Lab #04

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CPSC 1150 - 003

Instructor: H. Darbandi

Lab Title: Functions and Methods

Date Completed: June 7, 2020

Department: CSIS

Program: Problem Solving and Algorithms

File Name: Lab04.java

Purpose: Practice several aspects of Software Development, including Problem Solving, writing Java Programs and methods, and writing Algorithms utilizing Pseudocode

Technical Information:

(You should fill the following information based on compiler and computer you are using).

Compiler: Java SDK version 14

Computer: AMD Ryzen 5 2600 3.40 GHz, 16 GB ram, 64-bit processor, Java SDK 14

Operating System: Windows 10

Language: Java

Program Logic (Pseudocode)

Algorithm: Use Heron’s formula to calculate the perimeter and area of a triangle

**START**

Long Version

1. Accept user inputs.
2. Verify the inputs (function 1)
   1. Determine they are valid inputs within a specific range.
      1. If they are invalid, prompt the user to try again.
   2. If the inputs are valid inputs, check if it makes up a line. (function 5)
      1. To check if they make a line, use the discriminant value from being able to calculate the area using determinants.
         1. The area of a triangle using determinants can be described as 1/2 |(x2y3 - x3y2) - (x1y3 - x3y1) + (x1y2 - x2y1)| where |(x2y3 - x3y2) - (x1y3 - x3y1) + (x1y2 - x2y1)| is the discriminant
         2. Use the 3 points to create a 3x3 matrix with 1’s in the final column as the ‘z’ value.
         3. Check the discriminant against the value EPSILON (very small value set at 0.0000001) to determine if the discriminant is 0.
            1. If it is 0, it is a line
            2. Otherwise it is a triangle.
      2. If they make up a line, either Horizontal Line or Vertical Line, prompt the user to try again.
   3. If all the points are valid proceed to step three.
3. Calculate the distance between two points (function 2)
   1. Distance between two points is calculated by the formula sqrt((x2-x1)^2 + (y2-y1)^2)
4. Calculate the perimeter of the triangle (function 3)
   1. A triangle is made up of 3 lines, in this case AB, AC and BC.
   2. Add these three distances together using the distance function to determine the perimeter.
5. Calculate the area of the triangle (function 4)
   1. Using Heron’s formula where s is known as the semi perimeter and is determined by taking half of the value of the perimeter.
   2. Use the value of s and calculate the area of the function using the formula sqrt(s(s-a)(s-b)(s-c)) where a, b and c are the lengths of AB, AC and BC
6. Print the points, perimeter and area.

Short Version:

1. xA, yA, xB, yB, xC, yC 🡨 input
2. verify\_inputs(xA, yA)
3. verify\_inputs(xB, yB)
4. verify\_inputs(xC, yC)
   1. If any are invalid, prompt user if they want to restart
   2. else proceed to 5
5. isLine(xA, yA, xB, yB, xC, yC)
   1. if(xA == xB == xC)
      1. Vertical Line
   2. Else
      1. Horizontal Line
   3. Prompt user if they want to restart
   4. Else proceed to 6
6. Print Triangle A(xA, yA) B(xB, yB) C(xC, yC)
7. Print perimeter(xA, yA, xB, yB, xC, yC)
8. Print area(xA, yA, xB, yB, xC, yC)

**END**

Generate your test cases based on the specifications in your lab assignment. Follow following format for each test case: (Refer to external document of your previous lab)

*purpose*

*input*

*output*

*expected value*

*passed or failed*

**Test Cases:**

**Test Case 1:** All x values are the same (Vertical Line)

Inputs:

Point A(5, 4)

Point B(5, 18)

Point C(5, 20)

Expected output: This is a line. Try again?

Output: This is a line! Would you like to try again?

Passed

**Test Case 2:** All y values are the same (Horizontal Line)

Inputs:

Point A(12, 12)

Point B(5, 12)

Point C(9, 12)

Expected output: This is a line. Try again?

Output: This is a line! Would you like to try again?

Passed

**Test Case 3:** Points are invalid

Inputs:

Point A(85, 4)

Point B(5, 78)

Point C(32, 32)

Expected output: The point (85, 4) is not in the accepted range.

The point (5, 78) is not in the accepted range.

Would you like to try again?

Output: The point (85, 4) is not in the accepted range.

The point (5, 78) is not in the accepted range.

Would you like to try again?

Passed

**Test Case 4:** Points are valid

Inputs:

Point A(5, 20)

Point B(4, 32)

Point C(16, 2)

Expected output: Triangle: A(5, 20), B(4, 32), C(16, 2)

Perimeter = 65.45

Area = 57

Output: Triangle: A(5, 20), B(4, 32), C(16, 2)

Perimeter = 65.4476065313283

Area = 57.00000000000018

Passed