Arithmetic Expressions in Java

Objectives

At the end of this exercise, students will:

- Be able to evaluate the binary arithmetic expressions in Java.
- Be able to create arithmetic expressions in Java to solve arithmetically based problems.

Roles

- Coordinator – will make sure the team stays on task
- Presenter – will only be used if there is a question about your group's responses
- Recorder – will write on the board the group answers to **BOARD** questions
- Reflector – if present will fill out the exit pass, otherwise, team members will do so

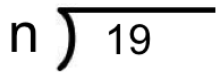
Getting ready

1. All team members - record your notes on your own response sheet.
2. Assign the roles that you will each fulfill.

Background – Relearning arithmetic – Channeling your inner 4th grader

While most of the Java operations act as we expect them to from Math classes, integer division is different. This part of the exercise will help you to practice how integer division works. It is very similar to the way you first learned division.

1. Each bag should have 19 pennies. Divide the pennies into piles so that each person in the group gets the same number of pennies.



(n is the number of people in your group)

2. You should have (n + 1) piles of pennies, one for each person in the group and one that has the leftovers. Since you can't divide a penny, we say that we have a quotient (the number of in each person's stack) and a remainder (the stack that contains the rest).

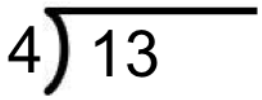
3. How many people in your group today? _____

4. What is the quotient (how many pennies does each person have)? _____

5. How many pennies are left over? _____

In Java, integer division is like this kind of division. 19 / 4 is 4 because when we divide 19 into 4 even piles, we get 4 pennies in each pile. 19 % 4 (read 19 remainder 4) is 3 because when we evenly divide 19 by 4 we have 3 left over.

Let's try a few more with the pennies. Count out 13 pennies.



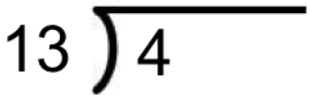
6. If you start with 13 pennies and divide them 4 ways (into 4 groups) how many pennies in each group? (13 / 4)

   _____

7. How many pennies are left over? (13 % 4) _____

Now a harder one.

Count out 4 pennies. Divide those 4 pennies into 13 even piles.



8. How many pennies do you have in each of the 13 piles? 4 / 13 _____

9. How many are leftover? 4 % 13 _____

Understanding Integer Division – more practice

3. What is the result of the each of the following integer division operations?

8 / 3	
8 % 3	
127 / 22	
127 % 22	
22 / 127	
22 % 127	

4. **BOARD** – On the board, write the result of the expression, 5 % 6 / 3. (The expression is evaluated from left to right.)

5. Describe the process of performing integer division. How did you figure out the division and modulus results from question 1?

More Arithmetic operations in Java – Gaddis 2.5

+	Addition	Binary	total = cost + tax;
-	Subtraction	Binary	cost = total – tax;
*****	Multiplication	Binary	tax = cost * rate;
/	Division	Binary	salePrice = original / 2;
%	Modulus	Binary	remainder = value % 5;

This table displays the 5 Java arithmetic operations in Java. They are **binary**, meaning that they take two operands. We saw addition already in the lab. Notice in the examples that every operator is separated from the operands by a single blank character. This is to provide better readability of the operations for the human reader. The compiler ignores any form of whitespace including spaces, tabs, and new line characters.

The order of precedence of these operations is * / %, then + -. Within levels, operations are carried out from left to right.

Also, something you need to know. Java operations must be done on the same data type. So if we mix integers and doubles, the overall operation will be carried out with double numbers. The integer value will widen to a double and the operation carried out. This happens operation by operation.

The model

The following are examples of arithmetic expressions in Java. Make sure you understand how we got the result.

	Data Type of Result	Value of Result
3 + 5	integer	8
5 – 7.0	double	-2.0
5.0 * 1.0	double	5.0
10.0 / 2.0	double	5.0
10 / 3	integer	3
10 % 3	integer	1
7 % 6	integer	1
7 / 6	integer	1
6 / 7	integer	0
6 % 7	integer	6
(6 % 7) / 5.0	double	1.2
(6 / 4.0) * 2	double	3.0

The following is an example of how Java will calculate an expression with mixed operations and operands. The arrows and numbers below show in what order Java will carry out the evaluation of this expression.

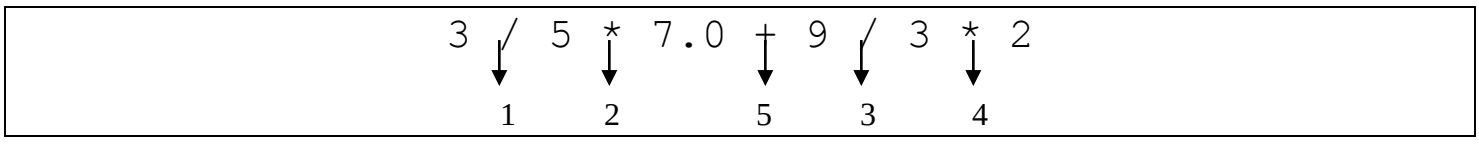


Figure 1

Exploring the model

Using the chart of examples, answer the following: (**YOU SHOULD NOT USE A CALCULATOR**). Assume that the result of each operation will be used in later steps, for example, step one result is used in step 2, etc.

6. What is the result of operation 1?
7. What is the data type of operation 1?
8. What is the result and data type of operation 2?
9. What is the result and data type of operation 3?
10. What is the result and data type of operation 4?
11. What is the result and data type of operation 5?
12. **BOARD** – Put your team name on the board and your answer to number 11.

Extending the model

13. Just like in math class, parentheses are used in Java to force an operation to be evaluated before operations outside of the parentheses are evaluated.
14. In Figure 1 above, put in parentheses to document the order of operations as described by the numbers.
15. In Figure 2 below, put in parentheses to force Java to evaluate the expression based in the order shown beneath the arrows.

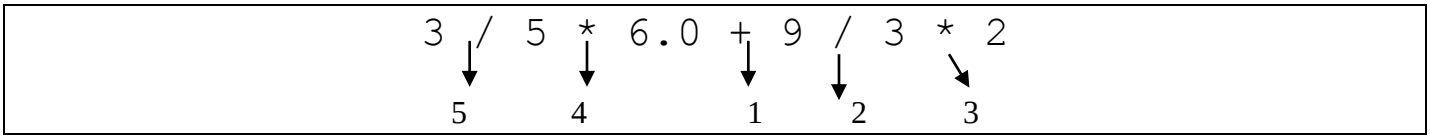


Figure 2

16. **BOARD** Evaluate the expression from Figure 2. Put your answer on the board under your group name.

Applying arithmetic operations to problems

17. **BOARD** What expression(s) would you use to solve this problem? Calculate the number of minutes, seconds, and hours in 7000 seconds?

18. Write another example of turning seconds into the equivalent hours, minutes and seconds.

Coordinator – Have someone from the team erase your team's responses from the boards. Turn in only the Exit Pass today.