

### Lab Assignment: Inheritance of the Class

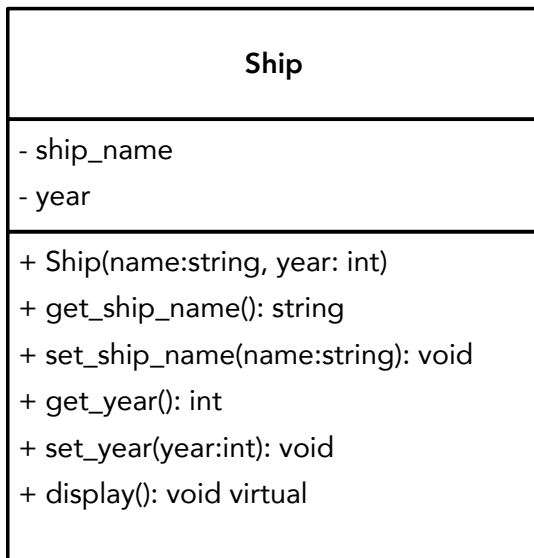
In this assignment, we are going to solve two programs from the chapter 15. Please study the following questions and prepare your solution for each question. Please submit the two solutions on the Blackboard website by Tuesday, 23 March 2021. Thank you.

#### Question 1: Abstract Member Function Project

Design a Ship class that has the following members:

- A member variable for the name of the ship (a string)
- A member variable for the year that the ship was built (a string)
- A constructor that accepts two parameter
- Accessors and mutators for each instance variables of the class
- A virtual display function that displays the ship's name and the year it was built.

The UML diagram for the class is given in the following:



Design a CruiseShip class that is derived from the Ship class. The CruiseShip class should have the following members:

- A member variable for the maximum number of passengers (an int)
- A constructor and appropriate accessors and mutators
- A display function that overrides the display function in the base class. The CruiseShip class's display function should output the ship's name and the maximum number of passengers.

Next, design a CargoShip class that is derived from the Ship class. The CargoShip class should have the following members:

- A member variable for the cargo capacity in tonnage (an int)
- A constructor and appropriate accessors and mutators
- A display function that overrides the display function in the base class. The CargoShip class's display function should output the ship's name and the ship's cargo capacity.

Demonstrate the classes in a program that has an array of Ship pointers (10 elements). The array elements should be initialized with the addresses of dynamically allocated Ship, CruiseShip, and CargoShip objects. (See Program 15-14, lines 17 through 22, for an example of how to do this.) The program should then step through the array, calling each object's display function.

Take screenshots of the sample runs of the program that clearly show the output. Attach the screenshots with your submission.

## **Question 2: Pure Abstract Base Class Project**

Define a pure abstract base class called BasicShape. The BasicShape class should have the following members:

*Private Member Variable:*

area: A double used to hold the shape's area.

*Public Member Functions:*

getArea: This function should return the value of the instance variable area.

setArea(double): This function updates the area variable by using the provided parameter.

calcArea: Define this function to be a pure virtual function.

Next, define a class named Circle. It should be derived from the BasicShape class. It should have the following members:

*Private Member Variables:*

centerX: a long integer used to hold the x coordinate of the circle's center

centerY: a long integer used to hold the y coordinate of the circle's center

radius: a double used to hold the circle's radius

*Public Member Functions:*

constructor: accepts values for centerX, centerY, and radius. Should call the overridden calcArea function described below.

getCenterX: returns the value in centerX

getCenterY: returns the value in centerY

calcArea: calculates the area of the circle ( $\text{area} = 3.14159 * \text{radius} * \text{radius}$ ) and stores the result in the inherited member variable, area.

Next, define a class named Rectangle. It should be derived from the BasicShape class. It should have the following members:

*Private Member Variables:*

width: a long integer used to hold the width of the rectangle

length: a long integer used to hold the length of the rectangle

*Public Member Functions:*

constructor: accepts values for width and length. Should call the overridden calcArea function described below.

getWidth: returns the value in width.

getLength: returns the value in length.

calcArea: calculates the area of the rectangle ( $\text{area} = \text{length} * \text{width}$ ) and stores the result in the inherited member area.

After you have created these classes, create a driver program that defines a Circle object and a Rectangle object. Demonstrate that each object properly calculates and reports its area.

Take screenshots of the sample runs of the program that clearly show the output. Attach the screenshots with your submission.