Computer Science Virtual Learning

HS Computer Science A

April 16th, 2020

Lesson: <mark>Operators</mark>

Objective/Learning Target:

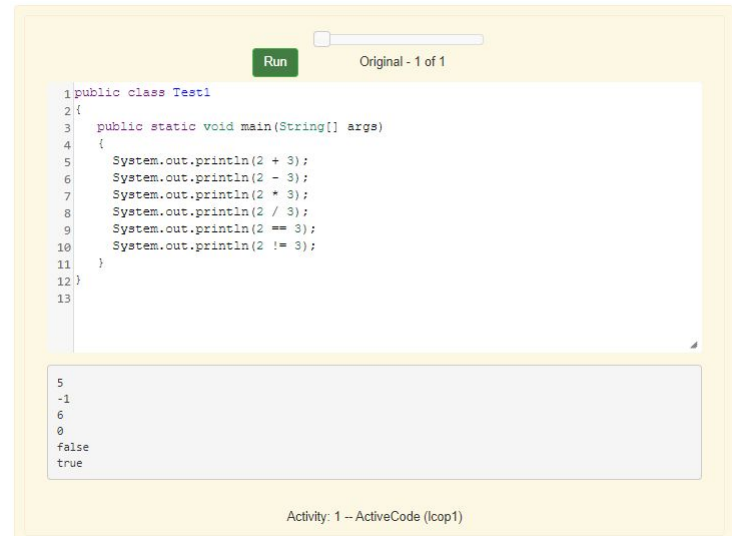Understanding how and why we use operators in Java

Operators

Java uses the standard mathematical operators for addition (+), subtraction (-), multiplication (*), and division (/). Java uses (==) to test if the value on the left is equal to the value on the right and (!=) to test if two items are not equal.

Go to:
https://runestone.academy/runestone/books/published/apcsareview/VariableBasics/operators.html and run the code

Do all of the operators do what you expected? What about how 2 / 3 prints 0?

Note: When Java sees you doing integer division it assumes you want an integer result so it throws away anything after the decimal point in the answer.

```
Run                Original - 1 of 1

1 public class Test1
2 {
3    public static void main(String[] args)
4    {
5       System.out.println(2 + 3);
6       System.out.println(2 - 3);
7       System.out.println(2 * 3);
8       System.out.println(2 / 3);
9       System.out.println(2 == 3);
10      System.out.println(2 != 3);
11   }
12 }
13
```

```
5
-1
6
0
false
true
```

Activity: 1 -- ActiveCode (Icop1)

Modulos

The percent sign operator (`%`) is the **modulo** or remainder operator. The **modulo** operator (`x % y`) returns the remainder after you divide `x` (first number) by `y` (second number) so `5 % 2` will return 1 since 2 goes into 5 two times with a remainder of 1. Remember long division when you had to specify how many times one number when into another evenly and the remainder? That remainder is what is returned by the modulo operator.

**Note The result of `x % y` when `x` is smaller than `y` is always `x`. The value `y` can't go into `x` at all (goes in 0 times), since `x` is smaller than `y`, so the result is just `x`. So if you see `2 % 3` the result is `2`.

Figure 1: Long division showing the whole number result and the remainder

Modulo

The **modulo** operator is often used in programs, so you should be familiar with it.

- Use it to check for odd or even numbers (`num % 2 == 1 is odd and num % 2 == 0 is even`). Actually, you can use it to check if any number is evenly divisible by another (`num1 % num2 == 0`)
- Use it to get the last digit from an integer number (`num % 10 = last digit on right`). This approach could be used on the free response question Self Divisor (Question 1 from 2007). See http://coweb.cc.gatech.edu/ice-gt/1277 for starter code and testing code.
- Use it to get the number of minutes left when you convert to hours (`num % 60`). Also whenever you have limited storage and you need to wrap around to the front if the value goes over the limit. See question 3 at http://coweb.cc.gatech.edu/ice-gt/1278.

Check Your Understanding

Answer the following questions to check your understanding of the material in the previous slides

1.   What is the result of 158 % 10?

2.   What is the result of 3 % 8

Shortcut Operators

You are also expected to know the double plus operator (`++`) and the double minus operator (`--`). The `++` operator is used to add one to the current value: `x++` is the same as `x = x + 1`. The `--` operator is used to subtract one from the current value: `y--` is the same as `y = y - 1`. You should know that `x += y` is the same as `x = x + y`, `x -= y` is the same as `x = x - y`, `x *= y` is the same as `x = x * y`, and `x /= y` is the same as `x = x / y`.

Run   Original - 1 of 1

```java
1 public class Test2
2 {
3   public static void main(String[] args)
4   {
5     int num = 0;
6     System.out.println(num);
7     num++;
8     System.out.println(num);
9   }
10 }
11
```

```
0
1
```

Activity: 5 -- ActiveCode (lcpp)

Check Your Understanding

Answer the following questions to check your understanding of the material in the previous slides

1. What are the values of x, y, and z after the following code executes?

```
int x = 0;
int y = 1;
int z = 2;
x--; // x followed bythe double minus sign
y++;
z+=y;
```

    A. x = -1, y = 1, z = 4
    B. x = -1, y = 2, z = 3
    C. x = -1, y = 2, z = 2
    D. x = -1, y = 2, z = 2
    E. x = -1, y = 2, z = 4

2. What are the values of x, y, and z after the following code executes?

```
int x = 3;
int y = 5;
int z = 2;
x = z * 2;
y = y / 2;
z++;
```

    A. x = 6, y = 2.5, z = 2
    B. x = 4, y = 2.5, z = 2
    C. x = 6, y = 2, z = 3
    D. x = 4, y = 2.5, z = 3
    E. x = 4, y = 2, z = 3

For More Resources and to Check Answers

Go to: https://runestone.academy/runestone/books/published/apcsareview/VariableBasics/operators.html