CS205 Object Oriented Programming in Java

Module 2 - **Core Java Fundamentals (Part 9)**

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Topics

- Core Java Fundamentals**:**

  ✓Inheritance :

   ✓ Super class

   ✓Sub class

   ✓keywords *super*

   ✓ *protected* Members

Inheritance

- Inheritance helps to create <u>hierarchical classifications</u>.

- Using inheritance we can create a **general class(base or super class)** that defines features **common** to a set of related items.

  – This class can then be **inherited** by other, more **specific classes(subclasses).**

Inheritance(contd.)

- A subclass is a specialized version of a superclass.

- Subclass **inherits all of the instance variables and methods defined** by the superclass and <u>adds its own, unique elements.</u>

- To inherit a class, we have to use **extends** keyword along <u>*with subclass definition.*</u>

class superclass**{ //statements……}**

class subclass **extends** superclass**{ //statements……}**

```java
// A simple example of inheritance.
class A
{
    int i, j;
    void showij()
    {
    System.out.println("i and j: " + i + " " + j);
    }
}
class B extends A {
int k;
void showk() {
            System.out.println("k: " + k);
            }
void sum() {
        System.out.println("i+j+k: " + (i+j+k));
            }
}
```

Here A is the superclass of B

```java
class A
{
    int i, j;
void showij()
{
System.out.println(i + "  " + j);
}
}
class B extends A
 {
int k;
void showk() {
    System.out.println("k: " + k);
            }
void sum() {
System.out.println("sum " + (i+j+k));
            }
}
```

```java
class SimpleInheritance
{
public static void main(String args[]) {
A superOb = new A();
B subOb = new B();
superOb.i = 10;
superOb.j = 20;
System.out.println("Superobj Contents ");
superOb.showij();
subOb.i = 7;
subOb.j = 8;
subOb.k = 9;
System.out.println("subOb contents ");
subOb.showij();
subOb.showk();
System.out.println("Sum in subOb:");
subOb.sum(); } }
```

Superobj Contents
10 20
subOb contents
7 8
k: 9
Sum in subOb:24

Member Access and Inheritance

- Subclass <u>cannot access</u> the private members in superclass.

class A {

int i;   // public by default

private int **j**; // private to A

void setj(int x) { j = x; };

}

class B extends A {

int total;

void sum()   {

total = i + **j**; // **ERROR, j(private) is not accessible here**

}

}

> A class member that has been declared as private will remain private to its class.
> It is not accessible by any code outside its class, including subclasses.

- A major advantage of inheritance is that **once you have created a superclass** that defines the attributes **common** to a set of objects, it can be used <u>to create any number of more specific subclasses</u>.

- Each subclass can have its own special features also.

A Superclass Variable Can Reference a Subclass Object

- A **reference variable of a superclass** can <u>be assigned a reference to any subclass</u> derived from that superclass.

class A

{

}

class B extends A

{

}

class Sample

{A oba=new A();

B obb=new B();

oba=obb; }

Superclassobject=subclassobject

When a reference to a subclass object is assigned to a superclass reference variable, we will have **access only to those parts of the** object defined by the **superclass**..

```java
class Sup
{
int a,b;
void area()
{
System.out.println("Product="+ a*b);
}

}
class Sub extends Sup
{
int i;
Sub(int x,int y,int z)
{
a=x;
b=y;
i=z;
}

}
```

```java
class InhRefsub{

public static void main(String args[])
 {
 Sup supob=new Sup();
 supob.area();
 Sub subob=new Sub(10,20,30);
 supob=subob;
 supob.area();
 //System.out.println("i="+ supob.i);//ERROR
 }
}
```

OUTPUT
Product=0
Product=200

Program explanaion

- Here the statement **Sup supob=new Sup();** creates an object of class Sup named supob using default constructor **Sup().** Supob has variables a and b. Since default constructor is not there, compiler provides default constructor by initializing all variables to zero, so a and b are initially 0.
- Next **supob.area();** will call area() in Sup and prints *Product=0*
- **Sub subob=new Sub(10,20,30);** creates object of Sub named **subob** using parameterized constructed *Sub(int x,int y,int z)* . Since Sup is the subclass of Sub, so Sub has variables a,b from Sup and i (own variable) and set a=10 b=20 i=30
- The statement **supob=subob;** assigns object **subob** to superclass object reference **supob.** So supob has value of a and b(superclass variables) same as subob. a=10 b=20 **supob.area();** will print *Product=200*

Using super

- Whenever a subclass needs to refer to its immediate superclass, it can be done using the keyword **super.**

- **super** has two general forms**.**

  1. To call **the superclass' constructor.**

  2. To **access a member of the superclass** that has been hidden by a member of a subclass.

- ❑ The **static methods** cannot refer to **super.**

Using super to Call Superclass Constructors

- A **subclass** can **call a constructor defined by its superclass** by use of the following form of **super:**

super(*arg-list);*

- Here, *arg-list specifies any arguments needed by the constructor in the superclass.*

- *super( )* must always be the **first statement** executed inside a subclass' constructor.

```java
class Sup
{
Sup()
{
System.out.println("Superclass");
}
}
class Sub extends Sup
{

Sub()
{
super();
System.out.println("Subclass");
}

}
```

```java
class Supersub{

public static void main(String args[])
  {

  Sub subob=new Sub();


  }
}
```

OUTPUT
Superclass
Subclass

super keyword to acess members

- **super** always refers to the superclass of the subclass in which it is used.
- To access the member in superclass from subclass

  super.*member*
  - *Here member can be either a method or an instance variable.*
- If subclass contains same variable as superclass, then in subclass, the superclass member will be hidden by corresponding subclass member.
  - This can be prevented using super keyword

```java
class A    {
int i;
        }


class B extends A
{
int i;              // this i hides the i in A


B(int a, int b)        {
super.i = a;          // i in A
i = b;                // i in B
        }


void show()        {
System.out.println("i in superclass: " + super.i);
System.out.println("i in subclass: " + i);
        }


}
```

```java
class UseSuper {

public static void main(String args[])

    {

B subOb = new B(1, 2);

subOb.show();

}

}
```

OUTPUT
i in superclass: 1
i in subclass: 2

Creating multiple hierarchy

```
class A
{
int x;
A(int p)
{
System.out.println("Superclass A ");
x=p;
}
}
class B extends A
{
int y;
B(int p,int q)
{
super(p);
System.out.println("B Subclass of A");
y=q;
}

}
```

```
class C extends B
{
int z;
C(int p,int q,int r)
{
super(p,q);
System.out.println("C Subclass of A");
z=r;
}


}

class Mulinh{

public static void main(String args[])
    {

    C ob=new C(10,20,30);
      System.out.println("x="+ob.x);
      System.out.println("y="+ob.y);
      System.out.println("z="+ob.x);
          }  }
```

```
Superclass A
B Subclass of A
C Subclass of A
x=10
y=20
z=10
```

Protected members

- Protected members are declared by prefixing the access specifierc protected.

  protected datatype member;

- The protected member in a class can be accessed by

  – any class within the **same** package.

  – direct **sub-classes in other package** also.

Protected members(contd;)

- If you want to allow an element(member) to be **seen** <u>outside your current package, but only to classes that subclass your class directly</u>, then declare that element (member) **protected.**

- **Eg.**

class A

{

protected int c;   //protected variable

int a;

private char b;

public float f;

protected void add()   //protected method

{   //statements

}

//methods and statements

}

Reference

- Herbert Schildt, Java: The Complete Reference, 8/e, Tata McGraw Hill, 2011.