ISSN: 2321-7782
Volume 1, Issue 2, July 2013
International Journal of Advance Research in Computer Science and Management Studies
Research Paper
Available online at: www.ijarcsms.com

A Study on Inheritance Using Object Oriented Programming with C++

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Abstract: C++ strongly supports the concept of Reusability. The C++ classes can be reused in several ways. Once a class has been written and tested, it can be adapted by another programmer to suit their requirements. This is basically done by creating new classes, reusing the properties of the existing ones. The mechanism of deriving a new class from an old one is called inheritance.

The old class is referred to as the base class and the new one is called the derived class or subclass. A derived class includes all features of the generic base class and then adds qualities specific to the derived class.

In this paper we have studied the Inheritance concept and its types using C++ (oop).

Keywords: Reusability, Base class – Subclass, Private data member, Public data member and Types of Inheritance.

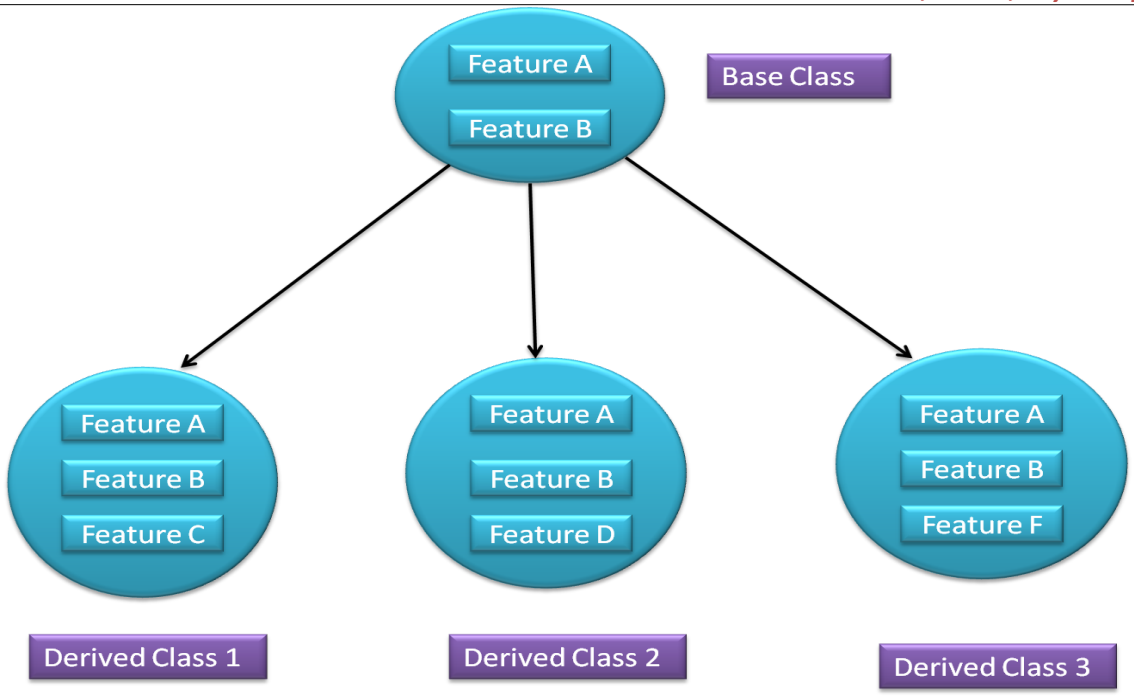
I. Introduction

Inheritance is the process by which objects of one class acquire the properties of objects of another class in the hierarchy.

Subclasses provide specialized behavior from the basis of common elements provided by the super class. Through the use of inheritance, programmers can reuse the code in the super class many times.

Once a super class is written and debugged, it need not be touched again but at the same time can be adapted to work in different situations. Reusing existing code saves time and money and increases a program's reliability.

For example, the scooter is a type of the class two-wheelers, which is again a type of (or kind of) the class motor vehicles. As shown in the below diagram the principle behind it is that the derived class shares common characteristics with the class from which it is derived.



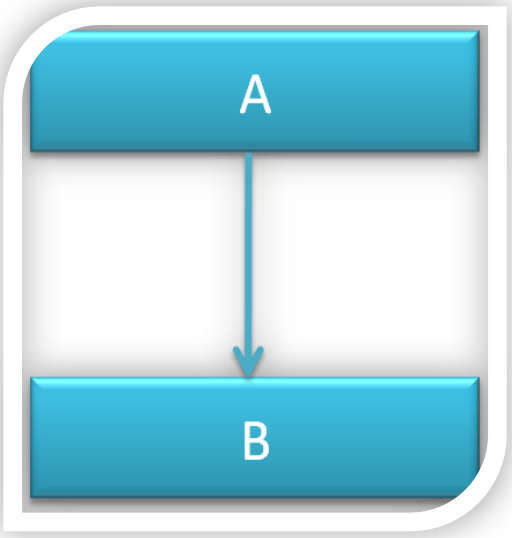
New classes can be built from the existing classes. It means that we can add additional features to an existing class without modifying it. The new class is referred as derived class or subclass and the original class is known as base classes or super class.

In this paper we have considered the following types of Inheritance:

I. **Single Level Inheritance**
II. **Multiple Inheritance**
III. **Hierarchical inheritance**
IV. **Multilevel Inheritance**
V. **Hybrid Inheritance.**

II. Single Level Inheritance

A derived class with only one base class is called single inheritance. Consider a simple example of single inheritance. In this program show a base class B and derived class D. The class B contains one private data member, one public data member, and three public member functions. The class D contains one private data members and two public member functions.



Example of single level inheritance

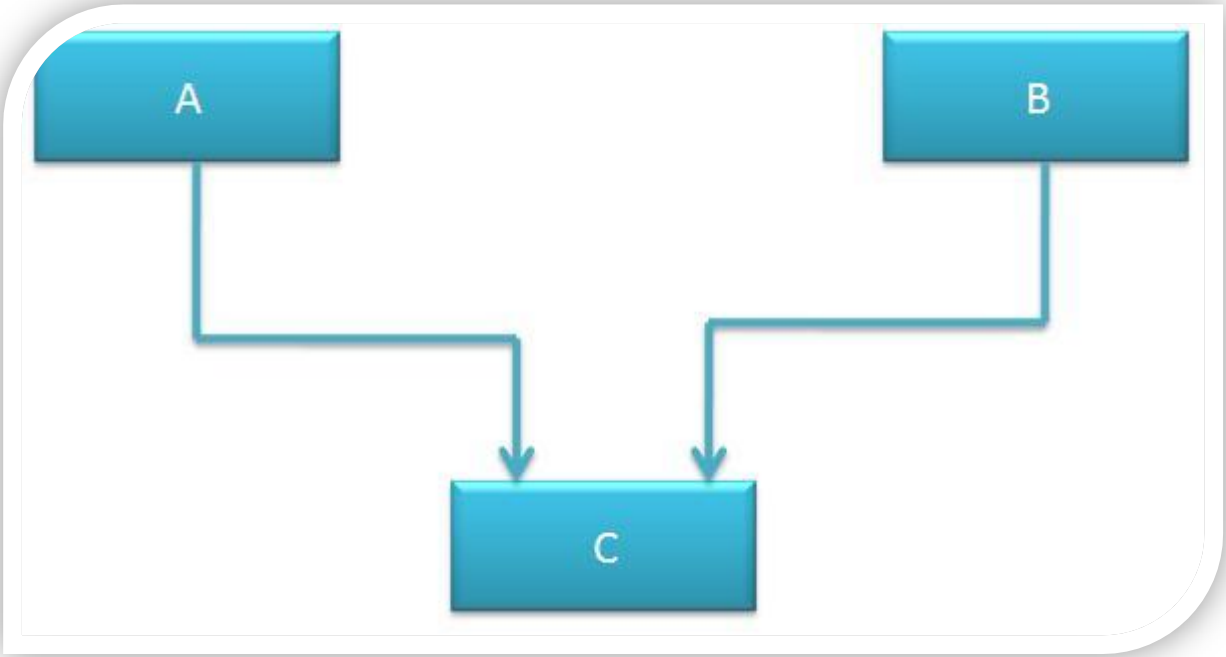
```
#include <iostream.h>
Class B
{
                int a;
        public:
                int b;
                   void get_ab();
                   int get_a();
                   void show_a();
};
Class D: public B
{
          int c;
public:
          void mul();
          void display();

};
Void B :: get_ab()
{ a=5;b=10; }

Int B :: get_a()
{ return a;}

Void B :: show_a()
{ count<< “a=”<<a<< “\n” ;}

Void D :: mul()
{ c=b*get_a();}

Void D :: display()
{
          Count<< “a=”<<get_a()
          Count<< “b=”<<b
          Count<< “c=”<<c
}
int main()
{
          D   d;
d.get_ab();
d.mul();
d.show_a();
d.display();

d.b=20;
d.mul();
d.display();

return 0:
```


III. Multiple Inheritance

A class can inherit properties from more than one class which is known as multiple inheritances.

This form of inheritance can have several super classes. A class can inherit the attributes of two or more classes as shown below diagram.

Multiple inheritances allow us to combine the features of several existing classes as a starting point for defining new classes. It is like a child inheriting the physical features of one parent and the intelligent if another.



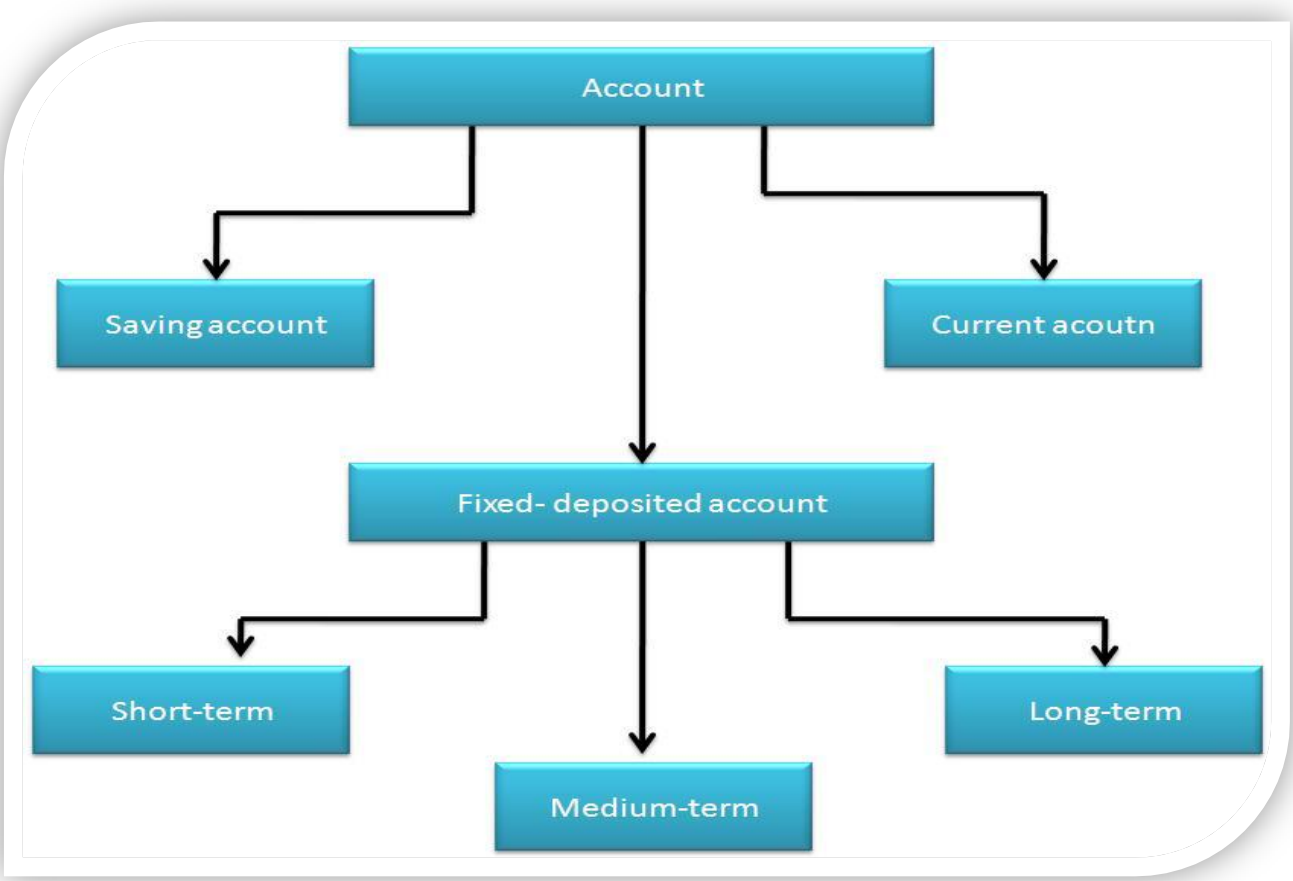
Example of Multiple Inheritances

```
#include <iostream.h>
Class M
{
        Protected:
                Int m;
        Public :
                Void get_m(int);
};
Class N
{
        Protected:
                Int n;
        Public :
                Void get_n(int);
};
Class P :public M,public N
{
        Public :
                Void display();
};
Void M :: get_m(int x)
{
             M=x;
}

Void N::get_n(int y)
{
                    N=y;
}
Void P:: dis play()
{
         Count<<"m="<<m<<"\n";
        Count<<"n="<<n<<"\n";
        Count<<"m*n="<<m*n<<"\n";

}
int  main()
{
        P p1;
        P1.get_m(10);
        P1.get_n(20);
        P1.display();
        Return 0;

}
```


IV. Hierarchical Inheritance

When the properties of one class are inherited by more than one class, it is called hierarchical inheritance.

This form has one super class and many Subclasses. More than one class inherits the traits of one class. For example: bank accounts.



Example of Hierarchical inheritance

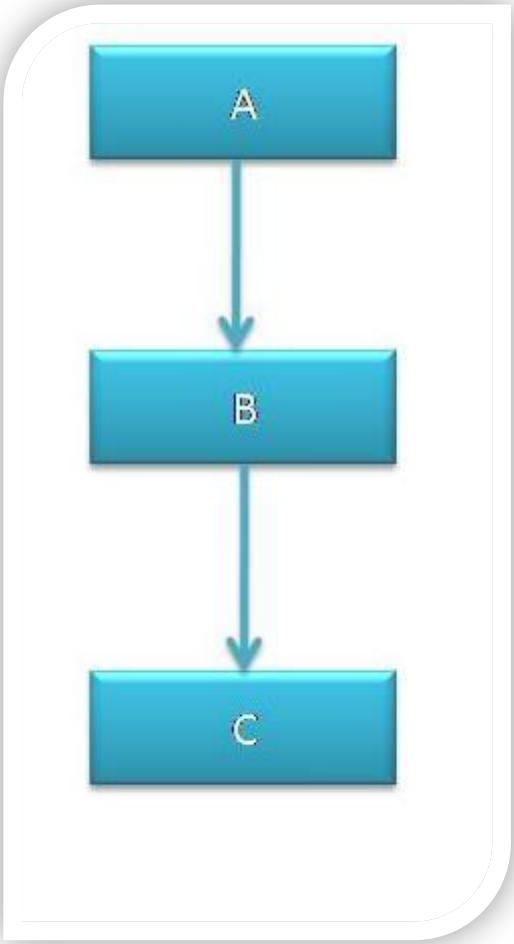
```
class first
{
        int x=10,y=20;
        void display()
        {
                System.out.println("This is the method in class one");
                System.out.println("Value of X= "+x);
                System.out.println("Value of Y= "+y);
        }
}

class two extends first
{
        void add()
        {
                System.out.println("This is the method in class two");
                System.out.println("X+Y= "+(x+y));
        }
}

class three extends first
{
        void mul()
        {
                System.out.println("This is the method in class three");
                System.out.println("X*Y= "+(x*y));
        }
}

class Hier
{
        public static void main(String args[])
        {
                two t1=new two();
                three t2=new three();
                t1.display();
                t1.add();
                t2.mul();
        }
}
```


V. Multi Level Inheritance

A class can be derived from another derived class which is known as multilevel inheritance.

Order of Constructor Calling in Multilevel Inheritance, when the object of a subclass is created the constructor of the subclass is called which in turn calls constructor of its immediate super class.

For example, if we take a case of multilevel inheritance, where class B inherits from class A, and class C inherits from class B, which show the order of constructor calling.



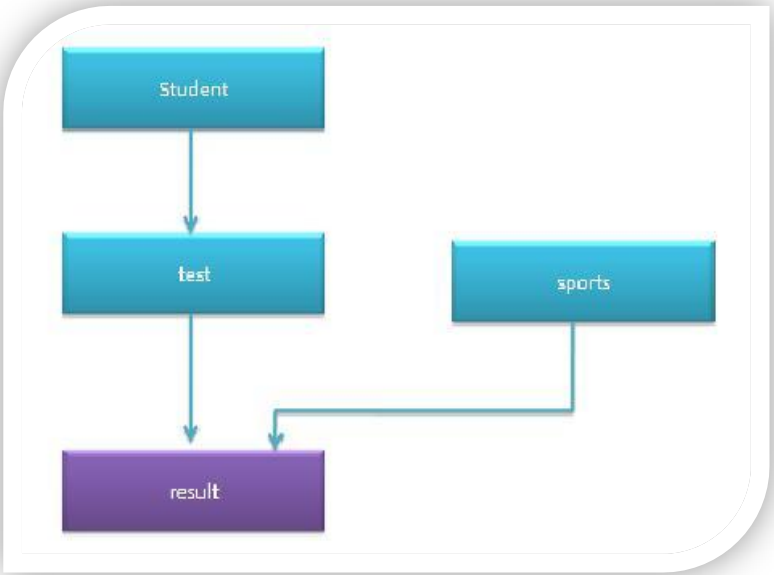
Example of Multilevel Inheritance

```
class A
{
A()
{
        System.out.println("Constructor of Class A has been called");
}
}
class B extends A
{
B()
{
        super();
        System.out.println("Constructor of Class B has been called");
}
}
class C extends B
{
C()
{
        super();
        System.out.println("Constructor of Class C has been called");
}
}
class Constructor_Call
{
        public static void main(String[] args)
        {
                System.out.println("------Welcome to Constructor call Demo------");
                C objc = new C();
            }
}
```


VI. Hybrid Inheritance

There could be situations where we need to apply two or more types of inheritance to design one inheritance called hybrid inheritance.

For instance, consider the case of processing the student results, the weight age for sport is stored in separate classes.



Example of Hybrid Inheritance


```
class stud
{
        Protected:
          int rno;
      Public:
          Void getno(int n)
          {  Rno=n;  }
          Void display_rno()
          {  Cout<<“Roll_no=”<<rno<<”\n”; }
};
Class test: Public stud
{
      Protected:
          Int sub1,sub2;
     Public:
          Void get_mark(int m1,int m2)
          {
                    Sub1=m1;
                    Sub2=m2;
          }
          Void display_mark()
          { Cout<<”sub1”<<sub1<<”\n”; Cout<<”sub2”<<sub2<<”\n”; }
};
Class sports
{
          Protected:
                    Float score;
          Public :
          Void get_score(float s)
          {  Score=s; }
          Void put_score()
          { Cout<<”Sort :”<<score<<”\n”; }
};
Class result: public test ,public sports
{
                    Float total;
          Public:
                    Void display();
};
Void result::display()
{
          Total=sub1+sub2+score;
          display_rno();
          display_mark();
          put_score();
          cout<<” total score:”<<total<<”\n”;
}
int main()
{       Result s r1;
         r1. getno(123);
         r1. get_mark(60,80)
         r1.get_score(6);
         r1.display();
```


VII. Conclusion

The mechanism of deriving a new class from an old class is called inheritance, it provides the concept of Reusability that is the most important concept in C++. All types of inheritance with its own features and its use to provide users to reusability concepts strongly, to give save time and reduce the complexity.

Here, in this paper we have to study the above five types of inheritance. We have to find that inheritance is central concepts in C++ that allows deriving a class from multiple classes at a time.

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