Java Package

Agenda:

Packages & API

(User defined and Built-in Packages)

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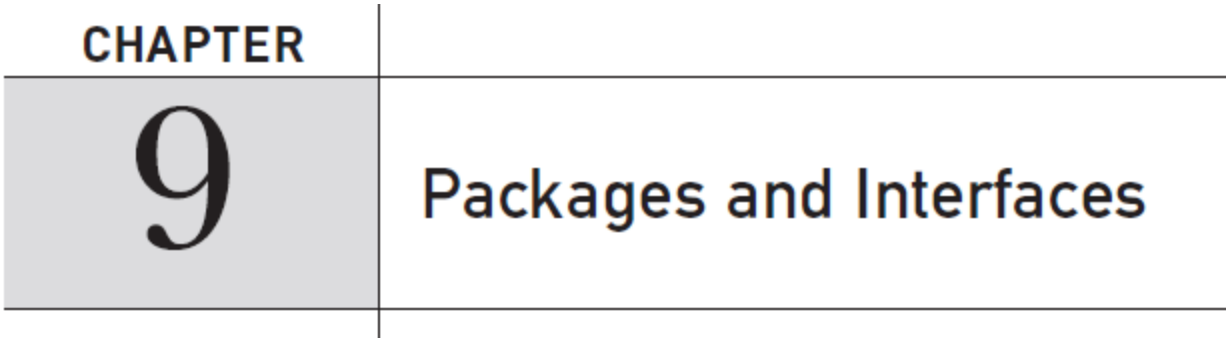
If you import a package, sub-packages will not be imported.

Reference Text : Chap. - 9

Packages and Interface



Key Concepts:

- **Packages basis:**
- **Importing Packages**
- **Sub-package**
- **Built-in Packages**
- **Hands on Session on Packages**
- **Miscellaneous : Assignment**

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Java : Package

- A **java package** is a group of similar types of ***classes, interfaces*** and ***sub-packages***.
- There are many built-in packages such as ***java, lang, awt, javax, swing, net, io, util, sql etc.***

❖ **Advantage of Java Package**

- ✓ Java package is used to categorize the classes and interfaces so that they can be easily maintained.
- ✓ Java package provides access protection.
- ✓ Java package removes naming collision.

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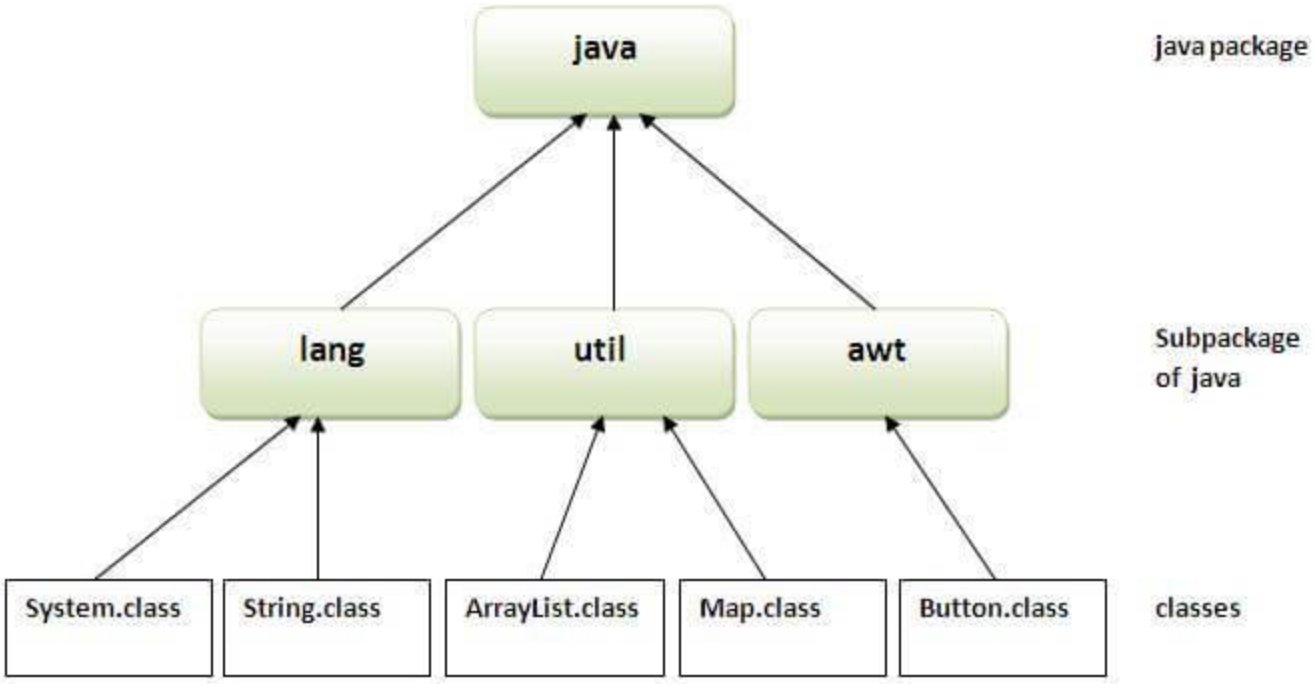
Package - Hierarchy



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Package - Category

- Package in java can be categorized in two form,
- ***User-defined package:*** ***p1*** & ***p2*** and

```
package p1;
public class Simple{
public static void main(String args[]){
System.out.println("package p1");
```

```
package p2;
public class A1{
 public void msg(){
        System.out.println("Hello p1 A1");
 }
```

- ***Built-in package : java.util***

```
import java.util.Scanner;

class MyClass {
  public static void main(String[] args) {
    Scanner myObj = new Scanner(System.in);
    System.out.println("Enter username");
```

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Java Packages & API:

User Defined Packages

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Java : Package

The ***package*** keyword is used to create a package in java.

```
//save as Simple.java
package p1;
public class Simple{
public static void main(String args[]){
System.out.println("package p1");
        }
}
```

A package may contains one or more class, sub-packages or interfaces

```
package p2;
public class A1{
  public void msg(){
          System.out.println("Hello p1 A1");
  }
  public static void main(String args[]){
    System.out.println(" package p2");

  }
}
 class A2{
  public void msg(){
          System.out.println("Hello p1 A2");
  }
}
```

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ACCESS PACKAGE FROM OUTSIDE

There are three ways to access the package from outside the package.

1. **import package.*;**

   Ex. – import pack1.*;

2. **import package.classname;**

   Ex. – import pack1.A;

3. **fully qualified name.**

   Ex. –pack1.A ob=new pack1.A();

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Package Access: Access All

- If you use package.* then all the classes and interfaces of this package will be accessible but not subpackages.
- The import keyword is used to make the classes and interface of another package accessible to the current package.

```
package p1;
public class A1{
  public void msg(){
        System.out.println("Hello p1 A1");
  }
}
 class A2{
  public void msg(){
        System.out.println("Hello p1 A2");
  }
}
```

```
package p2;
import p1.*;
class B{
  public static void main(String args[]){
        A1 obj 1= new A1();
        obj1.msg();

        A2 obj2 = new A2();
        obj2.msg();
  }
}
```

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Package Access: Access Specific

If you import package.classname then only declared class of this package will be accessible.

```
package p1;
public class A1{
  public void msg(){
        System.out.println("Hello p1 A1");
  }
}
 class A2{
  public void msg(){
        System.out.println("Hello p1 A2");
  }
}
```

```
package p2;
import p1.A1;
//import p1.A2;
class B{
  public static void main(String args[]){
        A1 obj 1= new A1(); //Okay
        obj1.msg();

        A2 obj2 = new A2(); //Error
        obj2.msg();
  }
}
```

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Package Access: fully qualified name

- If you use fully qualified name then only declared class of this package will be accessible. Now there is no need to import. But you need to use fully qualified name every time when you are accessing the class or interface.
- It is generally used when two packages have same class name e.g. java.util and java.sql packages contain Date class.

```
//save by A.java
package pack;
public class A{
  public void msg(){System.out.println("Hello");}
}
```

```
Output:Hello
```

```
//save by B.java
package mypack;
class B{
  public static void main(String args[]){
   pack.A obj = new pack.A();//using fully qualified
   obj.msg();
  }
}
```

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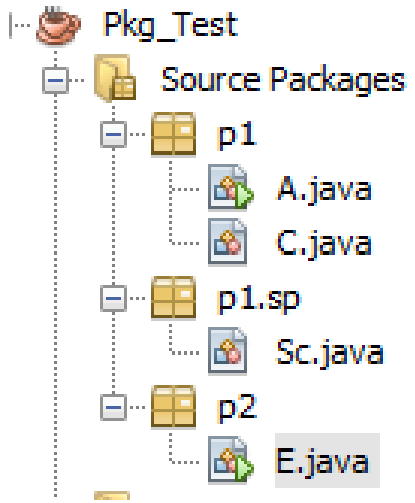
Package Access: sub-package

- ***If you import a package, subpackages will not be imported.***
- Package inside the package is called the subpackage. It should be created to categorize the package further.
- If you import a package, all the classes and interface of that package will be imported ***excluding the classes and interfaces of the sub-packages***.
- Hence, you need to import the sub-package as well.




```
1  package p2;
2  import p1.*;
3  //import p1.sp.*;
4  public class E {
5      public static void main(String[] args) {
6          System.out.println("Welcome to p2!");
           Sc ob=new Sc();
8              ob.show();
```

Package Access: sub-package- Problem

- ***If you import a package, sub-packages will not be imported.***

```
package p1;
public class A1{
  public void msg(){
          System.out.println("Hello p1 A1");
  }
}
```

```
package p1.sp;
public class A2{
  public void msg(){
          System.out.println("Hello p1 SP A2");
  }
}
```

```
package p2;
import p1.*;

class B{
  public static void main(String args[]){

    A1 obj = new A1();  // Okay
    obj.msg();

    A2 obj = new A2(); // Error
    obj.msg();
  }
}
```

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Package Access: sub-package - Solution

- ***If you import a package, sub-packages will not be imported.***

```
Package p1;
public class A1{
  public void msg(){
          System.out.println("Hello p1 A1");
  }
}
```

```
Package p1.sp;
public class A2{
  public void msg(){
          System.out.println("Hello p1 SP A2");
  }
}
```

```
package p2;
import p1.*;
import p1.sp.*;

class B{
  public static void main(String args[]){
   A1 obj = new A1();  // Okay
   obj.msg();
   A2 obj = new A2(); // Error
   obj.msg();
  }
}
```

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Package: public class

- There can be only one public class in a java source file and it must be saved by the public class name.

```
//save as C.java otherwise Compilte Time Error


class A{}

class B{}

public class C{}
```

Rule: There can be only one public class in a java source file and it must be saved by the public class name.

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How to put two public classes in a package?

- If you want to put two public classes in a package, Then you have to create two java source files containing one public class, but keep the package name same. For example:

```
//save as A.java

package javatpoint;
public class A{}
```

```
//save as B.java

package javatpoint;
public class B{}
```

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Java Packages & API:

Built-in Packages

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Java Packages & API: Built-in Packages

Built-in Packages

The Java API is a library of prewritten classes, that are free to use, included in the Java Development Environment. The library contains components for managing input, database programming, and much much more. The complete list can be found at Oracles ebsite: https://docs.oracle.com/javase/8/docs/api/.

The library is divided into **packages** and **classes**. Meaning you can either import a single class (along with its methods and attributes), or a whole package that contain all the classes that belong to the specified package.
To use a class or a package from the library, you need to use the import keyword:

Syntax

```
import package.name.Class;   // Import a single class
import package.name.*;   // Import the whole package
```

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Java Packages & API: Built-in Packages

Import a Class

If you find a class you want to use, for example, the Scanner class, **which is used to get user input**, write the following code:

Example

```
import java.util.Scanner;
```

In the example above, java.util is a package, while Scanner is a class of the java.util package.

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Java Packages & API: Built-in Packages

To use the Scanner class, create an object of the class and use any of the available methods found in the Scanner class documentation. In our example, we will use the nextLine() method, which is used to read a complete line:

Example

Using the `Scanner` class to get user input:

```
import java.util.Scanner;

class MyClass {
  public static void main(String[] args) {
    Scanner myObj = new Scanner(System.in);
    System.out.println("Enter username");

    String userName = myObj.nextLine();
    System.out.println("Username is: " + userName);
  }
}
```

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Input Types

In the example above, we used the nextLine() method, which is used to read Strings. To read other types, look at the table below:

Method	Description
`nextBoolean()`	Reads a `boolean` value from the user
`nextByte()`	Reads a `byte` value from the user
`nextDouble()`	Reads a `double` value from the user
`nextFloat()`	Reads a `float` value from the user
`nextInt()`	Reads a `int` value from the user
`nextLine()`	Reads a `String` value from the user
`nextLong()`	Reads a `long` value from the user
`nextShort()`	Reads a `short` value from the user

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Java Packages & API: Built-in Packages

In the example below, we use different methods to read data of various types:

```
import java.util.Scanner;

class MyClass {
  public static void main(String[] args) {
    Scanner myObj = new Scanner(System.in);

    System.out.println("Enter name, age and salary:");

    // String input
    String name = myObj.nextLine();

    // Numerical input
    int age = myObj.nextInt();
    double salary = myObj.nextDouble();

    // Output input by user
    System.out.println("Name: " + name);
    System.out.println("Age: " + age);
    System.out.println("Salary: " + salary);
  }
}
```

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Java Packages & API: Built-in Packages

Here, we will use the nextInt, NextFloat and nextLine() method, which is used to read a integer number, a floating point number and a complete line:

```
import java.util.Scanner; // import the Scanner class

class MyClass {
  public static void main(String[] args) {
    Scanner myObj = new Scanner(System.in);
    String userName;
    int userAge, Float userSalary;

          System.out.println("Enter username");
            userName = myObj.nextLine();
           System.out.println("Enter userAge");
            userAge = myObj.nextInt();
            System.out.println("Enter userSalary");
            userSalary = myObj.nextInt();

    System.out.println("Username is: " + userName);
   System.out.println(" userAge is: " + userAge);
   System.out.println(" userSalary is: " + userSalary);
  }
}
```

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Java Packages & API: Built-in Packages

Import a Package

There are many packages to choose from. In the previous example, we used the Scanner class from the java.util package. This package also contains date and time facilities, random-number generator and other utility classes.

To import a whole package, end the sentence with an asterisk sign (*). The following example will import ALL the classes in the java.util package:

Example

```
import java.util.*;
```

```
import java.util.Date;
import java.io.*;

import java.lang.*;
```

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Java Package

This part is cling to a

Hands on session

on

Java Package, Sub Packages & Access Protections

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Java Package

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Java Package & Sub Packages

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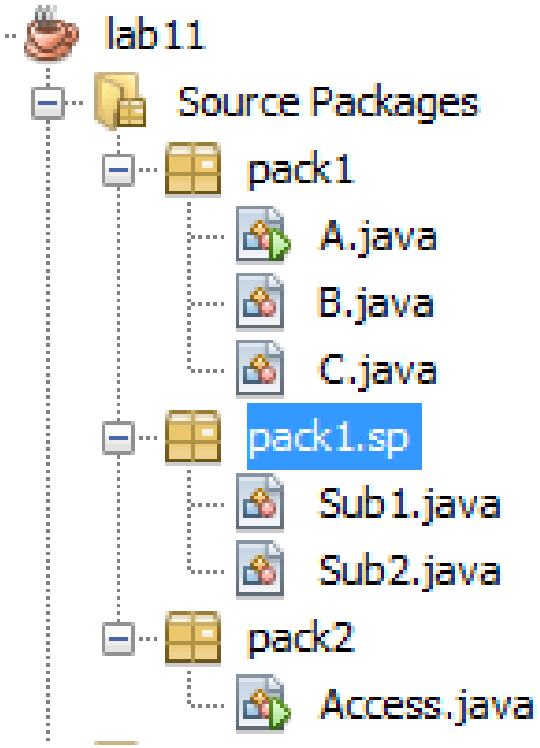
Java Package:
Package & Sub-package

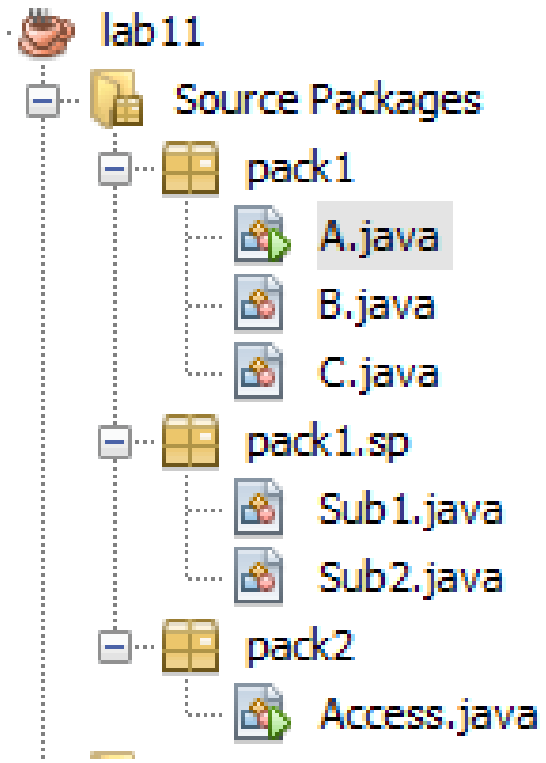
Project Structure :




```
package pack2;
import pack1.*;
import pack1.B;
import pack1.sp.*;
public class Access {
    public static void main(String[] args) {
        A a =new A();
           a.show();
        B b =new B();
            b.show();
        pack1.C c =new pack1.C();
                    c.show();
       Sub1 ob1=new Sub1();
              ob1.show();
      Sub2 ob2=new Sub2();
              ob2.hello();
  }
```

Java Package:
Package & Sub-package

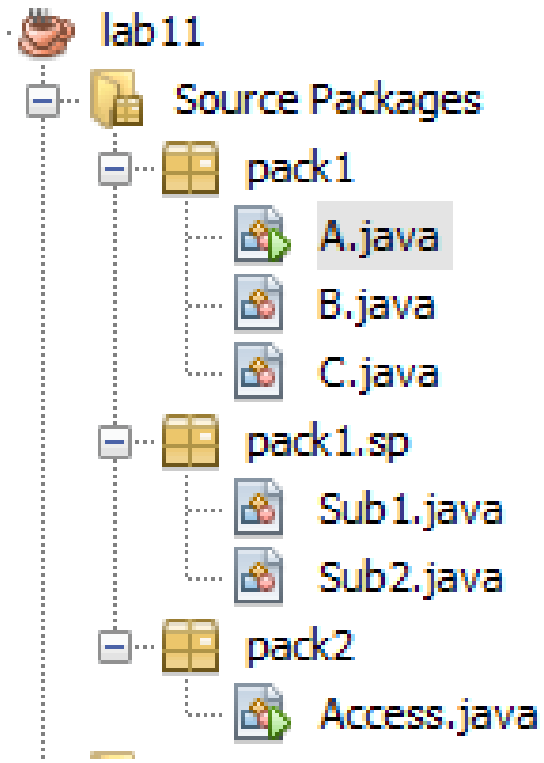
Project Structure :




```
package pack1;
public class A {
      public void show(){
        System.out.println("Hello Pack 1 A");
    }
     public static void main(String[] args) {
        A a =new A();
          a.show();
     }
}

class P {
      public void show(){
        System.out.println("Hello Pack 1 A");
    }
}
```

Java Package:
Package & Sub-package

Project Structure :

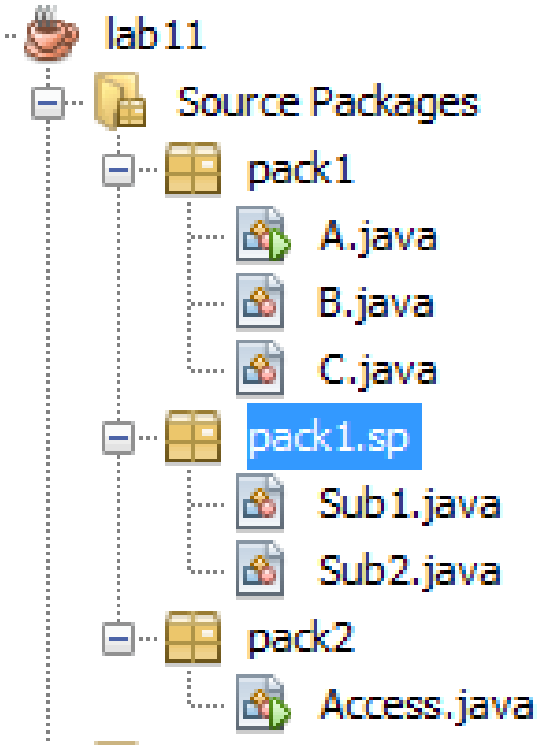



```
package pack1;

public class B  {
        public void show(){
        System.out.println("Hello Pack 1 B");
    }
}
```

```
package pack1;

public class C {
    public void show(){
        System.out.println("Hello Pack 1 C");
    }
}
```

Java Package:
Package & Sub-package

Project Structure :

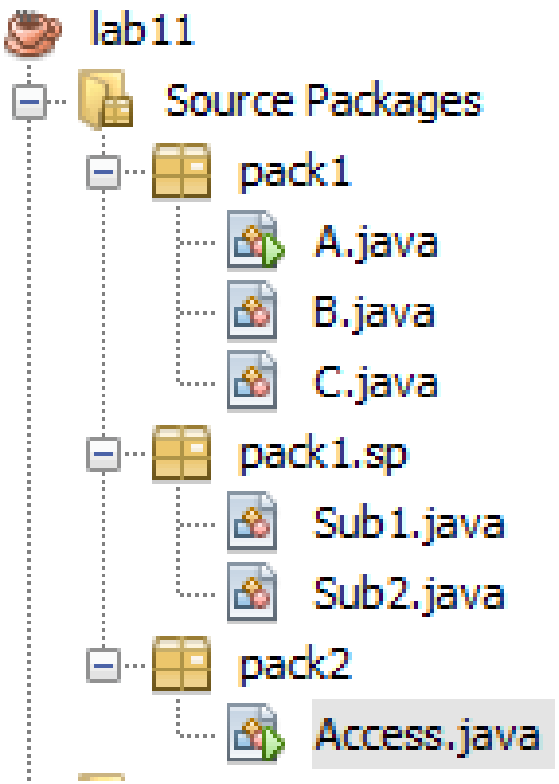



```java
package pack1.sp;

public class Sub1 {
    public void show(){
        System.out.println("Hello SP");
    }
}
```

```java
package pack1.sp;

public class Sub2 {
    public void hello(){
        System.out.println("Hello SP hello");
    }
}
```

Java Package:
Package & Sub-package

Project Structure :




```
package pack2;
import pack1.*;
import pack1.B;
import pack1.sp.*;
public class Access {
    public static void main(String[] args) {
        A a =new A();
           a.show();
        B b =new B();
            b.show();
        pack1.C c =new pack1.C();
                    c.show();
       Sub1 ob1=new Sub1();
              ob1.show();
      Sub2 ob2=new Sub2();
              ob2.hello();
  }
```

Java Package

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Access Protection

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Java Package:
Class Member Access

Package	Class	Private	Default/No Modifier	Protected	Public
P1	A1	Yes	Yes	Yes	Yes
	A2 Extends A1	No	Yes	Yes	Yes
	A3	No	Yes	Yes	Yes
p2	B1 extends A1	No	YeNo	Yes	Yes
	B2	No	No	No	Yes

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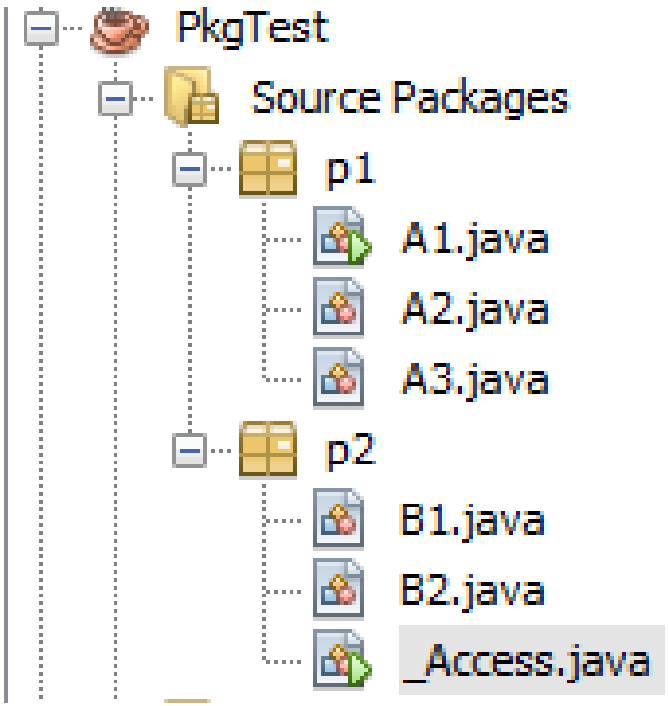
Java Package:
Class Member Access

Project Structure



Package	Class	Private	Default/ No Modifier	Protected	Public
p1	A1	Yes	Yes	Yes	Yes
	A2 Extends A1	No	Yes	Yes	Yes
	A3	No	Yes	Yes	Yes
p2	B1 extends A1	No	YeNo	Yes	Yes
	B2	No	No	No	Yes
	Access				

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Java Package:
Class Member Access

```
package p1;

public class A1 {
        private int pri_var=1;
                int nm_var=2;
      protected int pro_var=3;
      public      int pub_var=4;

      public void show_var(){
            System.out.println(" -- Same Class : A -- ");
            System.out.println("Private Variable:" +pri_var);
            System.out.println("Default/No modifier Variable:" +nm_var);
            System.out.println("Protected Variable:" +pro_var);
            System.out.println("Public Variable:" +pub_var);
      }
}
```

```
-- Same Class : A1 --
Private Variable:1
Default/No modifier Variable:2
Protected Variable:3
Public Variable:4
```

Java Package:
Class Member Access

```
package p1;

public class A2  extends A1 {
        public void show_var(){
                System.out.println(" -- Same Pkg Sub Class : B----");
               // System.out.println("Private Variable:" +pri_var);
                System.out.println("Default/No modifier Variable:" +nm_var);
                System.out.println("Protected Variable:" +pro_var);
                System.out.println("Public Variable:" +pub_var);
        }
}
```

```
-- Same Pkg Sub Class : A2----
Default/No modifier Variable:2
Protected Variable:3
Public Variable:4
```

Java Package:
Class Member Access

```
package p1;

public class A3 {
        public void show_var(){
                A1 ob=new A1();
                System.out.println(" -- Same Pkg Non Sub Class : C----");
                //System.out.println("Private Variable:" +ob.pri_var);
                System.out.println("Default/No modifier Variable:" +ob.nm_var);
                System.out.println("Protected Variable:" +ob.pro_var);
                System.out.println("Public Variable:" +ob.pub_var);

        }
}
```

```
-- Same Pkg Non Sub Class : A3----
Default/No modifier Variable:2
Protected Variable:3
Public Variable:4
```

Java Package:
Class Member Access

```
package p2;
import p1.A1;
public class B1 extends A1 {
    public void show_var(){
            System.out.println(" -- Diff Pkg Sub Class : B1 ----");
            //System.out.println("Private Variable:" +pri_var);
            //System.out.println("Default/No modifier Variable:" +nm_var);
            System.out.println("Protected Variable:" +pro_var);
            System.out.println("Public Variable:" +pub_var);

    }
}
```

```
-- Diff Pkg Sub Class : B1 ----
Protected Variable:3
Public Variable:4
```

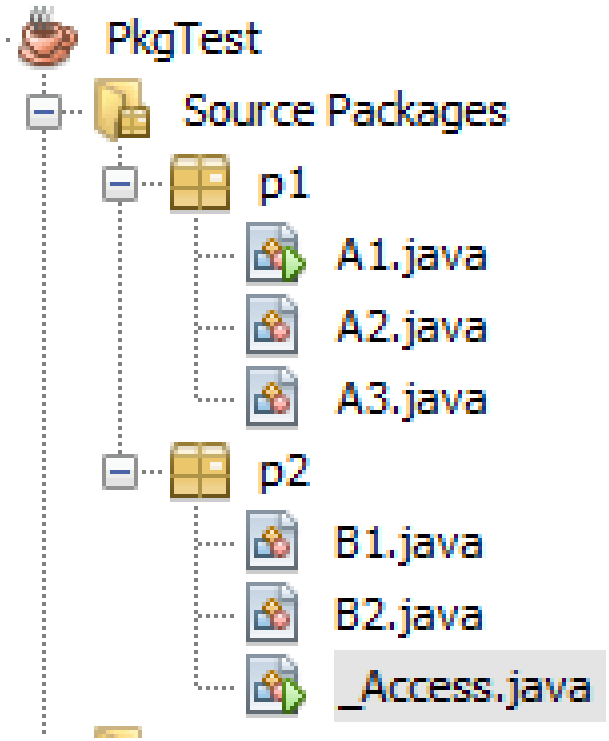
Java Package:
Class Member Access

```
package p2;
import p1.*;

public class B2 {
	public void show_var(){
		A1 ob=new A1();
		System.out.println(" -- Diff Pkg Non Sub Class : B2----");
		//System.out.println("Private Variable:" +ob.pri_var);
		//System.out.println("Default/No modifier Variable:" +ob.nm_var);
		//System.out.println("Protected Variable:" +ob.pro_var);
		System.out.println("Public Variable:" +ob.pub_var);
	}
}
```

```
-- Diff Pkg Non Sub Class : B2----
Public Variable:4
```

Java Package:
Class Member Access




```
package p2;
import p1.*;
public class _Access {
    public static void main(String[] args) {
      A1 ob1 =new A1();
        ob1.show_var();
      A2 ob2 =new A2();
        ob2.show_var();
      A3 ob3 =new A3();
        ob3.show_var();
      B1 ob4 =new B1();
        ob4.show_var();
      B2 ob5 =new B2();
        ob5.show_var();
    }
}
```

Java OOP : Miscellaneous

Miscellaneous

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Java OOPs Miscellaneous

Assignment: These concepts keeps as HW for the students

- **Inner class**
- Dynamic Binding
- Java Recursion
- Java Enum
- Java Dates
- Java Math class
- Wrapper classes – Auto boxing and Unboxing
- **Casting–Up-casting and Down-Casting**
- The Object Class in Java
- Object Cloning
- javadoc tool - Creating API Document

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