

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
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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:

- Comprehend building blocks of OOPs language, inheritance, package and interfaces

Faculty: Ms. Deepali Kayande

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Theory:

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

Ans:

Definition:

The capability of a class to derive properties and characteristics from another class is called Inheritance. Inheritance is one of the most important features of Object-Oriented Programming.

We know that the class that inherits properties from another class is called Sub class or Derived Class, and the class whose properties are inherited by sub class is called Base 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.

Syntax:

For creating a derived class which is inherited from the base class we have to follow the below syntax.

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

e.g

```
class result : public exam
{
    Body...
}
```

Here, subclass_name is the name of the sub class, access_mode is the mode in which you want to inherit this sub class for example: public, private etc. and base_class_name is the name of the base class from which you want to inherit the sub class.

Modes of Inheritance:

There are different modes of inheritances as follows:

(1) **Public mode:** If we derive a sub class from a public base class. Then the public member of the base class will become public in the derived class and protected members of the base class will become protected in derived class.

(2) **Protected mode:** If we derive a sub class from a Protected base class. Then both public member and protected members of the base class will become protected in derived class.

(3) **Private mode:** If we derive a sub class from a Private base class. Then both public member and protected members of the base class will become Private in derived class.

Types of Inheritances:

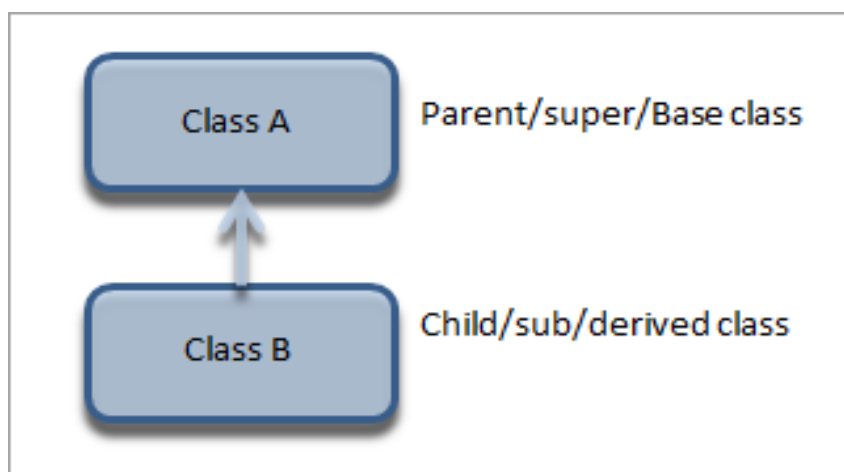
1. Single Inheritance:

In single inheritance, a class is allowed to inherit from only one class, one sub class is inherited by one base class only.

Syntax:

```
class subclass_name : access_mode base_class
{
    //body of subclass
};
```

Block Diagram:



2. Multiple Inheritance:

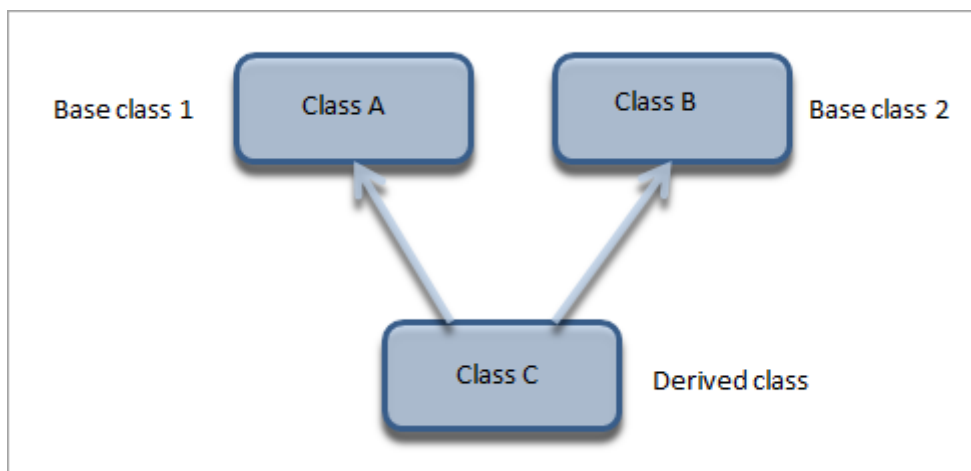
Multiple Inheritance is a feature of C++ where a class can inherit from more than one classes, one sub class is inherited from more than one base classes.

Syntax:

```
class subclass_name : access_mode base_class1, access_mode base_class2, ....  
{  
    //body of subclass  
};
```

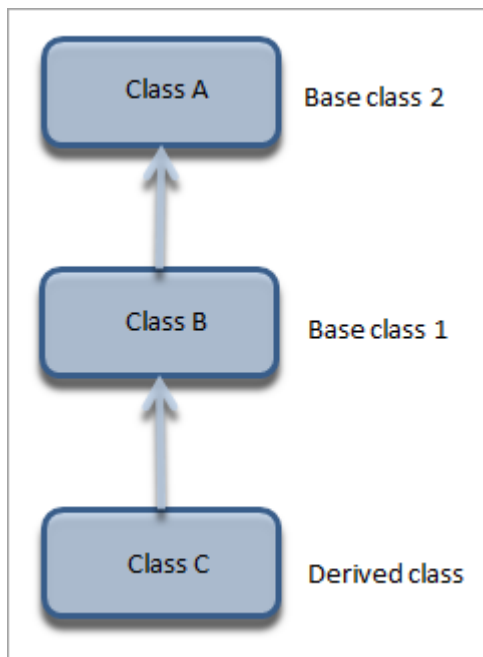
Here, the number of base classes will be separated by a comma (',') and access mode for every base class must be specified.

Block Diagram:



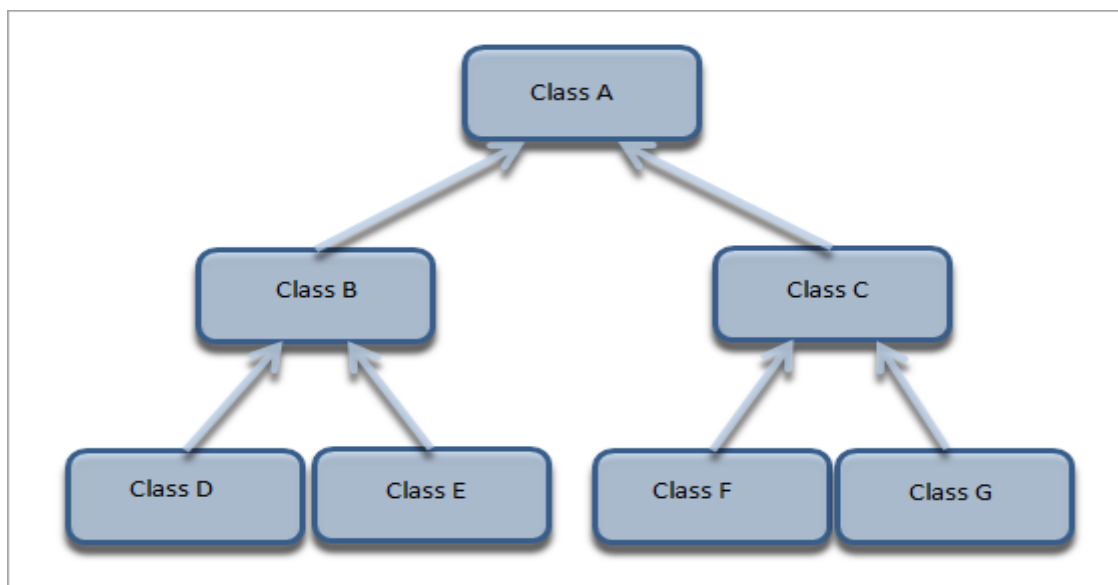
3. Multilevel Inheritance: In this type of inheritance, a derived class is created from another derived class.

Block Diagram:



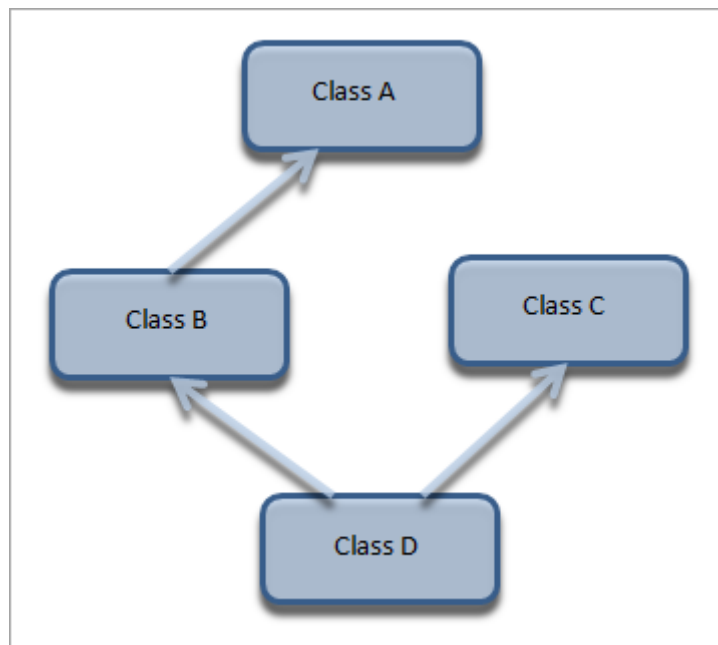
4. Hierarchical Inheritance: In this type of inheritance, more than one sub class is inherited from a single base class, more than one derived class is created from a single base class.

Block Diagram:



5. Hybrid Inheritance: Hybrid Inheritance is implemented by combining more than one type of inheritance. For example: Combining Hierarchical inheritance and Multiple Inheritance.

Block Diagram:



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Program 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 :

Step1: Start

Step 2: Create class student, and add parameters as student roll number, name and branch.

Step 3: derive a class from student class as exam class representing the scores of the student in various subjects.

Step 4: create sports class representing the score in sports.

Step 5: The sports and exam class is inherited by a result class which adds the exam marks and sports score.

Step 6: Compute the total marks of student.

Step 7: Create the object result class

Step 8: Stop

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Program:

```
#include<iostream>

using namespace std;

class student {
public:
    int rollno;
    string name;
    string branch;
    int get()
    {
        cout << "\nEnter the Roll no :";
        cin >> rollno;
        cout << "\nEnter the student name:";
        cin >> name;
        cout << "\nEnter your branch: ";
        cin >> branch;
    }
};

class exam : public student{
public:
    int m1,m2,m3;
    int getdata()
    {
        cout << "\nEnter marks in maths out of 100:" << endl;
        cin >> m1;
        cout << "\nEnter marks in physics out of 100:" << endl;
        cin >> m2;
```

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```
cout<<"\nenter marks in chemistry out of 100:"<<endl;

cin>>m3;

}

};

class sports {

public:

int sm; // sm = Sports mark

int getsm()

{

cout << "\n Enter the sports mark out off 50 : "<<endl;

cin>>sm;

}

};

class result : public exam, public sports {

public:

int total;

float p;

int display()

{

total = (m1 + m2 + m3 + sm);

p= (total*100)/350;

cout<<"\n"<<endl;

cout<<"\nReport card:"<<endl;

cout<<"\nRoll No.: "<<rollno;

cout<<"\nStudent name:"<<name;

cout<<"\nBranch: "<<branch;

cout<<"\nMarks in maths: "<<m1;
```

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```
cout<<"\nMarks in physics: "<<m2;

cout<<"\nMarks in chemistry: "<<m3;

cout<<"\nScore in sports out of 50 : "<<sm;

cout<<"\nTotal marks:"<<total;

cout<<"\nPercentage: "<<p;

}

};

int main() {

result res;

res.get();

res.getdata();

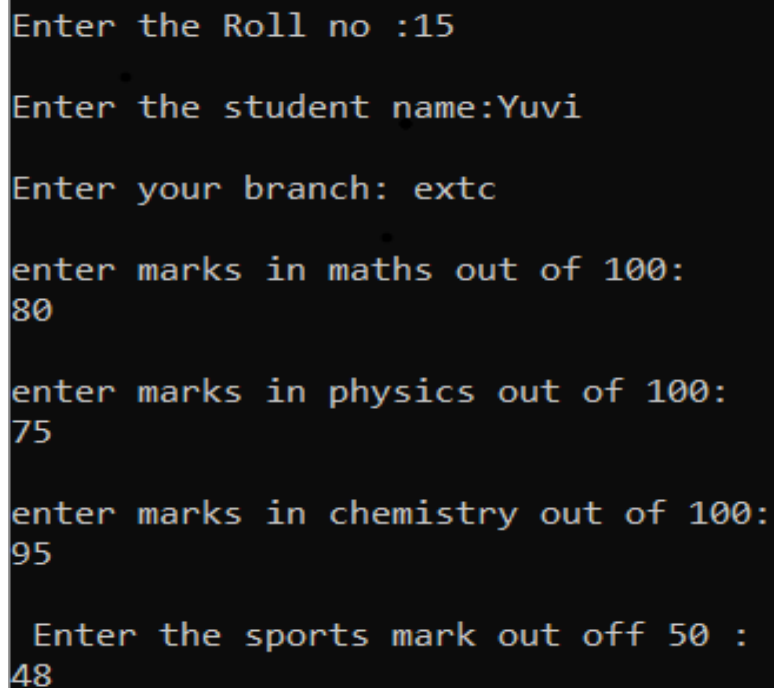
res.getsm();

res.display();

return 0;

}
```

Input Given:



```
Enter the Roll no :15

Enter the student name:Yuvi

Enter your branch: extc

enter marks in maths out of 100:
80

enter marks in physics out of 100:
75

enter marks in chemistry out of 100:
95

Enter the sports mark out off 50 :
48
```

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Output Screenshot:

```
Enter the Roll no :15

Enter the student name:Yuvi

Enter your branch: extc

enter marks in maths out of 100:
80

enter marks in physics out of 100:
75

enter marks in chemistry out of 100:
95

Enter the sports mark out off 50 :
48

Report card:

Roll No.: 15
Student name:Yuvi
Branch: extc
Marks in maths: 80
Marks in physics: 75
Marks in chemistry: 95
Score in sports out of 50 : 48
Total marks:298
Percentage: 85
-----
Process exited after 34.71 seconds with return value 0
```

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Program 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: Start

Step 2: Create an employee class with attributes as empid, and empsalary

Step 3: In class employee create a constructor, which collects the basic info from the user, and then call a function to print the results

Step 4: Create classes permanentEmployee and TemporaryEmployee which will be derived classes of Employee, add hike attribute in these derived classes and calculate the total salary using generate_salary() method for respective types of employees.

Step 5: Create the objects of the derived classes

Step 6: calculate the salaries of permanent and temporary employees, and displayed it as output.

Step 7: Stop

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Program:

```
#include <iostream>

using namespace std;

class Employee
{
protected:
    string EmpID = "";
    double Empsalary;
public:
    Employee()
    {
        cout<<endl<<"Enter employee ID : ";
        cin>>EmpID;
        cout<<endl<<"Enter employee Salary : ";
        cin>>Empsalary;
    }
    void getdata()
    {
        cout <<endl<< "Employee ID is : " << EmpID;
        cout <<endl<<"Total Salary of Employee is : " << Empsalary;
    }
};

class Permanent_Employee: public Employee
{
    double hike;
public:
```

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```
Permanent_Employee( double increment)
{
hike = increment;
}
void getdata()
{
cout<< "EmployeeID is : " << EmpID;
cout <<endl<<"Employee Total Salary is : " << generate_salary();
}
float generate_salary()
{
return (Empsalary + hike);
}
};
class Temporary_Employee: public Employee
{
double hike;
public:
Temporary_Employee( double increment)
{
hike = increment;
}
void getdata()
{
cout<< "EmployeeID is : " << EmpID;
cout <<endl<<"Employee Total Salary is : " << generate_salary();
}
```

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```
float generate_salary()
{
return (Empsalary + hike);
}

};

int main()
{
cout<<"Temporary Employee: ";
Temporary_Employee T(1050.75);
cout << endl<<"----Details of Temporary_Employee----" << endl;
T.getdata();
cout<<endl<<endl<<"Permanent Employee: ";
Permanent_Employee P(1750.84);
cout << endl<< "----Details of Permanent_Employee----" << endl;
P.getdata();
return 0;
}
```

Input Given:

--For Temporary employee--

Enter employee ID: 5

Enter employee Salary: 25000

--For Permanent employee--

Enter employee ID: 15

Enter employee Salary: 36000

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Output:

```
Temporary Employee:
Enter employee ID : 5

Enter employee Salary : 25000

----Details of Temporary_Employee---
EmployeeID is : 5
Employee Total Salary is : 26050.8

Permanent Employee:
Enter employee ID : 15

Enter employee Salary : 36000

----Details of Permanent_Employee----
EmployeeID is : 15
Employee Total Salary is : 37750.8
-----
Process exited after 34.62 seconds with return value 0
Press any key to continue . . .
```