C++ Offline - 3

Full Marks: 20

Submit your offline to Moodle. Submission link and deadline will be notified through Moodle.

You are given with a partial implementation of three classes: Point2D, Circle, and Rectangle. Extend the implementation according to the following instructions. Note that the numbers inside brackets specify the marks allotted to each task.

Point2D: [4 Marks]

- Let, $P_1 = (x_1, y_1)$ and $P_2 = (x_2, y_2)$ be two points. Overload the following operators according to their definitions given:

Operator	Type	Expression	Expression output
+	Binary	$P_1 + P_2$	A new point $P = (x, y)$ where $x = x_1 + x_2$ and $y = y_1 + y_2$. This operation represents a translation of the point P_1 by the amount specified by P_2
*	Binary	$P_1 * n$ where n is a real number	A new point $P = (x, y)$ where $x = x_1 * n$ and $y = y_1 * n$. This operation represents a scaling of the point P_1 by the amount n. The scaling is done with respect to the origin $(0,0)$.
==	Binary	$P_1 == P_2$	TRUE (Boolean) if both points have same coordinates; otherwise FALSE
!=	Binary	$P_1 ! = P_2$	TRUE (Boolean) if the points are different; otherwise FALSE

Circle: [10 Marks]

-Let, C_1 and C_2 be two circles having centers $c_1$and c_2 and radiuses r_1 and r_2. Overload the following operators according to their definitions given:

Operator	Type	Expression	Expression output
+	Binary	$C_1 + P$ where P is a 2D point.	A new circle whose center is translated by the amount specified by the point P. This operation represents a translation of the circle with respect to the origin $(0,0)$.
*	Binary	$C_1 * n$ where n is a real number	A new circle whose radius and center is scaled by the amount n. This operation represents a scaling operation for the circle with respect to the origin $(0,0)$.
+	binary	$C_1 + C_2$	A new circle whose center is the

			weighted average $c_1 * \alpha + c_2 * (1 - \alpha)$ and radius is $r_1 + r_2$. where $\alpha = r_1/(r_1 + r_2)$
-	Binary	$C_1 - C_2$	A new circle whose center is the weighted average $c_1 * \alpha + c_2 * (1 - \alpha)$ and radius is $r_1 - r_2$. where $\alpha = r_1/(r_1 + r_2)$
==	Binary	$C_1 == C_2$	TRUE (Boolean) if both circles are of equal area; otherwise FALSE
>	Binary	$C_1 > C_2$	TRUE (Boolean) if the area of C_1 is larger than the area of C_2; otherwise FALSE
>=	Binary	$C_1 >= C_2$	TRUE (Boolean) if the area of C_1 is larger than or equal to the area of C_2; otherwise FALSE
<	Binary	$C_1 < C_1$	TRUE (Boolean) if the area of C_1 is smaller than the area of C_2; otherwise FALSE
<=	Binary	$C_1 <= C_1$	TRUE (Boolean) if the area of C_1 is smaller than or equal to the area of C_2; otherwise FALSE
++	Unary	$++C_1$ C_1++	Increments of radius of C_1 by 1 unit. Should support both prefix and postfix version.

Rectangle: [2 Marks]

-Let, R_1 and R_2 be rectangles. Overload the following operators according to their definitions given:

Operator	Type	Expression	Expression output
+	Binary	$R + P$ where P is a 2D point.	A new rectangle translated by point P. This operation represents a translation of the rectangle with respect to the origin $(0,0)$.
*	Binary	$R * n$ where n is a real number	A new rectangle whose points are scaled by the amount n. This operation represents a scaling operation for the rectangle with respect to the origin $(0,0)$.

Main: [4 Marks]

-Create suitable examples to demonstrate all functionalities as specified in the cpp file.