19CSE201 :Advanced Programming

Lecture 11
More on Inheritance in C++

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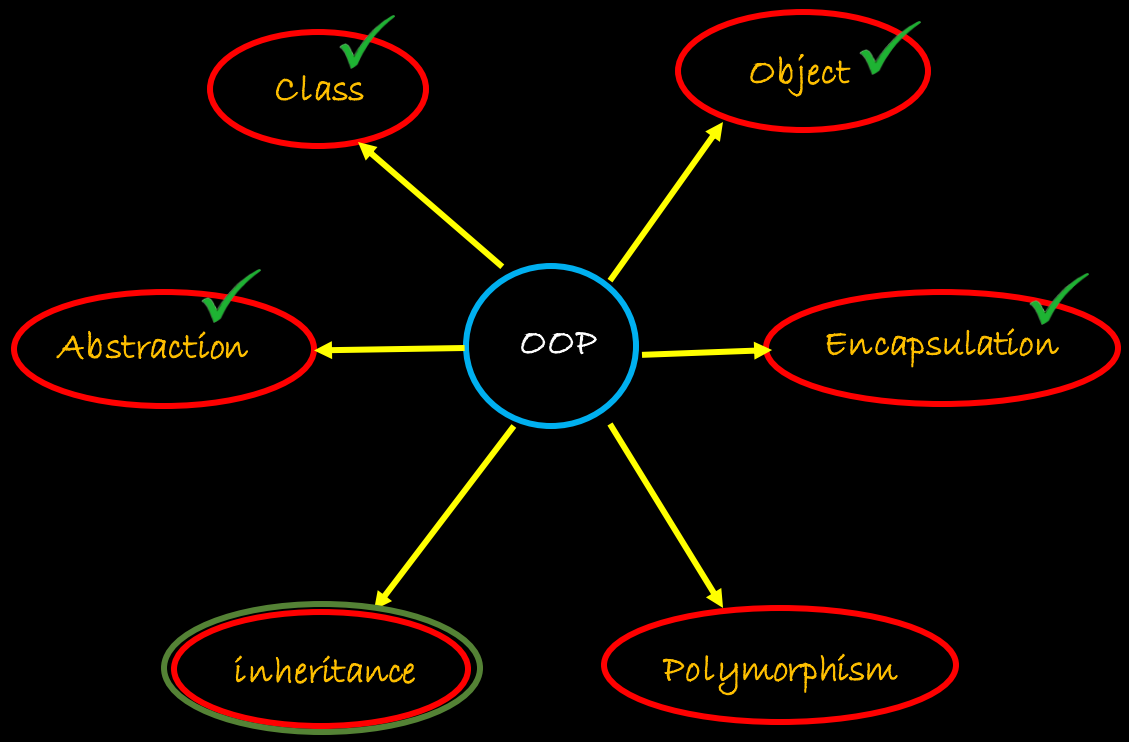
Based on material from Stroustrup B. Programming: principles and practice using C++. Second edition,Addison Wesley; 2014 and multiple sources on the internet

A Quick Recap

- Inheritance
- Why Inheritance
- Single inheritance
- Access specifiers and inheritance
- Examples and Exercises

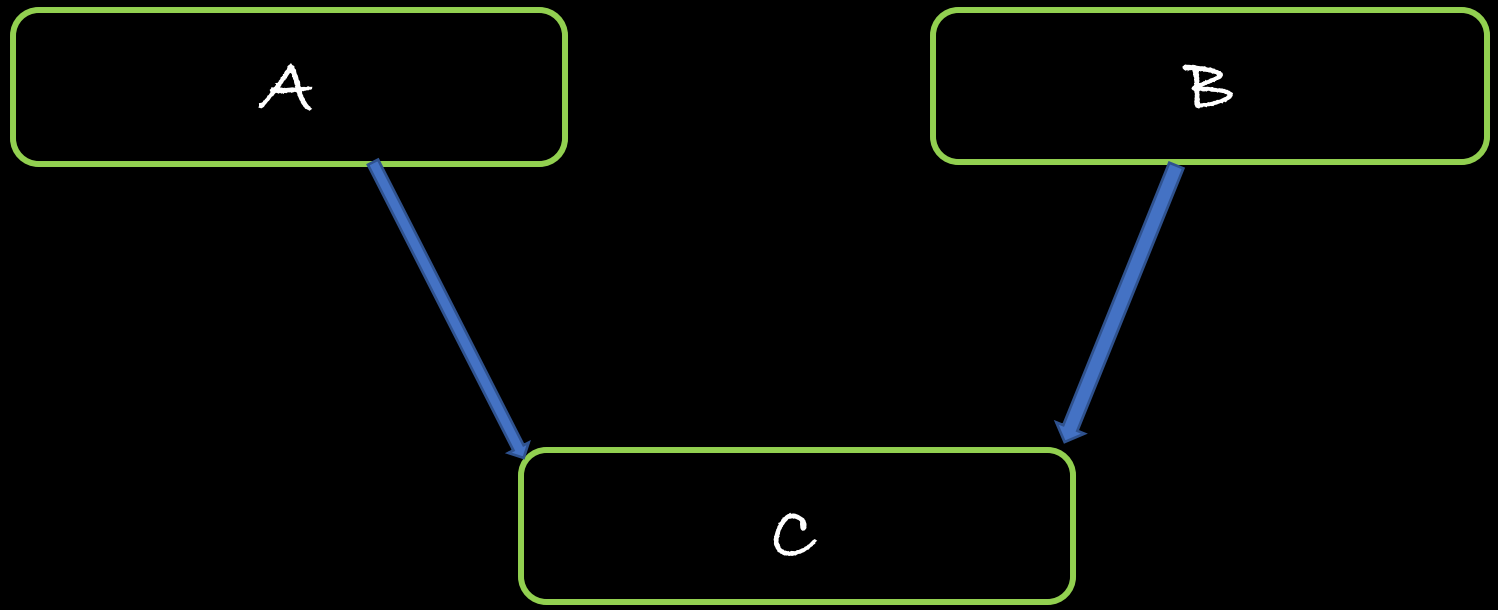


Types of Inheritance

- Single Inheritance ✓
- Multilevel Inheritance ✓
- Multiple Inheritance
- Hierarchical Inheritance
- Hybrid Inheritance

Multiple Inheritance

- The process where a single class acquires the behaviors and capabilities from 2 or more base classes called multiple inheritance



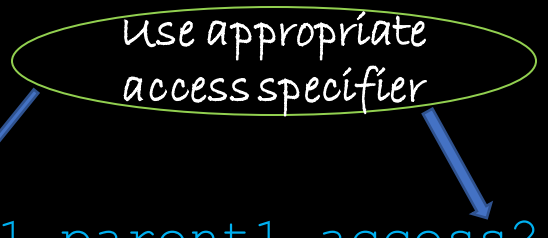
Multiple Inheritance Cont.

- Syntax

```
class parent1
   {
     ......;
   };

   class parent2
   {
     ......;
   };

   class child:accces1 parent1,access2 parent2//multiple parents
   {
      -----;//data of both parent1 +parent2+child
   };
```



Multiple Inheritance - Example

```
//Base class1
class P1
{
  public:
  void m1()
  {
    cout<<"Base class1"<<endl;
  }
};
```

```
//Base class2
class P2
{
  public:
  void m2()
  {
    cout<<"Base class2"<<endl;
  }
};
```

```
//Derived class2
class child : public p1, public p2
{
   public:
   void m3()
   {
      cout<<"Child class"<<endl;
   }
};
```

```
//Main function
int main()
{
  child c;
  c.m1();//derived from parent p1
  c.m2();//derived from parent p2
  c.m3();//Its own Method
}
```

What about the effect of the Access Specifiers?

- Try it!!
- Have 3 classes A,B,C where A and B are the base classes and C is the sub class
- Try out the different combinations
  - Public, Protected, Private

Multiple Inheritance – Exercise 1

- Create two classes named Mammals and MarineAnimals. Create another class named BlueWhale which inherits both the above classes.
- Now, create a function in each of these classes which prints "I am mammal", "I am a marine animal" and "I belong to both the categories: Mammals as well as Marine Animals" respectively.
- Now, create an object for each of the above class and try calling
  - 1 - function of Mammals by the object of Mammal
  - 2 - function of MarineAnimal by the object of MarineAnimal
  - 3 - function of BlueWhale by the object of BlueWhale
  - 4 - function of each of its parent by the object of BlueWhale

Multiple Inheritance – Exercise 2

- Make a class named Fruit with a data member to calculate the number of fruits in a basket.
- Create two other class named Apples and Mangoes to calculate the number of apples and mangoes in the basket.
- Print the number of fruits of each type and the total number of fruits in the basket.

Multiple Inheritance – Exercise 3

- We want to calculate the total marks of each student of a class in Physics, Chemistry and Mathematics and the average marks of the class.
- The number of students in the class are entered by the user. Create a class named Marks with data members for roll number, name and marks.
- Create three other classes inheriting the Marks class, namely Physics, Chemistry and Mathematics, which are used to define marks in individual subject of each student.
- Roll number of each student must be generated automatically.

Multiple Inheritance – Exercise 4

- We want to store the information of different vehicles. Create a class named Vehicle with two data member named mileage and price. Create its two subclasses
  - Car with data members to store ownership cost, warranty (by years), seating capacity and fuel type (diesel or petrol).
  - Bike with data members to store the number of cylinders, number of gears, cooling type (air, liquid or oil), wheel type (alloys or spokes) and fuel tank size (in inches)
- Make another two subclasses Audi and Ford of Car, each having a data member to store the model type.
- Next, make two subclasses Bajaj and TVS, each having a data member to store the make-type.
- Now, store and print the information of an Audi and a Ford car (i.e. model type, ownership cost, warranty, seating capacity, fuel type, mileage and price.)
- Do the same for a Bajaj and a TVS bike.

Multiple Inheritance – Exercise 5

- Create a class named Shape with a function that prints "This is a shape".
- Create another class named Polygon inheriting the Shape class with the same function that prints "Polygon is a shape".
- Create two other classes named Rectangle and Triangle having the same function which prints "Rectangle is a polygon" and "Triangle is a polygon" respectively.
- Again, make another class named Square having the same function which prints "Square is a rectangle".
- Now, try calling the function by the object of each of these classes.

Multiple Inheritance – Exercise 6

- All the banks operating in India are controlled by RBI. RBI has set a well defined guideline (e.g. minimum interest rate, minimum balance allowed, maximum withdrawal limit etc) which all banks must follow.
  - For example, suppose RBI has set minimum interest rate applicable to a saving bank account to be 4% annually; however, banks are free to use 4% interest rate or to set any rates above it.
- Write a program to implement bank functionality in the above scenario.
  - Note: Create few classes namely Customer, Account, RBI (Base Class) and few derived classes (SBI, ICICI, PNB etc).
  - Assume and implement required member variables and functions in each class. -

Multiple Inheritance – Exercise 6 - Prototype

```
Class Customer
{
//Personal Details ...
// Few functions ...
}
Class Account
{
// Account Detail ...
// Few functions ...
}
Class RBI
{
Customer c; //hasA relationship
Account a;  //hasA relationship
..
Public double GetInterestRate() {    }
Public double GetWithdrawalLimit() {
      }
}
```

```
Class SBI: public RBI
{
//Use RBI functionality or
  define own functionality.
}
Class ICICI: public RBI
{
//Use RBI functionality or
  define own functionality.
}
```

Quick Summary

- Multiple Inheritance
- Examples
- Exercises

Up Next

More on inheritance in C++