AP Computer Science A@Beijing National Day School

Lab 8: `APLine`

Due date: Friday, December 7, 2018
Instructor: Mr. Alwin Tareen
Total Points: 15

Task Overview

- Implement a program that defines the equation of a straight line.

Background

- An `APLine` is a line defined by the equation: $ax + by + c = 0$, where a is not equal to zero, b is not equal to zero, and a, b, and c are all integers.

- The slope of an `APLine` is defined to be the `double` value: $-a/b$.

- A point(represented by integers x and y) is on an `APLine` if the equation of the `APLine` is satisfied when those x and y values are substituted into the equation. That is, a point represented by x and y is on the line if $ax + by + c$ is equal to 0. Examples of two `APLine` equations are shown in the following table.

Equation	Slope($-a/b$)	Is point $(5, 2)$ on the line?
$5x + 4y - 17 = 0$	$-5/4 = -1.25$	Yes, because $5(5) + 4(-2) + (-17) = 0$
$-25x + 40y + 30 = 0$	$25/40 = 0.625$	No, because $-25(5) + 40(-2) + 30 \neq 0$

- Assume that the following code segment appears in the `APLineTest` class. The code segment shows an example of using the `APLine` class to represent the two equations shown in the table.

```
APLine line1 = new APLine(5, 4, -17);
double slope1 = line1.getSlope();        // slope1 is assigned -1.25
boolean onLine1 = line1.isOnLine(5, -2);  // true

APLine line2 = new APLine(-25, 40, 30);
double slope2 = line2.getSlope();        // slope2 is assigned 0.625
boolean onLine2 = line2.isOnLine(5, -2);  // false
```

- Your task is to write the entire `APLine` class. Your class must produce the indicated results when invoked by the code segment given above. You may ignore any issues related to integer overflow. Your implementation must include the following:

  - The declaration of the private instance variables `a`, `b` and `c`.

  - A constructor that has three integer parameters that represent `a`, `b`, and `c`, in that order. You may assume that the values of the parameters representing `a` and `b` are not zero.

  - A method `getSlope()` that calculates and returns the slope of the line.

  - A method `isOnLine(int x, int y)` that returns `true` if the point represented by its two parameters (`x` and `y`, in that order) is on the `APLine`, and returns `false` otherwise.

Specification

The Information Box Which Includes Your Name[5 points]

- Type your English and Pinyin name into the `Author` field, where it says: `YOUR NAME HERE`

Define the Equation of a Straight Line [10 points]

- Write a `Java` program in the file `APLine.java` that defines the equation of a straight line.

- You will write your solution in a class called: `public class APLine` right below the place where it says: `YOUR CODE HERE`.

- Make sure that you run your `Java` program, and ensure that it is free of errors.

Hints

- You will need to choose variable names for the parameters within the constructor of this class. It is tempting to use `int a, int b, int c` for these parameter names, but you should not do this. Those variable names are already being used with the instance variables. Instead, you should choose parameter names like the following: `int mya, int myb, int myc`

- Note that the `getSlope()` method of this class returns a `double`. You should be careful that the division of `-a/b` does not perform an integer division. An easy way to overcome this problem is to multiply `a` by `1.0`.

Testing

- The file `APLineJUniTest.java` contains the `JUnit` test cases which verify the correct functionality of the program.

Submission

- Submit your `Java` program by uploading it to the `Web-CAT` automated grading platform: `http://ec2-54-65-207-33.ap-northeast-1.compute.amazonaws.com:8080/Web-CAT/WebObjects/Web-CAT.woa`