

Don Bosco Institute of Technology, Kurla(W)
Department of Electronics and Tele-Communication Engineering
ECL304 - Skill Lab: C++ and Java Programming
Sem III
2021-22

Lab Number:	6
Student Name:	Shreyas Sanjay Nanaware
Roll No :	39

Title:

1. To perform Multiple Inheritance in C++. Create a student class representing student roll number, name and branch and an exam class (derived class of student) representing the scores of the student in various subjects (maths, physics and chemistry) and sports class representing the score in sports. The sports and exam class is inherited by a result class which adds the exam marks and sports score to generate the final result.
2. To perform Hierarchical Inheritance in C++. Create an Employee class with attributes EmpID and EmpSalary. Also create necessary methods/constructors to accept these values from the user. Create classes permanentEmployee and TemporaryEmployee which will be derived classes of Employee. Mention hike attribute in these derived classes and calculate the total salary using generate_salary() method for respective types of employees. Objects of the derived classes should be created and salaries for the permanent and temporary employees should be calculated and displayed on the screen.

Learning Objective:

- Students will be able to perform multiple inheritance using C++.

Learning Outcome:

- Understanding the inheritance concept and reusability of the code.

Course Outcome:

ECL304.2	Comprehend building blocks of OOPs language, inheritance, package and interfaces
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Theory:

- Explain in details about inheritance, its types, syntaxes and block diagrams.

Ans: Inheritance can be defined as the process where one class acquires the properties (methods and fields) of another. With the use of inheritance the information is made manageable in a hierarchical order.

The class which inherits the properties of other is known as subclass (derived class, child class) and the class whose properties are inherited is known as superclass (base class, parent class).

Using inheritance, we have to write the functions only one time instead of three times as we have inherited rest of the three classes from base class(Vehicle).

Implementing inheritance in C++: For creating a sub-class which is inherited from the base class we have to follow the below syntax.

A derived class doesn't inherit access to private data members. However, it does inherit a full parent object, which contains any private members which that class declares.

Syntax:

```
class subclass_name : access specifier base_class_name
{
    //body of subclass
};
```

There are many uses and advantages of using the concept of inheritance in C++.

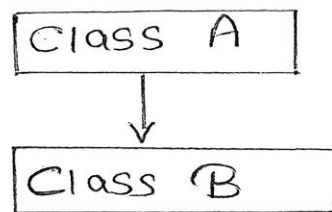
Inheritance allows us to define a class in terms of another class, which makes it easier to create and maintain an application. This also provides an opportunity to reuse the code functionality and fast implementation time.

When child class inherits the properties and functionality of parent class, we need not to write the same code again in child class.

Types of Inheritance in C++

1. **Single Inheritance:** In single inheritance, a class is allowed to inherit from only one class. i.e. one sub class is inherited by one base class only.

• Block diagram :-

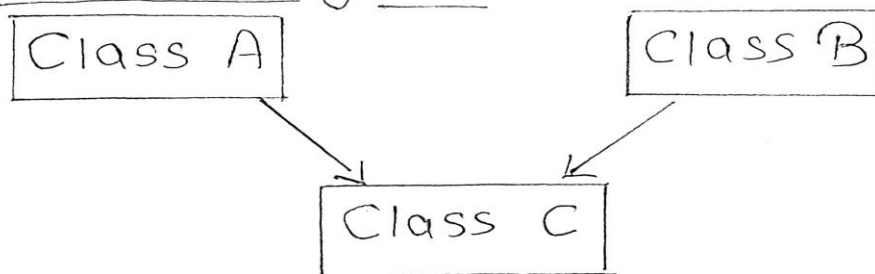


• Syntax:-

```
Class B : public class A {  
    // body of the derived class  
};
```

2. **Multiple Inheritance:** Multiple Inheritance is a feature of C++ where a class can inherit from more than one classes. i.e one **sub class** is inherited from more than one **base classes**.

• Block diagram:-

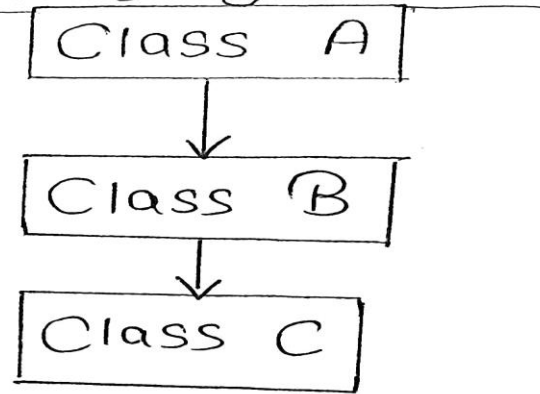


• Syntax:-

```
class C: public class A, public class B  
{ // body of derived class };
```

3. Multilevel Inheritance: In this type of inheritance, a derived class is created from another derived class.

• Block diagram :-



• Syntax:-

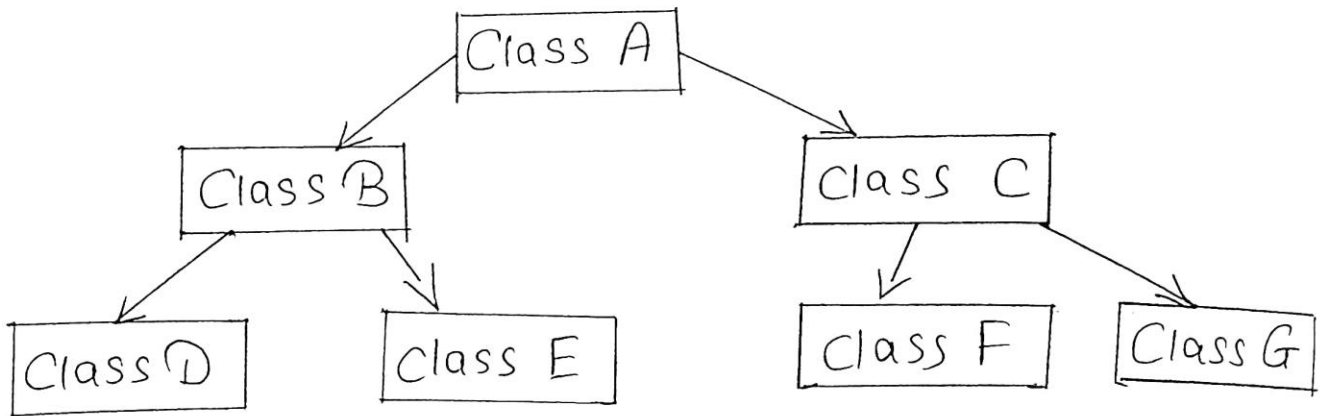
```
class A  
{  
};
```

```
class B : public class A {  
};
```

```
class C : public class B {  
};
```

- 4. Hierarchical Inheritance:** In this type of inheritance, more than one sub class is inherited from a single base class. i.e. more than one derived class is created from a single base class.

• Block diagram:-



• Syntax:-

```
Class A { };  
Class B : public class A { };  
Class C : public class A { };  
Class D : public class B { };  
Class E : public class B { };  
Class F : public class C { };  
Class G : public class C { };
```

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1. To perform Multiple Inheritance in C++. Create a student class representing student roll number, name and branch and an exam class (derived class of student) representing the scores of the student in various subjects (maths, physics and chemistry) and sports class representing the score in sports. The sports and exam class is inherited by a result class which adds the exam marks and sports score to generate the final result.

Algorithm:

Step 1: Create a class Student with the required attributes for roll no, name and branch. Take these values from the user.

Step 2: Using single inheritance concept, exam class will inherit student class and also it has its own attributes which are used for taking user input for the marks obtained in physics, chemistry and maths.

Step 3: A new class is created named sports class which will have the attribute for taking marks obtained in sports as the input from the user.

Step 4: In result class the calculation for total marks and percentage takes place and the output is displayed.

Step 5: In main function the object for result class is created and it calls the method in result class which initiates all the constructors in the previous class.

Program:

/*To perform Multiple Inheritance in C++. Create a student class representing student roll number,

name and branch and an exam class (derived class of student)

representing the scores of the student in various subjects

(maths, physics and chemistry) and sports class representing the score in sports.

The sports and exam class is inherited by a result class which adds the exam marks and

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sports score to generate the final result.*/*

```
#include<iostream>
```

```
using namespace std;
```

```
class Student{ //creating a class
```

```
    public: //access specifier
```

```
        int roll_no; //attributes
```

```
        string name; //attributes
```

```
        string branch; //attributes
```

```
        Student(){ //constructor
```

```
            cout<<"Enter roll number: "<<endl;
```

```
            cin>>roll_no;
```

```
            cout<<"Enter name: " <<endl;
```

```
            cin>>name;
```

```
            cout<<"Enter branch: "<<endl;
```

```
            cin>>branch;
```

```
        }
```

```
};
```

```
class exam: public Student { //exam class is inheriting the student class
```

```
    public: //access specifier
```

```
        int physics,chemistry,maths; //attributes
```

```
        exam(){ //constructor
```

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```
cout<<"Enter Marks obtained in Physics out of 100
:"<<endl;

cin>>physics;
if(physics>100)
{
    cout<<"Please Enter a value between 0-100 "<<endl;
    cout<<"Enter Marks obtained in Physics out of 100
:"<<endl;

    cin>>physics;
}
cout<<"Enter Marks obtained in Chemistry out of 100
:"<<endl;

cin>>chemistry;
if(chemistry>100)
{
    cout<<"Please Enter a value between 0-100 "<<endl;
    cout<<"Enter Marks obtained in Chemistry out of
100 :"<<endl;

    cin>>chemistry;
}
cout<<"Enter Marks obtained in Maths out of 100
:"<<endl;

cin>>maths;
if(maths>100)
{
    cout<<"Please Enter a value between 0-100 "<<endl;
```


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```
        cout<<"Enter Marks obtained in Maths out of 100 :  
"<<endl;  
        cin>>maths;  
    }  
}  
};  
class sports{  
    public:    //access specifier  
    int sports_marks; //attributes  
    sports(){    //constructor  
        cout<<"Enter the marks obtained in Sports out of 100  
: "<<endl;  
        cin>>sports_marks;  
        if(sports_marks>100)  
        {  
            cout<<"Please Enter a value between 0-100 "<<endl;  
            cout<<"Enter Marks obtained in Sports out of 100 :  
"<<endl;  
            cin>>sports_marks;  
        }  
    }  
};  
class Result: public exam , public sports { //Result class is inheriting exam  
class and sports class using multiple inheritance  
    int    total_marks; //attributes  
    float percentage; //attributes
```

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```
public:    //access specifier

    Result_obtained(){

        total_marks=physics+chemistry+maths+sports_marks;
//calculating the total marks obtained

        percentage=((float)total_marks* 100)/400 ; //calculating
the percentage

        /*  Displaying the Output */
        cout<<"\n\n Name of the Student: "<<name<<endl;
        cout<<"Roll No. of the student : " <<roll_no<<endl;
        cout<<"Branch of the student: "<<branch<<endl;
        cout<<"Marks obtained in Physics: "<<physics<<" /
100"<<endl;

        cout<<"Marks obtained in Chemistry: "<<chemistry<<" /
100"<<endl;

        cout<<"Marks obtained in Maths: "<<maths<<" /
100"<<endl;

        cout<<"Marks obtained in Sports: "<<sports_marks<<" /
100"<<endl;

        cout<<"Total Marks obtained : "<<total_marks<<" / 400
"<<endl;

        cout<<"The percentage obtained by the student is :
"<<percentage<<" %"<<endl;

    }

};

int main()

{

    Result object; //creating a object of the class Result
```

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```
object.Result_obtained(); //calling the method using the object created  
return 0;
```

```
}
```

Input Given:

Roll No. : 39 , Name : Shreyas , Branch: EXTC , Physics marks = 89 ,
Chemistry marks = 81 , maths marks = 100 , sports marks = 75

Output:

 C:\Users\Shreyas\Documents\SEM 3 C++ codes\Lab6.1.exe

```
Enter roll number:  
39  
Enter name:  
Shreyas  
Enter branch:  
EXTC  
Enter Marks obtained in Physics out of 100 :  
89  
Enter Marks obtained in Chemistry out of 100 :  
81  
Enter Marks obtained in Maths out of 100 :  
100  
Enter the marks obtained in Sports out of 100 :  
75  
  
Name of the Student: Shreyas  
Roll No. of the student :39  
Branch of the student: EXTC  
Marks obtained in Physics: 89 / 100  
Marks obtained in Chemistry: 81 / 100  
Marks obtained in Maths: 100 / 100  
Marks obtained in Sports: 75 / 100  
Total Marks obtained : 345 / 400  
The percentage obtained by the student is : 86.25 %  
  
-----  
Process exited after 25.61 seconds with return value 0  
Press any key to continue . . . _
```

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2. To perform Hierarchical Inheritance in C++. Create an Employee class with attributes EmpID and EmpSalary. Also create necessary methods/constructors to accept these values from the user. Create classes permanentEmployee and TemporaryEmployee which will be derived classes of Employee. Mention hike attribute in these derived classes and calculate the total salary using generate_salary() method for respective types of employees. Objects of the derived classes should be created and salaries for the permanent and temporary employees should be calculated and displayed on the screen.

Algorithm:

Step 1: Create a class employee with the required attributes like EmpID and EmpSalary and take these values for both the permanent employee and the temporary employee from the user.

Step 2: Then in class permanent employee which is inheriting the class employee , using generate_Salary method take the value of percentage hike for the permanent employees salary from the user.

Step 3: Then calculate the total salary after adding the percentage hike accordingly and display the output.

Step 4: Then in class temporary employee which is inheriting the class employee , using generate_Salary method take the value of percentage hike for the temporary employees salary from the user.

Step 5: Then calculate the total salary after adding the percentage hike accordingly and display the output.

Step 6: In the main function create two objects for both the permanent employee and the temporary employee class and call the methods in the respective class using the 2 objects in order to get the output.

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Program:

/*To perform Hierarchical Inheritance in C++. Create an Employee class with attributes EmpID and EmpSalary. Also create necessary methods/constructors to accept these values from the user. Create classes permanentEmployee and TemporaryEmployee which will be derived classes of Employee. Mention hike attribute in these derived classes and calculate the total salary using generate_salary() method for respective types of employees. Objects of the derived classes should be created and salaries for the permanent and temporary employees should be calculated and displayed on the screen.*/

```
#include<iostream>
```

```
using namespace std;
```

```
class Employee{ //creating a class
    public: //access specifier
        int EmpID; //attributes
        float EmpSalary; //attributes
        Employee(){
            cout<<"Enter your ID : "<<endl;
            cin>>EmpID;
            cout<<"Enter your salary : "<<endl;
            cin>>EmpSalary;
```

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```
    }  
};  
  
class Permenant_Employee : public Employee{  
    public:  
        float hike_permanent_emp , total_salary_permanent_emp;  
        void generate_Salary(){  
            cout<<"Enter the percentage hike for permanent employee :  
"<<endl;  
            cin>>hike_permanent_emp;  
            total_salary_permanent_emp = EmpSalary + ((EmpSalary *  
hike_permanent_emp )/100);  
            cout<<"The Salary of the Permanent Employee is :  
"<<total_salary_permanent_emp<<" Rs."<<endl;  
        }  
};  
  
class Temporary_Employee : public Employee{  
    public:  
        float hike_temporary_emp, total_salary_temporary_emp;  
        void generate_Salary(){  
            cout<<"Enter the percentage hike for temporary employee :  
"<<endl;  
            cin>>hike_temporary_emp;  
            total_salary_temporary_emp = EmpSalary + ((EmpSalary *  
hike_temporary_emp )/100);
```

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```
        cout<<"The Salary of the Temporary Employee is :  
"<<total_salary_temporary_emp<<" Rs."<<endl;  
    }  
  
};  
  
int main(){  
    Permenant_Employee ob1; //creating objects  
    ob1.generate_Salary(); //calling methods with the help of objects  
  
    Temporary_Employee ob2;  
    ob2.generate_Salary();  
    return 0;  
}
```

Input Given:

Permanent Employee Id: 39 , Permanent employee salary: 50000 Rs. ,
percentage hike on salary: 10%.

Temporary Employee Id: 10 , Temporary employee salary: 50000 Rs. ,
percentage hike on salary: 5%.

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Output:

```
C:\Users\Shreyas\Documents\SEM 3 C++ codes\Lab6.2.exe
Enter your ID :
39
Enter your salary :
50000
Enter the percentage hike for permanent employee :
10
The Salary of the Permanent Employee is : 55000 Rs.
Enter your ID :
10
Enter your salary :
50000
Enter the percentage hike for temporary employee :
5
The Salary of the Temporary Employee is : 52500 Rs.

-----
Process exited after 39.62 seconds with return value 0
Press any key to continue . . .
```