Assignment 2 (100 marks)

Due date: Thursday, July 27, 8:00pm

Hard copy due at Week 13 class

(This assignment can be done in a group of two (see Note section below for more details.)

(Late submission is not accepted.)

Submission Requirements

* *For each class in Q1, you need to separate the class definition and implementation in different files. Do not include the testing file or any testing code.*
* *For Q2, include the functions in a file named Q2.cpp*
* *Zip all the files (.h files and .cpp files) in one single .zip file and upload it on Moodle.*
* *Each group submits two copies of your assignment: an electronic copy through Moodle and a hard copy (printout) of your source code. Any submission without on-time electronic copy will get zero; any submission without the printout may be subject to a penalty of 10%.For your hard copy, print directly from Visual C++ or a text editor*
* *The hard copy must have the FIC Assignment Cover Sheet filled, signed, and attached. And your hard copy must be identical to your electronic copy. Otherwise, you will lose marks.*
* *Follow good coding style: appropriate indentation, good variable names, sufficient spaces, appropriate C++ program format … Coding style will also be marked.*
* *Global stand-alone variables other than constants are not allowed in this assignment.*

Note:

* *You may choose to do this assignment individually or in a group of two. Note the requirement for choosing a partner: two persons cannot form a group if the difference of your midterm marks is > 25 (out of 100).*
* *If you choose to do it with a partner, both of you must sign up on a sign-up sheet by Week 11 lab on July 19th. Then only one submission (electronic + hard copy) is required for your group. Please include both names in your submission, on the cover page of the hard copy and at the beginning of your electronic file as comments.*
* *Once you sign up as a group, you cannot change your partner.*

Q1 {75 marks} For this question, carefully read the problem description before designing your classes. Carefully investigate the testing class: ShapeTester.cpp and its output before coding. Only define functions that are needed. Also, take full advantage of inheritance. Avoid repeating code as much as possible. For anything that is not specified, make your best choice.

For this question, you need to define a group of shapes positioned on the 2-d plane. These shapes all have a centre point and are symmetrical. We can calculate their areas and perimeters. We can also reflect and translate them.

(For your information: there are three main transformations that can be carried out in Euclidean space: rotation, reflection and translation. In this question, we only deal with simple reflection and translation. Put it simply, a reflection is a flip over a line (we only use x-axis or y-axis) and a translation means moving or sliding the shape for a distance. For this question, we use functions to deal with reflection and translation. They are not complicated functions, very simple actually.)

Follow the steps below to help you design your classes. For each class, specify appropriate instance variable(s), constructor(s) and any other functions that you think are appropriate and needed for the class.

1. Define a `Point` class for representing a point with (x, y) co-ordinate on the plane.

2. Define an abstract `Shape` class.

What is an abstract class? An *abstract class* is a class with one or more pure virtual functions. A *pure virtual function* is a member function that has no definition. It is indicated by the word `virtual` and the notation `= 0` in the member function declaration. An abstract class is a type and can be used as a base class to derive other classes. However, you cannot create an object of an abstract class type (unless it is an object of some derived class).

A shape has a centre point. A shape has "behaviors" that can calculate the area and perimeter of itself. A shape can be reflected over x-axis or y-axis. A shape can be translated either by angle-and- distance, or by x-and-y. To make it simple, for this assignment, we do translations by x-and-y only.

3. Define a `Rectangle` class that is a sub-class of the `Shape`. A rectangle is specified by its centre and its length and width. In this assignment, we assume all rectangles have all four sides parallel to x-axis or y-axis on the plane. The length of the sides parallel to the x-axis is specified by `length`; the length of the sides parallel to the y-axis is specified by `width`.

4. Define a `Square` class that is a sub-class of the `Rectangle`.

5. Define a `Circle` class that is a sub-class of the `Shape`. A circle is specified by its centre and its radius.

Q2 {15 marks} Textbook <Problem Solving with C++> Chapter 14 Programming Projects #2 on page 828.

More requirements/explanation:

1) You need to write two functions for this question. The first one is a recursive function dealing with character array. It can reverse any segment of the array. The second one is a very short (only calling the first one) function that reverses a C-string entirely (using the first recursive function).
2) Name the second function `reverse`. Name the recursive function whatever you like as long as it is a good function name.
3) You must use the recursive function in function `reverse`.
4) In this question, we deal with C-string, not string.
5) Do not submit testing code. But you need to test your functions thoroughly.