In objected oriented programing language starts from bottom to top because we write main method in bottom In procedure-oriented programing language starts from top to bottom.

Types Of Inheritance:

- 1) Single Inheritance One level of Inheritance [OneParent-One Child]

 Every Java class by default exhibit single inheritance, because Object class is the parent Class for all the Classes by default.
- 2) Multi-Level Inheritance In Multilevel inheritance a child class object should be able to access both parent class methods and grandparent class methods.
- 3) Heirarchal Inheritance
- 4) Hybrid Inheritance
- 5) Multiple Inheritance

Understanding Inheritance

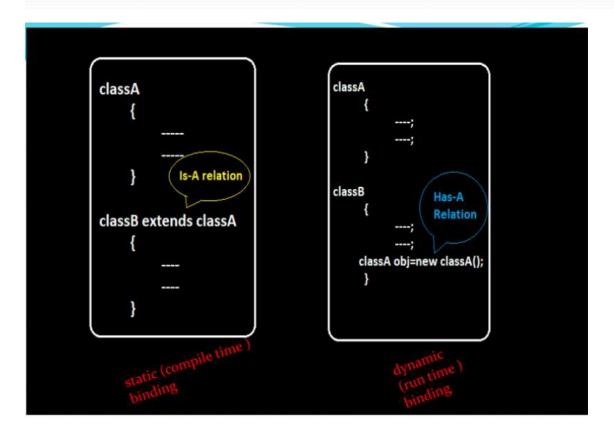
- Inheritance is the ability of a class inheriting data and behaviors from another class.
- It is also called "Is-A" relation.
- The main advantage of inheritance is code reusability.
- By using "extends" keyword we can implement IS-A relationship.
- After inheriting the complete functionality of super class Sub class can access the super class methods with its reference object.

Common Terminology:

Parent class - Child class

Base class - Derived class

Super class - Sub class



- All the data and methods which were present in parent class is by default available to child class, but the reverse is not applicable.
- Hence by using child class reference we can call both parent and child class methods.
- But by using parent reference we can call only methods available in the parent class and we can't call child class specific methods.
- Parent class reference can be used to hold child class object, but Child class reference cannot be used to hold parent class object.
- For all the java classes including predefined and user defined classes Object class acts as the super class to be precise <u>java.lang.Object</u> class is superclass of all classes.
- When a class extends another class, the subclass inherits all the public and protected members of the super class. The default members are inherited only in the same package.
- Constructors are not inherited in to the sub class during inheritance, we can call the constructors of super class by invoking super class object.

Types Of Inheritance:

- Java supports '3' types of inheritance.
 - Single Inheritance
 - Multi-Level Inheritance
 - 3 Hierarchal Inheritance

<u>Inheritance</u>: Inheritance means acquaring the properties of one class into another class. Inorder to acheive Inheritance we need to use either extends (or) implements keywords Reusability Keypoints public class ClassA public class ClassB extends ClassA 1) We can hold a parent class of Object with a parent class reference and with that reference we can call only parent class methods void meth1() void meth2() lassA aobj=new ClassA(); [P] System.out.println("Class A method") System.out.println("Class B method"); 2) We can hold a child class object with a parent class reference and with that reference we can call only parent class methods public static void main(String[] args) ClassA aobj=new ClassA(); ClassA ClassB 3) We can hold a child class object with a child class reference and we can aobj.meth1(); call both parent and child class methods Parent Class ⇒ Child Class ClassB bobj=new ClassB(); ClassB bobj=new ClassB(); [P & C] Super Class

Sub Class bobj.meth1(); 4) We cannot hold a parent class object with a child class reference will be Base Class - Derived Class bobj.meth2(); getting an compile time error ClassB bobj=new ClassA(); NVALID

1 package com.pack1;

```
2
                                                        2
                                                        3 public class ClassB
3 public class ClassA
4 {
                                                        4 {
5=
      void meth1()
                                                        5
                                                              void meth2()
 6
                                                        6
      {
           System.out.println("Class A method");
                                                        7
                                                                   System.out.println("Class B method");
8
                                                        8
                                                      8 9∞
9 }
                                                              public static void main(String[] args)
10
                                                       10
11
                                                       11
                                                                   ClassA aobj=new ClassA();
                                                       12
12
                                                                   aobj.meth1();
                                                       13
13
14
                                                       14
                                                                   ClassB bobj=new ClassB();
                                                       15
15
                                                                   bobj.meth1();
16
                                                       16
                                                                   bobj.meth2();
                                                       17
17
18
                                                       18 }
 1 package com.pack1;
                                                          1 package com.pack1;
  public class ClassA
 3
                                                          3 public class ClassB extends ClassA
 4 {
                                                          4 {
 5=
       void meth1()
                                                          5=
                                                                void meth2()
 6
 7
           System.out.println("Class A method");
                                                                    System.out.println("Class B method");
 8
                                                          8
                                                        9
                                                          90
                                                                public static void main(String[] args)
 9 }
10
11
                                                        11
                                                                    ClassA aobj=new ClassA();
12
                                                        12
                                                                    aobj.meth1();
                                                        13
13
                                                        14
                                                                    ClassB bobj=new ClassB();
14
                                                        15
15
                                                                    bobj.meth1();
                                                        16
16
                                                                    bobj.meth2();
                                                        17
                                                                }
17
18
                                                        18 }
```

1 package com.pack1;

IS-A-Relationship is nothing but inheritance.

```
1 package com.pack1;
                                                        1 package com.pack1;
                                                        3 public class ClassB extends ClassA
 3 public class ClassA
                                                        4 {
 5=
      void meth1()
                                                              void meth2()
 6
                                                        6
      {
 7
           System.out.println("Class A method");
                                                                  System.out.println("Class B method");
 8
                                                        8
                                                      9-
 9 }
                                                              public static void main(String[] args)
10
                                                       10
11
                                                       11
                                                                  ClassA aobj=new ClassA(); // HAS-A-Relation
12
                                                       12
                                                                  aobj.meth1();
                                                       13
13
                                                                  ClassB bobj=new ClassB(); // IS-A-Relation
                                                       14
14
15
                                                       15
                                                                  bobj.meth1();
                                                       16
16
                                                                  bobj.meth2();
                                                      17
17
                                                              }
                                                       18 }
18
19
                                                       19
                                                       20 // ClassA ===> Parent Class
20
                                                       21 // ClassB ===> Child Class
21
22
23
                                                       23
```

Inheritance: Inheritance means acquaring the properties of one class into another class.

Code
Reusability
Inorder to acheive Inheritance we need to use either extends (or) implements keywords

public class ClassA

public class ClassA extends ClassA

```
{
    void meth1()
    {
        System.out.println("Class A method");
    }
}
```

ClassA ClassB

Parent Class ⇒ Child Class
Super Class ⇒ Sub Class
Base Class ⇒ Derived Class

```
void meth2()
{
    System.out.println("Class B method");
}
public static void main(String[] args)
{
    ClassA aobj=new ClassA();
    aobj.meth1();
    ClassB bobj=new ClassB();
    bobj.meth1();
    bobj.meth2();
}
```

Keypoints

 We can hold a parent class of Object with a parent class reference and with that reference we can call only parent class methods

ClassA aobj=new ClassA(); [P]

2) We can hold a child class object with a parent class reference and with that reference we can call only parent class methods

ClassA aobj=new ClassB(); [P]

 We can hold a child class object with a child class reference and we can call both parent and child class methods

ClassB bobj=new ClassB(); [P & C]

4) We cannot hold a parent class object with a child class reference will be getting an compile time error

ClassB bobj=new ClassA(); ➡➤ INVALID

```
1 package com.pack1;
                                              1 package com.pack1;
                                              3 public class ClassB extends ClassA
 3 public class ClassA
 4 {
                                              4 {
 5=
        void meth1()
                                                    void meth2()
 6
            System.out.println("Class A
                                                         System.out.println("Class B method");
 7
 8
                                              8
 9 }
                                                    public static void main(String[] args)
10
                                                         ClassA aobj1=new ClassA(); // 1st Point ===> HAS-A-Relation
11
                                             11
                                             12
                                                         aobj1.meth1();
                     # X % | R L | P | P | P | P | T | T | 13
                                                         //obj1.meth2();// C.E
<terminated> ClassB [Java Application] C:\Program Files\Java\jdk-17\bin\javav 14
Class A method
                                            15
                                                         ClassA aobj2=new ClassB(); // 2nd point
Class A method
                                            16
                                                         aobj2.meth1();
Class A method
                                            17
                                                         //aobj2.meth2();// C.E
Class B method
                                             18
                                            19
                                                         ClassB bobj1=neW ClassB(); // 3rd Point ===> IS-A-Relation
                                            20
                                                         bobj1.meth1();
                                             21
                                                         bobj1.meth2();
                                            22
                                             23
                                                         //ClassB bobj2=new ClassA();// 4th Point ===> Invalid C.E
                                            24
                                                    }
```

```
1 package com.pack1;
                                             3 public class ClassB //extends ClassA
                                             4 {
 3 public class ClassA
                                             5
                                                   void meth2()
 4 {
                                                   {
 5°
       void meth1()
                                                       System.out.println("Class B method");
                                             7
 6
                                             8
            System.out.println("Class A
 7
                                           1 9-
                                                   public static void main(String[] args)
 8
                                           10
9 }
                                            11
                                                       ClassA aobj1=new ClassA(); // 1st Point ===> HAS-A-Relation
10
                                            12
                                                       aobj1.meth1();
11
                                            13
                                                       //obj1.meth2();// C.E
                                            14
                    15
                                                       ClassA aobj2=new ClassB(); // 2nd point
<terminated > ClassB [Java Application] C:\Program Files\Java\jdk-17\bin\javaw
                                                       aobj2.meth1();
                                            16
Class A method
                                           17
                                                       //aobj2.meth2();// C.E
Class A method
                                           18
Class A method
                                                       ClassB bobj1=new ClassB(); // 3rd Point ===> IS-A-Relation
                                           19
Class B method
                                                      Toobj1.meth1();
                                           20
                                           21
                                                       bobj1.meth2();
                                           22
23
                                                       //ClassB bobj2=new ClassA();// 4th Point ===> Invalid C.E
                                           24
                                            25 }
```

Multilevel inheritance

```
1 package com.pack1;
                                                                      1 package com.pack2;
 3 public class ClassA
                                                                      3 import com.pack1.ClassB;
 4 {
 5=
       public void meth1()
                                                                        public class ClassX extends ClassB
 6
                                                                      6 {
       {
 7
            System.out.println("Class-A method");
                                                                             public void meth3()
 8
                                                                      8
9 }
                                                                                 System.out.println("Class-X method");
                                                                      9
10
                                                                     10
                                                                    110
                                                                             public static void main(String[] args)
11
                                                                     12
                                                                                 ClassX xobj=new ClassX();
Lobj.meth1();
                                                                     13

☐ Training * ☐ src * ☐ com.pack1 * ☐ ClassB *

                                                                     114
1 package com.pack1;
                                                                    15
                                                                                 xobj.meth2();
                                                                    16
                                                                                 xobj.meth3();
 3 public class ClassB extends ClassA
                                                                    17
 4 {
                                                                     18 }
       public void meth2()
                                                                     19
 6
                                                                     20
            System.out.println("Class-B method");
 8
 9 }
10
```