Inheritance in Java

The process of obtaining the data members and methods from one class to another class is known as inheritance. It is one of the fundamental features of object-oriented programming.

Important points

- In the inheritance the class which gives the data members and the methods is known as base or super or parent class.
- The class which is taking the data members and the methods is known as sub or derived or child class.
- The data members and methods of a class are known as features.
- The concept of inheritance is also known as re-usability or extendable classes or sub classing or derivation.

Why use Inheritance?

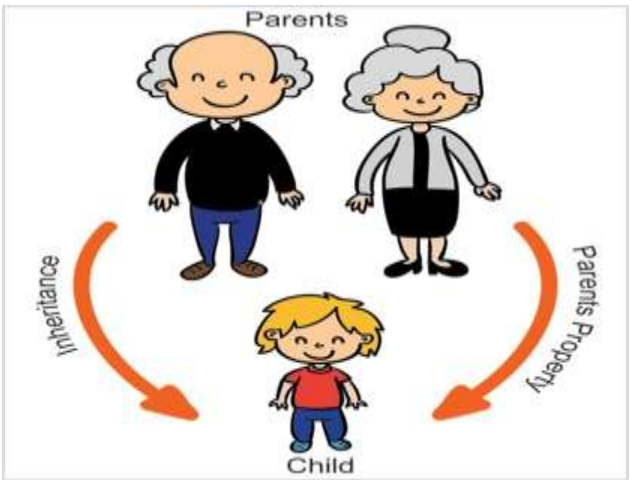
- For Method Overriding (used for Runtime Polymorphism).
- It's main uses are to enable polymorphism and to be able to reuse code for different classes by putting it in a common super class
- For code Re-usability

Syntax of Inheritance

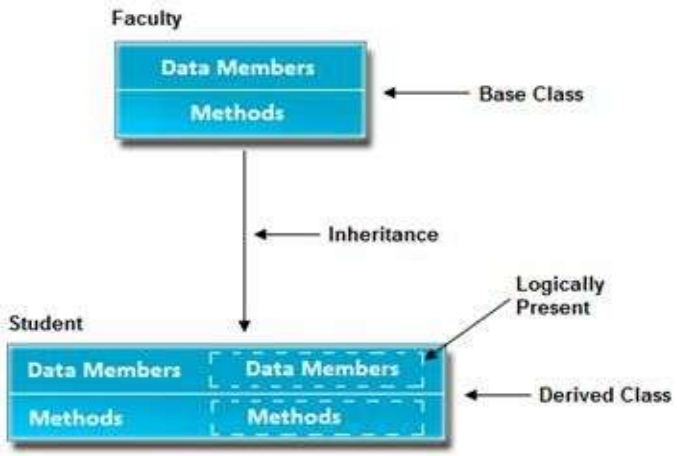
```
class Subclass-Name extends Superclass-Name
{
  //methods and fields
}
```

Real life example of inheritance

The real life example of inheritance is child and parents, all the properties of father are inherited by his son.



The following diagram use view about inheritance.



In the above diagram data members and methods are represented in broken line are inherited from faculty class and they are visible in student class logically.

Advantage of inheritance

If we develop any application using the concept of Inheritance then that application will have the following advantages,

- Application development time is less.
- Application takes less memory.
- Application execution time is less.
- Application performance is enhanced (improved).
- Redundancy (repetition) of the code is reduced or minimized so that we get consistence results and less storage cost.

Note: In Inheritance the scope of access modifier increasing is allowed but decreasing is not allowed. Suppose in parent class methods access modifier is default then it's present in child class with default or public or protected access modifier but not private (it decreases the scope).

Types of Inheritance

Based on number of ways inheriting the feature of base class into derived class we have five types of inheritance; they are:

- Single inheritance
- Multiple inheritance
- Hierarchical inheritance
- Multilevel inheritance
- Hybrid inheritance

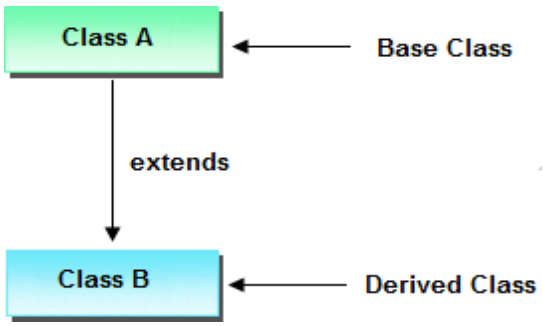
Single inheritance

In single inheritance there exists single base class and single derived class.

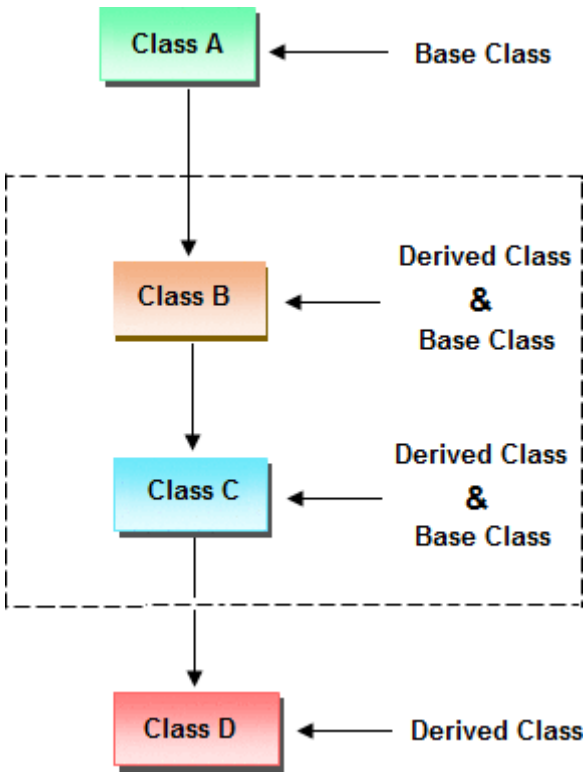
Example of Single Inheritance

```
class Faculty
{
float salary=30000;
}
class Science extends Faculty
{
float bonus=2000;
public static void main(String args[])
{
Science obj=new Science();
System.out.println("Salary is:"+obj.salary);
System.out.println("Bonus is:"+obj.bonus);
}
}
```

Output
Salary is: 30000.0
Bonus is: 2000.



Multilevel inheritances in Java
In Multilevel inheritances there exists single base class, single derived class and multiple intermediate base classes.
Single base class + single derived class + multiple intermediate base classes.
Intermediate base classes
An intermediate base class is one in one context with access derived class and in another context same class access base class.



Hence all the above three inheritance types are supported by both classes and interfaces.
Example of Multilevel Inheritance

```
class Faculty
{
float total_sal=0, salary=30000;
}

class HRA extends Faculty
{
float hra=3000;
}
class DA extends HRA{
float da=2000;
```

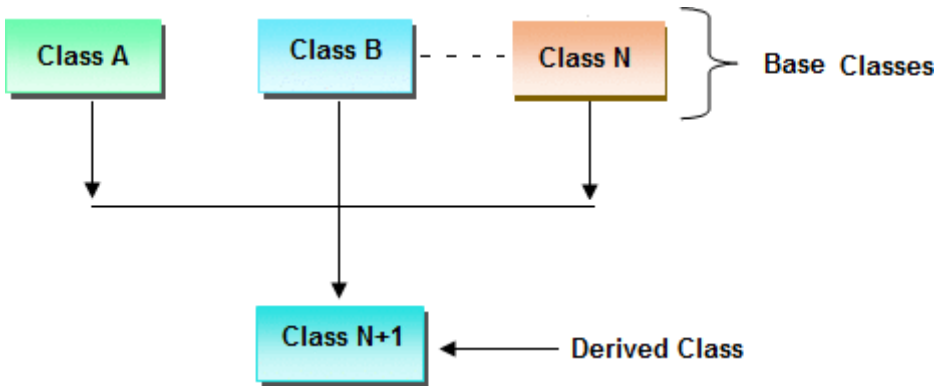
```
}

class Science extends DA
{
float bonus=2000;
public static void main(String args[])
{
Science obj=new Science();
obj.total_sal=obj.salary+obj.hra+obj.da+obj.bnous;
System.out.println("Total Salary is:"+obj.total_sal);
}
}
```

Output

Total Salary is: 37000.0

Multiple inheritance

In multiple inheritance there exist multiple classes and single derived class.

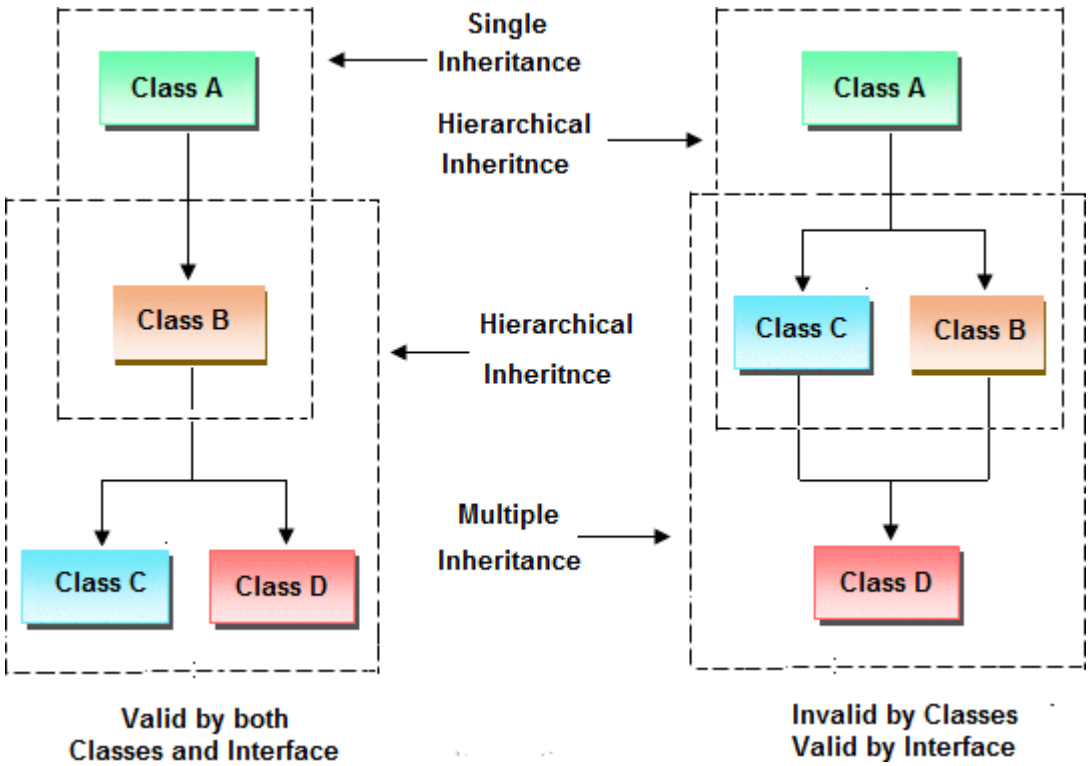


The concept of multiple inheritance is not supported in java through concept of classes but it can be supported through the concept of interface.

Hybrid inheritance

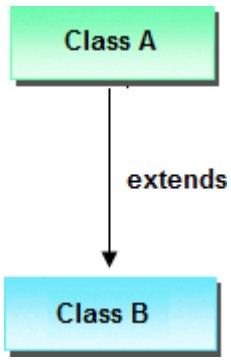
Combination of any inheritance type

In the combination if one of the combination is multiple inheritance then the inherited combination is not supported by java through the classes concept but it can be supported



Through the concept of interface.

Inheriting the feature from base class to derived class
In order to inherit the feature of base class into derived class we use the following syntax
Syntax
class ClassName-2 extends ClasssName-1
{
variable declaration;
Method declaration;
}



Explanation

1. ClassName-1 and ClassName-2 represents name of the base and derived classes respectively.
2. extends is one of the keyword used for inheriting the features of base class into derived class it improves the functionality of derived class.

Important Points for Inheritance:

- In java programming one derived class can extends only one base class because java programming does not support multiple inheritance through the concept of classes, but it can be supported through the concept of Interface.
- Whenever we develop any inheritance applications first create an object of bottom most derived class but not for top most base class.
- When we create an object of bottom most derived class, first we get the memory space for the data members of top most base class, and then we get the memory space for data member of other bottom most derived class.
- Bottom most derived class contains logical appearance for the data members of all top most base classes.
- If we do not want to give the features of base class to the derived class then the definition of the base class must be preceded by final hence final base classes are not reusable or not inheritable.
- If we are do not want to give some of the features of base class to derived class than such features of base class must be as private hence private features of base class are not inheritable or accessible in derived class.
- Data members and methods of a base class can be inherited into the derived class but constructors of base class cannot be inherited because every constructor of a class is made for initializing its own data members but not made for initializing the data members of other classes.
- An object of base class can contain details about features of same class but an object of base class never contains the details about special features of its derived class (this concept is known as scope of base class object).
- For each and every class in java there exists an implicit predefined super class called java.lang.Object. Because it provides garbage collection facility to its sub classes for collecting un-used memory space and improves the performance of java application.

Example of Inheritance

```
class Faculty
{
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}
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float bonus=2000;
public static void main(String args[])
{
Science obj=new Science();
System.out.println("Salary is:"+obj.salary);
System.out.println("Bonus is:"+obj.bonus);
}
}
```

Output

Salary is: 30000.0
Bonus is: 2000.0

Why multiple inheritance is not supported in java?

Due to ambiguity problem java does not support multiple inheritance at class level.

Example

```
class A
{
void disp()
{
System.out.println("Hello");
}
}
class B
{
void disp()
System.out.println("How are you ?");
}
}
class C extends A,B  //suppose if it were
{
Public Static void main(String args[])
{
C obj=new C();
obj.disp();//Now which disp() method would be invoked?
}
}
```

In above code we call both class A and class B disp() method then it confusion which class method is call. So due to this ambiguity problem in java do not use multiple inheritance at class level, but it support at interface level.