Computer Programming

Assignment #05

Deadline: 30/04/2018

Q1. Write a class `Time` which represents time. The class should have three fields for `hours`, `minutes` and `seconds`. It should have constructor to initialize the hours, minutes and seconds.
A method printTime() to print the current time.
Overload the following operators:
plus operator (+) (add two time objects based on 24 hour clock)
and < (compare two time objects), <<, >> shift operators for input and output.

Q2. Create `Circle` class and overload the + ,- operator so that you can add and subtract two `Circle` objects. Adding two `Circle` object should give another `Circle` whose `radius` the sum of the radii of the two `Circle` objects. Also overload <, > , !, ==, !=, += (e.g c1+=5 means increase c1 radius by 5 units).

Q3. A machine with 32-bit integers can represent integers in the range of approximately –2 billion to +2 billion. This fixed-size (4 bytes) restriction is rarely troublesome, but there are applications in which we would like to be able to use a much wider range of integers. This is what C++ was built to do, namely, create powerful new data types. Create a class HugeInteger (for deteial read deitel c++ how to program) and Overload the following operators:

- Overload the +,-,*,/ operators.
- Overload all the relational and equality operators.
- Overload [], new (for dynamic memory allocation), delete

Q4. Develop class Polynomial. The internal representation of a Polynomial is an array of terms. Each term contains a coefficient and an exponent, e.g., the term $2x^4$ has the coefficient 2 and the exponent 4. Develop a complete class containing proper constructor and destructor functions as well as set and get functions. The class should also provide the following overloaded operator capabilities:

a) Overload the addition operator (+) to add two Polynomials.

b) Overload the subtraction operator (-) to subtract two Polynomials.

c) Overload the assignment operator to assign one Polynomial to another.

d) Overload the multiplication operator (*) to multiply two Polynomials.

e) Overload the addition assignment operator (+=), subtraction assignment operator (-=), and multiplication assignment operator (*=).

f) overload [], new and delete operator

g) overload =,!=, == operator

Q5. Create a class RationalNumber (fractions) with the following capabilities: a) Create a constructor that prevents a 0 denominator in a fraction, reduces or simplifies fractions that are not in reduced form and avoids negative denominators.

- Overload the addition, subtraction, multiplication and division operators for this class.
- Overload the relational and equality operators for this class.
- Overload ++ and – which will increase and decrease the numerator and denominator by 1.

Q6. Write a program which can detect the sounds of Animals. Write a class Animals having the following attributes:

1. String Name
2. Sound()

Inherit the following classes from Animals having the same attributes and behavior of base class (polymorphism).

1. Cat
2. Dog
3. Tiger_Family
4. Deer

From Tiger_family class inherit the following sub classes publically:

1. Tiger
2. Lion
3. Leopard

- From main(), display sound of animals on the console using Pointer of base class to derived classes.
- From main () also find the type of error and comment the error if a Derived class pointer is assigned a Base class address or pointer.

Hint: Like sound for Cat is “Meowmeow” :P

Q7. Finding the areas of Polygon family (Square+Rectangle +Triangle) using Polymorphism and Virtual function.

Define a base class Polygon having the following attributes:

1. Float length
2. Float width

Pure Virtual Member functions:

1. Float Area() to calculate Area
2. Float Perimeter() to calculate Perimeter
3. Void Display() to calculate Display Area and Perimeter

Define the derived classes and inherit above attributes and function publically:

1. Square
2. Rectangle
3. Triangle

- Write default constructor and Overloaded constructor to overload the values of Length and Width.
- Calculate the Areas and Perimeters of Polygon family.
- Show the results on the console using Display () function.

- Write base class pointer "*Bptr" which points to the objects of derived classes and display the area and perimeter of subclass using Static and dynamic binding

Hint:

1. Square Area/Perimeter=4*L
2. Rectangle A=2*(LxW) P=2*(L+W)
3. Triangle A= (LxW)/2 P= (L+W+H) .

Q8. Using an abstract class with only pure virtual functions, you can specify similar behaviors for possibly disparate classes. Governments and companies worldwide are becoming increasingly concerned with carbon footprints (annual releases of carbon dioxide into the atmosphere) from buildings burning various types of fuels for heat, vehicles burning fuels for power, and the like. Many scientists blame these greenhouse gases for the phenomenon called global warming. Create three small classes unrelated by inheritance—classes Building, Car and Bicycle. Give each class some unique appropriate attributes and behaviors that it does not have in common with other classes. Write an abstract class CarbonFootprint with only a pure virtual getCarbonFootprint method. Have each of your classes inherit from that abstract class and implement the getCarbonFootprint method to calculate an appropriate carbon footprint for that class (check out a few websites that explain how to calculate carbon footprints). Write an application that creates objects of each of the three classes, places pointers to those objects in an array of CarbonFootprint pointers, then iterates through an array, polymorphically invoking each object's getCarbonFootprint method. For each object, print some identifying information and the object's carbon footprint.