Types of Inheritance

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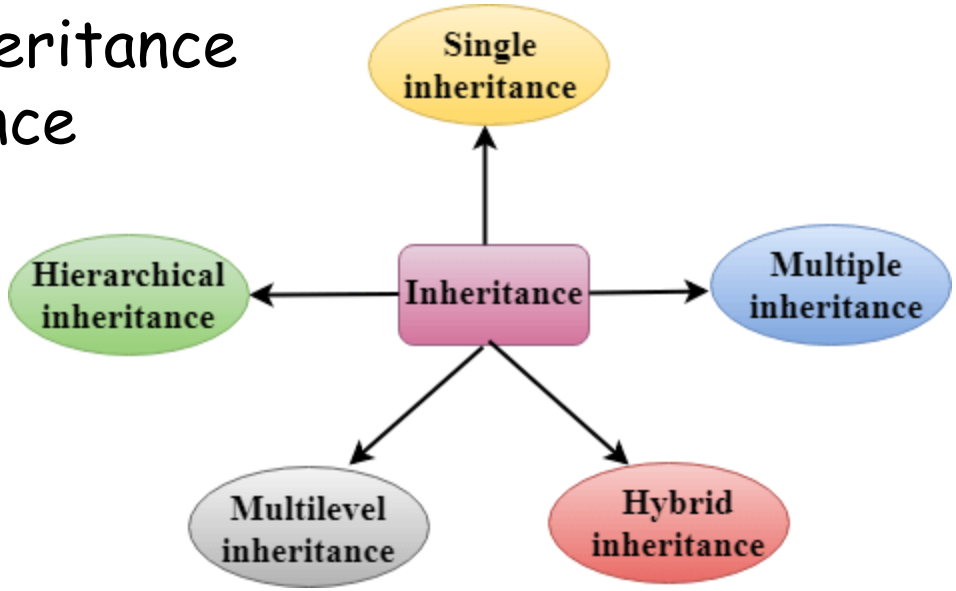
Types of Inheritance

C++ supports five types of inheritance:

1. Single inheritance
2. Multilevel inheritance
3. Multiple inheritance
4. Hierarchical inheritance
5. Hybrid inheritance



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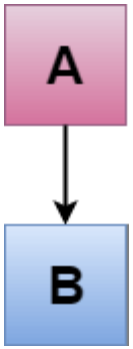
Single Inheritance

Single inheritance is defined as the inheritance in which a derived class is inherited from the only one base class.



Where 'A' is the base class, and 'B' is the derived class.

Multilevel Inheritance

Multilevel inheritance is a process of deriving a class from another derived class.

When one class inherits another class which is further inherited by another class, it is known as multi level inheritance in C++. Inheritance is transitive so the last derived class acquires all the members of all its base classes.

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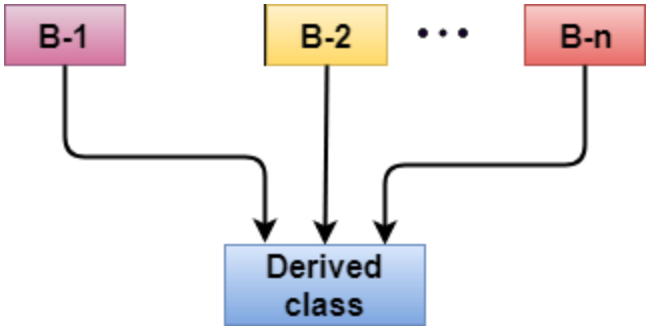
Multiple Inheritance

Multiple inheritance is the process of deriving a new class that inherits the attributes from two or more classes.



Syntax of the Derived class:

```
class D : visibility B-1, visibility B-2, ?
{
    // Body of the class;
}
```

Ambiguity Resolution in Inheritance

Ambiguity can be occurred in using the multiple inheritance when a function with the same name occurs in more than one base class.

```
#include <iostream>
using namespace std;
class A
{
    public:
    void display()
    {
        cout << "Class A" << endl;
    }
};
class B
{
    public:
    void display()
    {
        std::cout << "Class B" << std::endl;
    }
};
```

```
class C : public A, public B
{
    public:
    void view()
    {
        display();
    }
};
int main()
{
    C c;
    //c.display();
    c.view();
    return 0;
}
```

```
 In member function 'void C::view()':
24:13: error: reference to 'display' is ambiguous
14:14: note: candidates are: void B::display()
6:14: note:                  void A::display()
```

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Ambiguity Resolution in Inheritance

The above issue can be resolved by using the class **resolution operator** with the function. In the above example, the derived class code can be rewritten as:

```cpp
#include <iostream>
using namespace std;
class A
{
    public:
    void display()
    {
        cout << "Class A" << std::endl;
    }
};
class B
{
    public:
    void display()
    {
        std::cout << "Class B" << std::endl;
    }
};
```

```cpp
class C : public A, public B
{
    public:
    void view()
    {
        A :: display();       // Calling the
            display() function of class A.
        B :: display();       // Calling the
            display() function of class B.

    }
};

int main()
{
    C c;
    //c.display();
    //c.A::display();
    c.view();
    return 0;
}
```

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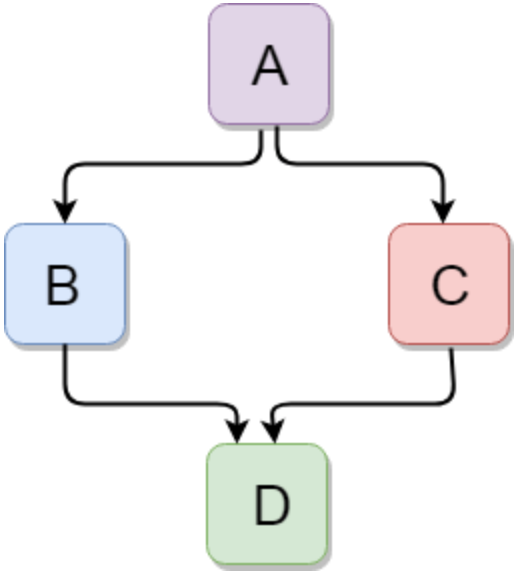
Hybrid Inheritance

Hybrid inheritance is a combination of more than one type of inheritance



Hybrid Inheritance

```
#include <iostream>
using namespace std;
class A
{
    protected:
    int a;
    public:
    void get_a(){
       std::cout << "Enter the value of 'a' : ";
       cin>>a;
    }
};

class B : public A
{
    protected:
    int b;
    public:
    void get_b()
    {
        std::cout << "Enter the value of 'b' : ";
       cin>>b;
    }
};
```

Hybrid Inheritance

```
class C
{
    protected:
    int c;
    public:
    void get_c()
    {
        std::cout << "Enter the value of c is : " ;
        cin>>c;
    }
};

class D : public B, public C
{
    protected:
    int d;
    public:
    void mul()
    {
        get_a();
        cout << a <<endl;
        get_b();
        cout << b <<endl;
        get_c();
        cout << c << endl;
        std::cout << "Multiplication of a,b,c is : " <<a*b*c<< std::endl;
    }
};
```

```
int main()
{
    D d;
    d.mul();
    return 0;
}
```

INPUT

```
100 200 300
```

OUTPUT

```
Enter the value of 'a' : 100
Enter the value of 'b' : 200
Enter the value of c is : 300
Multiplication of a,b,c is : 6000000
```

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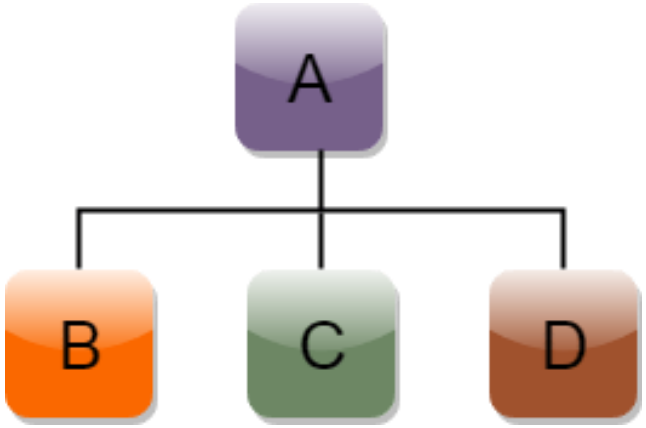
Hierarchical Inheritance

Hierarchical inheritance is defined as the process of deriving more than one class from a base class.



Syntax:

```
class A
{
    // body of the class A.
}
class B : public A
{
    // body of class B.
}
class C : public A
{
    // body of class C.
}
class D : public A
{
    // body of class D.
}
```

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Hierarchical Inheritance

```
#include <iostream>
using namespace std;
class Shape
{
    public:
    int a;
    int b;
    void get_data(int n,int m)
    {
        a= n;
        b = m;
    }
};
class Rectangle : public Shape
{
    public:
    int rect_area()
    {
        int result = a*b;
        return result;
    }
};
```

```
class Triangle : public Shape
{
    public:
    int triangle_area()
    {
        float result = 0.5*a*b;
        return result;
    }
};
```

Hierarchical Inheritance

```
int main()
{
    Rectangle r;
    Triangle t;
    int length,breadth,base,height;
    std::cout << "Enter the length and breadth of a rectangle: ";
    cin>>length>>breadth;
    cout << length << "   " << breadth << endl;

    r.get_data(length,breadth);
    int m = r.rect_area();
    std::cout << "Area of the rectangle is : " <<m<< std::endl;
    std::cout << "Enter the base and height of the triangle: ";
    cin>>base>>height;
    cout << base <<"   "<< height << endl;

    t.get_data(base,height);
    float n = t.triangle_area();
    std::cout <<"Area of the triangle is : "  << n<<std::endl;
    return 0;
}
```

INPUT

```
45 50
3 6
```

OUTPUT

```
Enter the length and breadth of a rectangle: 45   50
Area of the rectangle is : 2250
Enter the base and height of the triangle: 3   6
Area of the triangle is : 9
```