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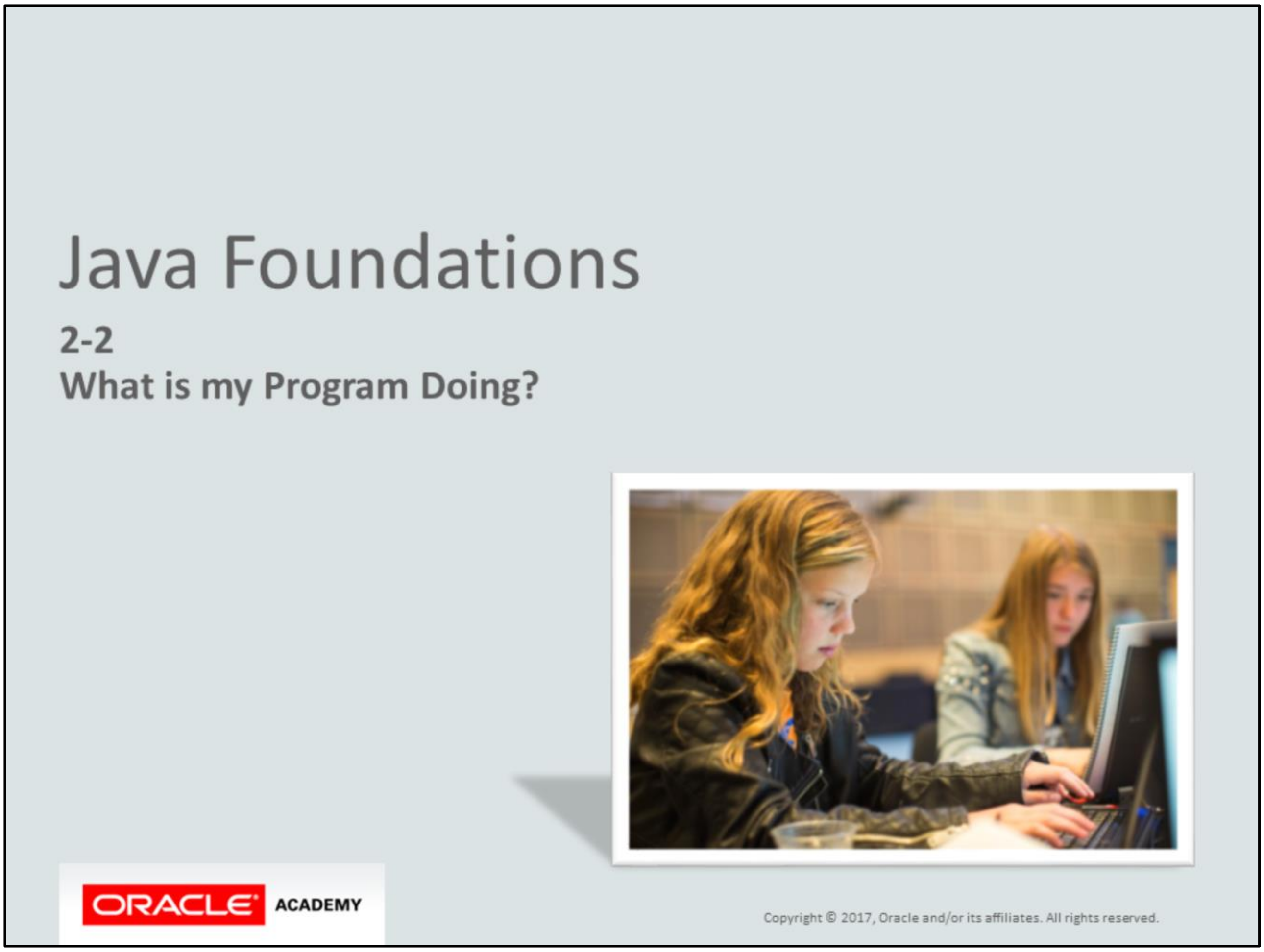

Java Foundations

2-2
What is my Program Doing?

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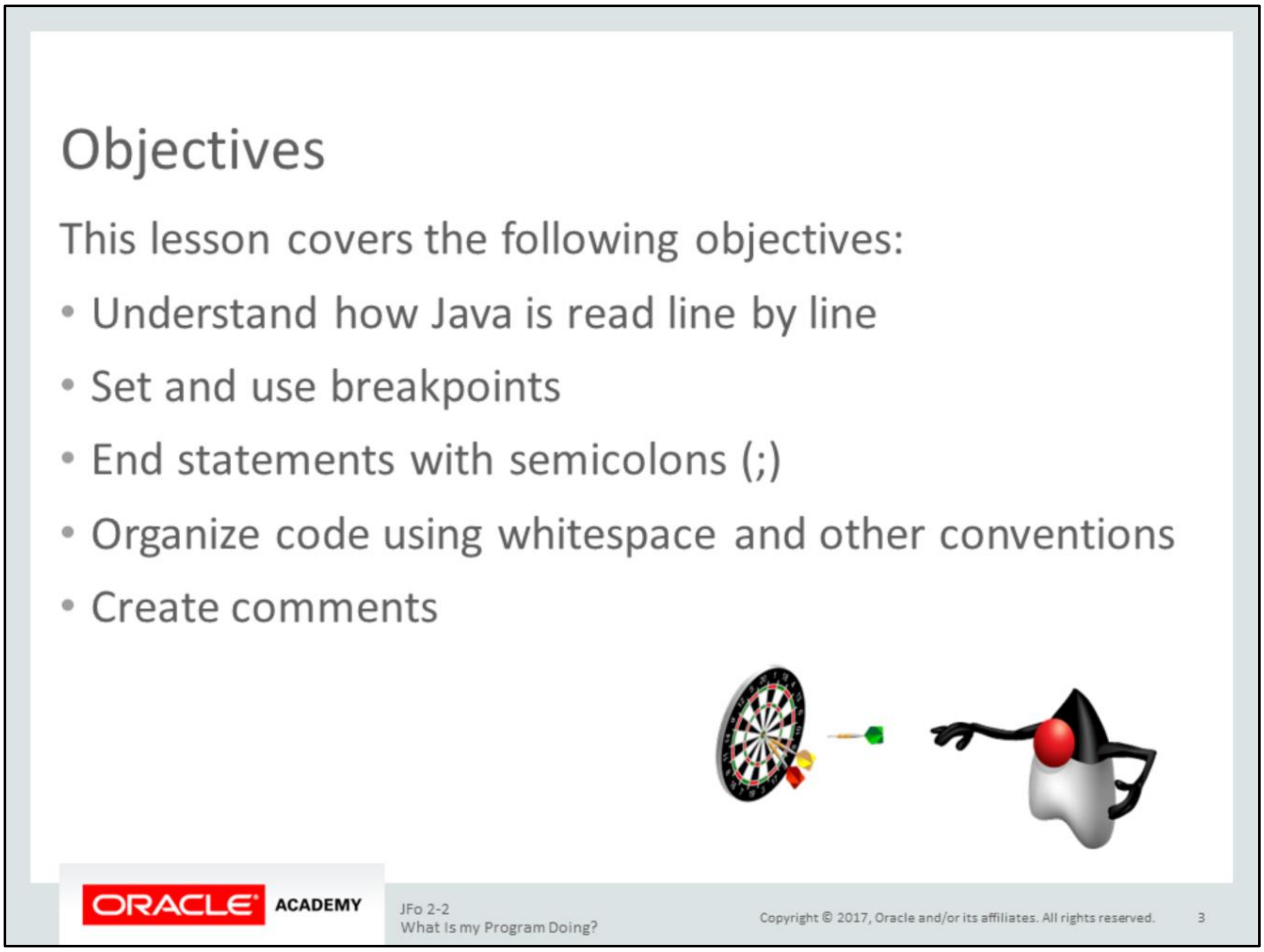
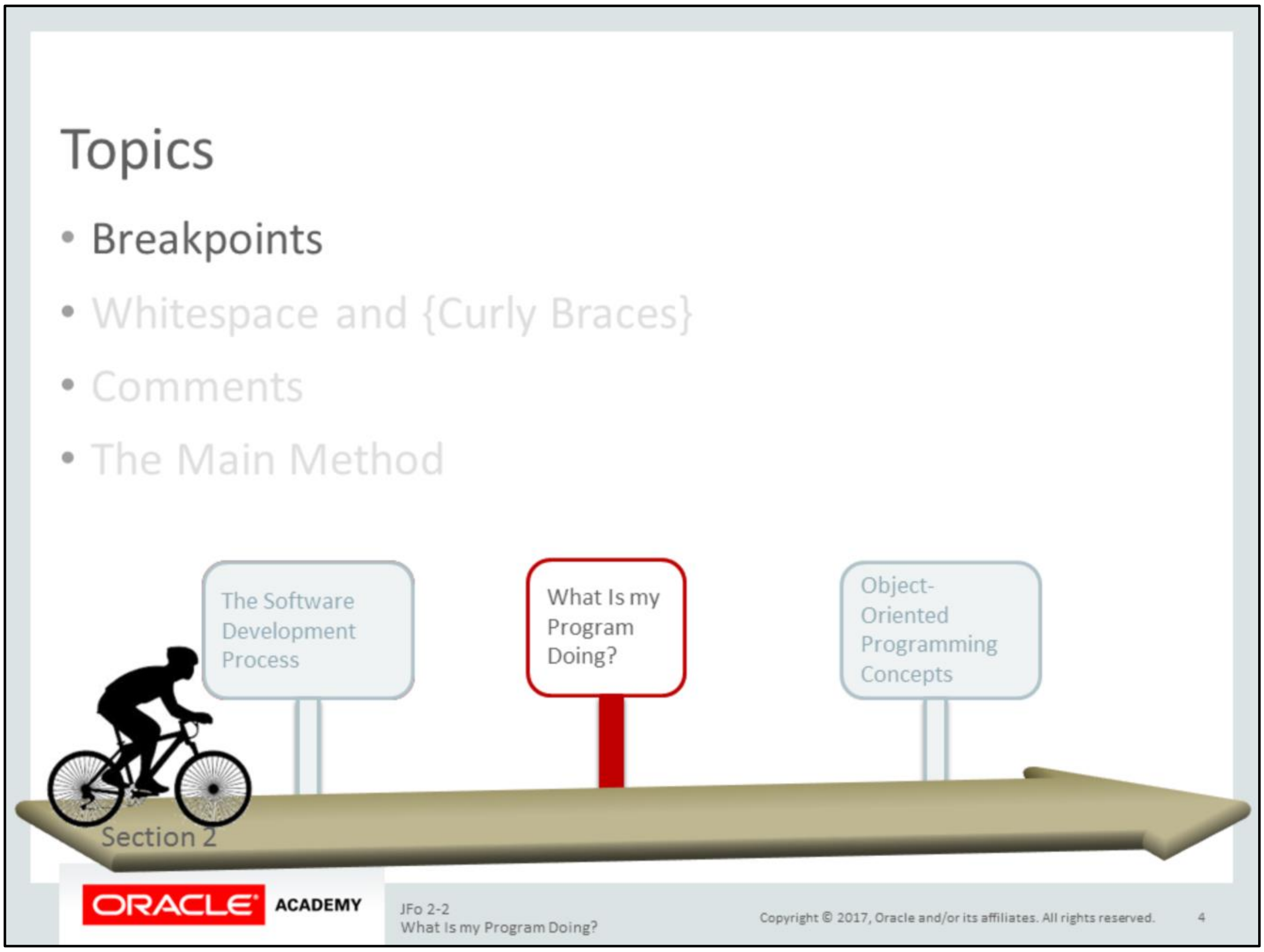


Objectives

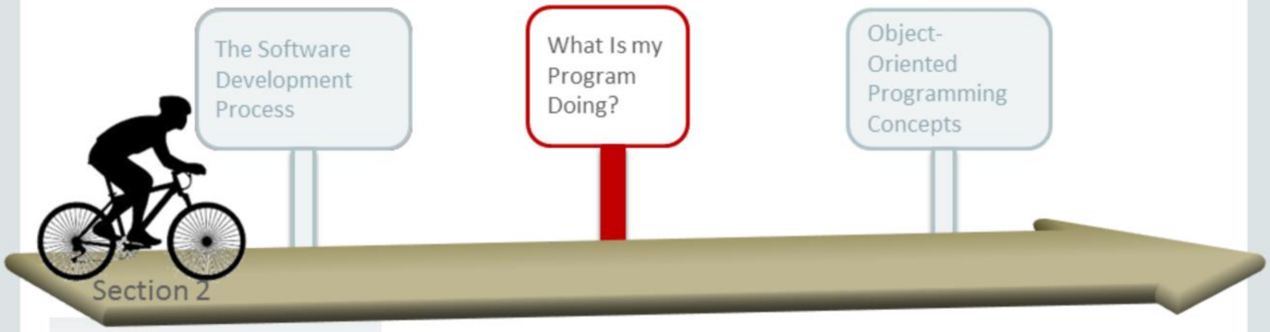
This lesson covers the following objectives:

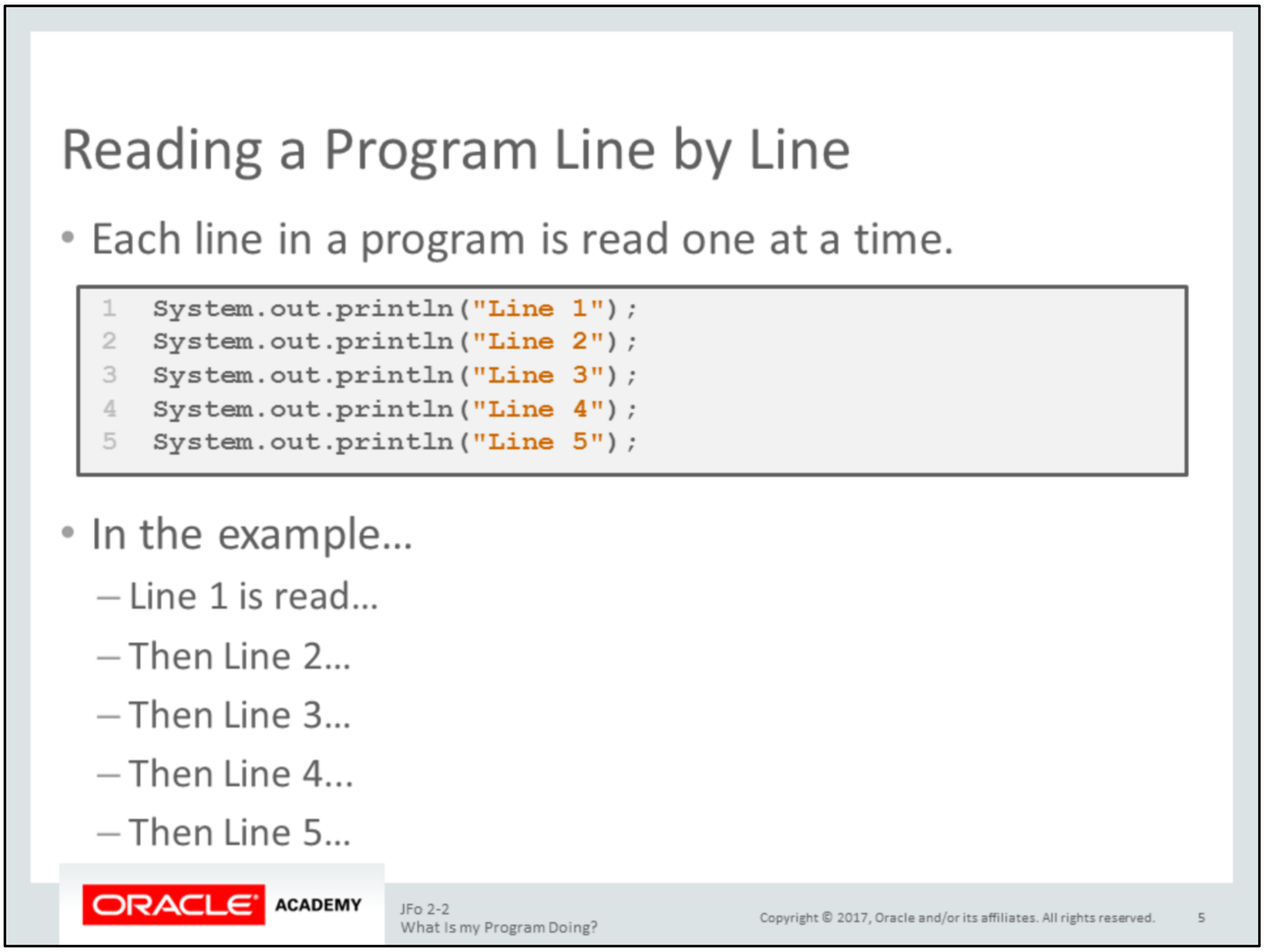
- Understand how Java is read line by line
- Set and use breakpoints
- End statements with semicolons (;)
- Organize code using whitespace and other conventions
- Create comments



Topics

- Breakpoints
- Whitespace and {Curly Braces}
- Comments
- The Main Method


The Software Development Process
What Is my Program Doing?
Object-Oriented Programming Concepts
Section 2

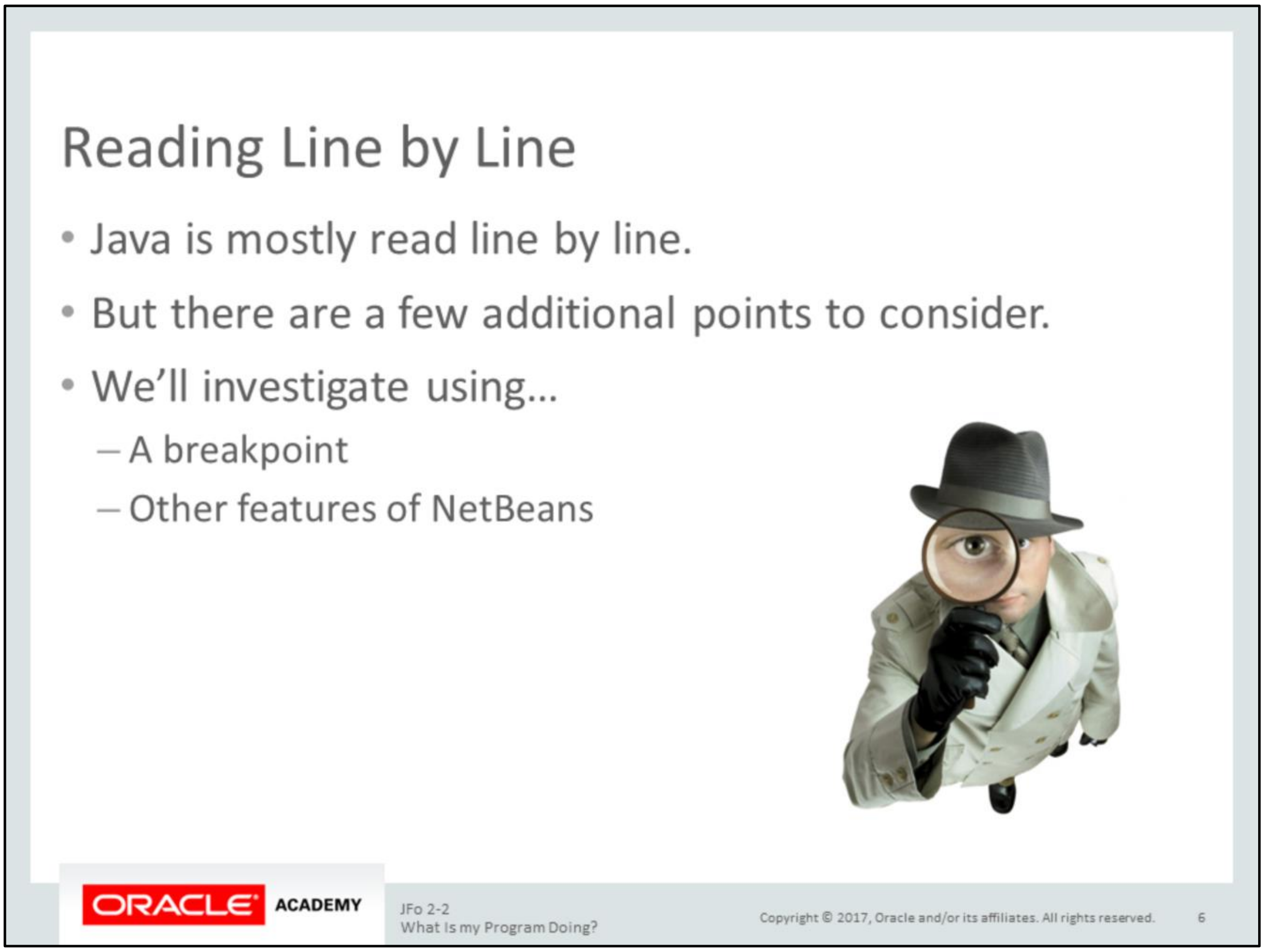


Reading a Program Line by Line

- Each line in a program is read one at a time.

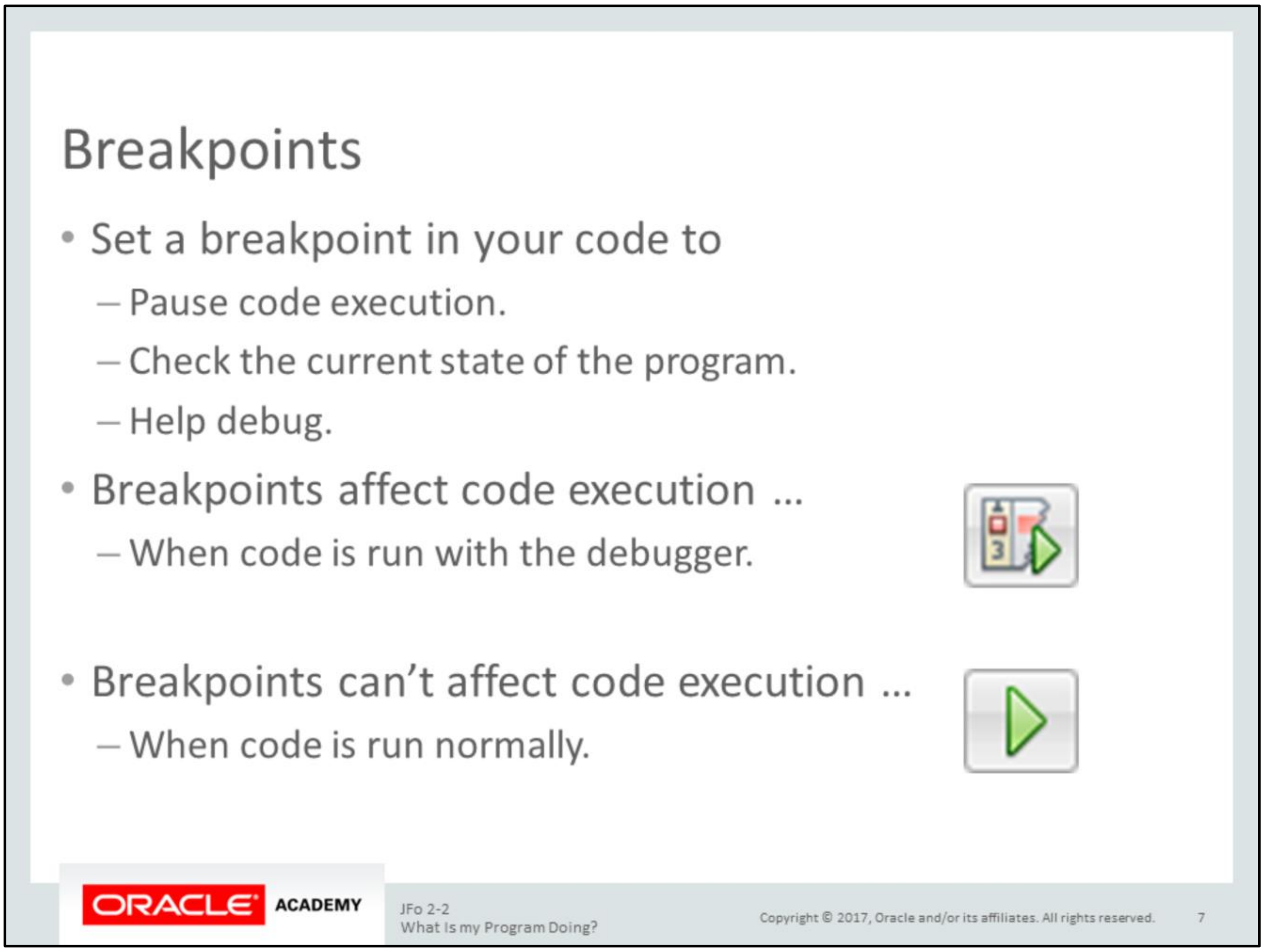
```
1  System.out.println("Line 1");
2  System.out.println("Line 2");
3  System.out.println("Line 3");
4  System.out.println("Line 4");
5  System.out.println("Line 5");
```

- In the example…
  - Line 1 is read…
  - Then Line 2…
  - Then Line 3…
  - Then Line 4…
  - Then Line 5…



Reading Line by Line

- Java is mostly read line by line.
- But there are a few additional points to consider.
- We'll investigate using…
  - A breakpoint
  - Other features of NetBeans



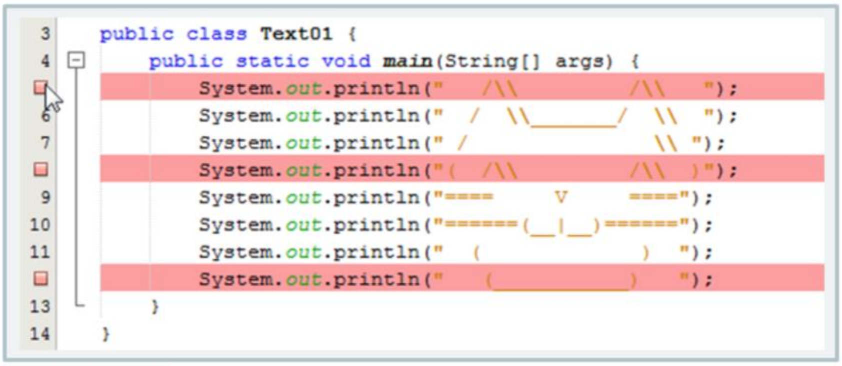
Breakpoints

- Set a breakpoint in your code to
  - Pause code execution.
  - Check the current state of the program.
  - Help debug.
- Breakpoints affect code execution …
  - When code is run with the debugger.
- Breakpoints can't affect code execution …
  - When code is run normally.

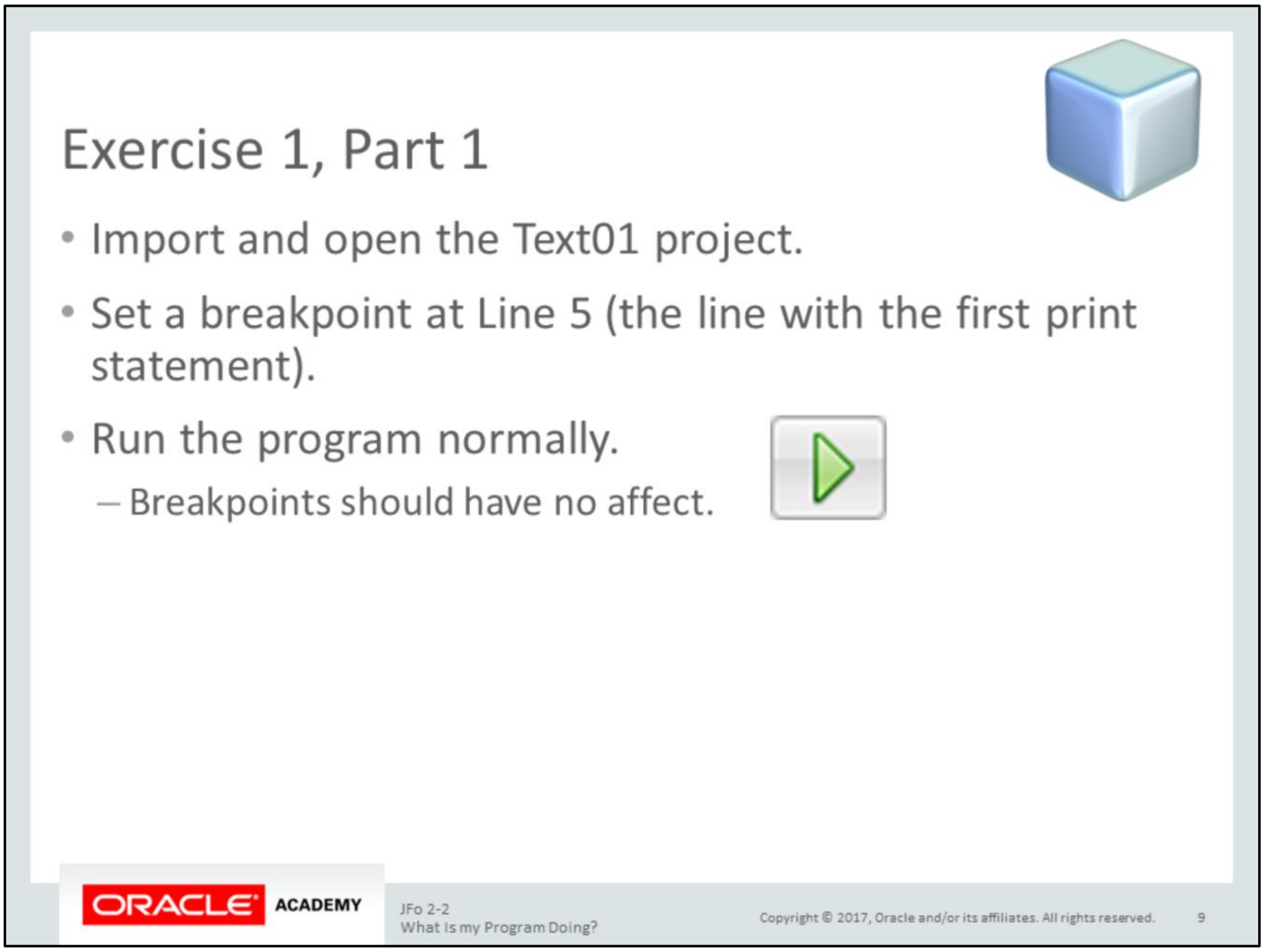
Setting a Breakpoint Animation

To set a breakpoint …

- Place your cursor over a number in the left margin.
- Click … and you have a breakpoint!
- Click again to remove a breakpoint.
- You can set many breakpoints.



```
public class Text01 {
    public static void main(String[] args) {
        System.out.println("   /\\          /\\   ");
        System.out.println("  /  \\________/  \\  ");
        System.out.println(" /                \\ ");
        System.out.println("(  /\\          /\\  )");
        System.out.println("====      V     ====");
        System.out.println("======(__|__)======");
        System.out.println("   (             )   ");
        System.out.println("    (___________)   ");
    }
}
```

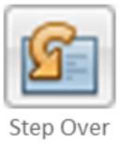


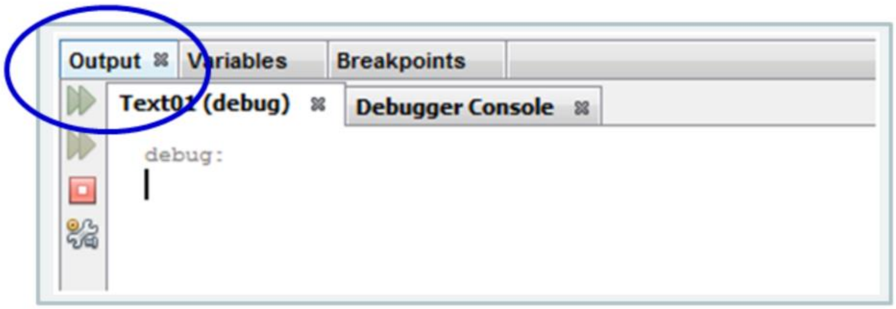
Exercise 1, Part 1

- Import and open the Text01 project.
- Set a breakpoint at Line 5 (the line with the first print statement).
- Run the program normally.
  - Breakpoints should have no affect.

Exercise 1, Part 2

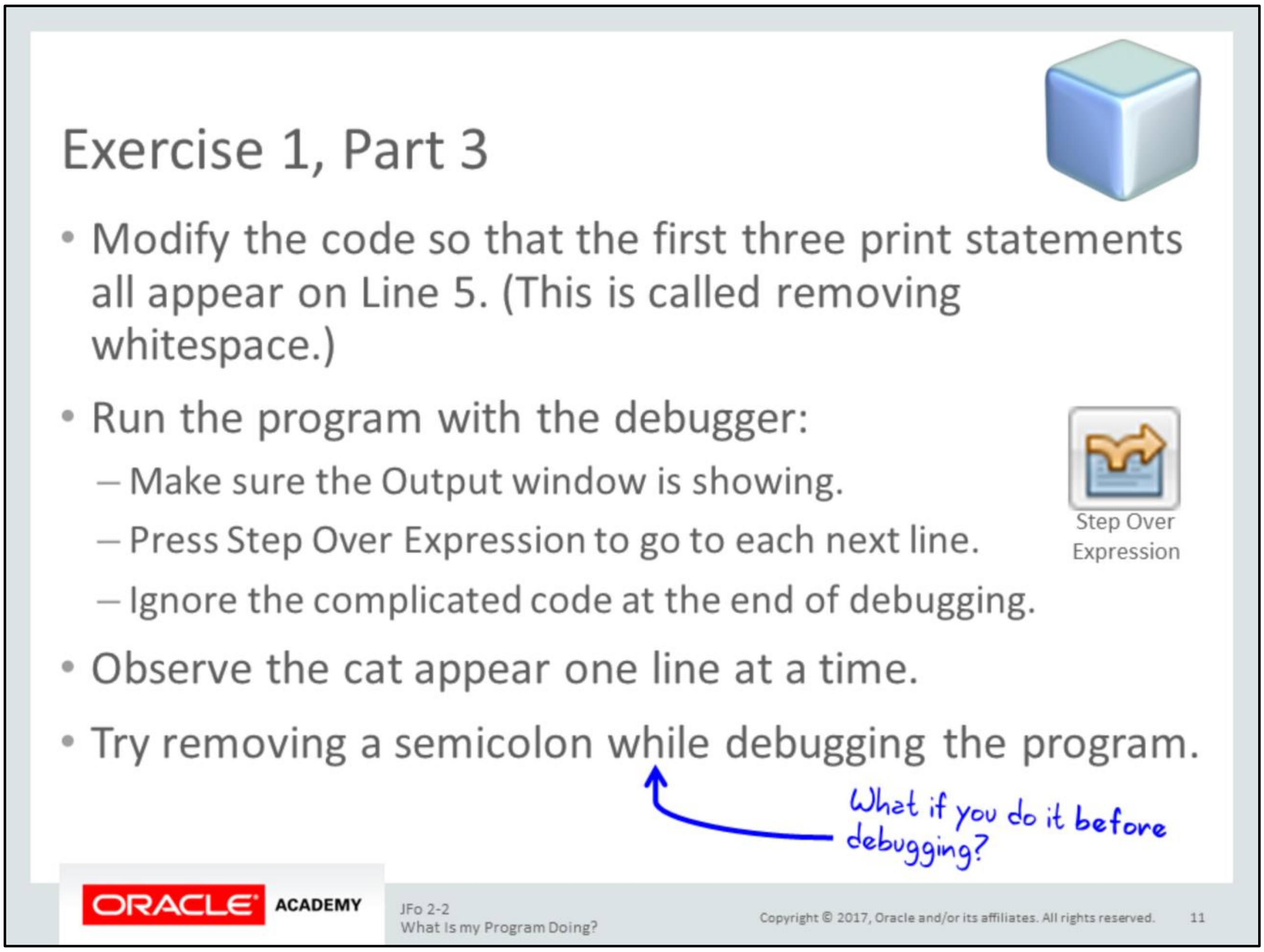
- Run the program with the debugger:
  - Make sure the Output window is showing.
  - Press Step Over to go to each next line.
- Observe the cat appear one line at a time.





```
debug:
```

Select the Output window by clicking the Output button in the lower-left corner of the IDE. Press Step Over repeatedly until you reach the end of the program.



Exercise 1, Part 3

- Modify the code so that the first three print statements all appear on Line 5. (This is called removing whitespace.)
- Run the program with the debugger:
  - Make sure the Output window is showing.
  - Press Step Over Expression to go to each next line.
  - Ignore the complicated code at the end of debugging.
- Observe the cat appear one line at a time.
- Try removing a semicolon while debugging the program.

Step Over Expression

What if you do it before debugging?

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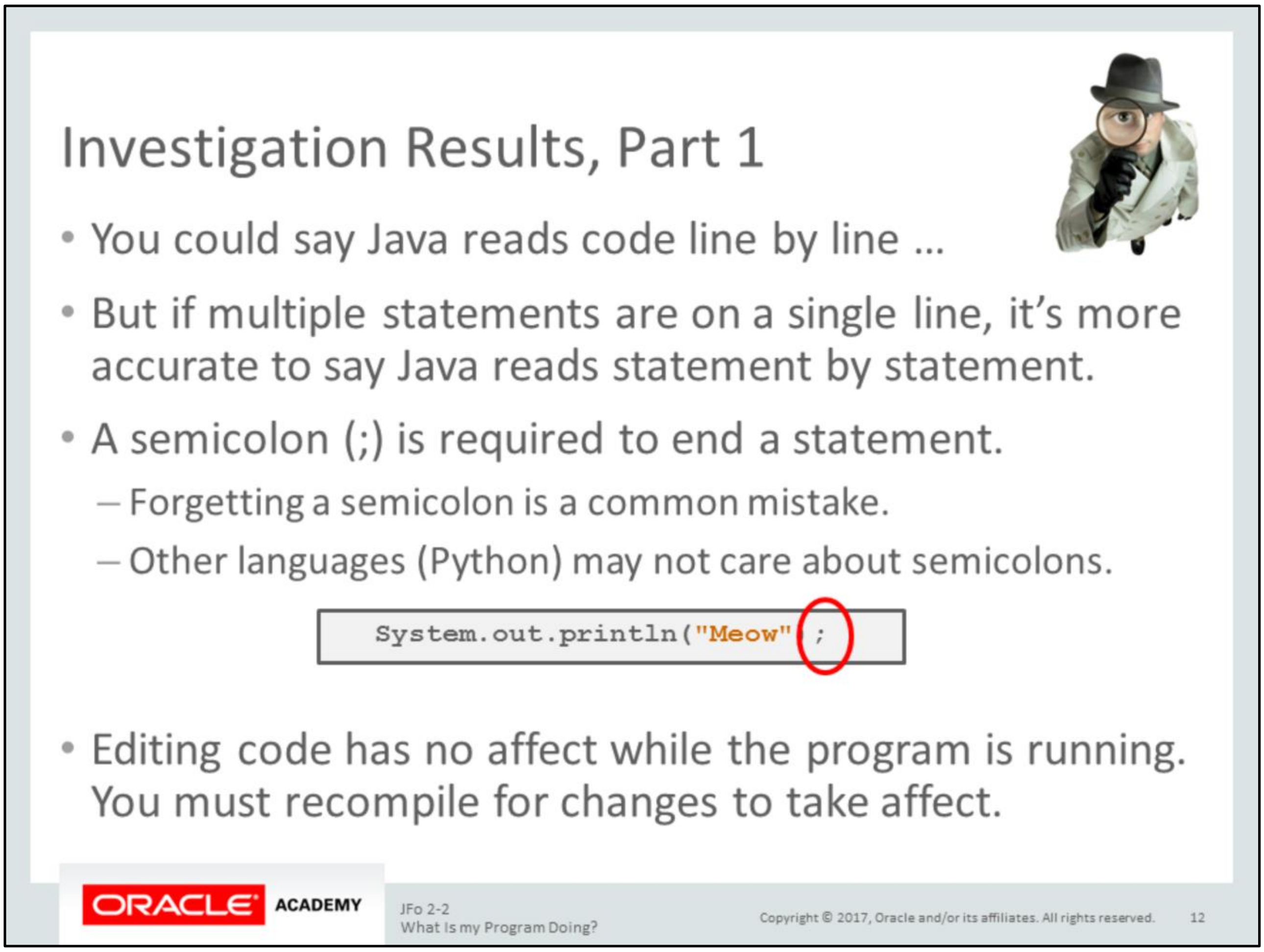
Continue pressing Step Over Expression until the complicated code appears. Step Over Expression is similar to Step Over, except that it provides for more fine-grained stepping through code. But this level of detail is sometimes unwanted.



Investigation Results, Part 1

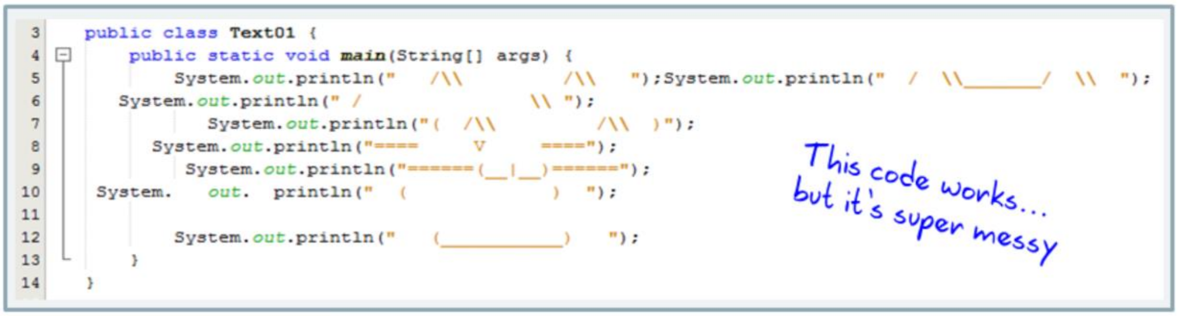
- You could say Java reads code line by line …
- But if multiple statements are on a single line, it's more accurate to say Java reads statement by statement.
- A semicolon (;) is required to end a statement.
  - Forgetting a semicolon is a common mistake.
  - Other languages (Python) may not care about semicolons.

```
System.out.println("Meow");
```

- Editing code has no affect while the program is running. You must recompile for changes to take affect.

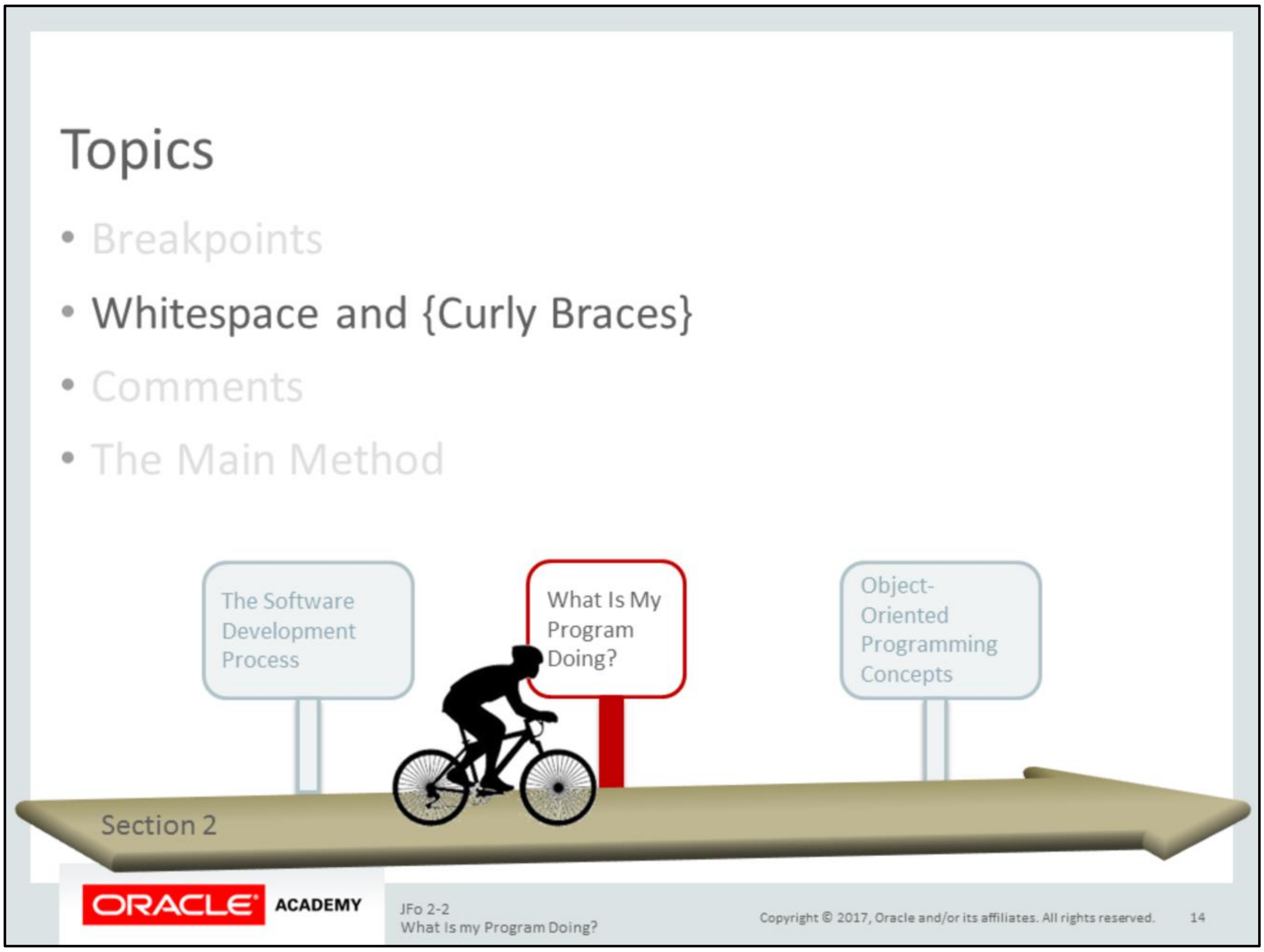
Investigation Results, Part 2

- Java isn't precise about whitespace.
- Other languages (Python) may be extremely precise.
- You could write an entire program in a single line.
  - But this is messy and almost impossible to work with.
  - Use whitespace to keep code organized.



```
public class Text01 {
    public static void main(String[] args) {
        System.out.println("   /\\          /\\    ");System.out.println("  /  \\______/  \\  ");
  System.out.println(" /                \\ ");
           System.out.println("(  /\\          /\\  )");
      System.out.println("====      V      ====");
         System.out.println("======(__|__)======");
 System.   out.  println("   (               )   ");

        System.out.println("    (___________)    ");
    }
}
```



Topics

- Breakpoints
- Whitespace and {Curly Braces}
- Comments
- The Main Method

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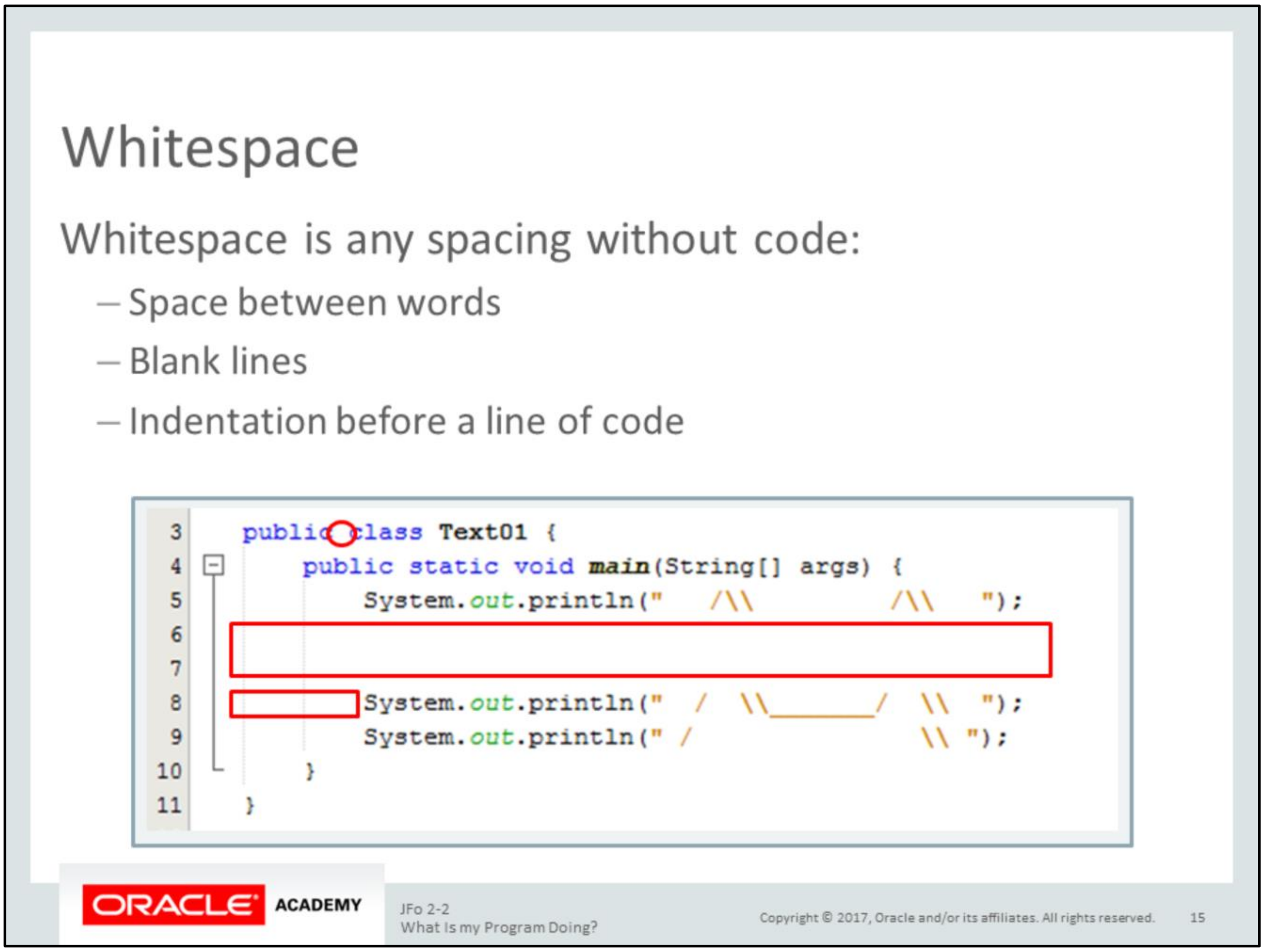


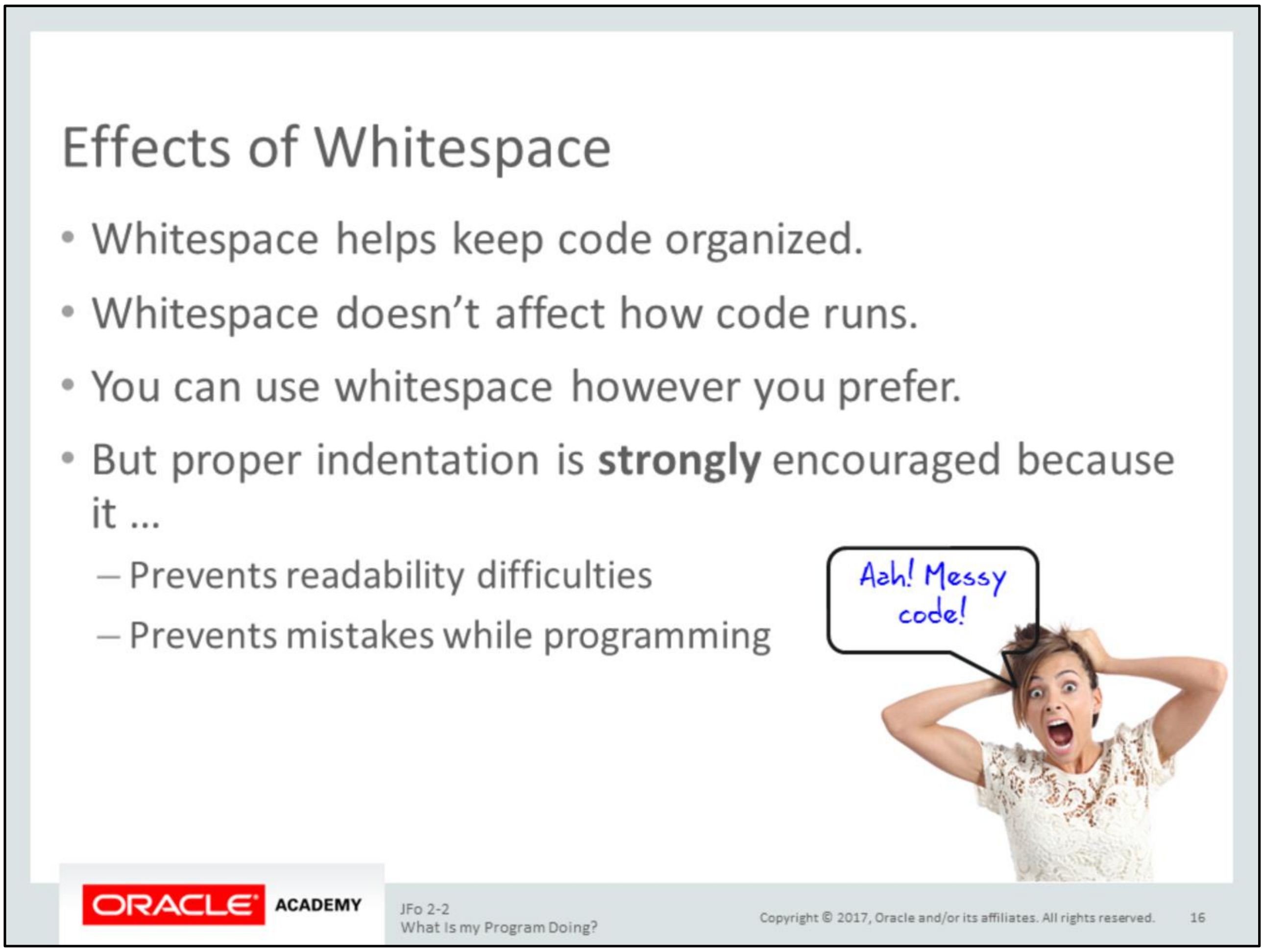
Whitespace

Whitespace is any spacing without code:

- Space between words
- Blank lines
- Indentation before a line of code

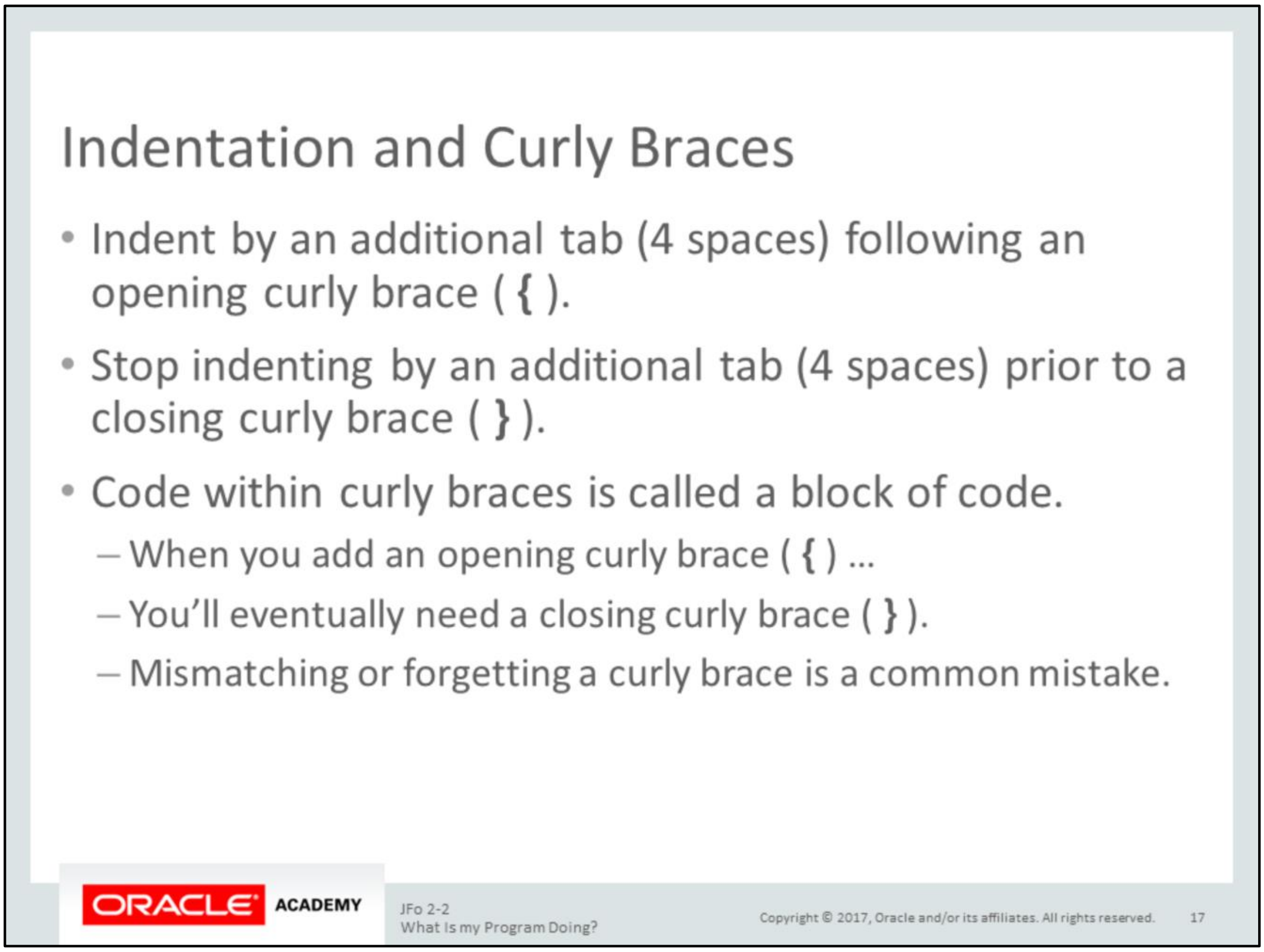
```
public class Text01 {
    public static void main(String[] args) {
        System.out.println("   /\\          /\\   ");


        System.out.println("  /  \\_______/  \\  ");
        System.out.println(" /              \\ ");
    }
}
```

Whitespace doesn't include spaces in print statements. (Strings are covered later.)



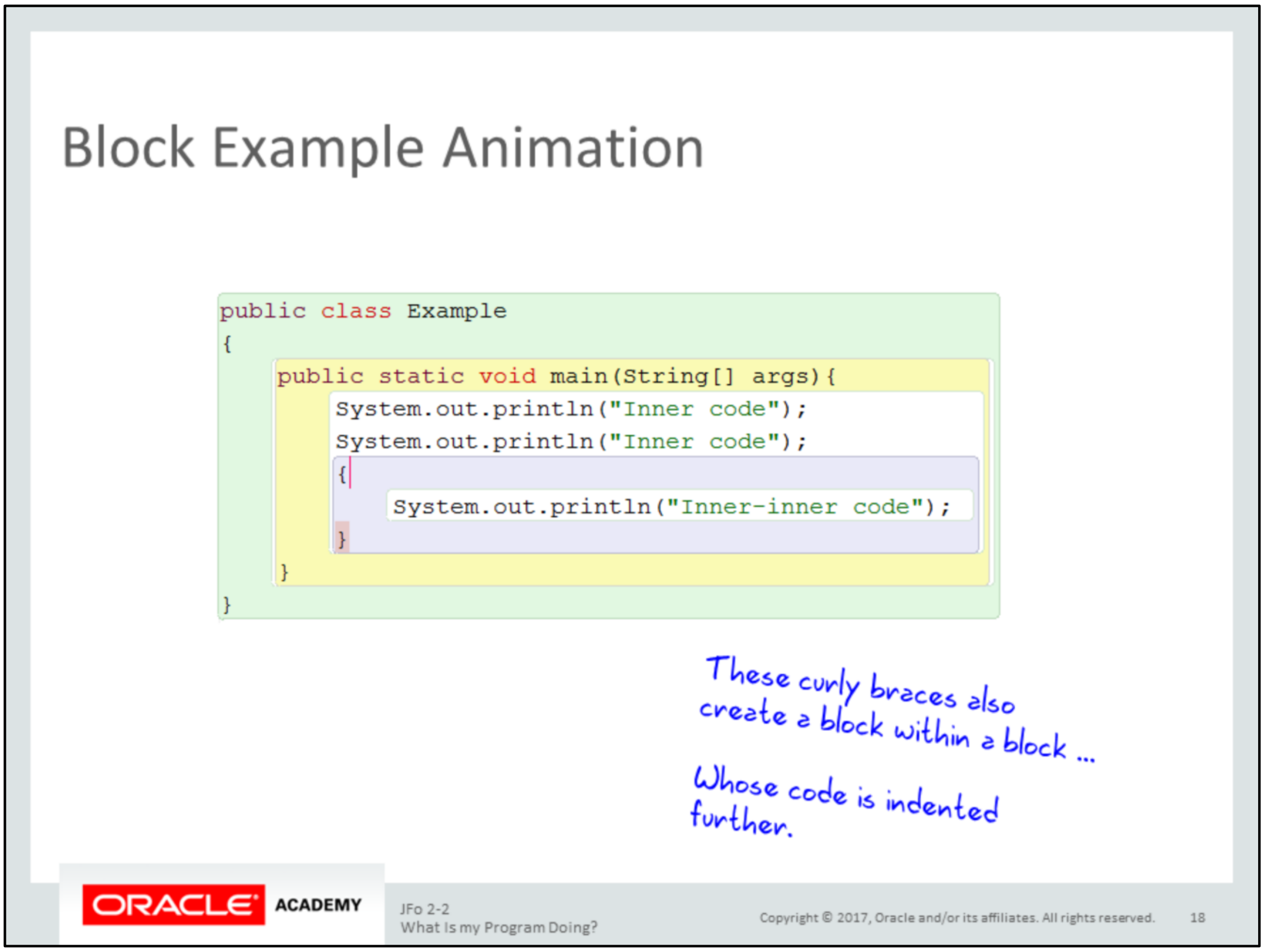
Effects of Whitespace

- Whitespace helps keep code organized.
- Whitespace doesn't affect how code runs.
- You can use whitespace however you prefer.
- But proper indentation is **strongly** encouraged because it ...
  - Prevents readability difficulties
  - Prevents mistakes while programming

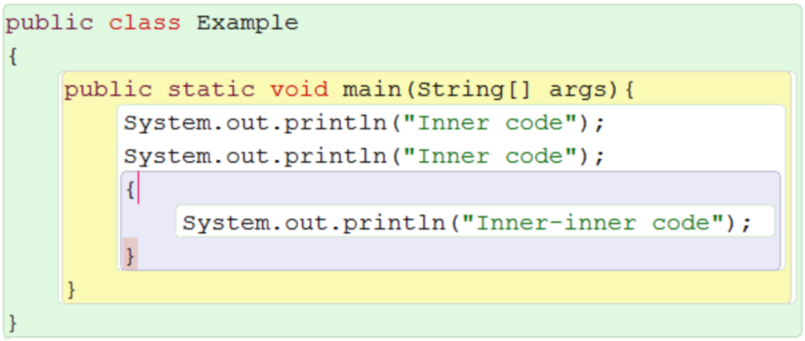


Indentation and Curly Braces

- Indent by an additional tab (4 spaces) following an opening curly brace (**{**).
- Stop indenting by an additional tab (4 spaces) prior to a closing curly brace (**}**).
- Code within curly braces is called a block of code.
  - When you add an opening curly brace (**{**) …
  - You'll eventually need a closing curly brace (**}**).
  - Mismatching or forgetting a curly brace is a common mistake.



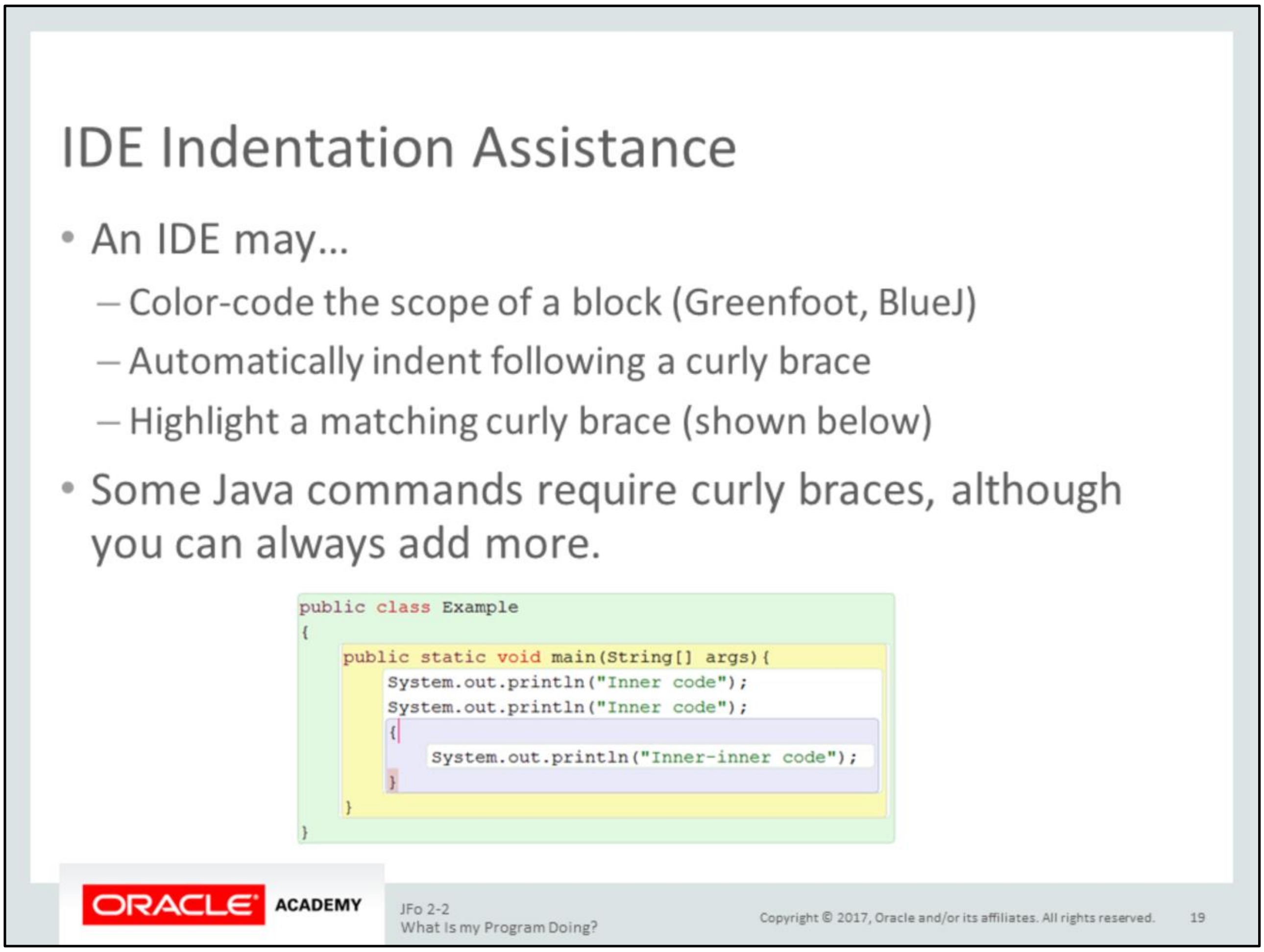
Block Example Animation



```
public class Example
{
      public static void main(String[] args){
            System.out.println("Inner code");
            System.out.println("Inner code");
            {
                  System.out.println("Inner-inner code");
            }
      }
}
```

These curly braces also create a block within a block …

Whose code is indented further.



IDE Indentation Assistance

- An IDE may…
  - Color-code the scope of a block (Greenfoot, BlueJ)
  - Automatically indent following a curly brace
  - Highlight a matching curly brace (shown below)
- Some Java commands require curly braces, although you can always add more.

```
public class Example
{
    public static void main(String[] args){
        System.out.println("Inner code");
        System.out.println("Inner code");
        {
            System.out.println("Inner-inner code");
        }
    }
}
```

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JFo 2-2
What Is my Program Doing?

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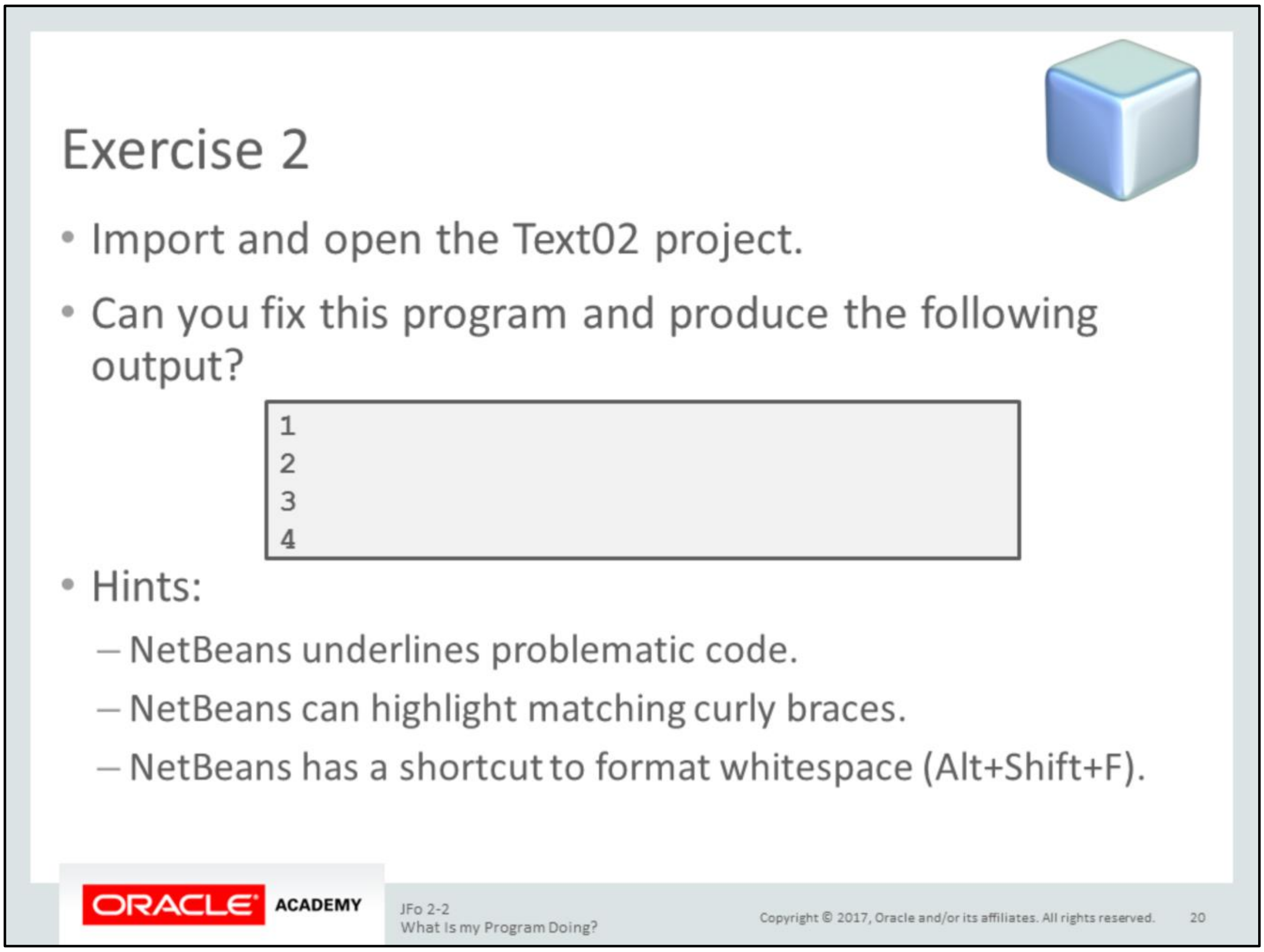
This lesson adds extra curly braces to code for demonstration purposes. Adding extra curly braces isn't a common practice.

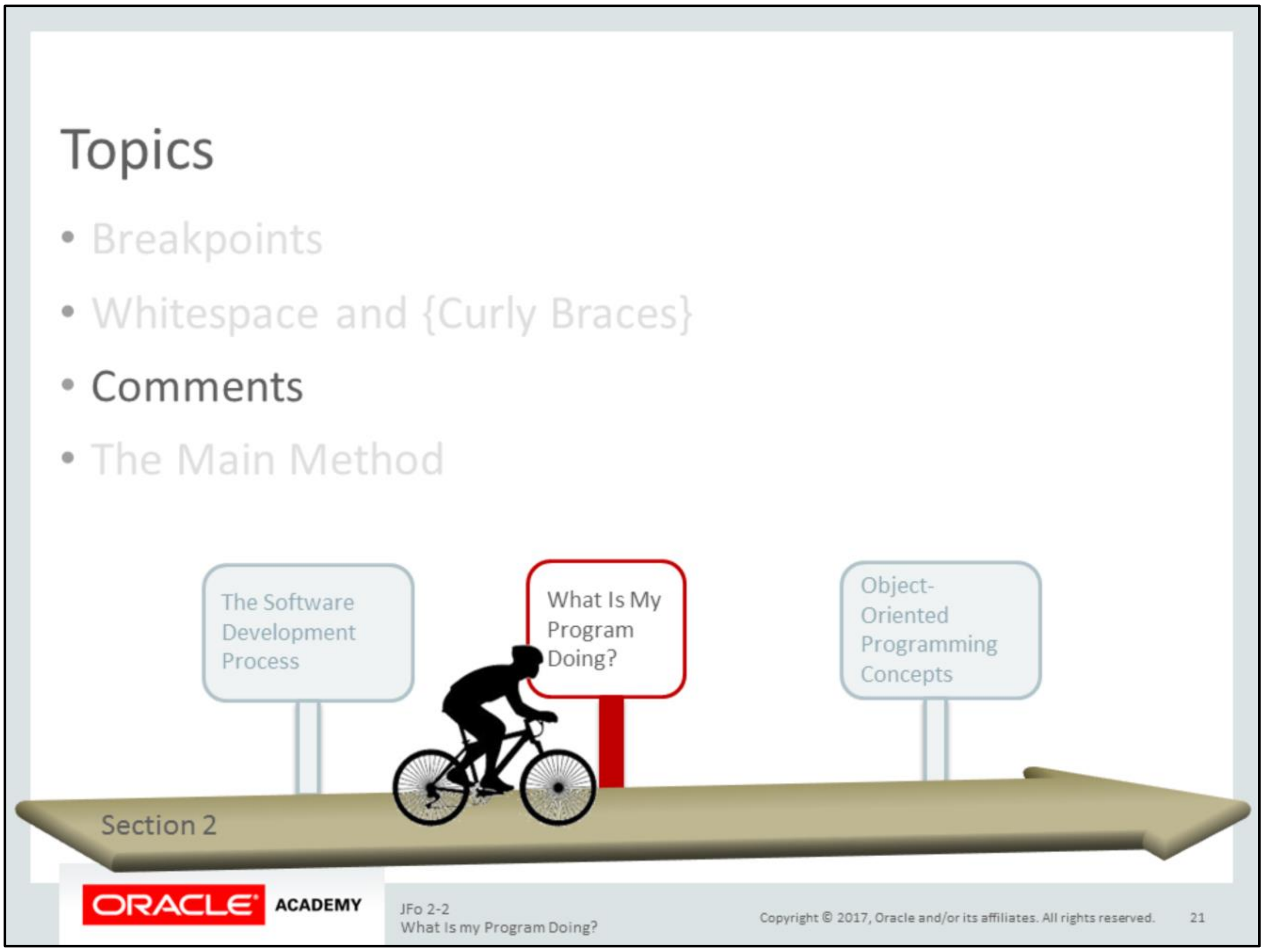


Exercise 2

- Import and open the Text02 project.
- Can you fix this program and produce the following output?

```
1
2
3
4
```

- Hints:
  - NetBeans underlines problematic code.
  - NetBeans can highlight matching curly braces.
  - NetBeans has a shortcut to format whitespace (Alt+Shift+F).



Topics

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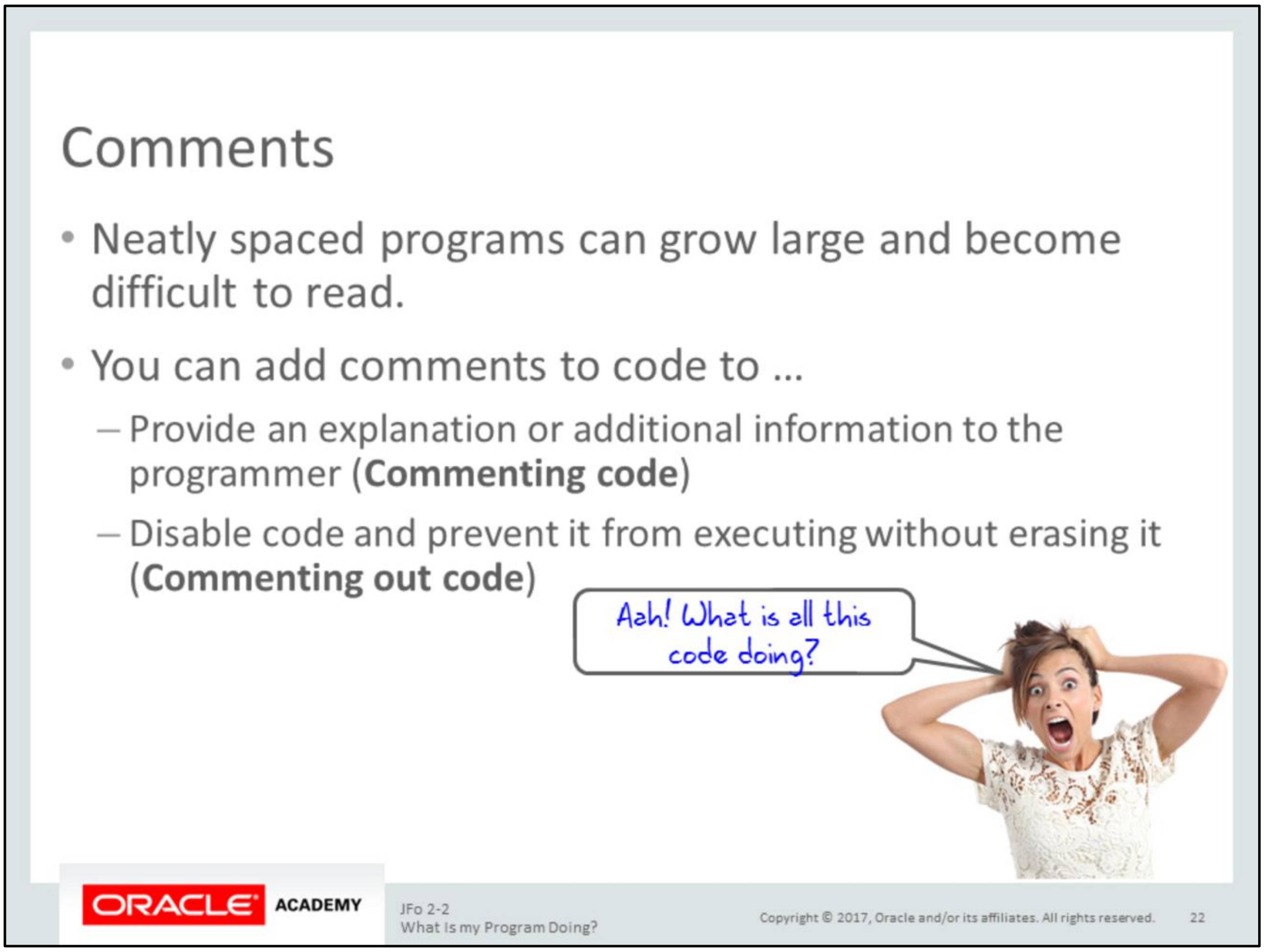
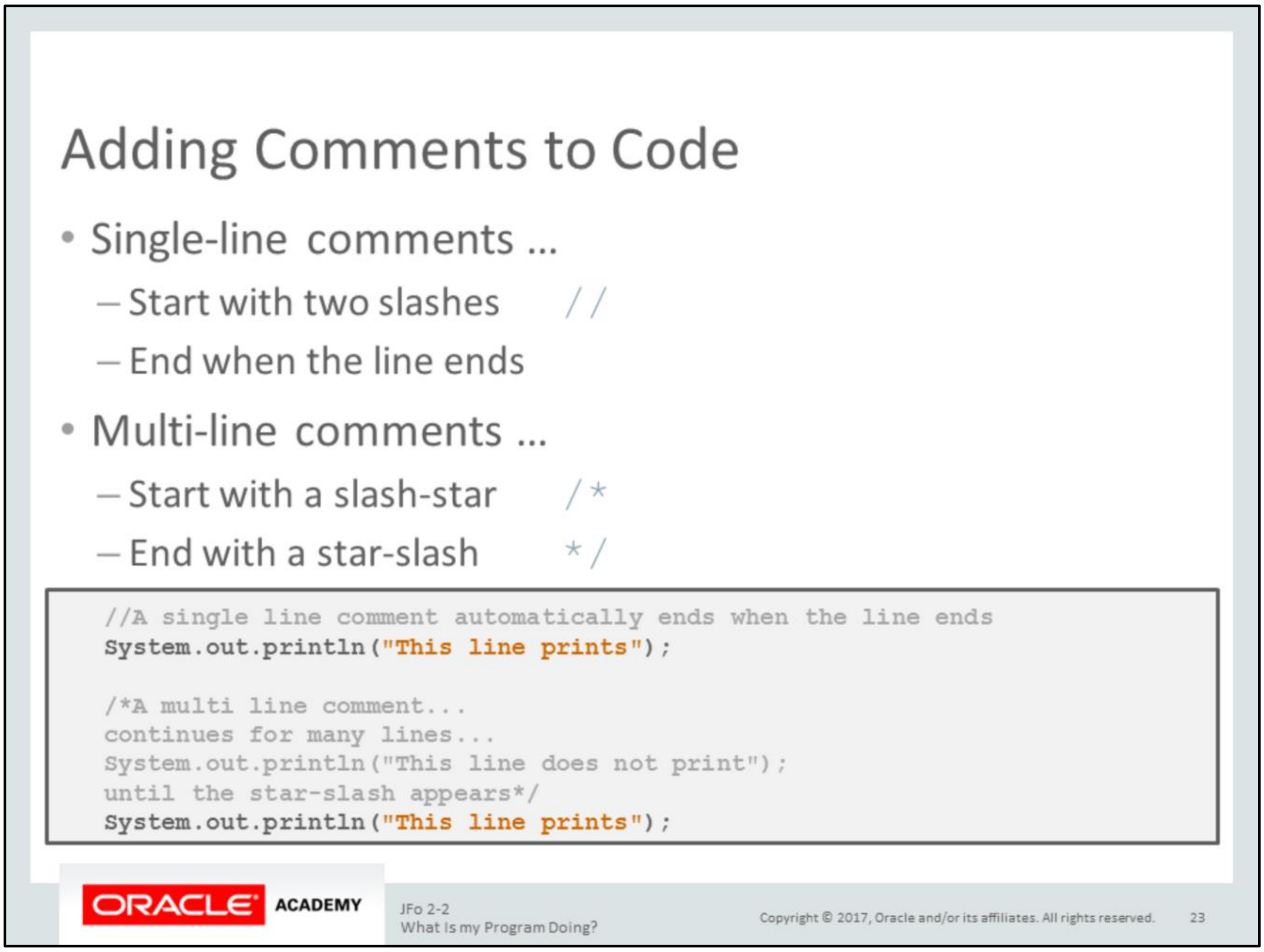


Comments

- Neatly spaced programs can grow large and become difficult to read.
- You can add comments to code to …
  - Provide an explanation or additional information to the programmer (**Commenting code**)
  - Disable code and prevent it from executing without erasing it (**Commenting out code**)

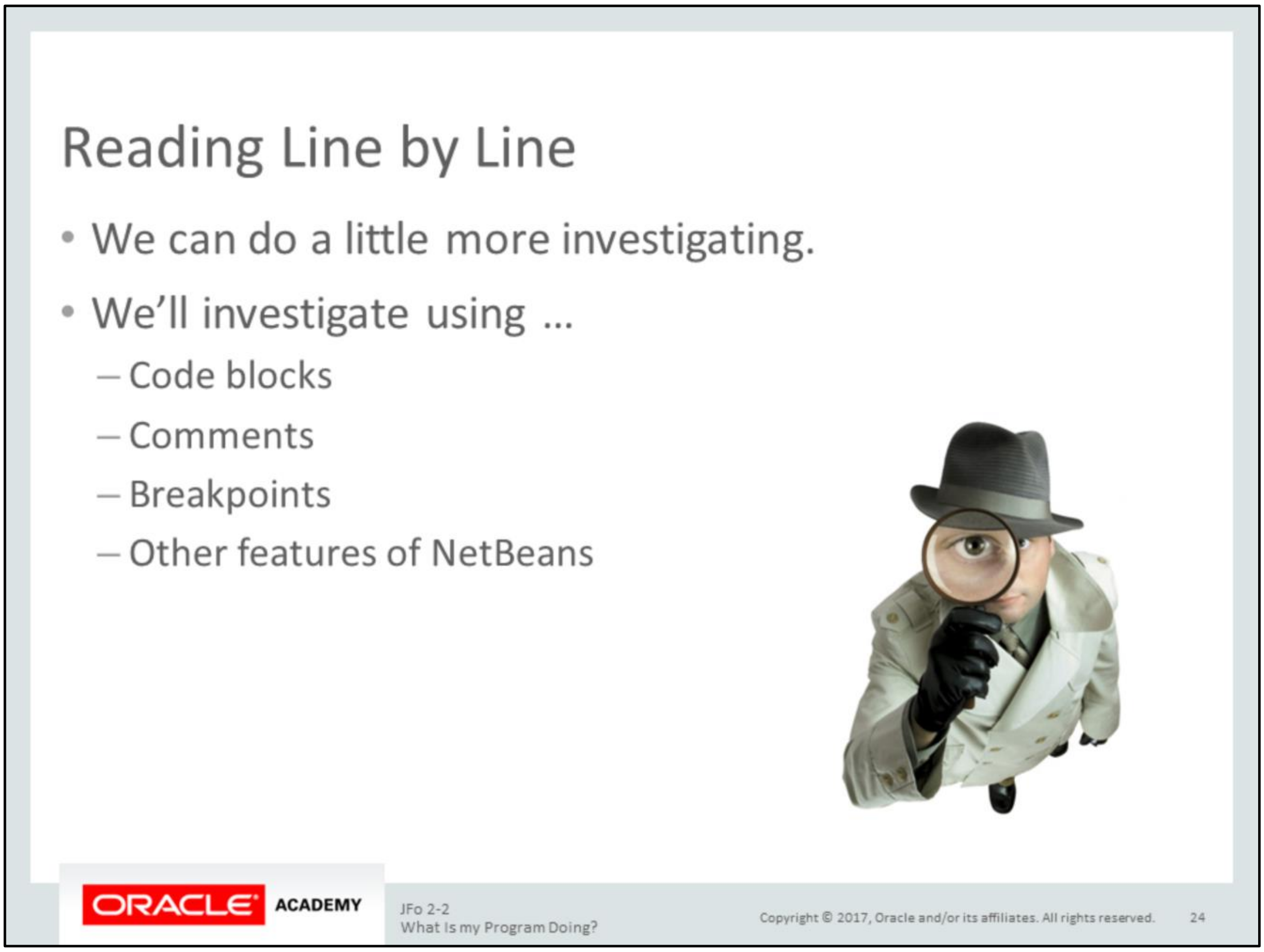


Adding Comments to Code

- Single-line comments ...
  - Start with two slashes //
  - End when the line ends
- Multi-line comments ...
  - Start with a slash-star /*
  - End with a star-slash */

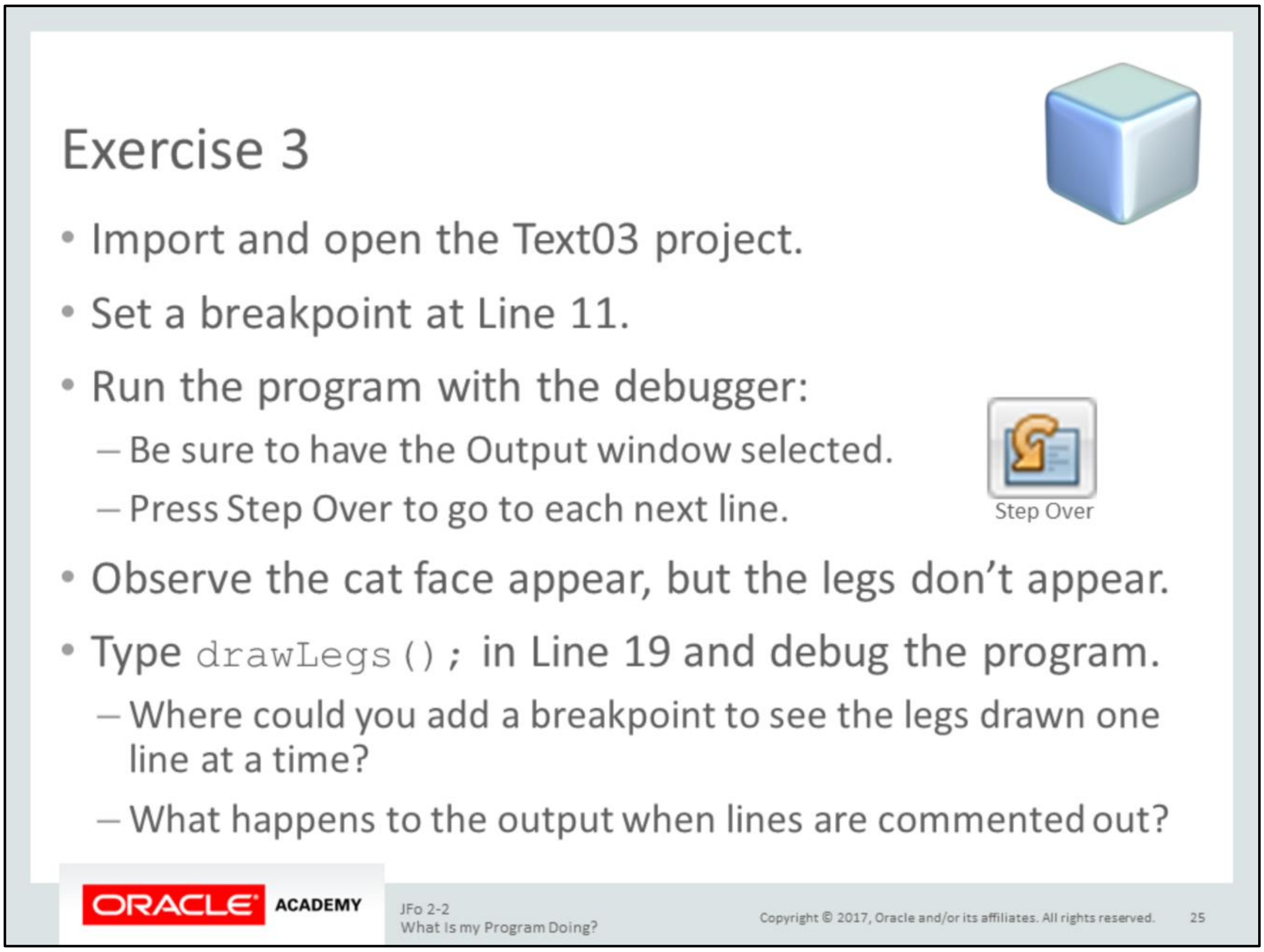
```
//A single line comment automatically ends when the line ends
System.out.println("This line prints");

/*A multi line comment...
continues for many lines...
System.out.println("This line does not print");
until the star-slash appears*/
System.out.println("This line prints");
```



Reading Line by Line

- We can do a little more investigating.
- We'll investigate using …
  - Code blocks
  - Comments
  - Breakpoints
  - Other features of NetBeans



Exercise 3

- Import and open the Text03 project.
- Set a breakpoint at Line 11.
- Run the program with the debugger:
  - Be sure to have the Output window selected.
  - Press Step Over to go to each next line.

Step Over

- Observe the cat face appear, but the legs don't appear.
- Type `drawLegs();` in Line 19 and debug the program.
  - Where could you add a breakpoint to see the legs drawn one line at a time?
  - What happens to the output when lines are commented out?

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Investigation Results, Part 3

- When Java reads line by line …
- It starts within the special block of code known as the **main method**.

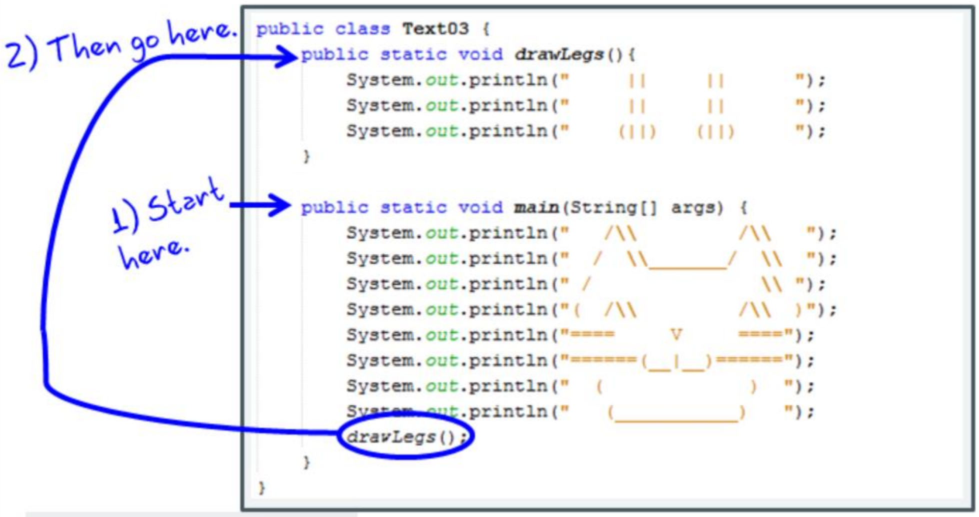
```
public static void main(String[] args){

}
```

- No other code executes unless it's called.
  - In this exercise, the main method must specifically call the block of code that prints legs.
- Commented code is ignored.
  - Comments are removed in bytecode.

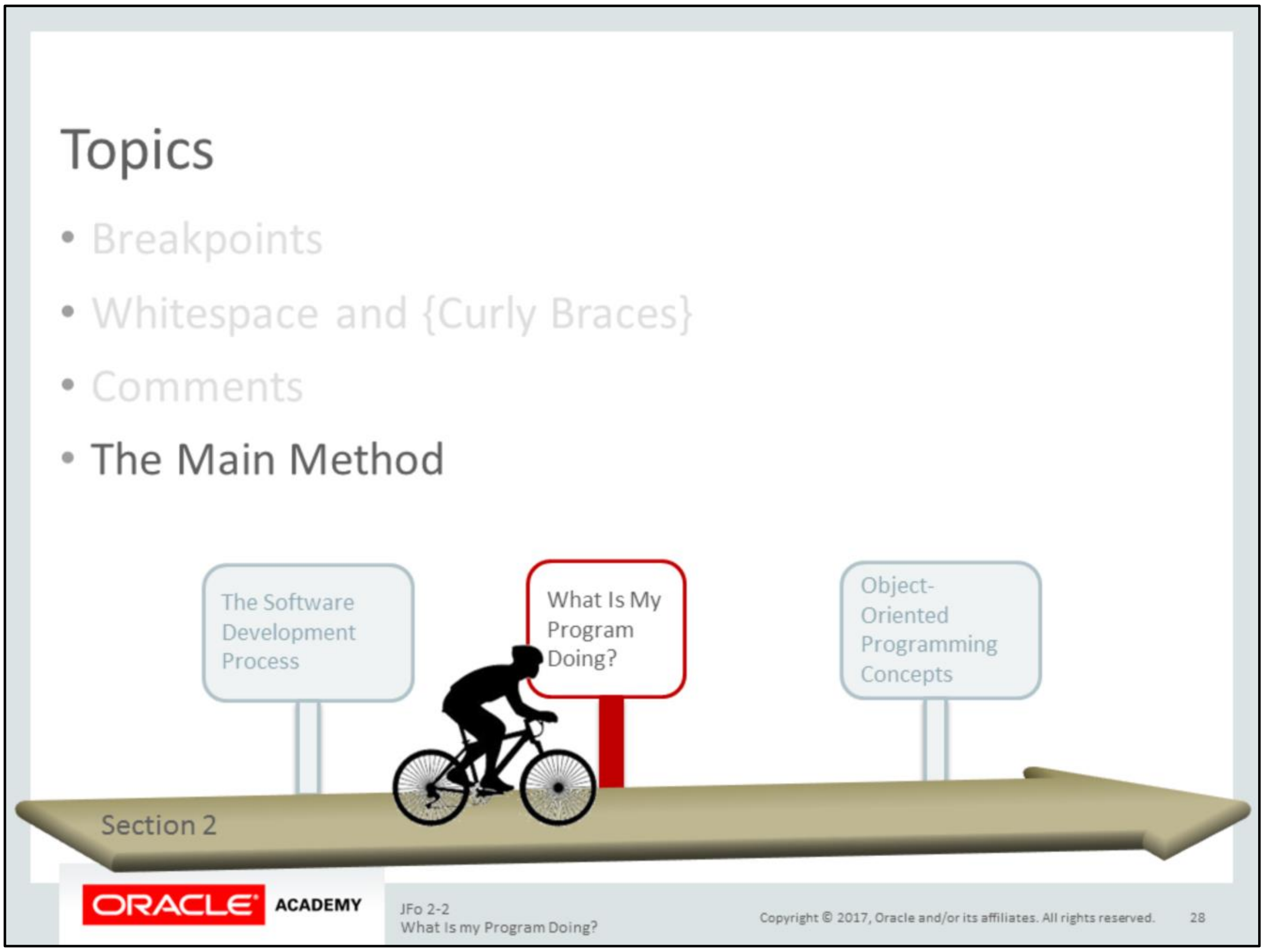
The Program's Flow

1. All Java programs start in the main method.
2. No other code executes unless it's called.



```
public class Text03 {
    public static void drawLegs(){
        System.out.println("     ||      ||      ");
        System.out.println("     ||      ||      ");
        System.out.println("    (||)    (||)     ");
    }

    public static void main(String[] args) {
        System.out.println("   /\\         /\\   ");
        System.out.println("  /  \\_______/  \\  ");
        System.out.println(" /               \\ ");
        System.out.println("(  /\\         /\\  )");
        System.out.println("====      V     ====");
        System.out.println("======(__|__)======");
        System.out.println("  (              )  ");
        System.out.println("   (____________)   ");
        drawLegs();
    }
}
```



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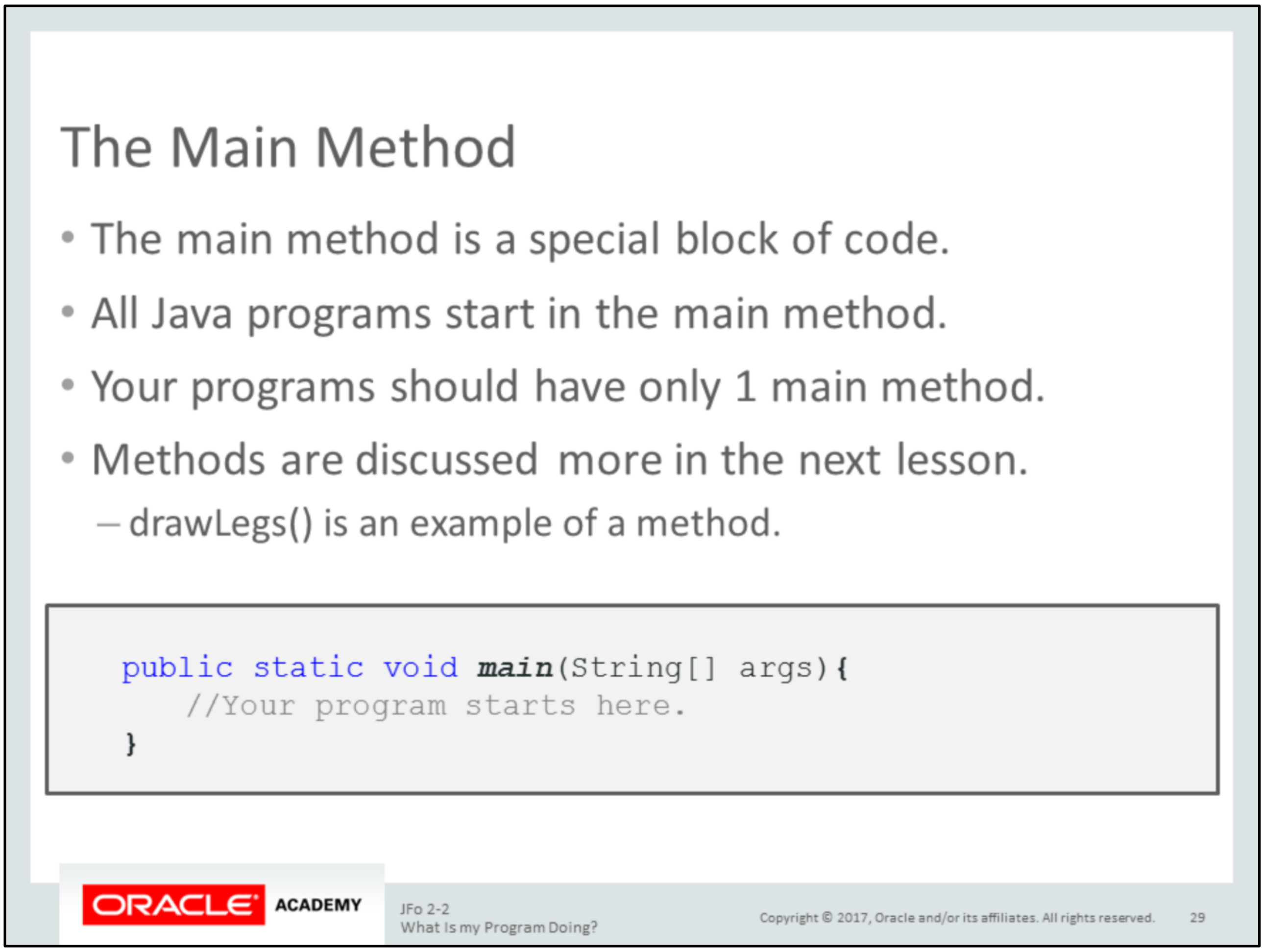
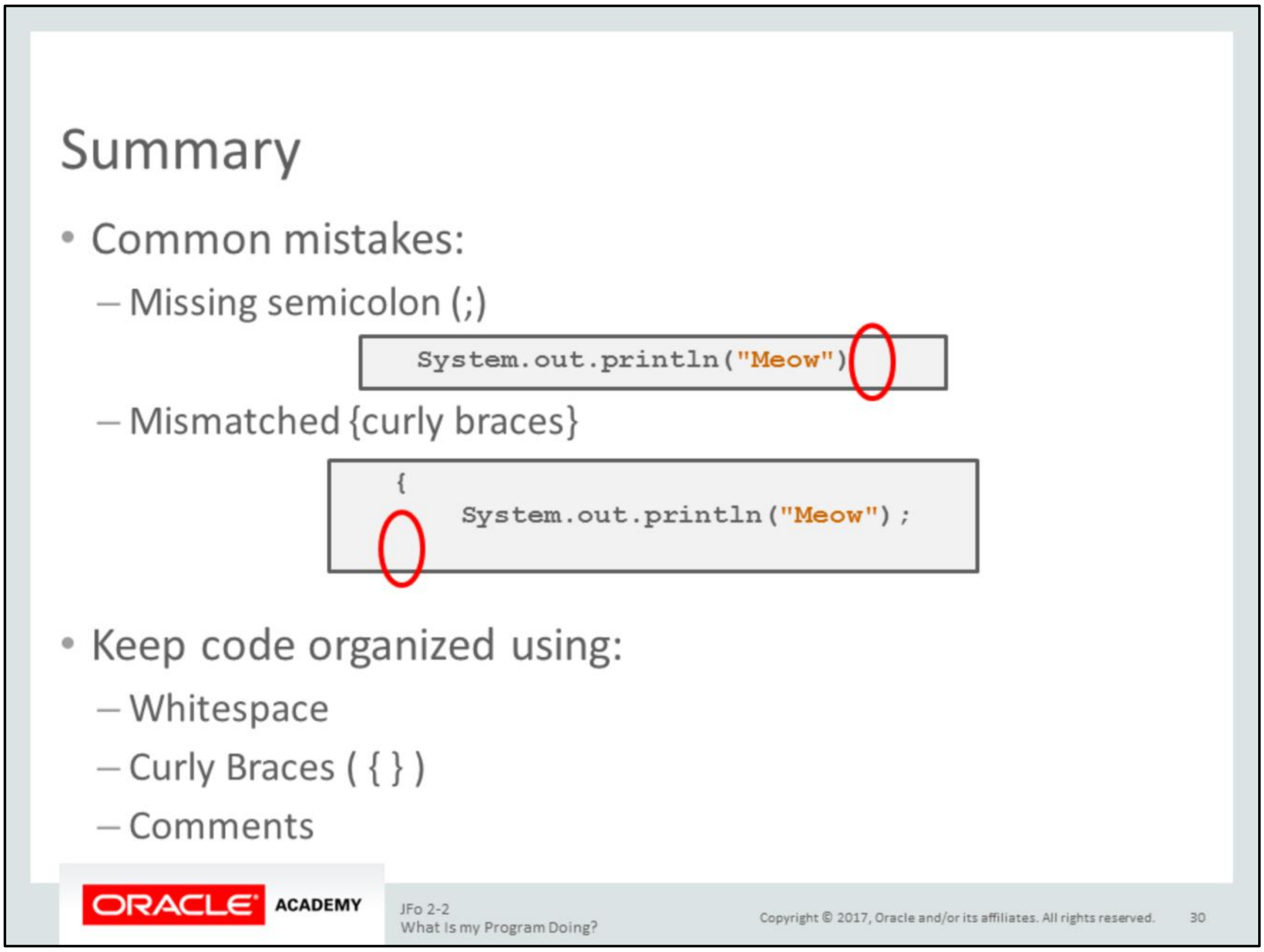


The Main Method

- The main method is a special block of code.
- All Java programs start in the main method.
- Your programs should have only 1 main method.
- Methods are discussed more in the next lesson.
  - drawLegs() is an example of a method.

```
public static void main(String[] args){
    //Your program starts here.
}
```



Summary

- Common mistakes:
  - Missing semicolon (;)

```
System.out.println("Meow")
```

  - Mismatched {curly braces}

```
{
    System.out.println("Meow");
```

- Keep code organized using:
  - Whitespace
  - Curly Braces ({ })
  - Comments

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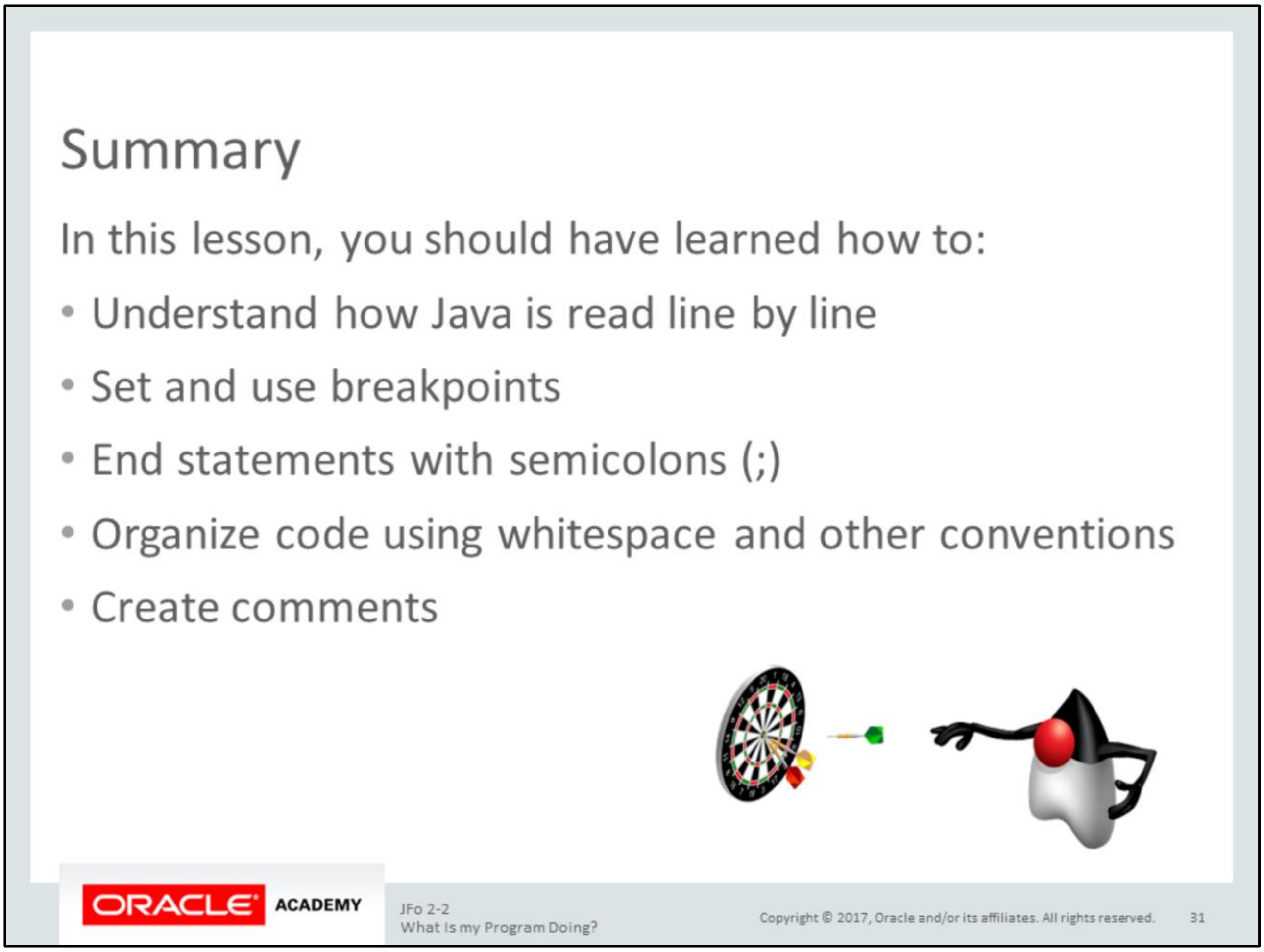

Summary

In this lesson, you should have learned how to:

- Understand how Java is read line by line
- Set and use breakpoints
- End statements with semicolons (;)
- Organize code using whitespace and other conventions
- Create comments

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