Object Oriented Programming Lab#9

Topics covered in this lab:

1. Abstract Base Classes
2. Pure Virtual Functions
3. Multiple Inheritance

Section A

1. Can we instantiate objects from base classes?

2. Abstract base class should contain at least 1 _____?
   a) Virtual function
   b) Static function
   c) Pure virtual function

3. What is meant by multiple inheritance?
   a) Deriving a base class from derived class
   b) Deriving a derived class from base class
   c) Deriving a derived class from more than one base class

4. Which symbol is used to create multiple inheritance?
   a) Dot
   b) Comma
   c) Dollar
   d) Star

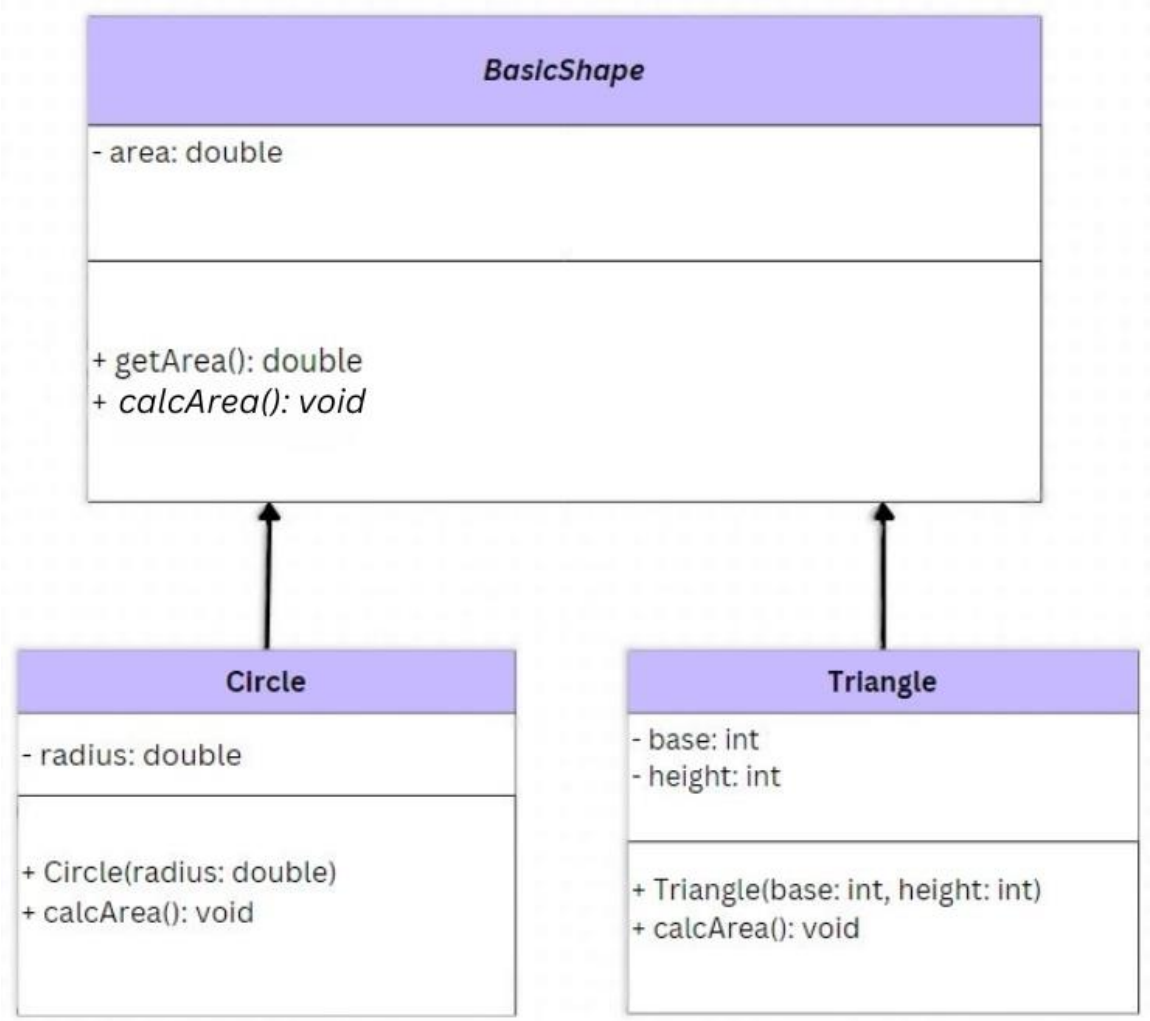
5. What is a pure virtual function?
   a) A virtual function defined in a base class
   b) A virtual function declared in a base class
   c) Any function in the class
   d) A function without definition

6. Which is the correct syntax of defining a pure virtual function?
   a) pure virtual return_type func();
   b) virtual return_type func() pure;
   c) virtual return_type func() = 0;
   d) virtual return_type func();

7. Choose the correct statement.
   a) Pure virtual functions and virtual functions are the same
   b) Both Pure virtual function and virtual function have an implementation in the base class
   c) Pure virtual function has no implementation in the base class whereas virtual function may have an implementation in the base class d) The base class has no pure virtual function

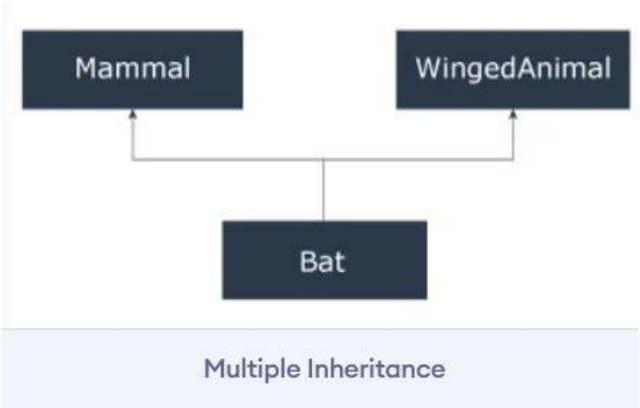
Section B

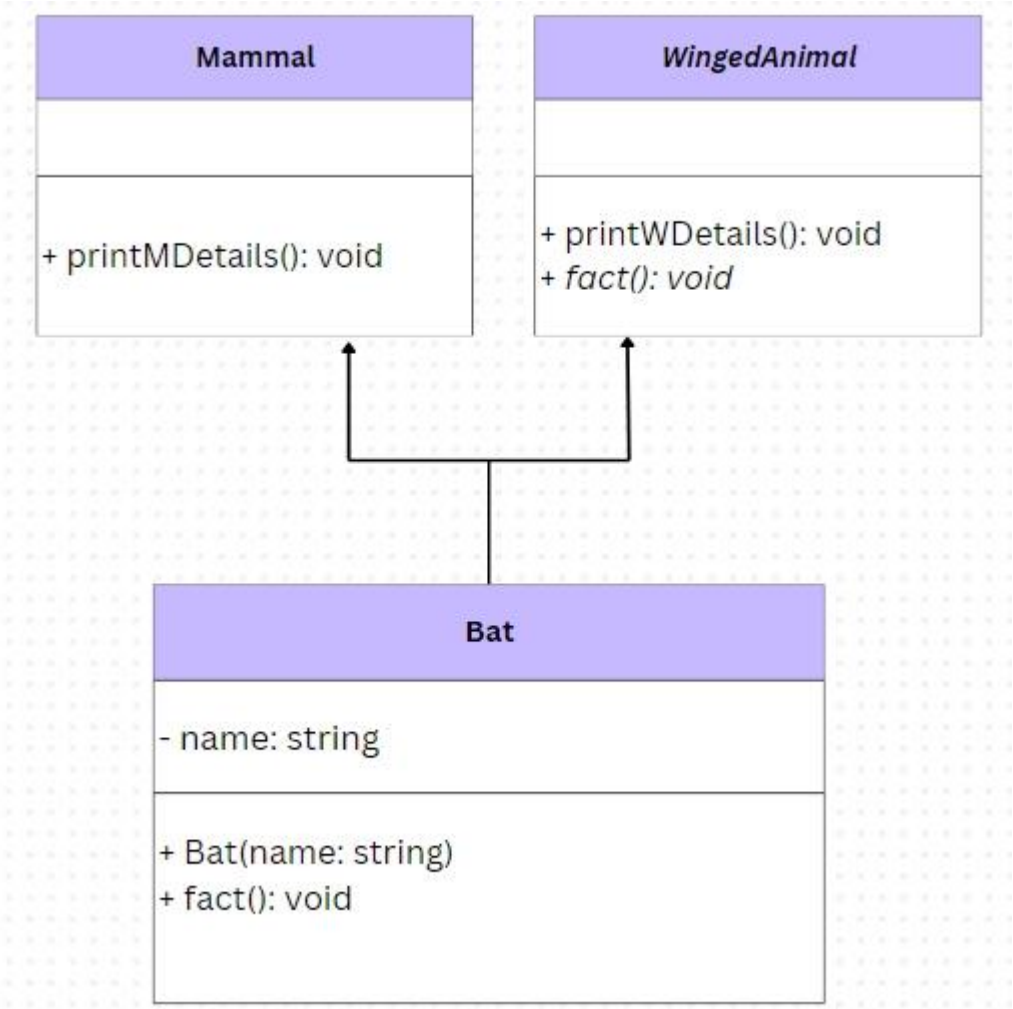
Problem 1:



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

Problem 2:


Mammal
WingedAnimal
Bat
Multiple Inheritance


Mammal
+ printMDetails(): void
WingedAnimal
+ printWDetails(): void
+ fact(): void
Bat
- name: string
+ Bat(name: string)
+ fact(): void

Design a class named Mammal that has only one public function called printMDetails() that has a cout statement "Mammals can give birth".

Design a class named WingedMammal that has two functions.

- printWDetails() that has a cout statement "Winged animals can flap".
- fact() that has no implementation. It will be re-defined in the class named Bat.

Design a class named Bat that inherits both Mammal and WingedMammal classes and has the following:

- private member (name)
- parameterized constructor
- Override the function named fact() so that it couts the message "Bat name: " (name of the bat) and "Bats are the only mammals that have wings and can fly".

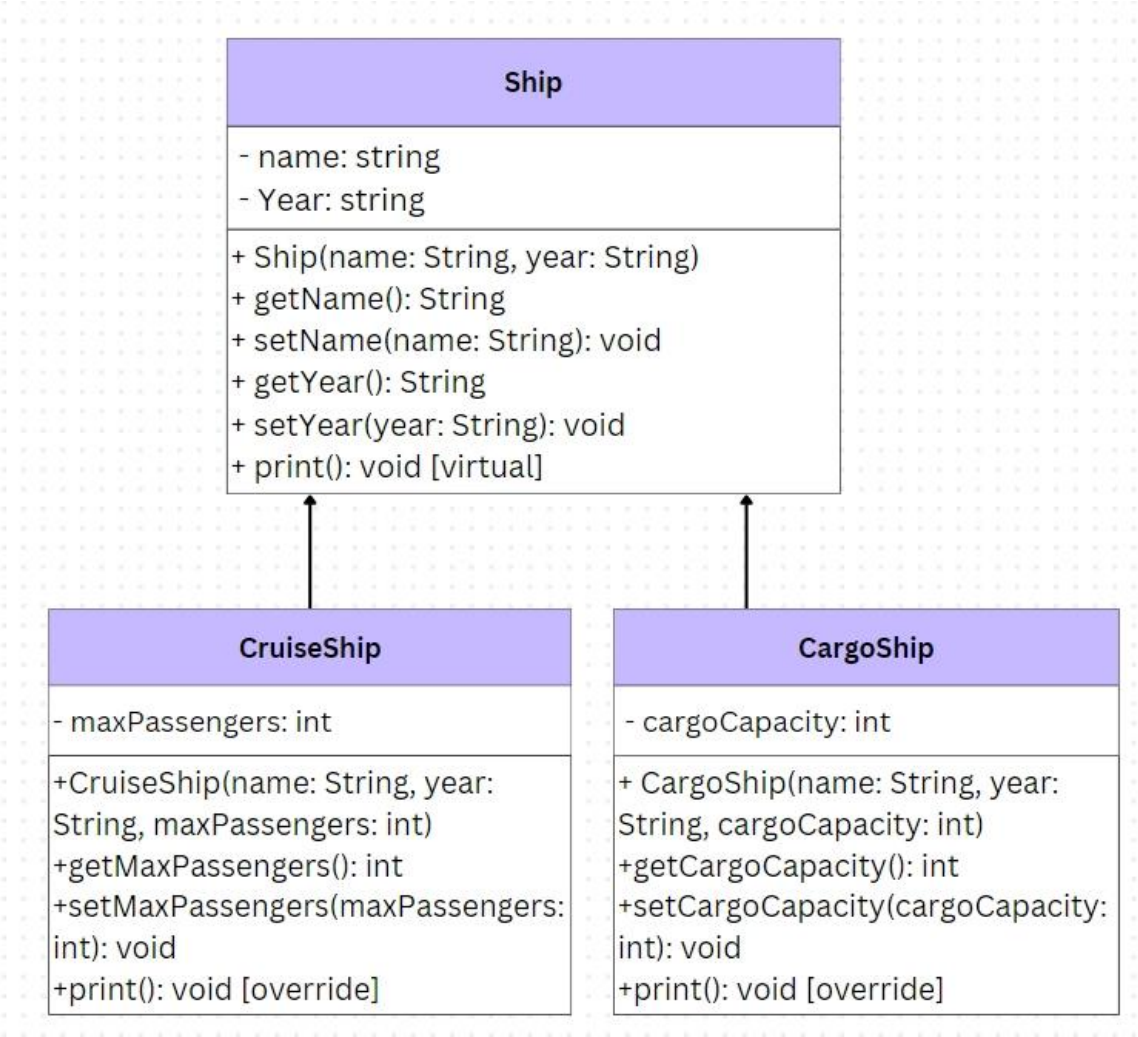
Demonstrate the classes in a program that has the following:

- An object of type Mammal named m.
- Call the printMDetails() using the object named m.
- Create an object of type Bat using the parameterized constructor. (name = "Little Brown Bat")
- Call the printMDetails() using the object named b1.
- Call the printWDetails() using the object named b1.
- Call the fact() using the object named b1.

```
Mammals can give direct birth.
Mammals can give direct birth.
Winged animal can flap.
Bat name: Little brown bat
Bats are the only mammals that have wings and can fly
```

Sample Output

Problem 3:



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 and appropriate accessors and mutators
- A virtual print function that displays the ship's name and the year it was built.

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 print function that overrides the print function in the base class. The CruiseShip class's print function should display only the ship's name and the maximum number of passengers.

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 print function that overrides the print function in the base class. The CargoShip class's print function should display only the ship's name and the ship's cargo capacity.

Demonstrate the classes in a program that has an array of Ship pointers, the size of the array is 4. The array elements should be initialized with the addresses of dynamically allocated Ship, CruiseShip, and CargoShip objects. The program should then step through the array, calling each object's print function.