

## **Exercise 1: Linear Data Structures**

The purpose of this exercise is to give you more experience with programming using linear data structures. Starter code for this exercise is provided in `BalancerStarter.java`. You may choose to write your code either in a single static method or in a default constructor method. This exercise is due in the Exercise 1 dropbox by the due date specified. To get full credit for this exercise, you must submit your code and a PDF containing screen shots with correct output for the four Test Cases shown on the next page with each test case clearly marked. Please submit the code and your PDF in a zip file called `Exercise1.zip`.

### **Expression Balancing with Stacks**

Using the `Stack` class, create a program, `Balancer.java`, that takes a mathematical expression, stored in a hard-coded `String`, and determines if the expression is balanced. For example, let's look at the Quadratic Equation:

$$\underset{1}{-}(b * b - \underset{2}{(4 * a * c)}) / \underset{1}{(2 * a)} \underset{0}{}$$

If we were to only allow parentheses in an expression, you could simply increment a counter when you see a "(" and decrement it when you see a ")". The counter would never go negative and would be zero at the end of the expression, if the expression is balanced.

However, most often, expressions are written with (, {, and [. Such as:

$$-\{ [ b * b - (4 * a * c) ] / (2 * a) \}$$

Use the following pseudocode to determine if the expression is balanced:

When you see an opening character, add it to the stack.

When you see a closing character, remove a character from the stack. If the character you removed doesn't match the closing character (or the stack is empty), the expression is unbalanced.

If the stack is empty after reading through the entire expression, the expression is balanced. Otherwise, the expression is unbalanced.

**Test Cases**

To prove functionality, you must show that the following test cases work properly.  
Your grade is out of a total of 10 points.

1.  $-\{ [ b * b - (4 * a * c) ] / (2 * a) \}$  is balanced. (4 points)
2.  $-\{ [ b * b - (4 * a * c) ] / (2 * a) \}$  is **not balanced**. (2 points)
3.  $-\{ [ b * b - (4 * a * c) ] / (2 * a) \}$  is **not balanced**. (2 points)
4.  $-\{ [ b * b - (4 * a * c) ] / (2 * a) \}$  is **not balanced**. (2 points)