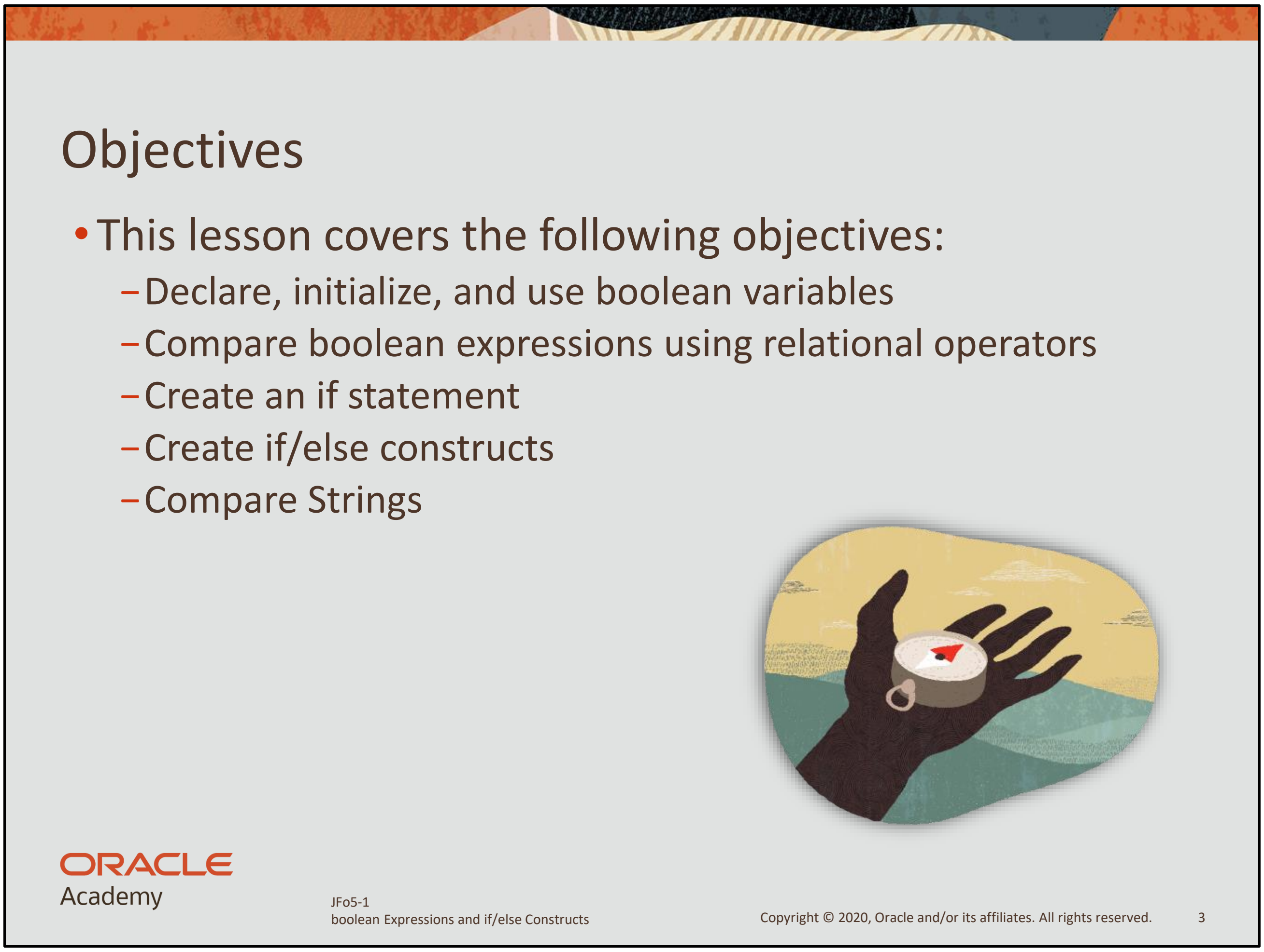
ORACLE

Academy

Java Foundations

5-1
boolean Expressions and if/else Constructs

ORACLE
Academy



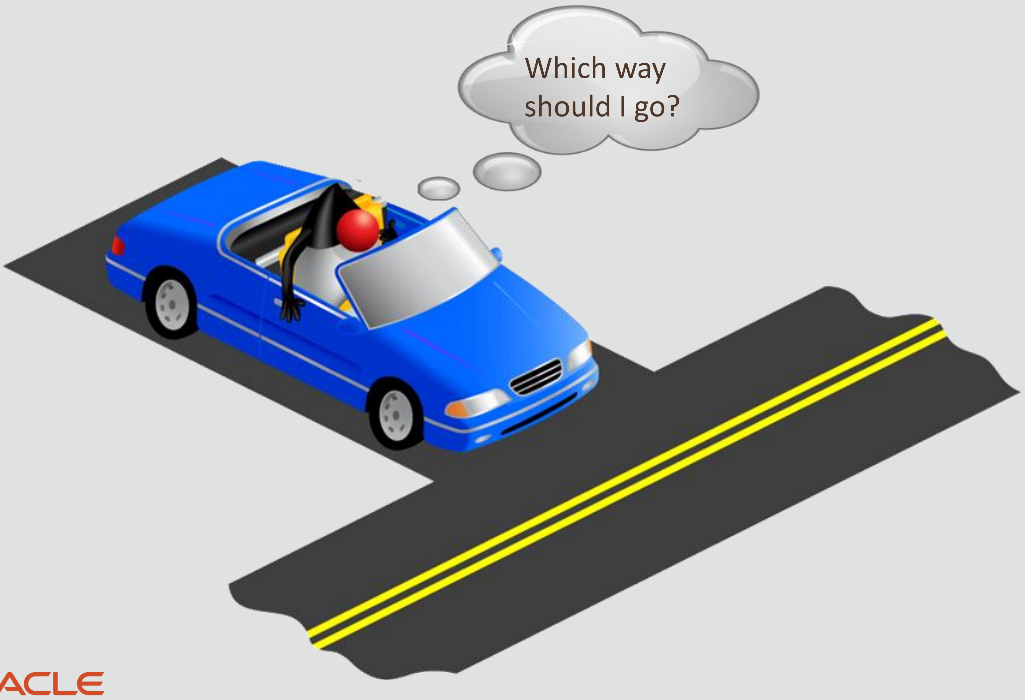
Objectives

- This lesson covers the following objectives:
  - Declare, initialize, and use boolean variables
  - Compare boolean expressions using relational operators
  - Create an if statement
  - Create if/else constructs
  - Compare Strings

Making Decisions

- So far in the previous lessons, you saw different data types supported in Java
- boolean is another data type in Java that helps to add logic to a program
- It helps to make decisions

Making Decisions



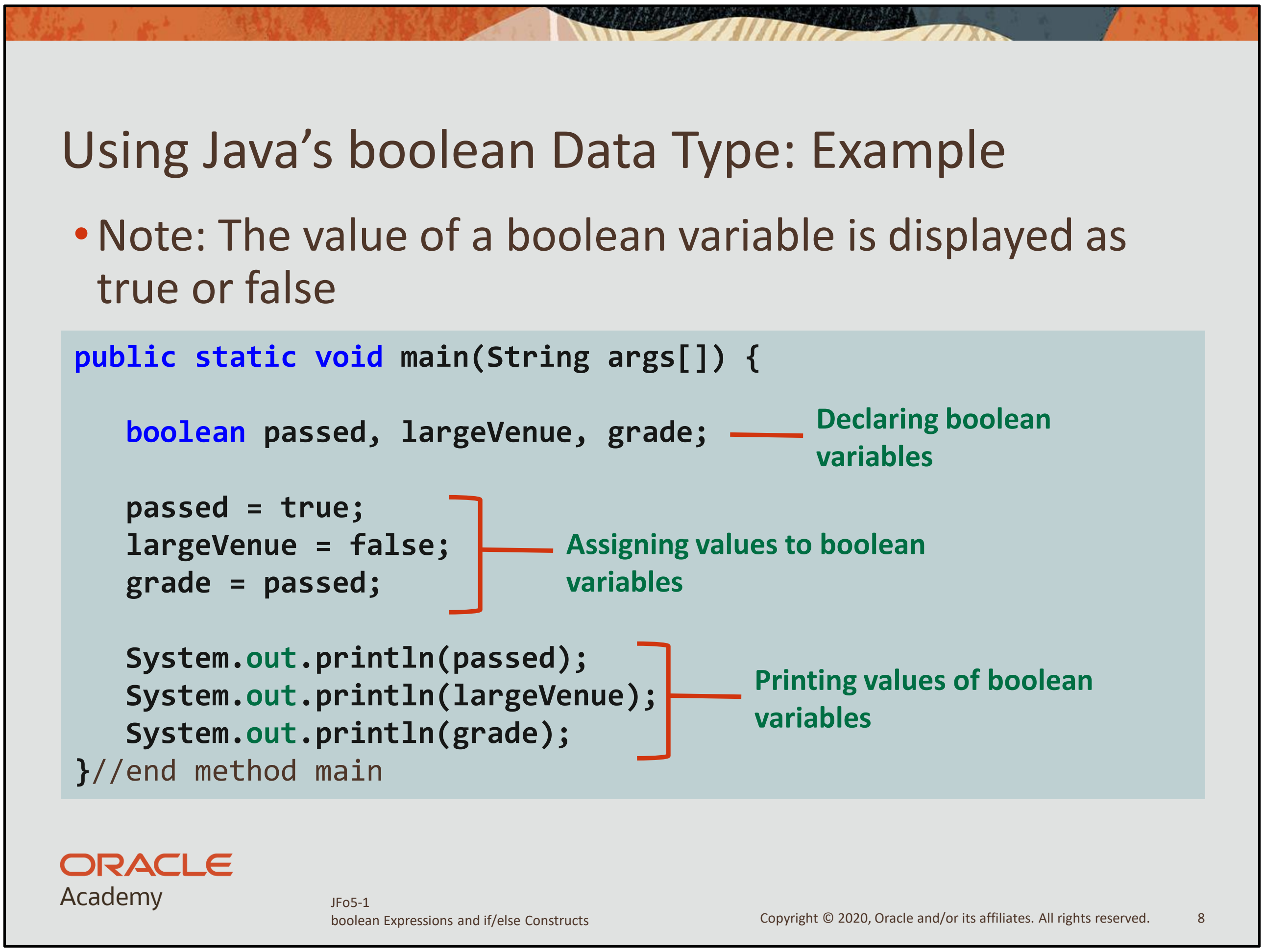
Making Decisions

- Let’s say that you’re driving to the school
- You stop at an intersection
- And now you have to make a logical decision:
  - If I turn left, will it take me to the school?
  - If I go straight, will it take me to the school?
  - If I turn right, will it take me to the school?
- There are only two answers to each of these questions:
  - yes or no

Java's boolean Data Type

- It's basically the same in Java, where booleans will tell the program which is the best course of action to take
- In Java the values for the boolean data type are true and false, instead of yes and no
- You declare the boolean data type by using the boolean keyword

ORACLE
Academy



Using Java’s boolean Data Type: Example

- Note: The value of a boolean variable is displayed as true or false

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

   boolean passed, largeVenue, grade;

   passed = true;
   largeVenue = false;
   grade = passed;

   System.out.println(passed);
   System.out.println(largeVenue);
   System.out.println(grade);
}//end method main
```

Declaring boolean variables

Assigning values to boolean variables

Printing values of boolean variables

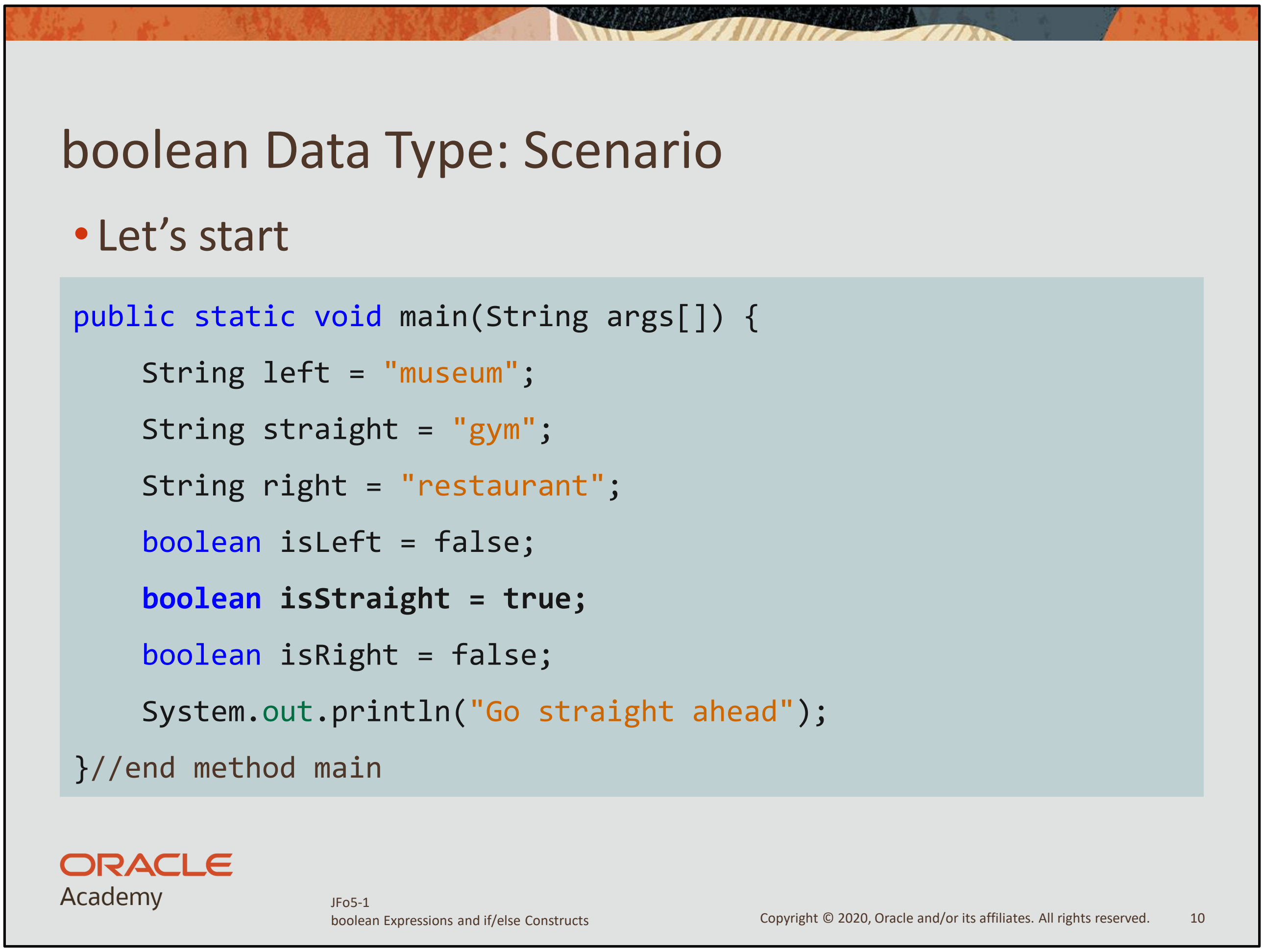
Remember that a boolean data type can have only two possible values: true and false.
Note: True and false are never enclosed within quotes because they are boolean values, not Strings.

Output of the example shown in the slide:

```
true
false
true
```

boolean Data Type: Scenario

- What if you were driving a car that has an installed GPS system running on Java?
- Before you leave home, you ask the GPS system to take you to the school
- What simple code would you write to help you decide which way to turn?



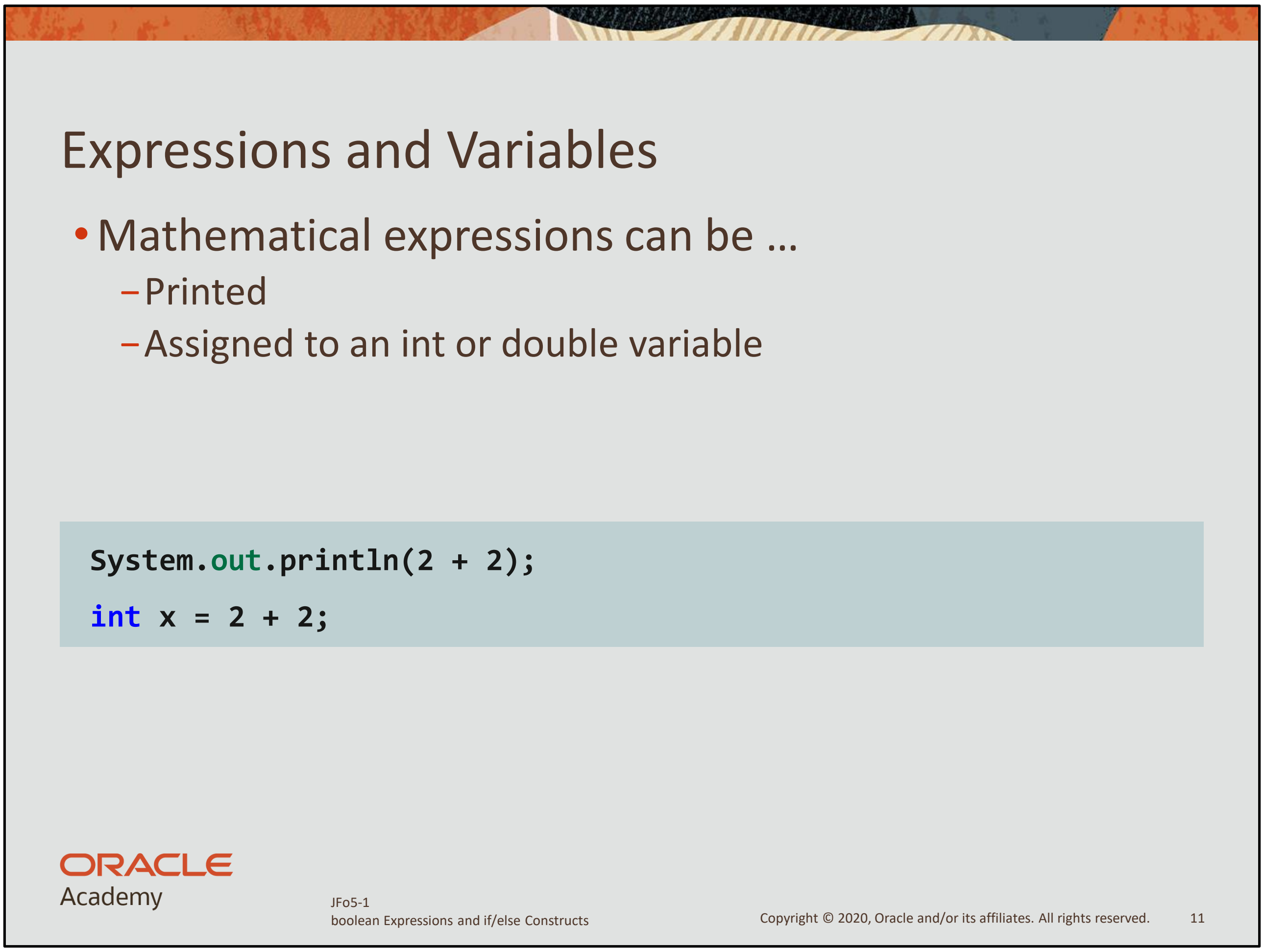
boolean Data Type: Scenario

- Let’s start

```
public static void main(String args[]) {
    String left = "museum";
    String straight = "gym";
    String right = "restaurant";
    boolean isLeft = false;
    boolean isStraight = true;
    boolean isRight = false;
    System.out.println("Go straight ahead");
}//end method main
```

ORACLE
Academy

Based on this simple code, the car will go in the direction that has a boolean variable with a value of true.
Note: Enhancing this example with more code will be covered further in this lesson.



Expressions and Variables

- Mathematical expressions can be …
  - Printed
  - Assigned to an int or double variable

```
System.out.println(2 + 2);
int x = 2 + 2;
```

ORACLE
Academy

Use the equal sign (=) to make an assignment and use the == sign to make a comparison and return a boolean.

Expressions and Variables

- boolean expressions can be …
  - Printed
  - Assigned to a boolean variable

```
System.out.println(x == 5);
boolean isFive = x == 5;
```

Equality and Assignment

- == is a relational operator
- This operator tests to see if both sides of a boolean expression equal each other
- A boolean expression returns a value of true or false

```
x == 5
```

Equality and Assignment

- = is an assignment operator
- This operator assigns a value to a variable
- A boolean variable can be assigned whichever value a boolean expression returns

```
int x = 4;
boolean isFive = x == 5;
```

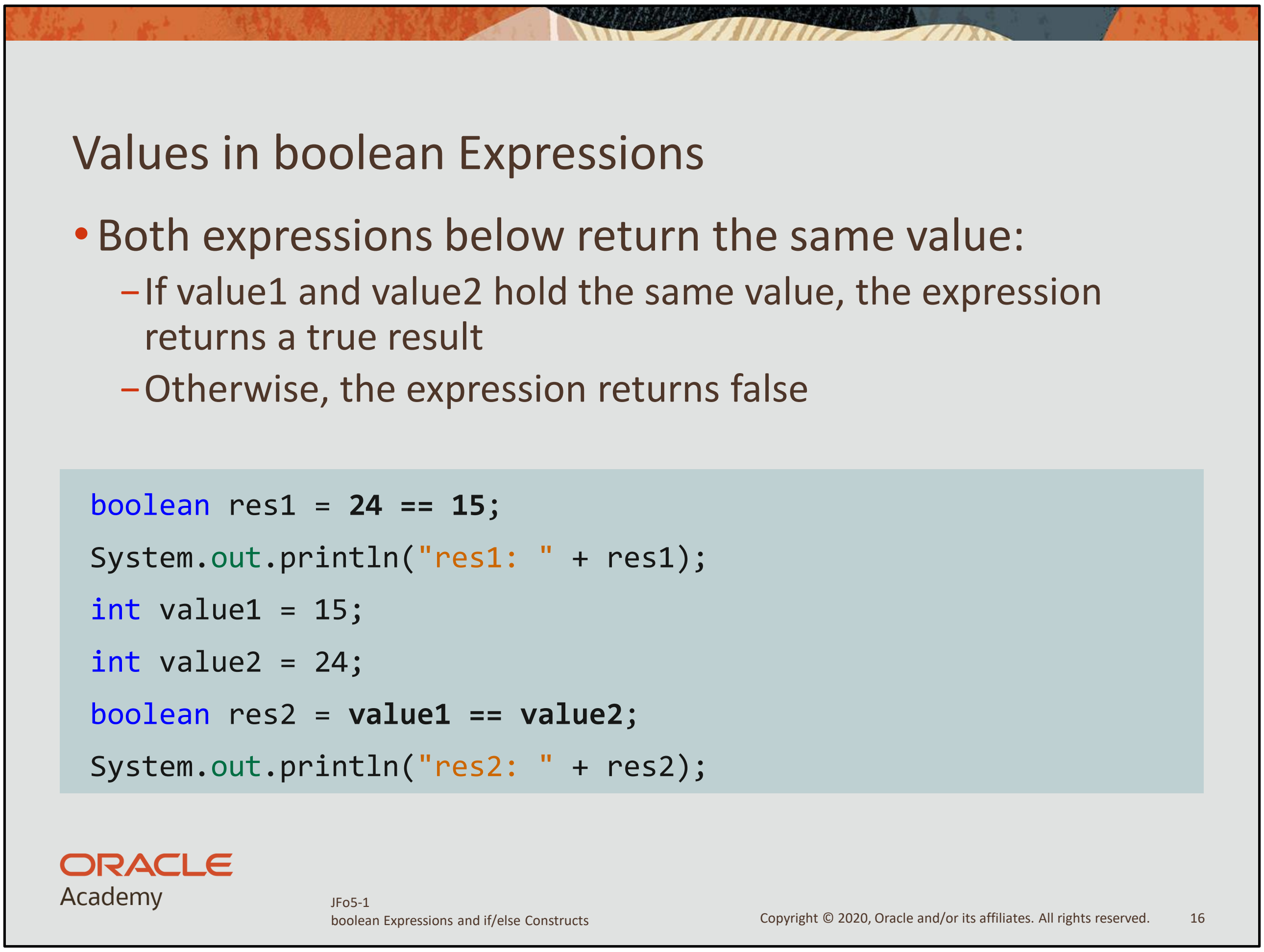
ORACLE
Academy

Values in boolean Expressions

- Use == to test equality between primitive values
- boolean expressions may contain variables or hard-coded values

```
boolean res1 = 24 == 15;
System.out.println("res1:  " + res1);
int value1 = 15;
int value2 = 24;
boolean res2 = value1 == value2;
System.out.println("res2:  " + res2);
```

ORACLE
Academy



Values in boolean Expressions

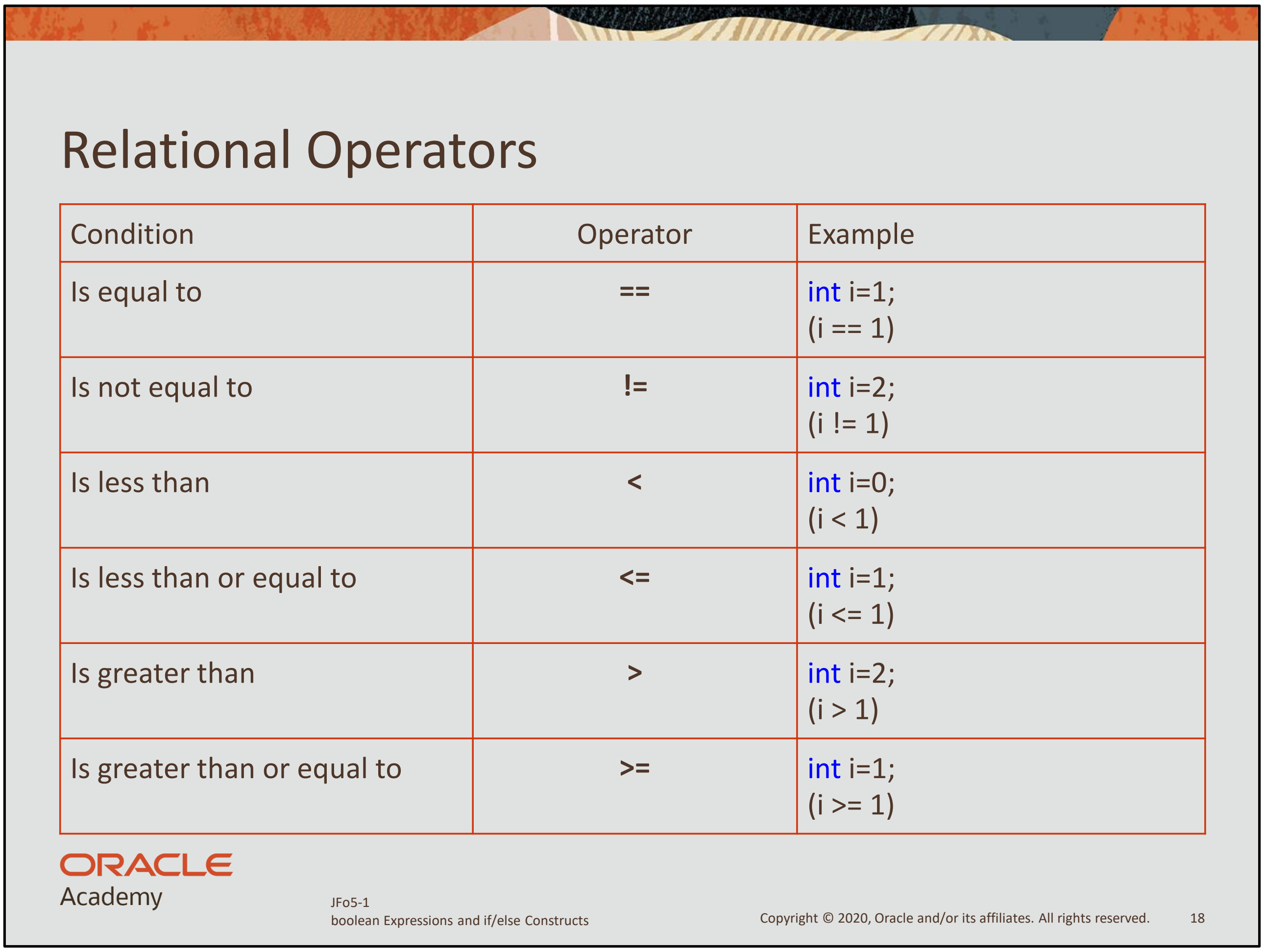
- Both expressions below return the same value:
  - If value1 and value2 hold the same value, the expression returns a true result
  - Otherwise, the expression returns false

```
boolean res1 = 24 == 15;
System.out.println("res1: " + res1);
int value1 = 15;
int value2 = 24;
boolean res2 = value1 == value2;
System.out.println("res2: " + res2);
```

ORACLE
Academy

Relational Operators

- Use relational operators in boolean expressions that are used to evaluate if/else statements

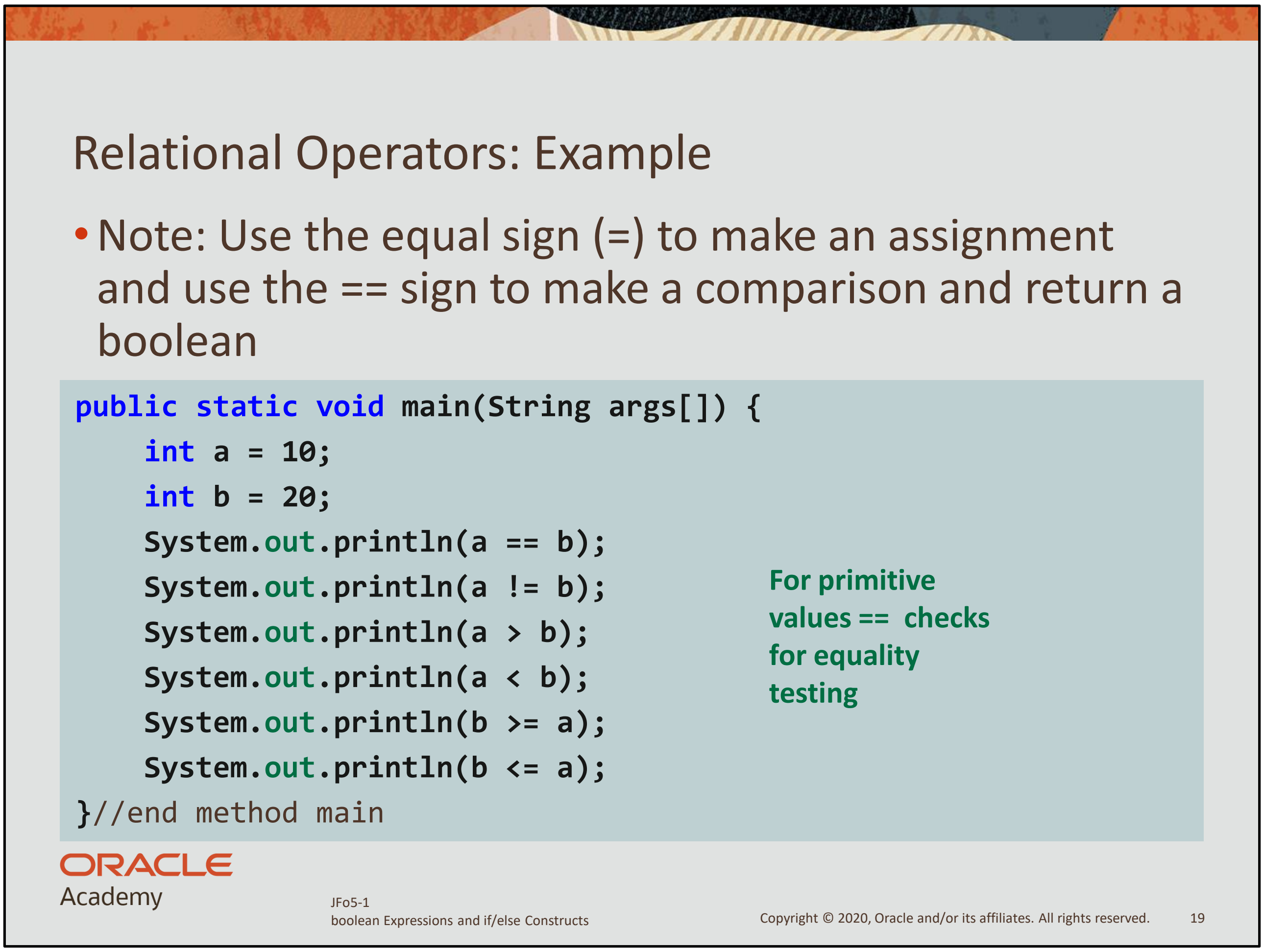


Relational Operators

Condition	Operator	Example
Is equal to	==	int i=1; (i == 1)
Is not equal to	!=	int i=2; (i != 1)
Is less than	<	int i=0; (i < 1)
Is less than or equal to	<=	int i=1; (i <= 1)
Is greater than	>	int i=2; (i > 1)
Is greater than or equal to	>=	int i=1; (i >= 1)

ORACLE
Academy

Here you see a more complete list of relational operators. The table lists the different conditions that you can test by using relational operators. The result of all relational operators is a boolean value. All examples yield a boolean result of true.



Relational Operators: Example

- Note: Use the equal sign (=) to make an assignment and use the == sign to make a comparison and return a boolean

```
public static void main(String args[]) {
    int a = 10;
    int b = 20;
    System.out.println(a == b);
    System.out.println(a != b);
    System.out.println(a > b);
    System.out.println(a < b);
    System.out.println(b >= a);
    System.out.println(b <= a);
}//end method main
```

For primitive values == checks for equality testing

ORACLE Academy

Equality Testing:
For objects, use the equals method for testing equality.

Output:
```
false
true
false
true
true
false
```

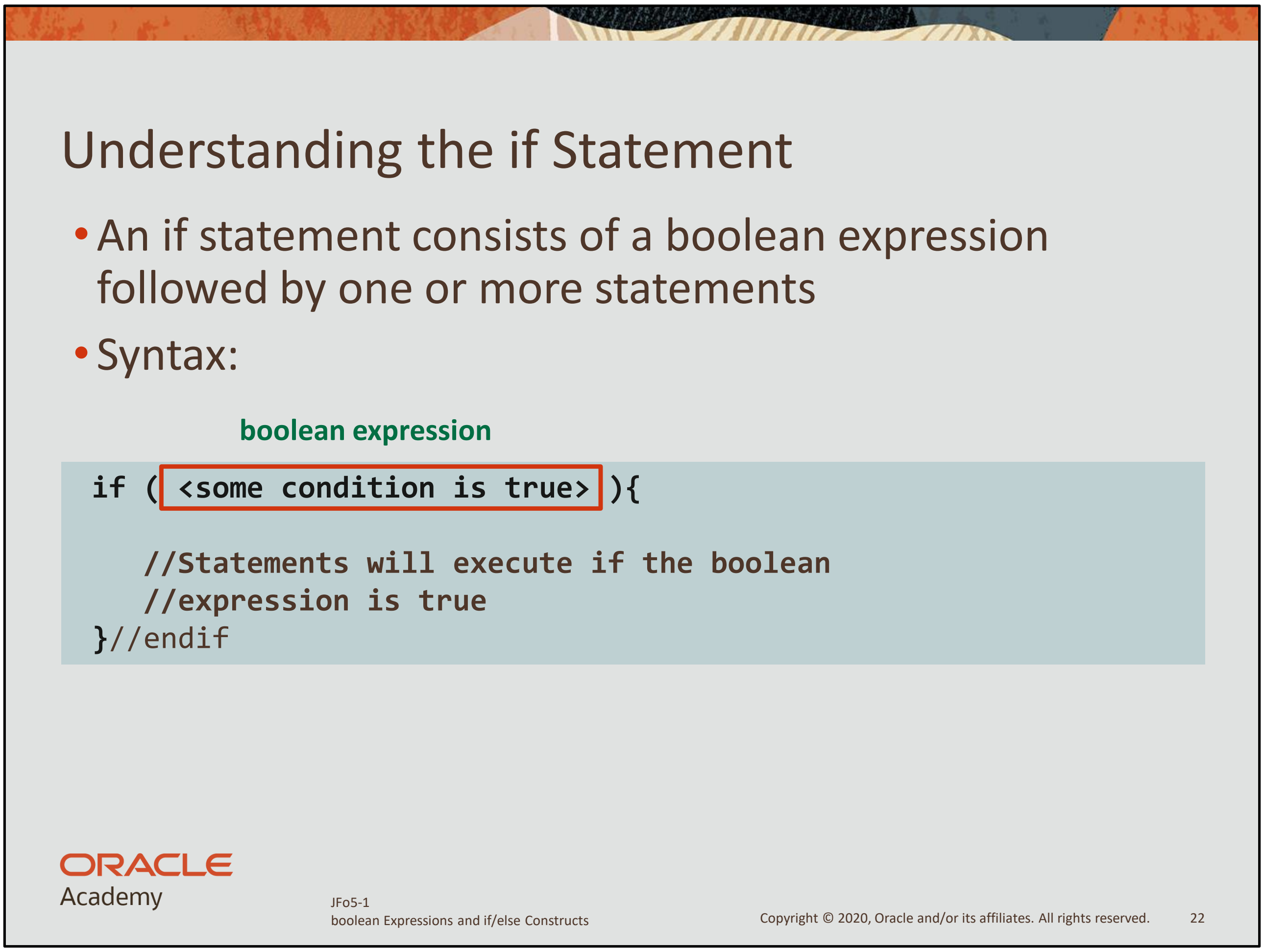
Exercise 1

- Import and open the `IfElseEx` project
- Modify `AgeValidity.java` to implement the following:
  - Have users enter their age
  - Declare a boolean variable, drivingUnderAge
  - Initialize drivingUnderAge to false
  - Write a boolean expression to check if the age entered by the user is less than or equal to 18, and then set drivingUnderAge to true
  - Print the value of drivingUnderAge

Conditional Statements

- Conditional statements let us choose which statement are executed next
- These decisions are based on boolean expressions (or conditions) that evaluate to true or false
- Conditional statements in Java are:
  - if statement
  - if/else statement
  - switch statement

ORACLE
Academy



Understanding the if Statement

- An if statement consists of a boolean expression followed by one or more statements
- Syntax:

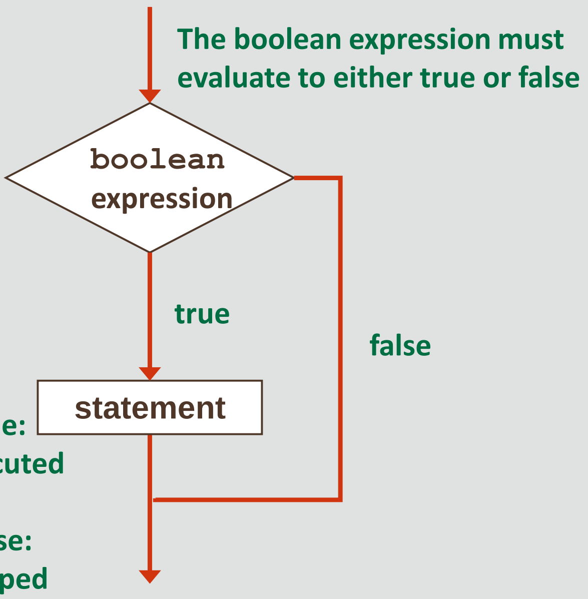
boolean expression

```
if ( <some condition is true> ){

   //Statements will execute if the boolean
   //expression is true
}//endif
```

ORACLE
Academy

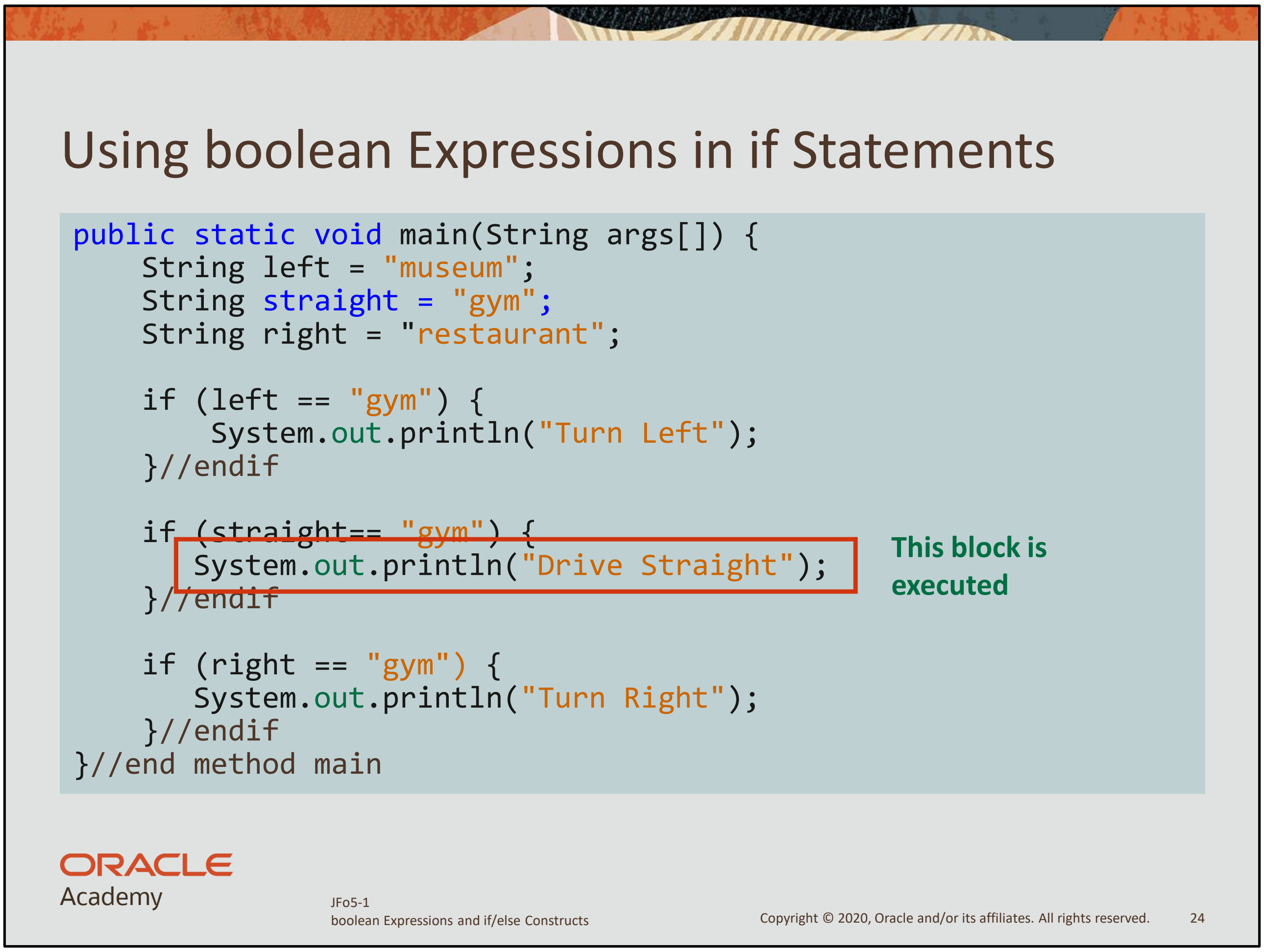
The condition to be evaluated is surrounded by parentheses. It is referred to as a boolean expression because it must evaluate to either true or false.

Understanding the if Statement


The boolean expression must evaluate to either true or false
boolean expression
true
false
statement

If boolean expression is true:
Statement is executed

If boolean expression is false:
Statement is skipped



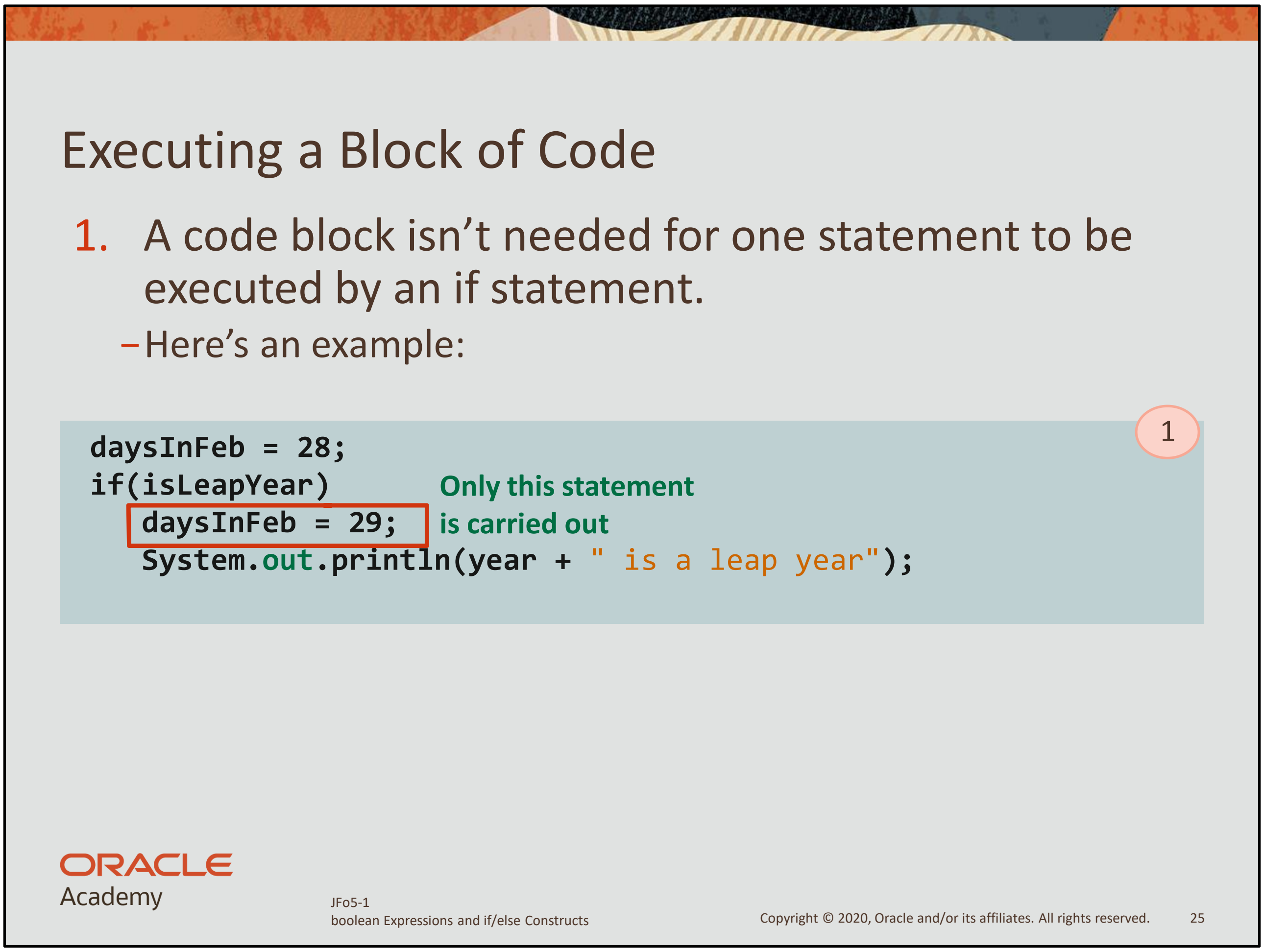
Using boolean Expressions in if Statements

```
public static void main(String args[]) {
    String left = "museum";
    String straight = "gym";
    String right = "restaurant";

    if (left == "gym") {
        System.out.println("Turn Left");
    }//endif

    if (straight== "gym") {
       System.out.println("Drive Straight");
    }//endif

    if (right == "gym") {
       System.out.println("Turn Right");
    }//endif
}//end method main
```

This block is executed

Academy

In the slide example, the boolean expression in the second if statement returns true. Therefore, “Drive Straight” is printed to the console.



Executing a Block of Code

1. A code block isn't needed for one statement to be executed by an if statement.
   – Here's an example:

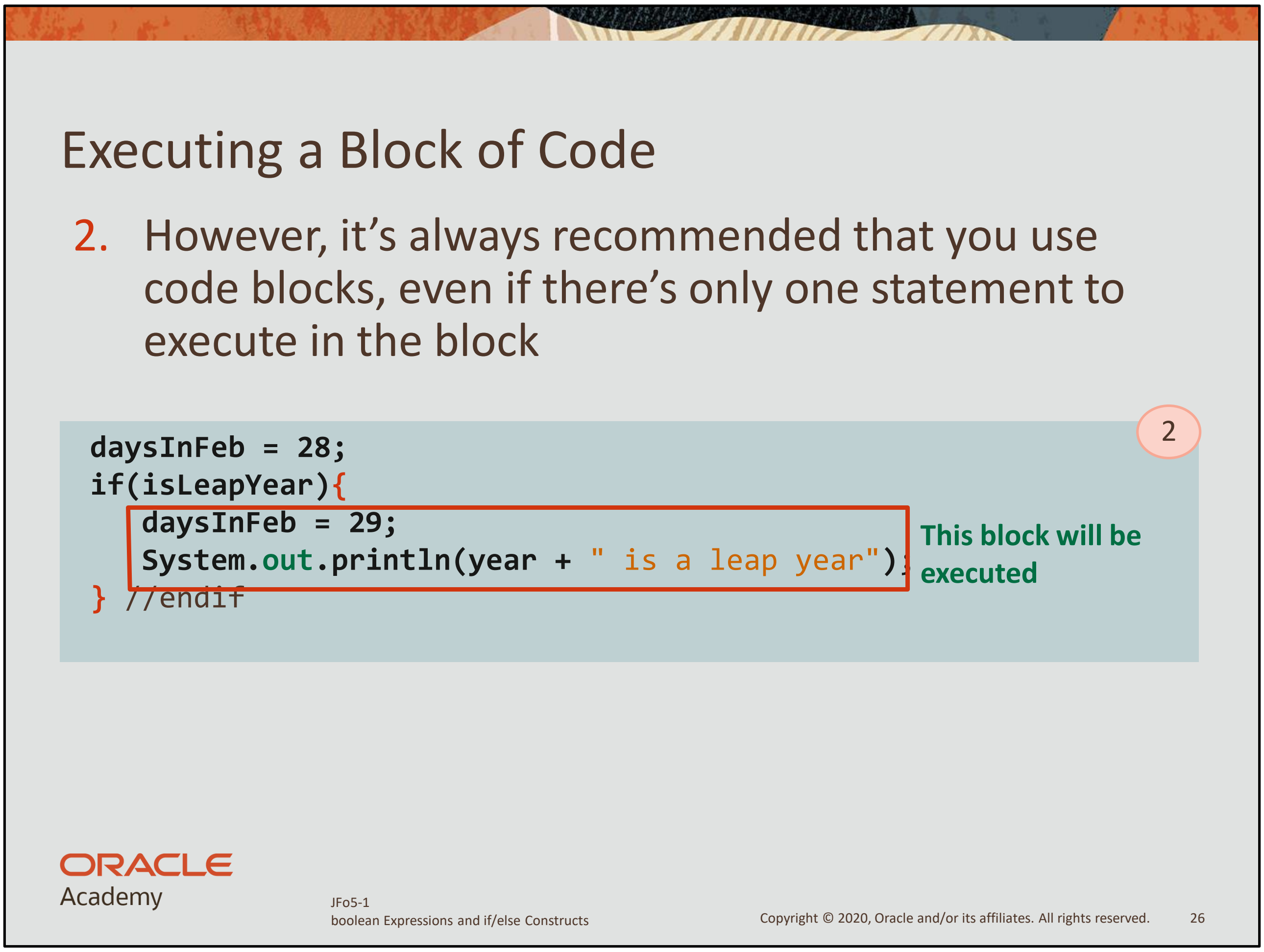
```
daysInFeb = 28;
if(isLeapYear)
   daysInFeb = 29;
   System.out.println(year + " is a leap year");
```

1

Only this statement is carried out

ORACLE Academy

In example 1, you want both statements to be executed when the condition is true. Because there's no code block, only the first statement is executed.



Executing a Block of Code

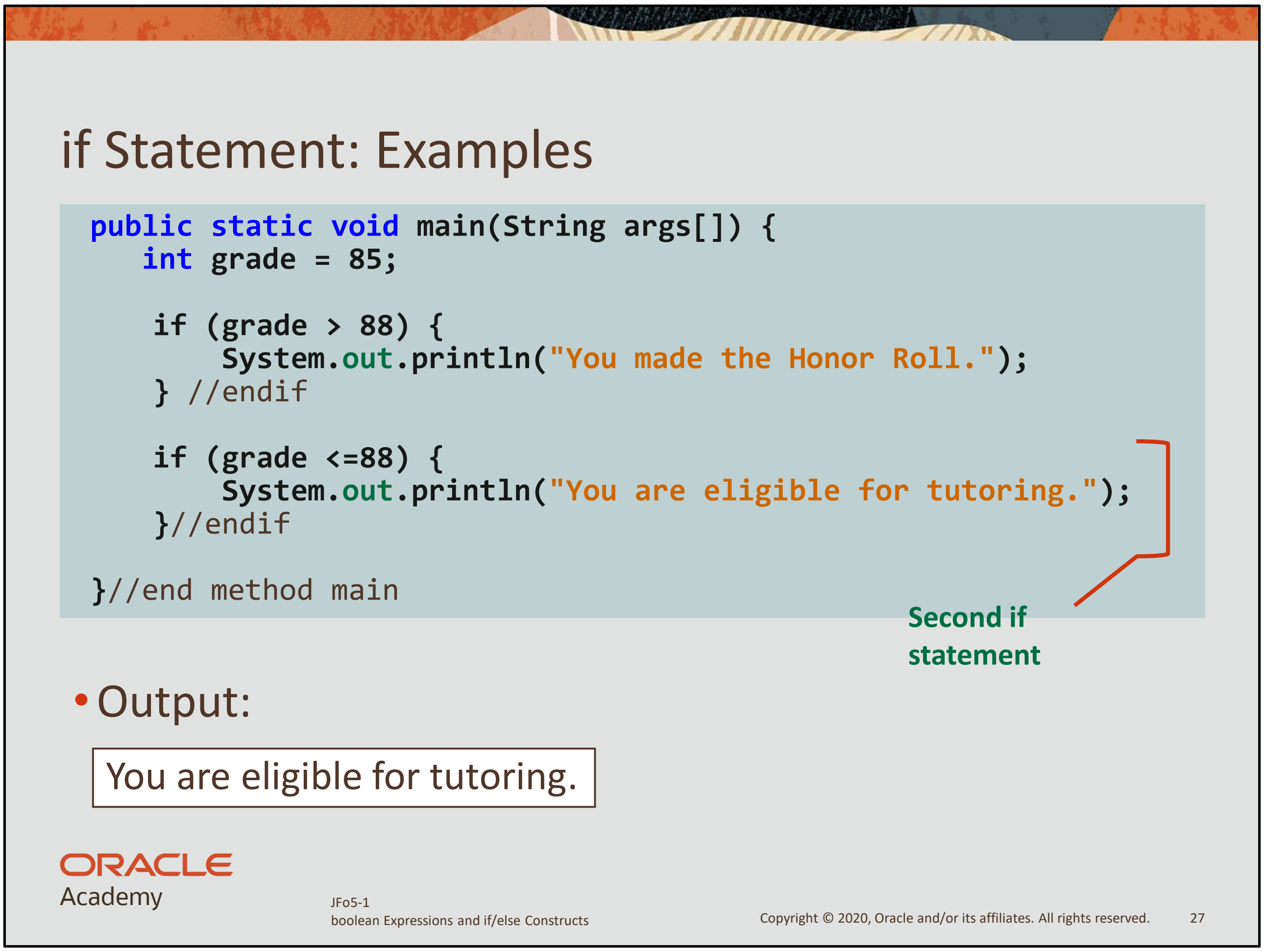
2. However, it’s always recommended that you use code blocks, even if there’s only one statement to execute in the block

2

```
daysInFeb = 28;
if(isLeapYear){
   daysInFeb = 29;
   System.out.println(year + " is a leap year");
} //endif
```

This block will be executed

In example 2, both statements are executed when the condition is true because there’s a code block for the if statement .
To avoid this error, you must use code blocks even if there’s only one statement to execute in the if block.



if Statement: Examples

```
public static void main(String args[]) {
   int grade = 85;

    if (grade > 88) {
        System.out.println("You made the Honor Roll.");
    } //endif

    if (grade <=88) {
        System.out.println("You are eligible for tutoring.");
    }//endif

}//end method main
```

Second if statement

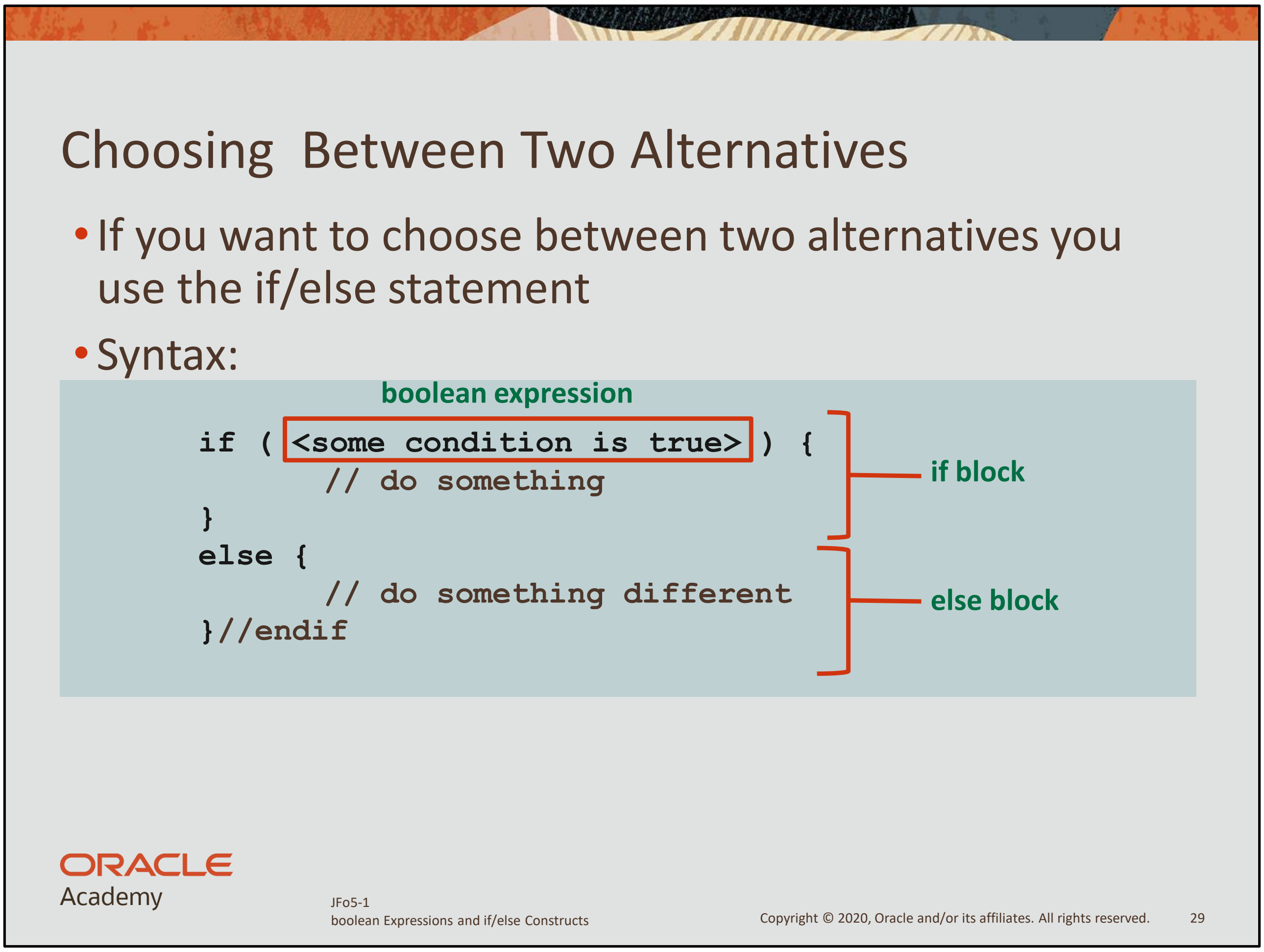
- Output:

```
You are eligible for tutoring.
```

In the slide example, there are two if statements: The first tests for values greater than 88. The second tests for values less than or equal to 88.
Both of the if statements are evaluated, even if the first one is true.

Exercise 2

- Import and open the `IfElseEx` project
- Modify the `ChkOddEven.java` to implement the following:
  - Input a number between 1 and 10
  - Use if statements
  - Test whether a number is odd or even
- The program should generate the following output:
  - Enter a number: 7
  - The num is odd 7



Choosing Between Two Alternatives

- If you want to choose between two alternatives you use the if/else statement
- Syntax:

boolean expression

```
if ( <some condition is true> ) {
          // do something
}
else {
          // do something different
}//endif
```

if block

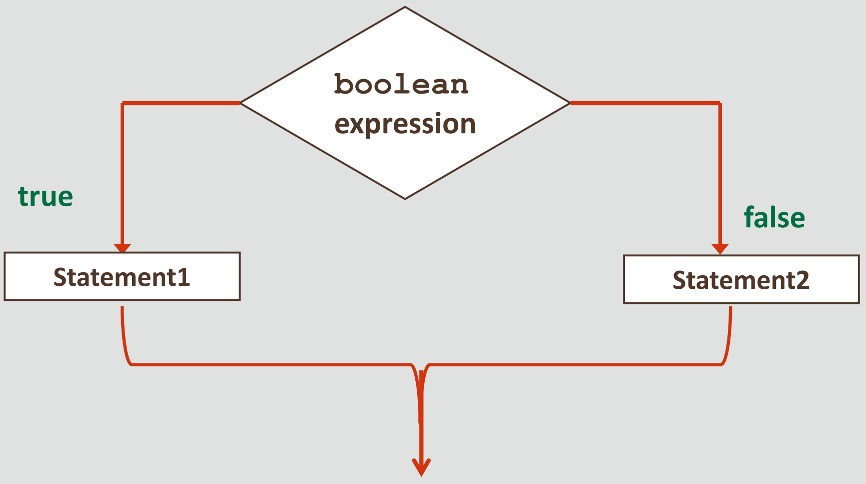
else block

ORACLE Academy

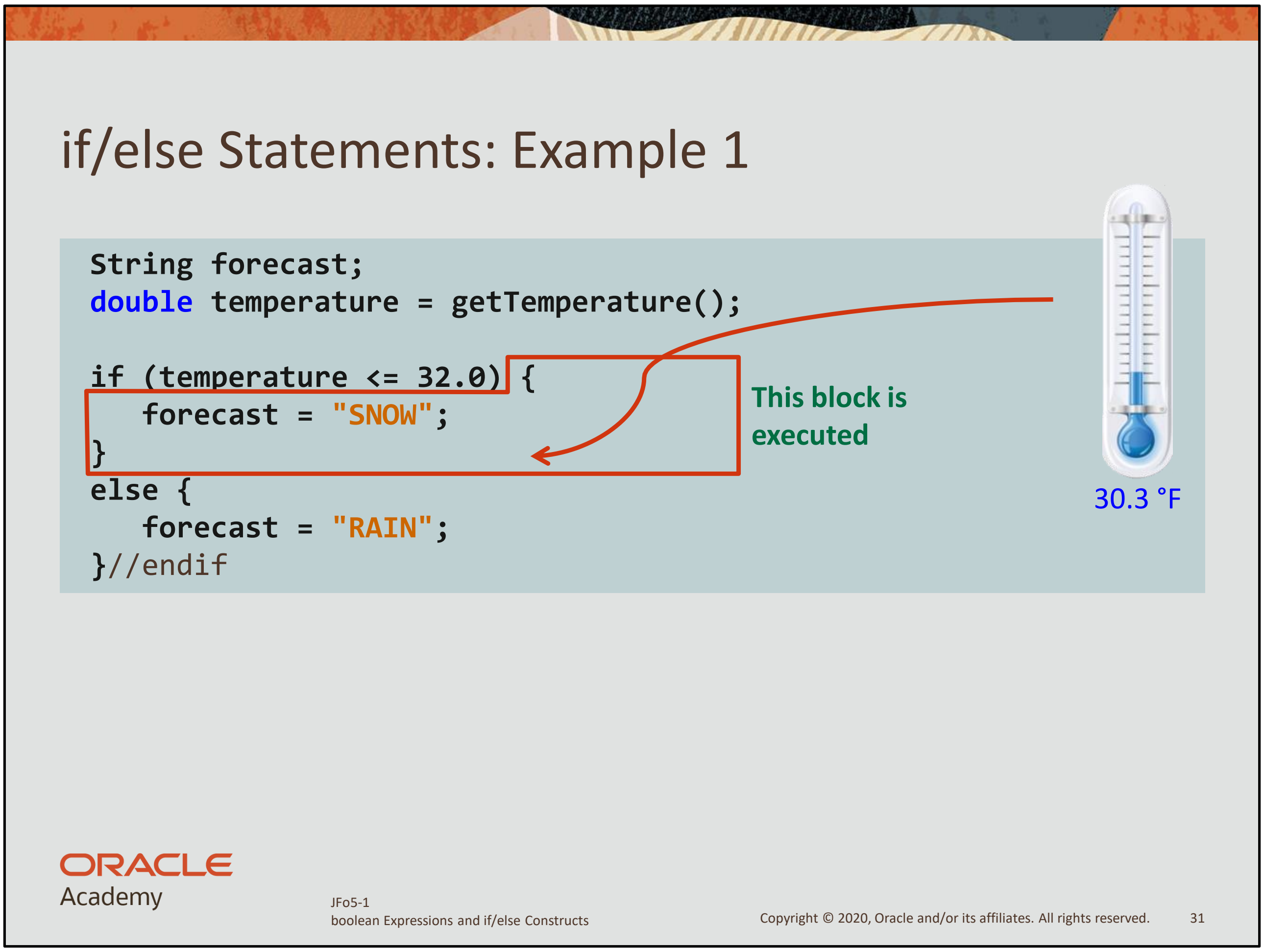
The if/else statement is one way of branching your code depending on some condition. It uses two Java keywords, if and else.

- If some condition is true, execute the code within the if block.
- If that condition is false, execute the code in the else block.

Understanding if/else Statements



If boolean expression is true: Statement1 is executed
If boolean expression is false: Statement2 is skipped



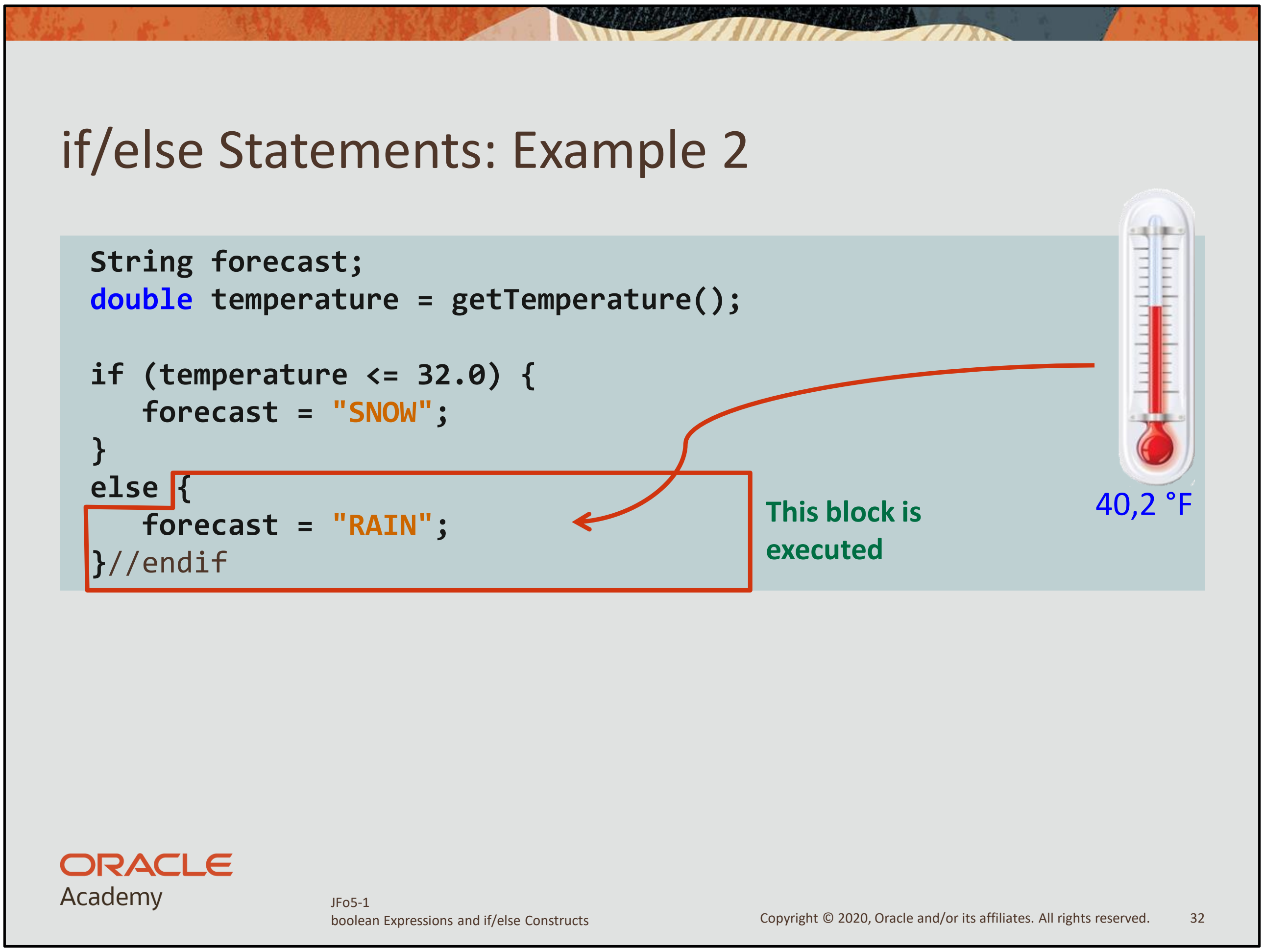
if/else Statements: Example 1

```
String forecast;
double temperature = getTemperature();

if (temperature <= 32.0) {
   forecast = "SNOW";
}
else {
   forecast = "RAIN";
}//endif
```

This block is executed

ORACLE Academy

This slide demonstrates an if/else example. The getTemperature() method returns the temperature as 30.3. Because the temperature is less than 32 degrees, the boolean expression (temperature <= 32.0) returns true, and the if block is executed.



if/else Statements: Example 2

```
String forecast;
double temperature = getTemperature();

if (temperature <= 32.0) {
   forecast = "SNOW";
}
else {
   forecast = "RAIN";
}//endif
```

This block is executed

40,2 °F

ORACLE Academy

This slide demonstrates if/else example, the getTemperature() method returns the temperature as 40.2.In the if/else statement, since the temperature <= 32 degrees, the boolean expression, temperature <= 32.0 returns false, and the else block is executed.

if/else Statements: Example 3

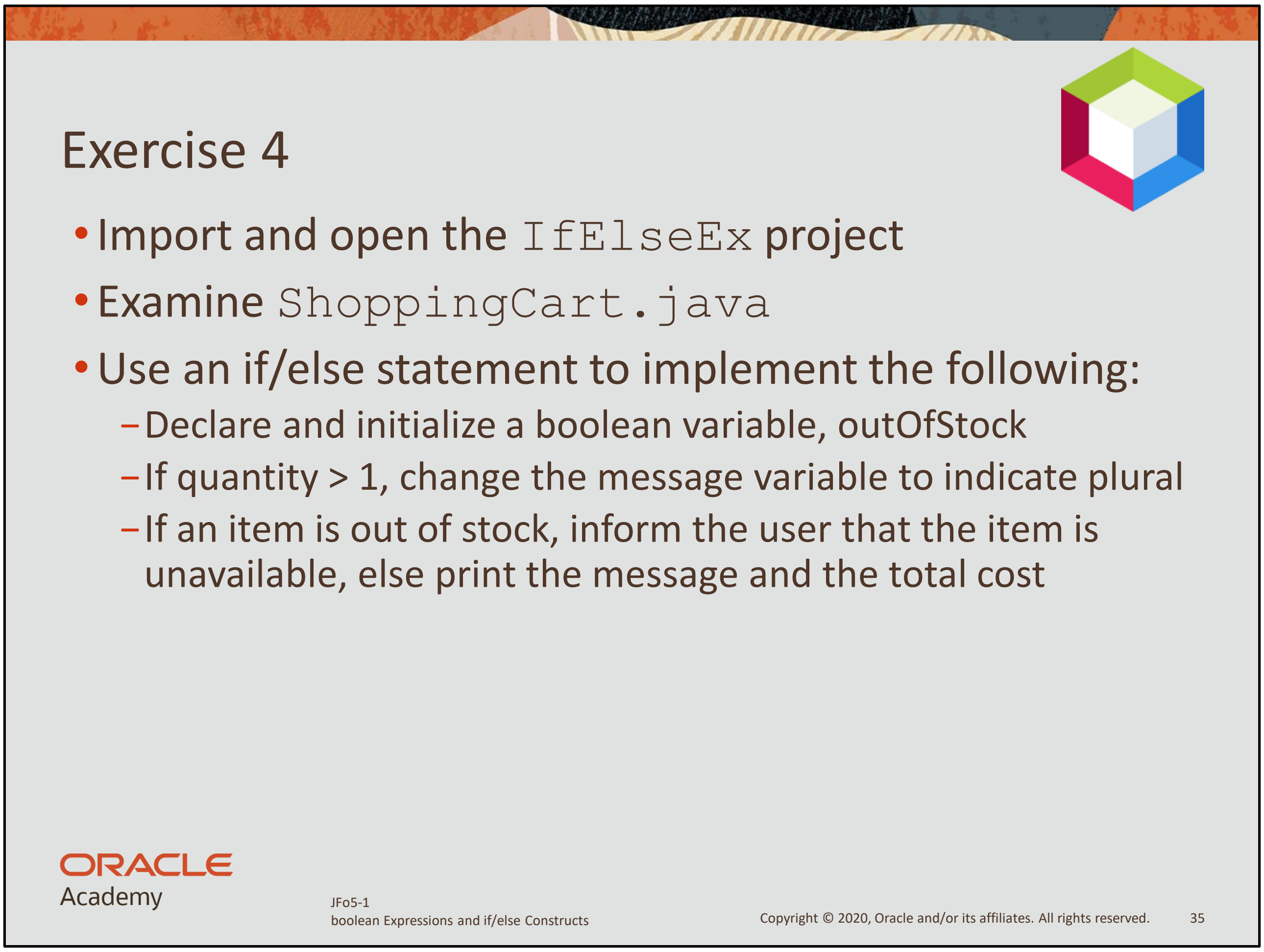
- You can replace the two if statements with an if/else statement
- The if/else statement is more efficient because only one comparison is being made

```
public static void main(String args[]) {
    int grade = 85;
    if (grade > 88) {
        System.out.println("You made the Honor Roll.");
    }
    else {
        System.out.println("You passed.");
    }//endif
}//end method main
```

ORACLE
Academy

Exercise 3

- Import and open the `IfElseEx` project
- Examine `AgeCheck.java`:
  - The program has a logic problem
  - For some values, it prints the wrong answer
  - Find the problems and fix them. (You may need to run the program a few times and try different values to see which ones fail)
  - Replace the two if statements with an if/else statement



Exercise 4

- Import and open the `IfElseEx` project
- Examine `ShoppingCart.java`
- Use an if/else statement to implement the following:
  - Declare and initialize a boolean variable, outOfStock
  - If quantity > 1, change the message variable to indicate plural
  - If an item is out of stock, inform the user that the item is unavailable, else print the message and the total cost

ORACLE
Academy

Comparing Variables

- When you compare values by using boolean expressions, you need to understand the nuances of certain data types
- Relational operators such as == are …
  - Great for comparing primitives
  - Terrible for comparing Strings (and other objects)
- Let’s examine why

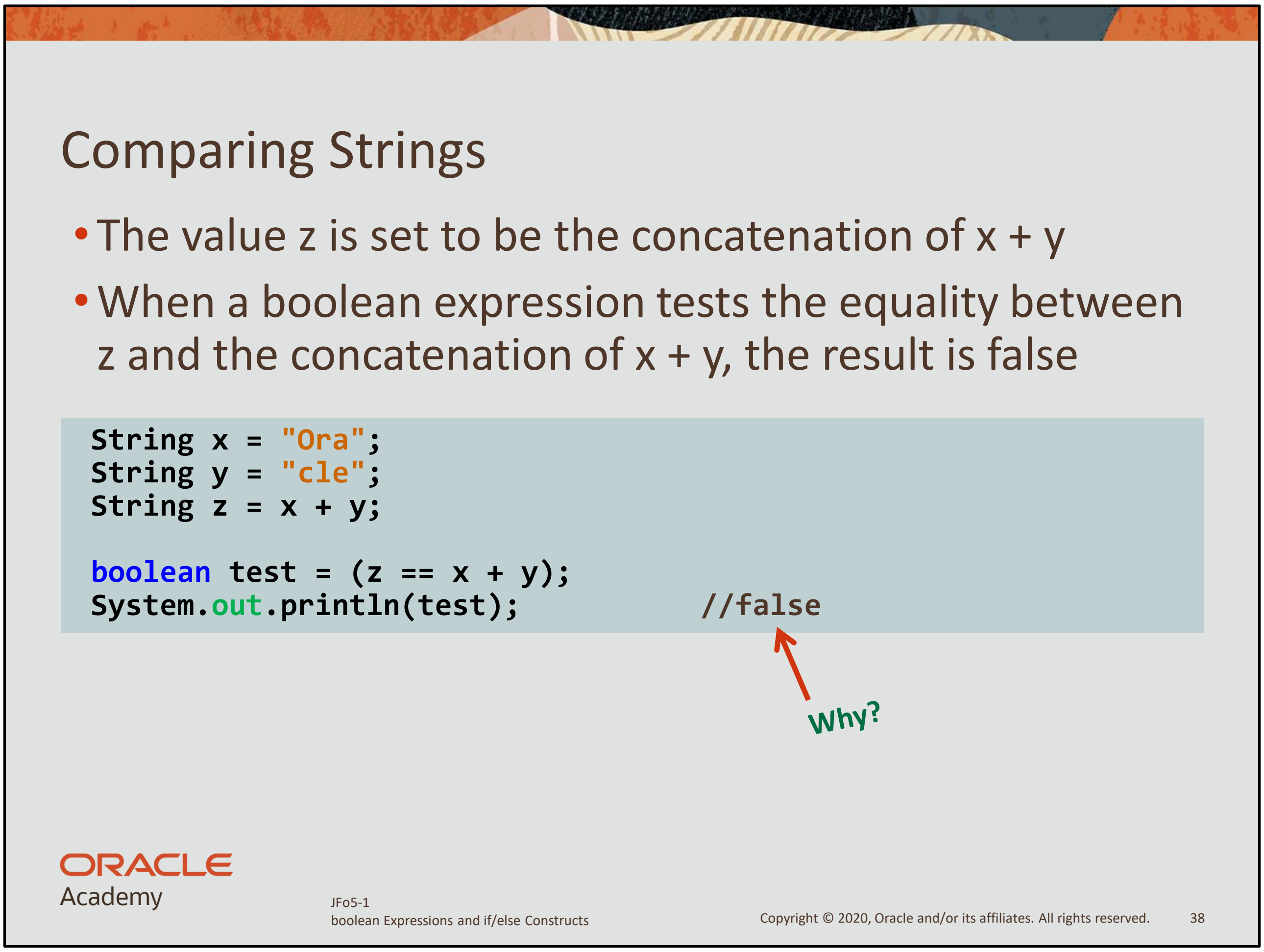
ORACLE
Academy

Comparing Primitives

- The value z is set to be the sum of x + y
- When a boolean expression tests the equality between z and the sum of x + y, the result is true

```
int x = 3;
int y = 2;
int z = x + y;

boolean test = (z == x + y);
System.out.println(test);           //true
```

ORACLE
Academy



Comparing Strings

- The value z is set to be the concatenation of x + y
- When a boolean expression tests the equality between z and the concatenation of x + y, the result is false

```
String x = "Ora";
String y = "cle";
String z = x + y;

boolean test = (z == x + y);
System.out.println(test);            //false
```

Note to Instructors: The code box in this slide should be in the same position so that the slight differences become more apparent.

Why Are There Contradictory Results?

- Primitives and objects are stored differently in memory
  - Strings are given special treatment
  - This is discussed later in the course
- As a result …
  - == compares the values of primitives
  - == compares the objects’ locations in memory
- It’s much more likely that you’ll need to compare the content of Strings and not their locations in memory

How Should You Compare Strings?

- You should almost never compare Strings using ==
- Instead, compare Strings using the equals() method
  - This method is part of the String class
  - It accepts one String argument, checks whether the contents of Strings are equal, and then returns a boolean
  - There is also a similar method, equalsIgnoreCase()

```
String x = "Ora";
String y = "cle";
String z = x + y;
boolean test = z.equals(x + y);
System.out.println(test);                //true
```

Exercise 5

- Import and open the `IfElseEx` project
- Examine `StringEquality.java`
- Use an if and an if/else statement:
  - Declare a String variable name
  - Have the user input a value for the name
  - Check whether the name is “Moe,” and then print “You are the king of rock and roll”
  - Otherwise print “You are not the king”
  - Don’t use ==

ORACLE
Academy

Summary

- In this lesson, you should have learned how to:
  - Declare, initialize, and use boolean variables
  - Compare primitive values using relational operators
  - Create an if statement
  - Create if/else constructs
  - Compare Strings

ORACLE
Academy

ORACLE

Academy