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Class and Section CSC201 M6\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Total Points (50 points) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Project: Circles and more Circles**

CSC 201 – Computer Science I

New River Community College

Problem Description:

Write a Circle class with the following specifications

1. Three double data fields centerX, centerY and radius (centerX and centerY represents the x and y coordinates of the center of the circle)
2. No-arg constructor which sets the value of zero to centerX and centerY and one to radius.
3. A constructor with three arguments and set the values for centerX, centerY and radius with the specified values.
4. The get methods for the three data fields.
5. A method calculateArea that returns the area of the circle
6. A method calculatePerimeter that returns the perimeter of the circle.
7. A method contains (double x, double y) that returns true if the specified point (x, y) is inside this circle (see Figure 1).
8. A method contains(Circle c) that returns true if the specified circle c is inside this circle (see Figure 2).
9. A method overlaps(Circle c) that returns true if the specified circle c overlaps with this circle (see Figure 3).
10. A toString method which returns a string with circle information.
11. A method distance(double x1, double y1,double x2, double y2) that returns the distance between the points (x1, y1) and (x2, y2)

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**Figure 1 Figure 2 Figure 3**

Note:

* A circle contains a point (x, y) if the distance between the point and the center of the circle is less that the radius of the circle.
* A circle with radius r1 contains another circle with radius r2 if the distance between their centers is less than r1 – r2
* If the distance between the centers of two circle is more than the sum of their radii, they do not overlap.

The distance between two points (x1, y1) and (x2, y2) is given by the formula

Write a TestCircle class that will create

1. Circle c1 with center at (0,0) and radius 1 and print out the info of circle c1.
2. Circle c2 with center at (1.5, 0) and radius 3 and print out the info of circle c2.
3. Circle c3 with center at (2, 2.5) and radius 3.5 and print out the info of circle c3.
4. Circle c4 with center (3, 3) and radius 1 and print out the info of circle c4.
5. Determine whether c2 contains the point (2,1.5)
6. Determine whether c1 contains the point (1.7, 2.3)
7. Determine whether circle c2 contains circle c1.
8. Determine whether circle c3 contains circle c2.
9. Determine whether circle c1 and circle c2 overlap.
10. Determine whether circle c1 and circle c4 overlap.

Analysis:

(Describe the purpose, processing, input and output in your own words.)

The purpose of the project is to get familiar with the implementation of Java Class, class variables, instance variables and methods.

A Circle class is implemented as a Java Class that has private instance variables – x and y coordinate of the center and the radius. Various methods including constructors are implemented to create and work with Circle Objects.

No user inputs are implemented in this particular assignment, however, a Scanner object could easily be incorporated to get X, Y coordinates and the radius before creating a Circle object.

The main output is from the “toString” method implemented within the Circle class, which displays the basic Circle object information.

Several other outputs are presented in the TestCircle Class to demonstrate use of various methods implemented within the Circle Class.

Design:

(Draw the UML diagram for circle class and describe the major steps for TestCircle class)

UML Class Diagram

|  |
| --- |
| Circle |
| - centerX: d ouble  - centerY: d ouble  - radius: double |
| + Circle()  +Circle(centerX: double, centerY: double, radius: double)  +getCenterX(): double  +getCenterY(): double  +getRadius(): double  +calculateArea(): double const  +calculatePerimeter(): double  +distance(x1: double, y1: double, x2:double, y2: double): double  +contains(x: double, y: double): boolean  +contains(c: Circle): boolean  +overlaps(c: Circle): boolean  +toString() : String |
|  |

TestCircle class was implemented to use the Circle Class. Four circle objects were first created as per project guideline. Consequently, various testing operations were performed on the circle objects to answer questions 5 to 10 in the project 10 document. TestCircle class has the main method.

Instead of printing true/false, I have implemented another method decisionPrint that prints Yes for true, and No for False.

Testing: (Describe how you test this program).

Testing of the Circle Class and the TestCircle Class were performed in various stages of program development. Seperate debug lines are added to make sure that the calculateArea, calculatePerimeter and distance methods are working right. Outputs from the methods were also checked against an excel spreadsheet formula.



During the early phase of testing, output formatting was not the primary goal. Once desired outputs are consistently found, focus was shifted to output formating.

Test1: to make sure toString method is working.

TestCircle.main();

The center of the circle is (0.0,0.0) and radius is 1.0

Test2: check for contains

TestCircle.main();

The center of the circle is (0.0,0.0) and radius is 1.0

The center of the circle is (1.5,0.0) and radius is 3.0

The center of the circle is (2.0,2.5) and radius is 3.5

The center of the circle is (3.0,3.0) and radius is 1.0

false

Test3: basic check for method outputs

TestCircle.main();

The center of the circle is (0.0,0.0) and radius is 1.0

The center of the circle is (1.5,0.0) and radius is 3.0

The center of the circle is (2.0,2.5) and radius is 3.5

The center of the circle is (3.0,3.0) and radius is 1.0

false

false

true

false

true

true

Test4:

Debugging code for calculateArea and calculatePerimeter

TestCircle.main();

For c1: The center of the circle + is (0.0,0.0) and radius is 1.0

3.141592653589793 // area

6.283185307179586 //perimeter

For c2: The center of the circle + is (1.5,0.0) and radius is 3.0

For c3: The center of the circle + is (2.0,2.5) and radius is 3.5

For c4: The center of the circle + is (3.0,3.0) and radius is 1.0

1.5811388300841898

-2.0

false

2.8600699292150185

-2.3999999999999995

false

Final outputs

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Create four circle objects as per Project 10 guideline

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For c1: The center of the circle is (0.0,0.0) and radius is 1.0

For c2: The center of the circle is (1.5,0.0) and radius is 3.0

For c3: The center of the circle is (2.0,2.5) and radius is 3.5

For c4: The center of the circle is (3.0,3.0) and radius is 1.0

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Test for various conditions as per Project 10 guideline

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c2 contains the point (2,1.5) ? Yes

c1 contains the point (1.7, 2.3) ? No

circle c3 contains circle c2 ? Yes

circle c3 contains circle c2 ? No

circle c1 and circle c2 overlap ? No

circle c1 and circle c4 overlap ? No

Debugging and testing was continued after the first submission of the jar files and a bug was discovered due to improper use of Math.abs() function in the contains(Circle c) method. The code was rectified and additional debugging code was added as below:

This portion of the code is commented out once testing was completed.

|  |
| --- |
| Circle cc1 = new Circle(0,0,1);  Circle cc11 = new Circle(0,0,1);  System.out.println("======Debug/testing for circle contains another point ========================================================");  System.out.println("T1.a "+ cc1.contains(0,0)); // true, YES  System.out.println("T1.b "+ cc1.contains(0,1)); // true, YES  System.out.println("T1.c "+ cc1.contains(0,2)); // false/ NO    System.out.println("======Debug/testing for circle contains another circle with same center and radius ========================================================");  System.out.println("T2.1 "+ cc1.contains(cc1)); // true/ YES  System.out.println("T2.b "+ cc1.contains(cc11)); // true/ YES  System.out.println("T2.c "+ cc11.contains(cc1)); // true / YES  System.out.println("T2.d "+ cc1.overlaps(cc11)); // false / NO      System.out.println("======Debug/testing for circle contains another circle with same circle but different radius ========================================================");  Circle ccc1 = new Circle(0,0,1);  Circle ccc11 = new Circle(0,0,5);  System.out.println("T3.1 "+ ccc1.contains(ccc1)); // true/ YES  System.out.println("T3.b "+ ccc1.contains(ccc11)); //false/NO  System.out.println("T3.c "+ ccc11.contains(ccc1)); // true / YES  System.out.println("T3.d "+ ccc1.overlaps(ccc11)); // false / NO    System.out.println("======Debug/testing for getArea and get Perimeter ========================================================");  System.out.println("T4.a " + cc1.calculateArea()); // NO  System.out.println("T4.b " + cc11.calculatePerimeter()); // YES  System.out.println("T4.c " + cc11.calculateArea()); // NO |

|  |
| --- |
| Result included testing and debuging |
| TestCircle.main();  ======Debug/testing for circle contains another point ========================================================  T1.a true  T1.b true  T1.c false  ======Debug/testing for circle contains another circle with same center and radius ========================================================  T2.1 true  T2.b true  T2.c true  T2.d false  ======Debug/testing for circle contains another circle with same circle but different radius ========================================================  T3.1 true  T3.b false  T3.c true  T3.d false  ======Debug/testing for getArea and get Perimeter ========================================================  T4.a 3.141592653589793  T4.b 6.283185307179586  T4.c 3.141592653589793  ==============================================================  Create four circle objects as per Project 10 guideline  ==============================================================  For c1: The center of the circle is (0.0,0.0) and radius is 1.0  For c2: The center of the circle is (1.5,0.0) and radius is 3.0  For c3: The center of the circle is (2.0,2.5) and radius is 3.5  For c4: The center of the circle is (3.0,3.0) and radius is 1.0  ==============================================================  Test for various conditions as per Project 10 guideline  ==============================================================  c2 contains the point (2,1.5) ? Yes  c1 contains the point (1.7, 2.3) ? No  circle c3 contains circle c2 ? Yes  circle c3 contains circle c2 ? No  circle c1 and circle c2 overlap ? No  circle c1 and circle c4 overlap ? No |

In the third and final version of submission, the toString method was updated. Final output example:

|  |
| --- |
| ==============================================================  Create four circle objects as per Project 10 guideline  ==============================================================  For c1:  The center of the circle is (0.0,0.0)  and the radius is 1.0  and the area is: 3.14  and the perimeter is: 6.28  For c2:  The center of the circle is (1.5,0.0)  and the radius is 3.0  and the area is: 28.27  and the perimeter is: 18.84  For c3:  The center of the circle is (2.0,2.5)  and the radius is 3.5  and the area is: 38.48  and the perimeter is: 21.99  For c4:  The center of the circle is (3.0,3.0)  and the radius is 1.0  and the area is: 3.14  and the perimeter is: 6.28  ==============================================================  Test for various conditions as per Project 10 guideline  ==============================================================  c2 contains the point (2,1.5) ? Yes  c1 contains the point (1.7, 2.3) ? No  circle c3 contains circle c2 ? Yes  circle c3 contains circle c2 ? No  circle c1 and circle c2 overlap ? No  circle c1 and circle c4 overlap ? No |

How to submit your assignment

1. Login Blackboard
2. Click on Assignments on the left
3. Click on Week 13 Work folder
4. Read the instruction there and submit the following items:

* Your jar file with source code. **The jar file without the source code will not be graded.** Please use the steps given on Project 1 Instructions to create your jar file. Rename your jar file as YourName\_Project10. Suppose your name is Susan Boyd, you should rename your jar file as SusanBoyd\_Project10. **Files with wrong name will not be graded.**
* This document with answers for analysis, design and testing. Rename this document as Project10\_Yourname. Suppose your name is Susan Boyd, you should rename this document as Project10\_SusanBoyd. **Files with wrong name will not be graded.**
* This document is worth 10 points and the comments in your program is worth 10 points. Working code is worth 30 points.