CS205 Object Oriented Programming in Java

Module 2 - **Core Java Fundamentals (Part 7)**

Prepared by

Renetha J.B.
AP
Dept.of CSE,
Lourdes Matha College of Science and Technology

Topics

- Core Java Fundamentals:

✓ **Returning Objects**

✓ **Recursion**

✓ **Access Control**

✓ **Static Members**

Returning objects

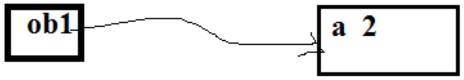
- A method can **return any type of data,**
  - **Primitive data (int ,float, char, double etc.)**
  - class types(objects) that you create.
  - etc.

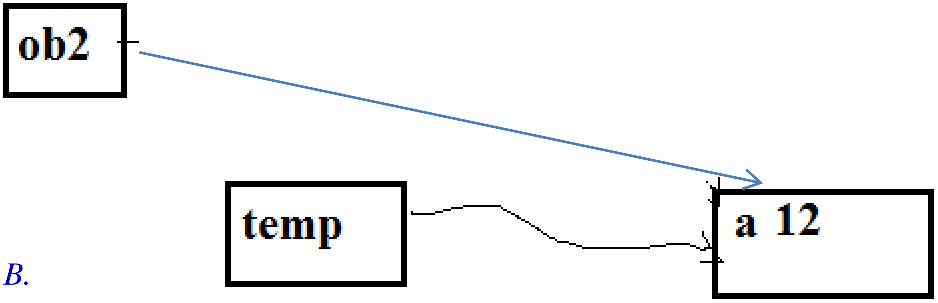
```
// Returning an object.
class Test {
    int a;
    Test(int i)
    {
        a = i;
    }
Test increase()
{
Test temp = new Test(a+10);
return temp;
}
```

```
class RetOb {
public static void main(String args[]) {
Test ob1 = new Test(2);
Test ob2;
ob2 = ob1.increase();
System.out.println("ob1.a: " + ob1.a);
System.out.println("ob2.a: " + ob2.a);
ob2 = ob2.increase ();
System.out.println(“increase ob2.a: ” +ob2.a);
  }
 }
```

OUTPUT

```
ob1.a: 2
ob2.a: 12
increase ob2.a: 22
```





Recursion

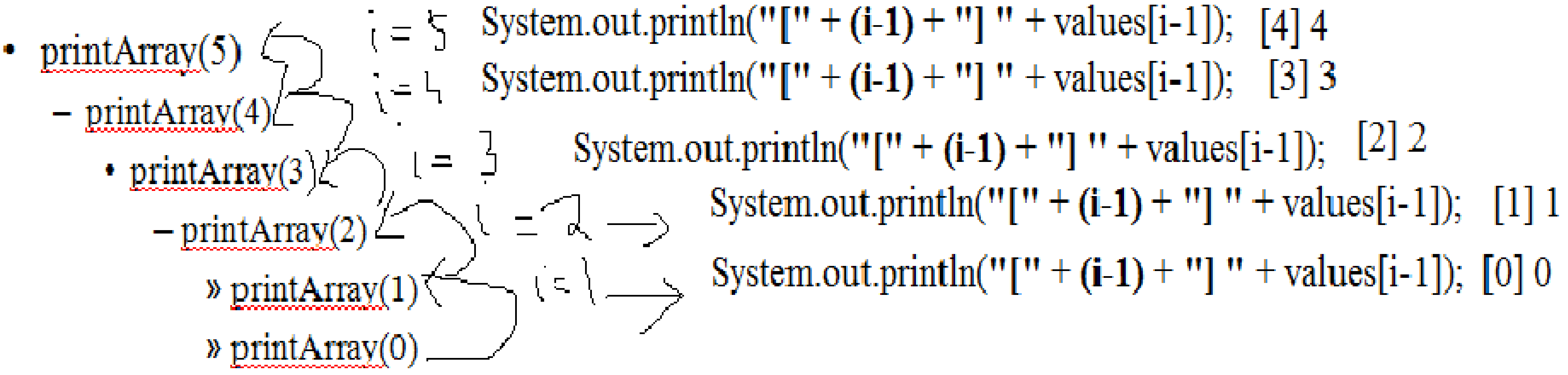
- Recursion is the process of **defining something in terms of itself.**
- A method that calls itself is called *recursive function.*

```
// A simple example of recursion.
class Factorial {
    int fact(int n)
     {
        int result;
        if(n==1)
          return 1;
        result = n* fact(n-1) ;
        return result;
}
}
class Recursion {
public static void main(String args[]) {
Factorial f = new Factorial();
int s= f.fact(3)
System.out.println("Factorial of 3 is " + s);
}
}
```

Example

```
class RecTest {
int values[];
RecTest(int i) {
values = new int[i];
}
void printArray(int i) {
if(i==0)
     return;
else
    printArray(i-1);
System.out.println("[" + (i-1) + "] " + values[i-1]);
}
}
```

```
class Recursion2 {
public static void main(String args[])
    {
RecTest ob = new RecTest(5);
int i;
for(i=0; i<5; i++)
    ob.values[i] = i;
ob.printArray(5);
}
}
```



- printArray(5)
  - printArray(4)
    - printArray(3)
      - printArray(2)
        - » printArray(1)
        - » printArray(0)

i = 5 System.out.println("[" + (i-1) + "] " + values[i-1]); [4] 4

i = 4 System.out.println("[" + (i-1) + "] " + values[i-1]); [3] 3

i = 3 System.out.println("[" + (i-1) + "] " + values[i-1]); [2] 2

i = 2 → System.out.println("[" + (i-1) + "] " + values[i-1]); [1] 1

i = 1 → System.out.println("[" + (i-1) + "] " + values[i-1]); [0] 0

```
OUTPUT
[0] 0
[1] 1
[2] 2
[3] 3
[4] 4
[5] 5
```

Prepared by Renetha J.B.

Access Control

- Through encapsulation, we can **control** what parts of a program can **access the members** of a class.
  - By controlling access, you can prevent misuse.
- How a member can be accessed is determined by the *access specifier that modifies its declaration*
- Java’s access specifiers are
  - ✓ **public**
  - ✓ **private**
  - ✓ **protected**
  - ✓ ***default***

Access Control(contd.)

- When a **member** of a class is modified by the **public** specifier, then that member can be accessed by any other code. (ACCESSIBLE TO ALL)
  - public int i;
- When a member of a class is specified as **private**, then that member can only be accessed by any members of the same class.
  - private int a;

Access Control(contd.)

- When a member of a class is specified as **protected** , then that member can be accessed within the package and by any of its subclasses.

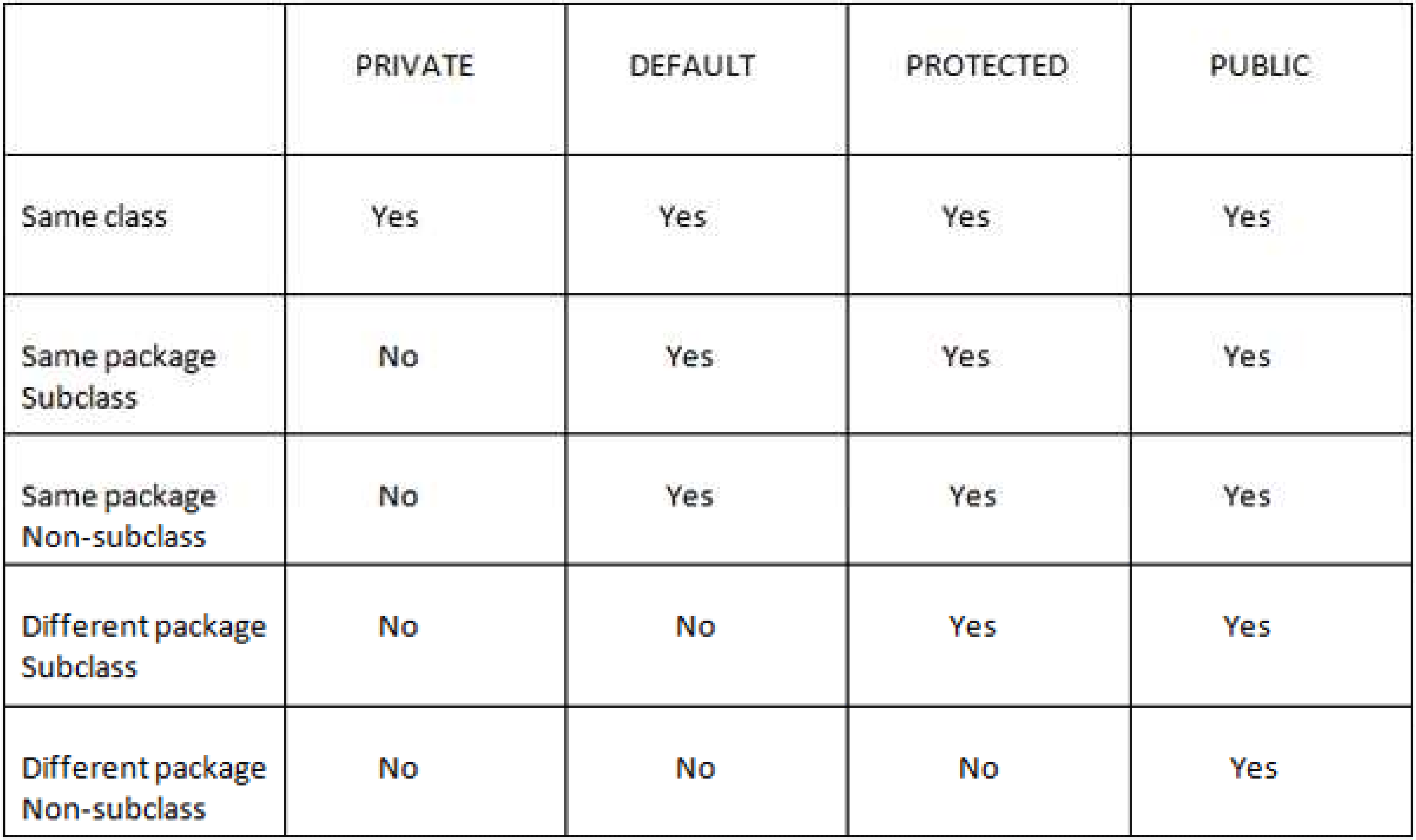
  protected char c;

- When no access specifier is there, then its access specifier is **default.**
  - It can be accessed within its own package, but **cannot be accessed outside of its package**

int c;

Access sprcifier-E.g.

```
class A{
    public int i;

    private double j;

    protected char c;

    float f;                        //default access

    public int myMethod(int a, char b)          //public method

    {   //..

    }

}
```



	PRIVATE	DEFAULT	PROTECTED	PUBLIC
Same class	Yes	Yes	Yes	Yes
Same package Subclass	No	Yes	Yes	Yes
Same package Non-subclass	No	Yes	Yes	Yes
Different package Subclass	No	No	Yes	Yes
Different package Non-subclass	No	No	No	Yes

SAME CLASS

SAME PACKAGE,

SAME PACKAGE
,
ANY SUBCLASS

ALL

```
class Test
{
int a;              // default access
public int b;       // public access
private int c;      // private access

void setc(int i)              //setter
{
c = i;
}

int getc()          //getter
{
return c;
}   }
```

```
class AccessTest {
public static void main(String args[]) {
Test ob = new Test();
ob.a = 10;
ob.b = 20;
// ob.c = 100; // Error! // PRIVATE
// You must access private variable c
    //through its methods
ob.setc(100);          // OK
System.out.println("a=“+ ob.a);
System.out.println("b="ob.b”);
System.out.println(“c= " + ob.getc() );
}
}
```

static Members

- Usually we access the member of another class using object. *Syntax is:* objectname.member**;**
- If we want to access a member of another class without using object, then we have to make it a **make it a static member.**
  - Static class member is **independent of any object** of that class. We can make a member static by preceding the member declaration with the keyword **static.**

static datatype member**;**

static Members(contd.)

- When a member is declared **static,** it can be accessed before any objects of its class are created, and without reference to any object.
- Static member can be accessed using

```
classname.member;
```

static Members(contd.)

- The most common example of a **static member is** main function.
  - main( ) is declared as static because it must be called before any objects is created.
- Instance variables declared as **static** are global variables.
- When objects of its class are declared, separate copy of a static variable is NOT made.
- All instances(objects) of the class **share the same static variable.**

static Members(contd.)

- Methods declared as **static(static methods)** have several restrictions**:**
  - **static methods** can only call other **static methods.**
  - **static methods** must only access **static data.**
  - **static methods** cannot refer to **this** or **super.**

static Members(contd.)

- If we need to do computation to initialize your static variables, we can **declare a static block** that gets executed exactly once, when the class is first loaded.

```
// Demonstrate static variables, methods, and blocks.
class UseStatic {
static int a = 3;
static int b;
static void show(int x) {
System.out.println("x = " + x);
System.out.println("a = " + a);
System.out.println("b = " + b);
}
static {
System.out.println("Static block initialized.");
b = a * 4;
}
public static void main(String args[])
{show(42);
}
}
```

```
OUTPUT
Static block initialized.
x = 42
a = 3
b = 12
```

Working of e.g. code

- As soon as the **UseStatic** class is loaded, all of the static statements are run.
  - First, static member **a** is set to 3,
  - then the static block executes, which prints a message and then initializes b to a * 4 or 12.
  - Then main( ) is called, which calls show( ), passing 42 to x.
  - The three println( ) statements in show refer to the two static variables a and b, as well as to the local variable x.

- if we want to call a **static method from outside its class, we** can do so using the following general form:

classname.method( )

- *Here classname is the name of the class in which the* ***static method is declared.***

Non-static method invocation

```
class Demo {
int a = 42;
int b = 99;
void callme()
{
System.out.println("a = " + a);
}
}
class Sample {
public static void main(String args[]) {
Demo dm=new Demo ();
dm.callme();
System.out.println("b = " + dm.b);
} }
```

static method invocation

```
class StaticDemo {
static int a = 42;
static int b = 99;
static void callme()
{
System.out.println("a = " + a);
}
}
class StaticByName {
public static void main(String args[])
{
StaticDemo.callme();
System.out.println("b = " + StaticDemo.b);
} }
```

Nonstatic members

```
class Demo {
int a = 42;
int b=5;
void callme()
{
System.out.println("a = " + a);
}


}
class Sample {
public static void main(String args[])
     {
Demo dm=new Demo();
dm.callme();
System.out.println("b = " + dm.b);
} }
```

static members

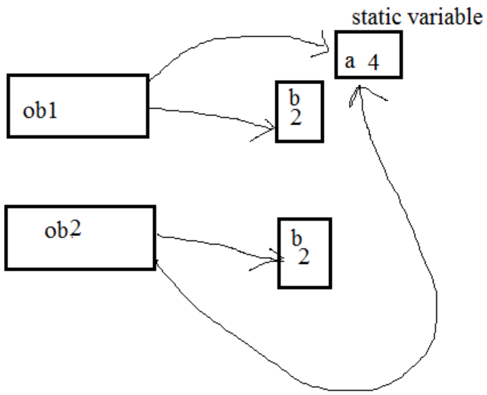
```
class StaticDemo {
int a = 42;
static int b = 5;
static void callme()
{
System.out.println("a = " + a);
}
}
class StaticByName {
public static void main(String args[])
{
StaticDemo.callme();
System.out.println("b = " + StaticDemo.b);
} }
```

Prepared by Renetha J.B.

```
class Sample
{
static int a = 0;
int b;
Sample()
{
    b=0;

}
void callme()
{

a=a+2;
b=b+2;
System.out.println("static after +2 a = " + a);
System.out.println("b after +2 = " + b);
}
}
```

```
OUTPUT
ob1
static after +2 a = 2
b after +2 = 2
ob2
static after +2 a = 4
b after +2 = 2
```

```
class Samplestat {
public static void main(String args[])
{
Sample ob1=new Sample();
System.out.println("ob1");
ob1.callme();

Sample ob2=new Sample();
System.out.println("ob2");
ob2.callme();


} }
```



Reference

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