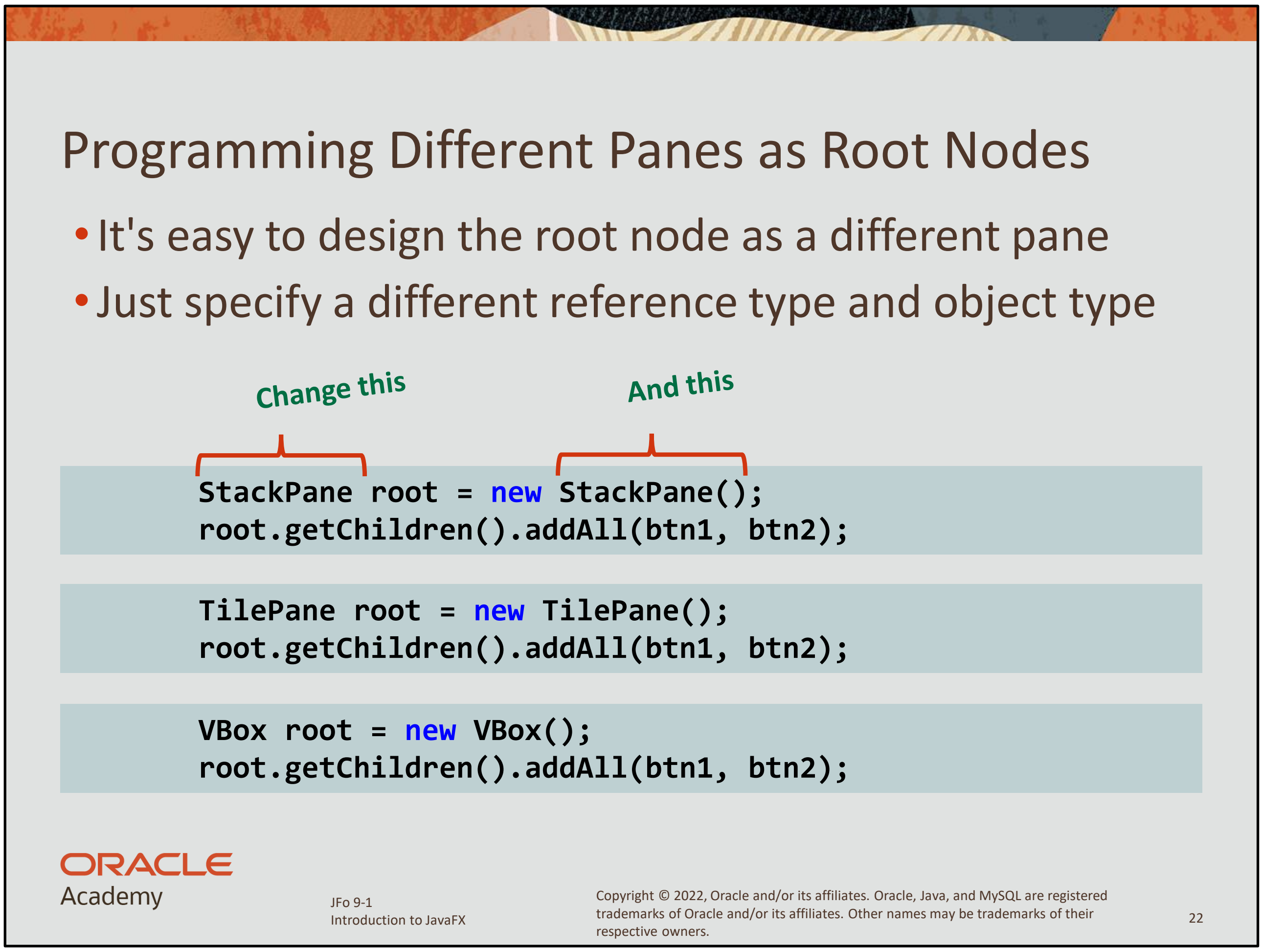
  - The StackPane stacks Nodes on top of each other
  - But small buttons could become buried and unreachable



Panes as Root Nodes

- Each Pane determines the layout of Nodes





Programming Different Panes as Root Nodes

- It's easy to design the root node as a different pane
- Just specify a different reference type and object type

Change this　　　　And this

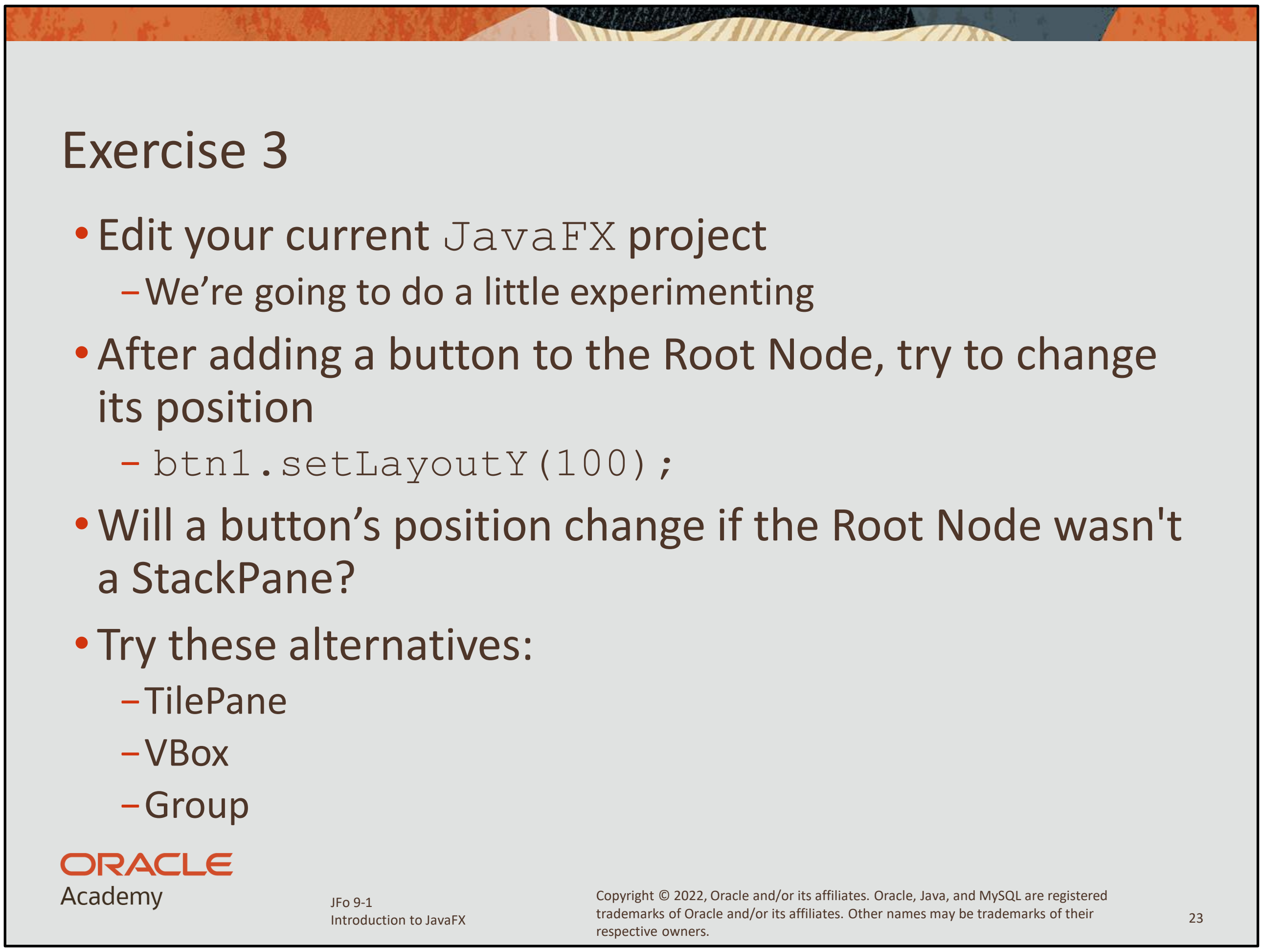
```
StackPane root = new StackPane();
root.getChildren().addAll(btn1, btn2);
```

```
TilePane root = new TilePane();
root.getChildren().addAll(btn1, btn2);
```

```
VBox root = new VBox();
root.getChildren().addAll(btn1, btn2);
```

ORACLE
Academy

JFo 9-1
Introduction to JavaFX



Exercise 3

- Edit your current `JavaFX` project
  - We're going to do a little experimenting
- After adding a button to the Root Node, try to change its position
  - `btn1.setLayoutY(100);`
- Will a button's position change if the Root Node wasn't a StackPane?
- Try these alternatives:
  - TilePane
  - VBox
  - Group

ORACLE
Academy

Group Root Node

- A Group allows you to place Nodes anywhere

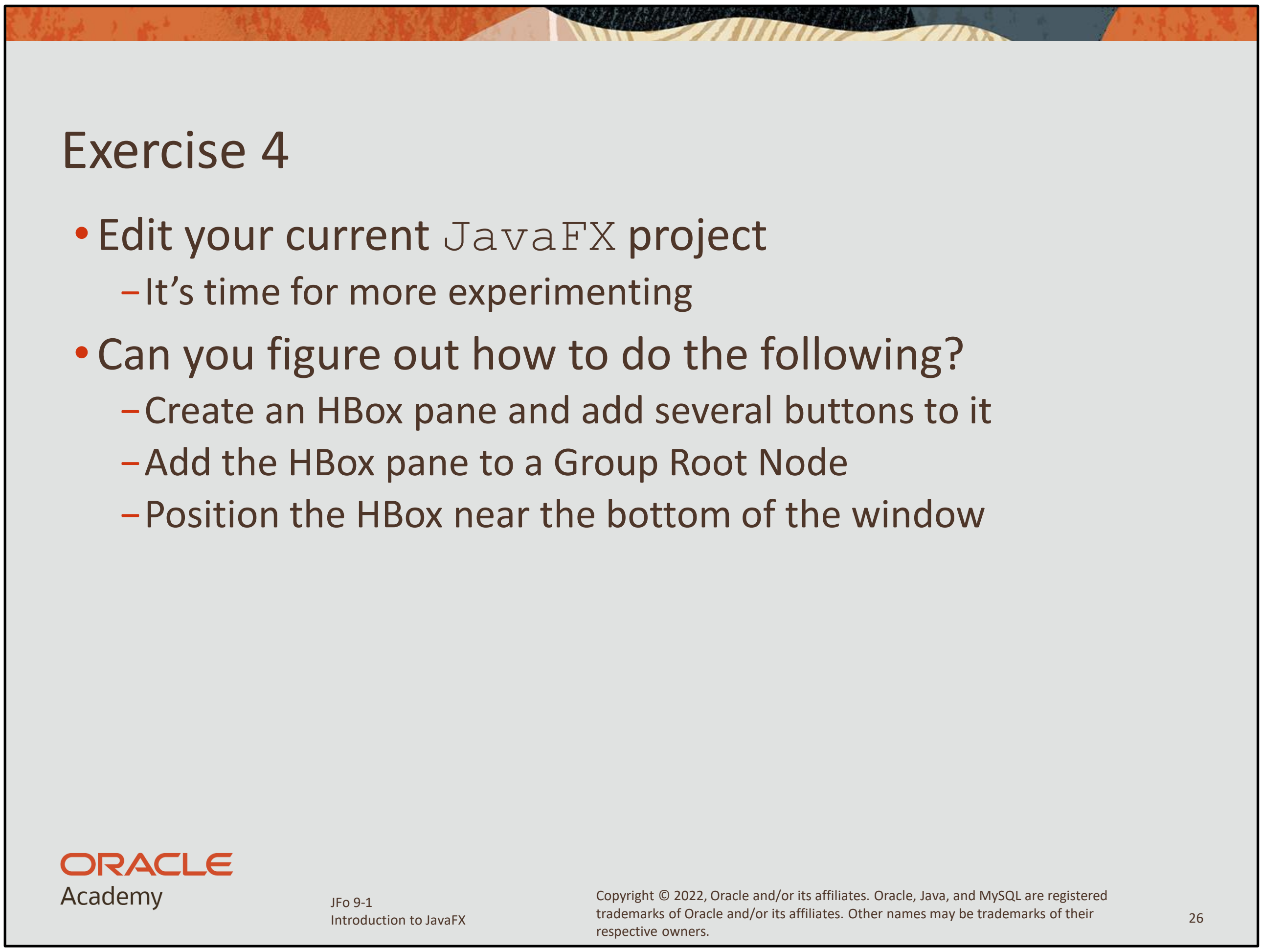
```
Group root = new Group();
root.getChildren().addAll(btn1, btn2);
btn1.setLayoutY(100);
```

- A pane may restrict where Nodes are placed
  - You couldn't move them even if you wanted to
  - You couldn't click and drag a node that's locked in a pane

```
StackPane root = new StackPane();
root.getChildren().addAll(btn1, btn2);
btn1.setLayoutY(100);                   //Has no effect
```

A Group Can Contain a Pane

- Panes are also Nodes
  - Any node can be added to the Root Node
- A Pane may be a good option for storing buttons, text input dialog boxes, and other GUI elements
  - You can't quite move individual Nodes in a Pane
  - But you can move the entire Pane in a Group
  - Move the Pane like you would any other Node

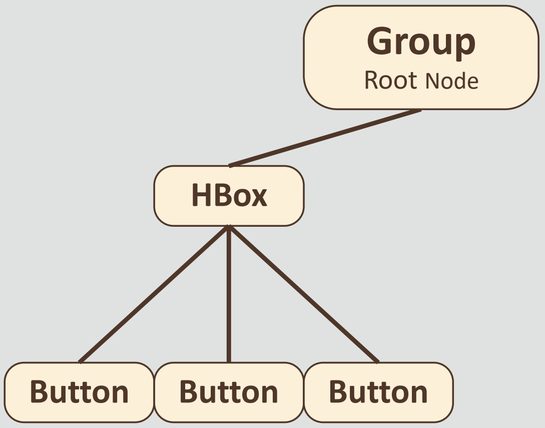

Exercise 4

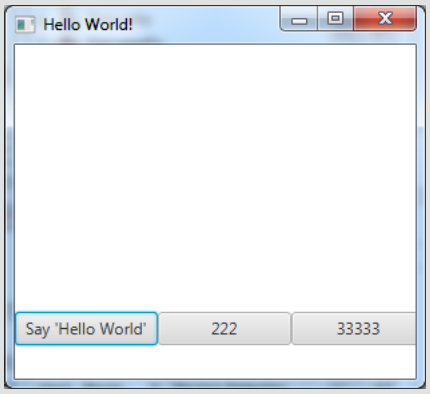
- Edit your current `JavaFX` project
  - It's time for more experimenting
- Can you figure out how to do the following?
  - Create an HBox pane and add several buttons to it
  - Add the HBox pane to a Group Root Node
  - Position the HBox near the bottom of the window

ORACLE Academy

The JavaFX Scene Graph

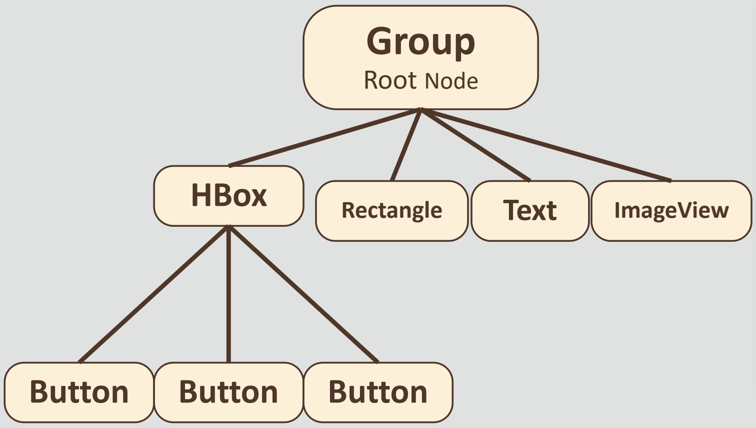
- How you decide to add nodes can be drawn as a Scene Graph
  - The Root Node contains an Hbox
  - The HBox acts as a container for buttons

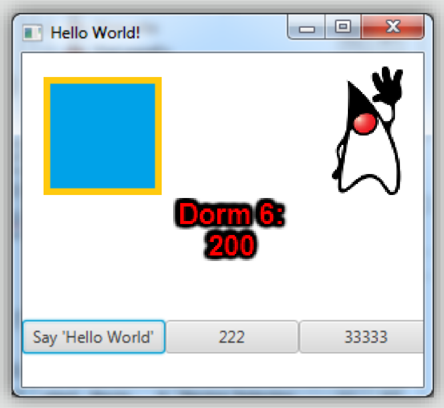




The Scene Graph

- The HBox keeps the GUI organized and conveniently located
- The rest of the window could be used for other Nodes





ORACLE Academy

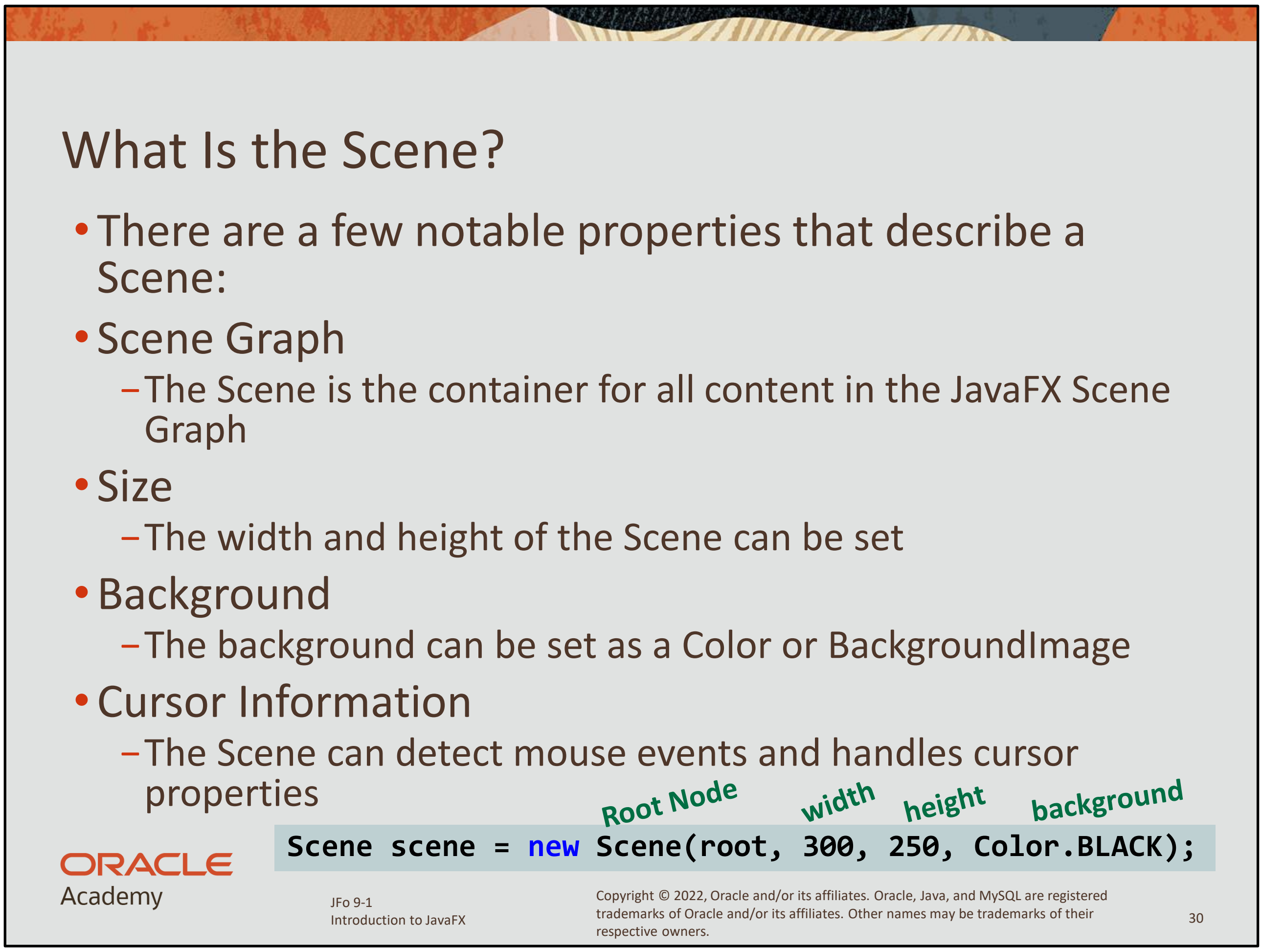
The Scene and Stage

- If we look at the rest of the default JavaFX program, we notice two more things:
  - A Scene (which contains the Root Node)
  - A Stage (which contains the Scene)

```
public void start(Stage primaryStage) {
   …
   Scene scene = new Scene(root, 300, 250);

   primaryStage.setTitle("Hello World!");
   primaryStage.setScene(scene);
   primaryStage.show();
}//end method start
```

ORACLE
Academy



What Is the Scene?

- There are a few notable properties that describe a Scene:
- Scene Graph
  - The Scene is the container for all content in the JavaFX Scene Graph
- Size
  - The width and height of the Scene can be set
- Background
  - The background can be set as a Color or BackgroundImage
- Cursor Information
  - The Scene can detect mouse events and handles cursor properties

Root Node width height background

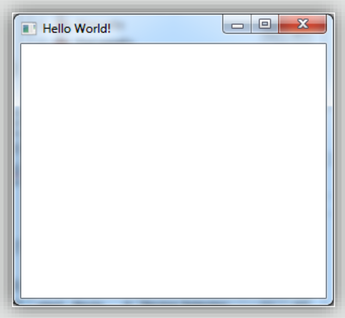
```
Scene scene = new Scene(root, 300, 250, Color.BLACK);
```

ORACLE Academy

What Is the Stage?

- Think of the Stage as the application window

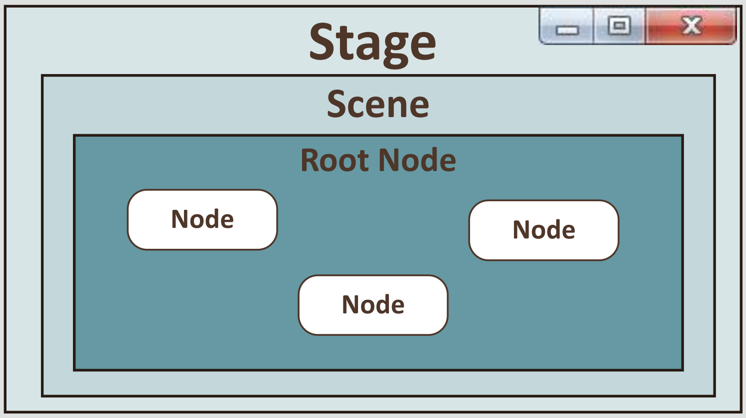
- Here are two notable Stage properties:
- Title
  - The title of the Stage can be set
- Scene
  - The Stage contains a Scene



```
primaryStage.setTitle("Hello World!");
primaryStage.setScene(scene);
primaryStage.show();
```

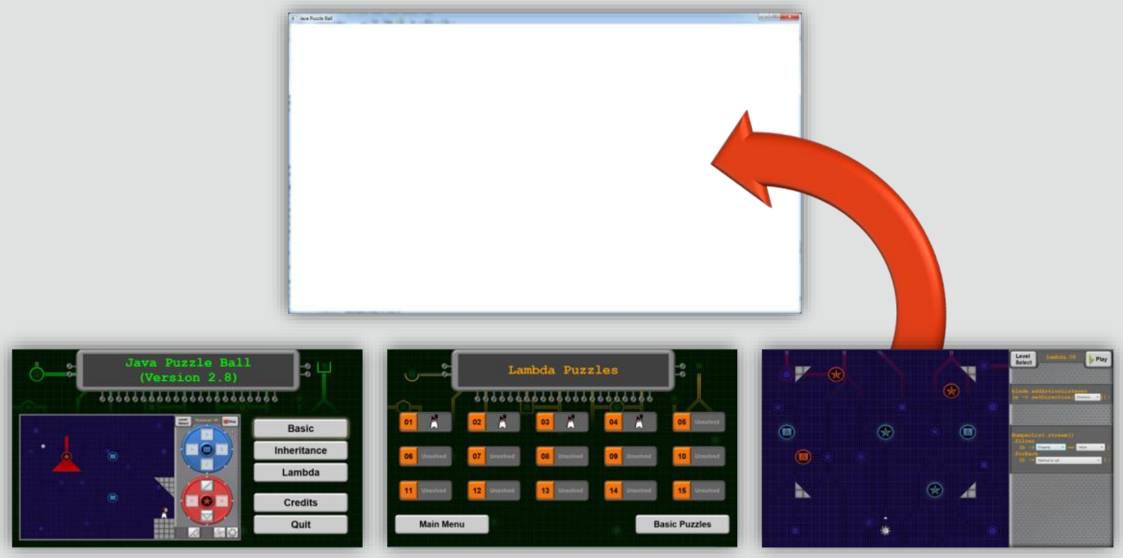
Hierarchy Animation

- A Stage is the top-level container
- A Stage contains a Scene
- A Scene contains a Root Node
- The Root Node contains other Nodes



Many Scenes, One Stage

- It’s possible to swap any scene into a single Stage

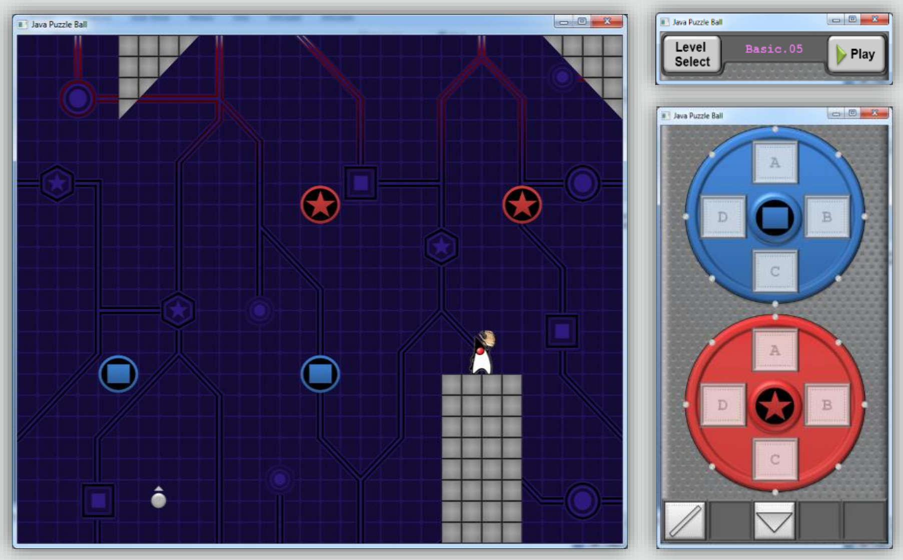


ORACLE Academy

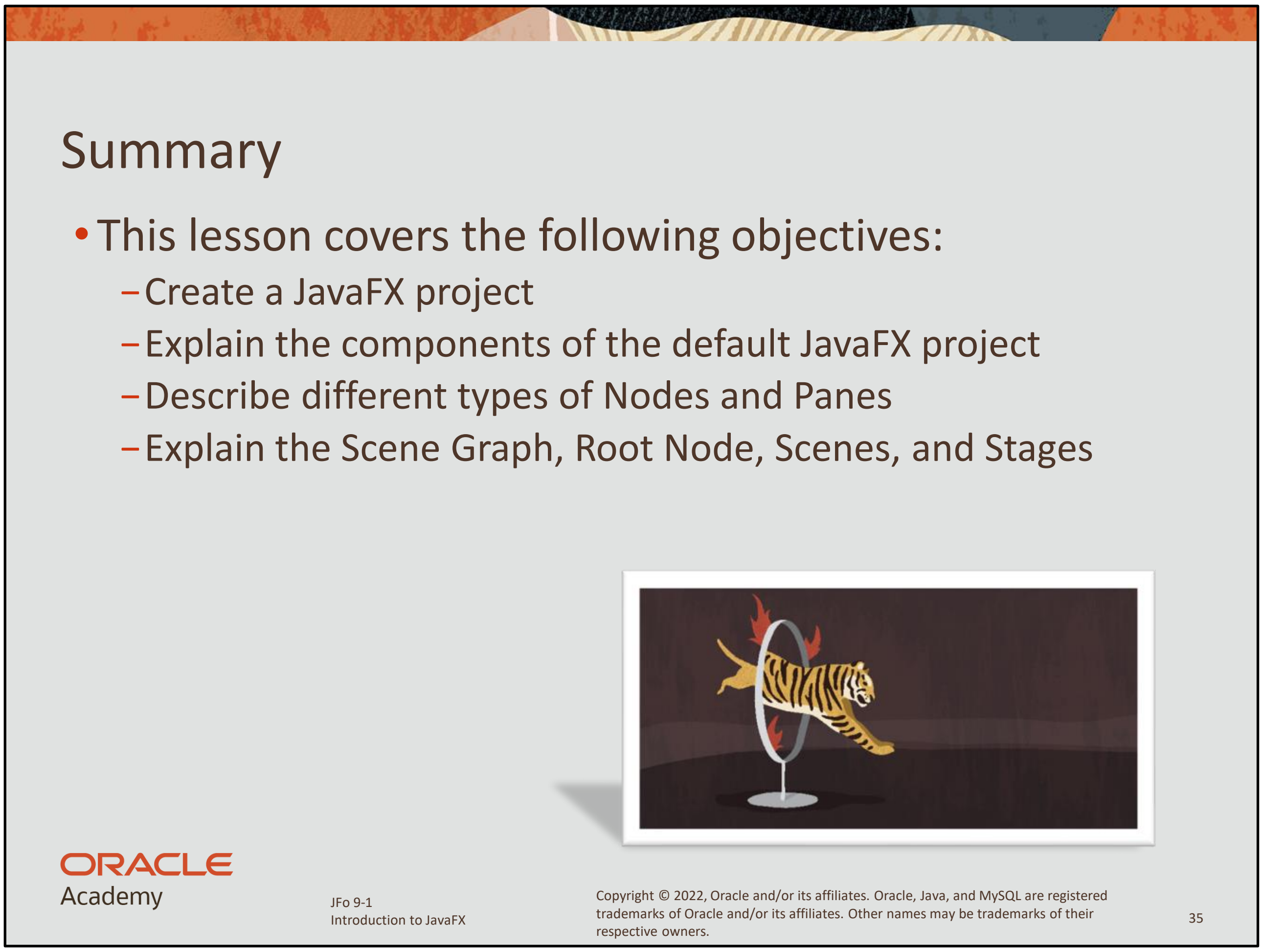
We used a single Stage in Java Puzzle Ball. If we used many Stages, it would look messy to see windows opening and closing as you navigated through the menus.

Many Scenes, Many Stages

- It's also possible to create many Stages



This is commonly done with tools. But not so much with games.



Summary

- This lesson covers the following objectives:
  - Create a JavaFX project
  - Explain the components of the default JavaFX project
  - Describe different types of Nodes and Panes
  - Explain the Scene Graph, Root Node, Scenes, and Stages

ORACLE Academy

ORACLE
Academy