PIC 10B SPRING 2013 HOMEWORK 6

Assignment

In homework 3 we used polymorphism to store a vector of pointers to objects of type Point2D and derived classes ColorPoint2D and WeightedPoint2D. In this assignment we will assign an *ordering* on points so that we can sort them[1]. As before, we will let the user input as many points as desired, and then print them out in *sorted* order.

Note also that the color of a point can consist of multiple words, e.g., Sea Green, so it is a good idea to use getline() instead of cin; recall that getline behaves differently than cin so you may have to look up how to use cin.ignore() in order to properly implement the assigned functionality.

Ordering Defintions

Here are a list of rules to determine the lesser of two points.

1. Any Point2D object, no matter what input values, is less than a ColorPoint2D object.

2. Any ColorPoint2D object, no matter what the assigned values, is always less than a WeightedPoint2D object.

3. The lesser of two Point2D objects is defined to be the lesser of the distances from the origin (i.e., $\sqrt{x^2+y^2}$). For example, the point (1,2) is less than the point (3,4) because $\sqrt{5} < \sqrt{25}$.

4. In the event of a tie, i.e., the points (-1,2) and (1,2), the one with the smallest angle to the origin in a counterclockwise orientation is the smaller; see the picture which was taken from the Wikipedia page for Complex Numbers `http://en.wikipedia.org/wiki/Complex_number`. (hint: use the `atan2` function in the cmath library, but beware that it returns values between $-\pi$ and π.).

5. For a ColorPoint2D object, first attempt to compare the (x, y)-coordinates, and if there is a tie, the lesser point is the one whose color is smaller in lexicographic ordering, or dictionary ordering. So for example "blue" < "red" because "b" < "r". *The string library has this operation built in, so you can compare strings directly using the < operator.*
6. For a WeightedPoint2D object, first attempt to compare the (x, y)-coordinates, and if there is a tie, the lesser point is the one whose weight is smaller.

Date: May 3, 2013.

[1]Our order will not be one in the mathematical sense, which needs to preserve order under certain operations like point-wise addition to both points by a third point. No need to dwell on this, but a quick google search on ordering may leave you confused.

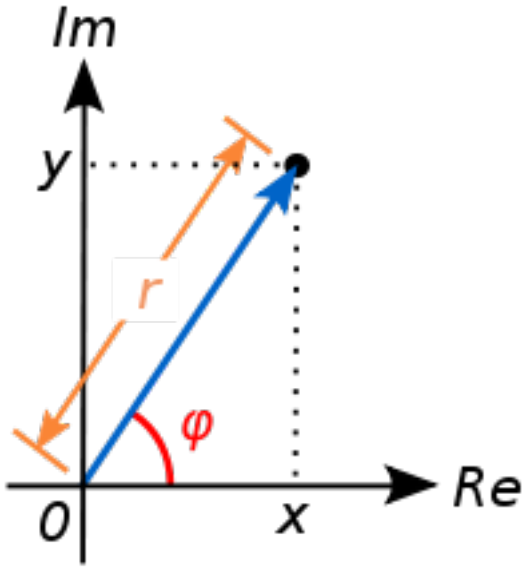

FIGURE 1. Picture of a point in polar coordinates, with radius r and angle φ. Taken from the Wikipedia page for Complex Numbers.

Place your code in a source file labeled *hw6.cpp*. ***If your file is not named this exactly, your homework will not be collected***. As with all programs in this course, your code should contain useful comments. In particular, your name, the date, and a brief description of what the program does should appear at the top of your source file.

You may assume the user will input one of the numbers 0, 1, 2, 3 for the selection (i.e., no need to worry about a 4, -24, etc. as input). You may also assume that the user will correctly input numbers when appropriate and strings when appropriate.

What to Turn in

Place in your Submit folder the source file *hw6.cpp* with exactly this name (all lowercase, no spaces). The files will be automatically collected on Friday 5/10/13 at 5:00pm.

Grading		
Correctness	No errors, input/output correct, output presented nicely	5 points
Sort	Correctly sorts points	5 points
Solution	Code is efficient but easy to follow	5 points
Style	Variable names, comments, indentation	5 points
	TOTAL	20 points

Note on grading: There is an automatic 5 point penalty for any homework that does not compile.

```
Welcome to Point Printer! You can create three different kinds of points:

1. Point2D, e.g., (2,6.5)
2. ColorPoint2D, e.g., blue(-4.5,3.5)
3. WeightedPoint2D, e.g., .12(3.6,8.7)

Enter 0 when you are finished.

Selection: 1
x = 2
y = 3
Selection: 2
x = 3.3
y = 4.7
color = sea green
Selection: 1
x = 2.4
y = -7.8
Selection: 3
x = 7.8
y = 12.9
weight = 0.0001
Selection: 2
x = 3.3
y = 4.7
color = blue
Selection: 2
x = 3.3
y = 4.7
color = blue green
Selection: 3
x = 7.8
y = 12.9
weight = 3.14
Selection: 2
x = 3.3
y = 4.7
color = bluer
Selection: 0

Your points in sorted order are

1: (2,3)
2: (2.4,-7.8)
3: blue(3.3,4.7)
4: blue green(3.3,4.7)
5: bluer(3.3,4.7)
6: sea green(3.3,4.7)
7: 0.0001(7.8,12.9)
8: 3.14(7.8,12.9)
```