Seneca College

May 24, 2019

Applied Arts & Technology
SCHOOL OF COMPUTER STUDIES

JAC444 Demo & Final Code Due date : May 31, 2019

Workshop 2

Notes:

i. Each task should be presented during the lab, demo worth 70% of the workshop marks and code uploading worth the other 30%.
ii. Make sure you have all security and check measures in place, like wrong data types etc., no need to implement Exception as we haven't covered yet. There are other ways to handle bad input data.
iii. Given output structure is just for student to have a glimpse what the output can look, student are free to make the output better in any way.
iv. The final should be submitted by the midnight to avoid late penalties which are 10% each day late.

Other inputs can be given during demo, so make sure you test your program properly.

Task 1: Design a class named ***MyPoint*** to represent a point with ***x*** and ***y*** coordinates. The class contains:

- The data fields **x** and **y** that represent the coordinates with getter methods.
- A no-arg constructor that creates a point (**0**, **0**).
- A constructor that constructs a point with specified coordinates.
- A method named **distance** that returns the distance from this point to a specified point of the **MyPoint** type.
- A method named **distance** that returns the distance from this point to another point with specified **x** and **y** coordinates.

Define another class named **Triangle2D** class that contains:

- Three points named **p1**, **p2**, and **p3** of the type **MyPoint** with getter and setter methods.
- A no-arg constructor that creates a default triangle with the points (**0**, **0**), (**1**, **1**), and (**2**, **5**).
- A constructor that creates a triangle with the specified points.
- A method **getArea()** that returns the area of the triangle.
- A method **getPerimeter()** that returns the perimeter of the triangle.
- A method **contains(MyPoint p)** that returns **true** if the specified point **p** is inside this triangle (see Figure A).

- A method **contains(Triangle2D t)** that returns **true** if the specified triangle is inside this triangle (see Figure B).
- A method **overlaps(Triangle2D t)** that returns **true** if the specified triangle overlaps with this triangle (see Figure C).

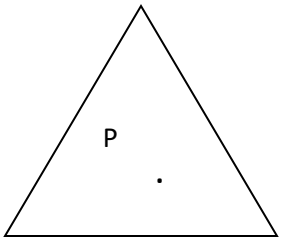


Figure (A)

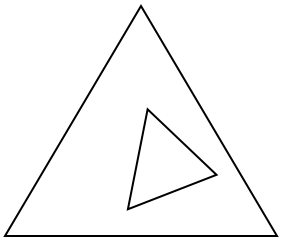


Figure (B)

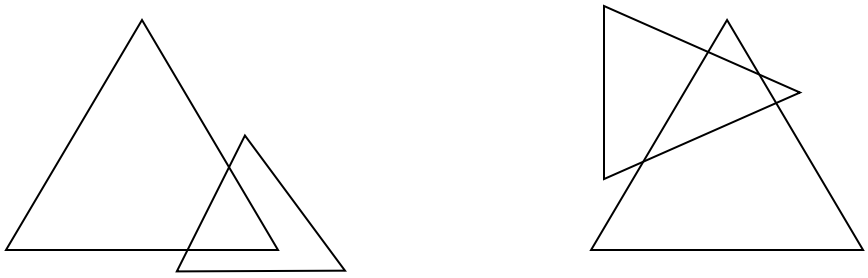


Figure (C)

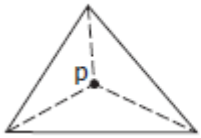
Write a test program that creates a **Triangle2D** objects **t1** using the constructor **new Triangle2D(new MyPoint(2.5, 2), new MyPoint(4.2, 3), new MyPoint(5, 3.5))**, displays its area and perimeter, and displays the result of **t1.contains(3, 3)**, **r1.contains(new Triangle2D(new MyPoint(2.9, 2), new MyPoint(4, 1), MyPoint(1, 3.4)))**, and **t1.overlaps(new Triangle2D(new MyPoint(2, 5.5), new MyPoint(4, -3), MyPoint(2, 6.5)))**.

Create another **Triangle2D** object **t2** using the constructor **new Triangle2D(new MyPoint(0, 0), new MyPoint(0, 2), new MyPoint(2, 0))**, displays its area and perimeter, and display the results of **t2.contains(1 , 1), r2.contains(new Triangle2D(new MyPoint(4, 5), new MyPoint(10.5, 3.2), new MyPoint(-0.5, -10.5)))**, and **t2.overlaps(new Triangle2D(new MyPoint(1, 1.7), new MyPoints(-1, 1.7), new MyPoints(0, -3))).**
Note: Students can also design the program to take these points as input from the user as well.

Hint: Formula to compute the area of the Triangle:

$$s = (\text{side1} + \text{side2} + \text{side3})/2;$$
$$\text{area} = \sqrt{s(s - \text{side1})(s - \text{side2})(s - \text{side3})}$$

To detect whether a point is inside a triangle, draw three dashed lines, as shown in Figure D.



Point is inside

Point is outside

If the point is inside a triangle, each dashed line should intersect a side only once. If a dashed line intersects a side twice, then the point must be outside the triangle. For the algorithm of finding the intersecting point of two lines,

The intersecting point of two lines can be found by solving the following linear equation:

$$(y_1 - y_2)x - (x_1 - x_2)y = (y_1 - y_2)x_1 - (x_1 - x_2)y_1$$
$$(y_3 - y_4)x - (x_3 - x_4)y = (y_3 - y_4)x_3 - (x_3 - x_4)y_3$$

The linear equations can be solved using the Cramar's rule:

Cramar's rule for solving 2 x 2 system of linear equation

$$\begin{aligned} ax + by &= e \\ cx + dy &= f \end{aligned} \quad x = \frac{ed - bf}{ad - bc} \quad y = \frac{af - ec}{ad - bc}$$

If ad – bc = 0, the equations has no solution. (mean they are parallel lines.

You can also explore java.awt.geom.Line2D class for the calculation.