OBJECT ORIENTED PROGRAMMING WITH JAVA

Dr. N MEHALA
Department of Computer Science and Engineering

Anonymous Inner classes

- ***Another category of local inner classes***
- ***Classes without any name i.e classes having no name***
- ***Can either implements an interface or extends a class.***
- ***Can not have more than one instance active at a time.***
- ***Whole body of the class is declared in a single statement ending with ;***

Cont…

- Syntax [If extending a class]

[variable_type_superclass =] new superclass_name() {
// properties and methods
} [;]

- Syntax [If implementing an interface]

[variable_type_reference =] new reference_name() {
// properties and methods
} [;]

Anonymous Inner Class Example


```
class A
{
private int a;
A(int a)
{
this.a =a;
}
void show()
{
System.out.println("a="+a);
} // End of show()
}// End of class A
```

```
class innertest1
{
public static void main(String args[])
{
```

Anonymous inner class extending super class A

```
A a1 = new A(20){
        public void show()
        {
        super.show();
        System.out.println("Hello");
        }
        public void display()
        {
        System.out.println("Hi");
        }
        };
a1.show();
// a1.display();
}
}
```

Calling show from inner class

```
interface X
{
int sum(int a,int b);
int mul(int x,int y);
}
class innertest2
{
public static void main(String args[])
{
```

Anonymous inner class implementing an interface

```
X x1 = new X()
        {
        public int sum(int a,int b)
        {
        return a+b;
        }
        public int mul(int a,int b)
        {
        return a*b;
        }
    };
System.out.println(x1.sum(10,20));
System.out.println(x1.mul(10,20));
}// End of main
}// End of innertest2
```

Home Exercise

- Write 5 BOX Comparator classes using anonymous inner classes.

Packages

- Classes can be grouped in a collection called *package*
- ***Package names are dot separated, e.g., java.lang.***

- Java's standard library consists of hierarchical packages, such as java.lang and java.util

  http://java.sun.com/j2se/1.4.2/docs/api

- Main reason to use package is to guarantee the uniqueness of class names
  - classes with same names can be encapsulated in different packages
  - tradition of package name: reverse of the company's Internet domain name e.g. hostname.com -> com.hostname

i.e.Packages Avoid name space collision. There can not be two classes with same name in a same Package But two packages can have a class with same name.

- ***Exact Name of the class is identifed by its package structure. << Fully Qualified Name>>***

java.lang.String ; java.util.Arrays; java.io.BufferedReader ; java.util.Date

Why do we need packages?

(1) Higher efficiency, easy to manage.

(2) Safety. Via “package” modifier, you can define variables only usable within package.

(3) Each to name classes and variables. Do not have to worry about a name like “Helloworld” has been used by somebody somewhere in the world.

General format

- The general format of a Java source file is as follows:

  [package xxx;]

  [some import statements;]

  a public class;

  [some package private classes;]

Java 2 Platform Packages	
java.applet	Provides the classes necessary to create an applet and the classes an applet uses to communicate with its applet context.
java.awt	Contains all of the classes for creating user interfaces and for painting graphics and images.
java.awt.color	Provides classes for color spaces.
java.awt.event	Provides interfaces and classes for dealing with different types of events fired by AWT components.
java.beans	Contains classes related to developing *beans* -- components based on the JavaBeans™ architecture.
java.beans.beancontext	Provides classes and interfaces relating to bean context.
java.io	Provides for system input and output through data streams, serialization and the file system.
java.lang	Provides classes that are fundamental to the design of the Java programming language.
java.math	Provides classes for performing arbitrary-precision integer arithmetic (BigInteger) and arbitrary-precision decimal arithmetic.
java.net	Provides the classes for implementing networking applications.
java.nio	Defines buffers, which are containers for data, and provides an overview of the other NIO packages.
java.rmi	Provides the RMI package.
java.security	Provides the classes and interfaces for the security framework.
java.sql	Provides the API for accessing and processing data stored in a data source (usually a relational database) using the Java™ programming language.
java.text	Provides classes and interfaces for handling text, dates, numbers, and messages in a manner independent of natural languages.
java.util	Contains the collections framework, legacy collection classes, event model, date and time facilities, internationalization, and miscellaneous utility classes (a string tokenizer, a random-number generator, and a bit array).

Packages provided by Java

- java.lang: includes classes like Object, String, System, Math, Thread …
- java.util: Date, Hashtable, Stack, Vector, …
- java.io: for input/output
- java.net: `InetAddress,ServerSocket,URL`
- java.awt: includes classes like Menu, Button, Graphics …
- java.applet: Applet, Audio, …

java.lang is always implicitly imported.

Define Your Own Package

- To be included in a package A, use this statement:

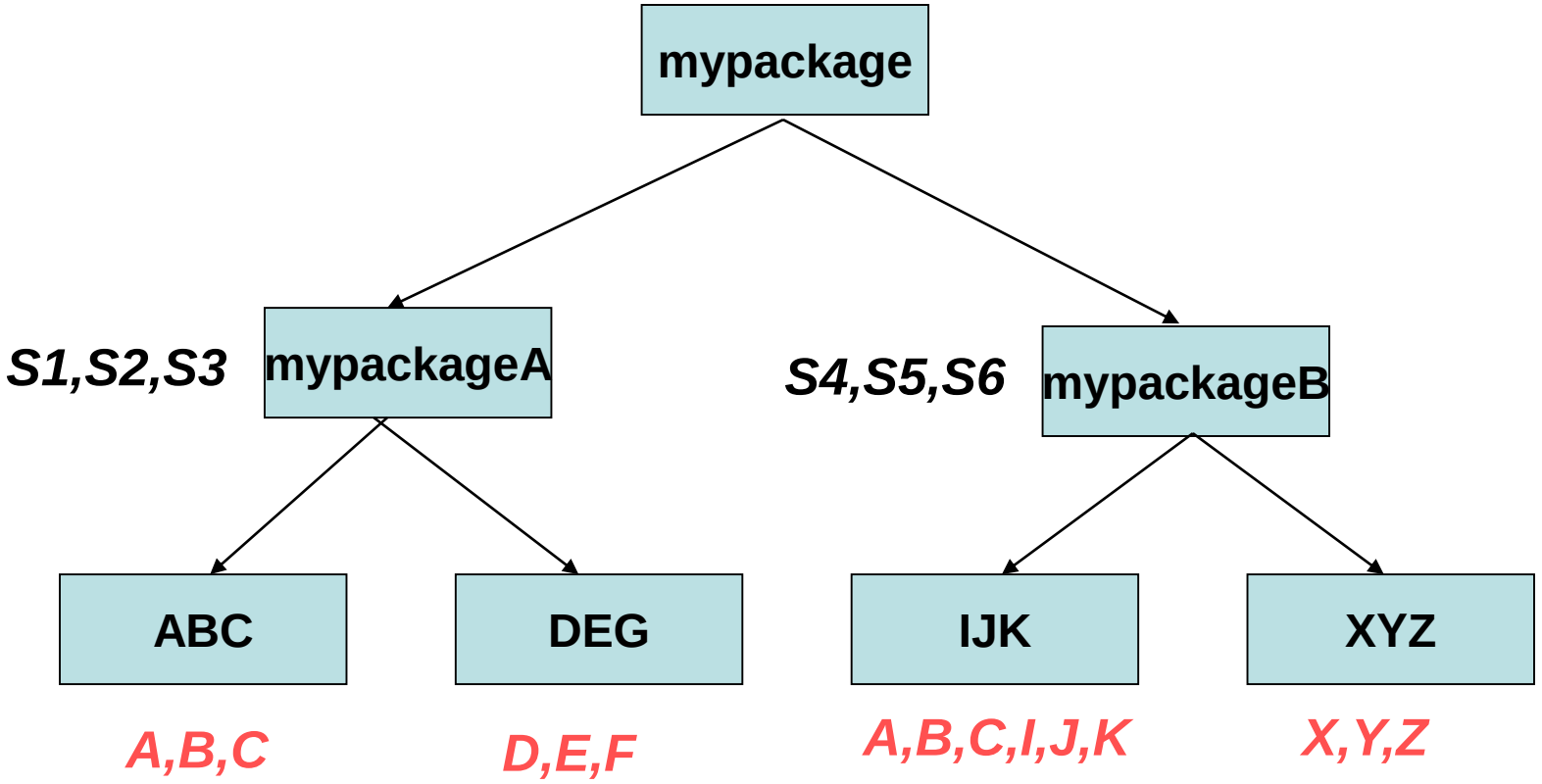
  package A;

  // then define your class

- The package structure must match precisely your directory structure.

  i.e. starting from classes directory, package A corresponds to sub-directory A, all the classes for package A should be put in directory A. A sub-package B of package A corresponds to a sub-directory B of directory A. And so on.

Exercise Creating Packages



Package ABC and IJK have classes with same name.

A class in ABC has name mypackage.mypackageA.ABC.A

A class in IJK has name mypackage.mypackageB.IJK.A

Example

```
package rabbit; //declare belong to rabbit package
public class MotherRabbit{
   public void say(){
       System.out.println("MotherRabbit");
   }}
```

- Create directory rabbit.
- Put this file MotherRabbit.java in directory rabbit
- Compile it.

Add more to this package

```
/*file: SonRabbit.java*/
package rabbit; //declare belong to rabbit package
public class SonRabbit {
    void say() {
      System.out.println(“sonrabbit");
    }
}
```

- Also put this file in rabbit directory
- Compile it.

Create a sub-package for rabbit

```
/* Run1.java */
package rabbit.run; //this is a subpackage of rabbit
public class Run1{
  void run() {
    System.out.println("Run, Hare, Run!");
  }}
```

- Under rabbit directory, create run directory.
- Put Run1.java in run directory.
- Compile it. To import, use:

  import rabbit.run.*

Note, import rabbit.* only imports two classes, not the sub-package run, or its classes.

Importing a package's classes

- There are two ways of using classes from a package. (a) Specify the path, use directly like:

```
public class Example extends java.applet.Applet {  ..  }
```

(b) Use the import statement:

```
import java.applet.Applet; // or  java.applet.*
public class Example extends Applet { … }
```

- Usually, when using *, it will import ALL classes, affect efficiency. Better just import what you want.

Package Structure and Naming

- Package structure matches the tree-like directory structure.
- Naming: if you are developing some package that is useful on the web. You should give it a good name. The naming scheme could be reversal of your web address plus the name.

Variables&Methods Access Protection

- Here is a table of access rights:

	No modifier	private	private protected	protected	public
same class	yes	yes	yes	yes	yes
Same package subclass	yes	no	yes	yes	yes
same package non-subclass	yes	no	no	yes	yes
diff. package subclass	no	no	yes	yes	yes
diff. package non-subclass	no	no	no	no	yes

Class importation (1)

- Two ways of accessing **PUBLIC** classes of another package

1) explicitly give the full package name before the class name.
   - E.g.

```
java.util.Date today = new java.util.Date( );
```

2) import the package by using the `import` statement at the top of your source files (but below package statements). No need to give package name any more.

   - **to import a single class from the java.util package**

```
import java.util.Date;
Date today = new Date( );
```

   - **to import all the public classes from the java.util package**

```
import java.util.*;
Date today = new Date( );
```

   - *** is used to import classes at the current package level. It will NOT import classes in a sub-package**.

Sample class:

```
import javax.swing.*;

public class SampleClass {
   MenuEvent c;
}
```

```
%> javac SampleClass.java
SampleClass.java:4: cannot find symbol
Symbol  : class MenuEvent
Location: class SampleClass
    MenuEvent c;
    ^
1 error
```

MenuEvent is a class in the package `javax.swing.event`, which locates in the package `javax.swing`. You need this statement:

```
import javax.swing.event.*;
```

Class importation (2)

- **What if you have a name conflict?**

  E.g

```
import java.util.*;
import java.sql.*;
Date today = new Date( );    //ERROR:java.util.Date
                             //or java.sql.Date?
```

  - **if you only need to refer to one of them, import that class explicitly**

```
import java.util.*;
import java.sql.*;
import java.util.Date;
Date today = new Date( );   // java.util.Date
```

  - **if you need to refer to both of them, you have to use the full package name before the class name**

```
import java.util.*;
import java.sql.*;
java.sql.Date today = new java.sql.Date( );
java.util.Date nextDay = new java.util.Date( );
```

See this code:

```
import java.lang.Math;

public class importTest {
   double x = sqrt(1.44);
}
```

Compile:

```
%> javac importTest.java
importTest.java:3: cannot find symbol
symbol  : method sqrt(double)
location: class importTest
double x = sqrt(1.44);
           ^
1 error
```

?

For the static members, you need to refer them as
className.memberName

Static importation

- In J2SE 5.0, importation can also be applied on static fields and methods, not just classes. You can directly refer to them after the static importation.
  - E.g. import all static fields and methods of the Math class

```
import static java.lang.Math.*;
double x = PI;
```

  - E.g. import a specific field or method

```
import static java.lang.Math.abs;
double x = abs(-1.0);
```

- Any version before J2SE 5.0 does NOT have this feature!

Encapsulation of classes into a package

- Add a class into a package — two steps:
  1. put the name of the package at the top of your source file

```
package com.hostname.corejava;
public class Employee {
        . . .
}
```

  2. put the files in a package into a subdirectory which matches the full package name

stored in the file "Employee.java" which is stored under "somePath/com/hostname/corejava/"

To emphasize on data encapsulation (1)

Let's see a sample class first

```
public class Body {
   public long idNum;
   public String name = "<unnamed>";
   public Body orbits = null;
   public static long nextID = 0;

   Body( ) {
     idNum = nextID++;
   }

   Body(String bodyName, Body orbitsAround) {
     this( );
     name = bodyName;
     orbits = orbitsAround;
   }
}
```

Problem: all the fields are exposed to change by everybody

To emphasize on data encapsulation (2)

improvement on the previous sample class with data encapsulation

```
public class Body {
   private long idNum;
   private String name = "<unnamed>";
   private Body orbits = null;
   private static long nextID = 0;

   Body( ) {
     idNum = nextID++;
   }

   Body(String bodyName, Body orbitsAround) {
     this( );
     name = bodyName;
     orbits = orbitsAround;
   }
}
```

Problem: but how can you access the fields?

To emphasize on data encapsulation (6)

improvement on the previous sample class with accessor methods

```
public class Body {
  private long idNum;
  private String name = "<unnamed>";
  private Body orbits = null;
  private static long nextID = 0;

  Body( ) {
    idNum = nextID++; }

  Body(String bodyName, Body orbitsAround) {
    this( );
    name = bodyName;
    orbits = orbitsAround; }

  public long getID() {return idNum;}
  public String getName() {return name;};
  public Body getOrbits() {return orbits;}
}
```

Note: now the fields `idNum`, `name` and `orbits` are read-only outside the class. Methods that access internal data are called *accessor methods* sometime

To emphasize on data encapsulation (4)

modification on the previous sample class with methods setting fields

```
class Body {
   private long idNum;
   private String name = "<unnamed>";
   private Body orbits = null;
   private static long nextID = 0;

   // constructors omitted for space problem. . .

   public long getID() {return idNum;}
   public String getName() {return name;};
   public Body getOrbits() {return orbits;}

   public void setName(String newName) {name = newName;}
   public void setOrbits(Body orbitsAround) {orbits =
   orbitsAround;}
}
```

Note: now users can set the `name` and `orbits` fields. But `idNum` is still read-only

- Making fields private and adding methods to access and set them enables the users adding actions in the future
- Don't forget the `private` modifier on a data field when necessary! The default access modifier for fields is `package`

THANK YOU

Dr. N MEHALA

Department of Computer Science and Engineering

mehala@pes.edu

OBJECT ORIENTED PROGRAMMING WITH JAVA

Dr. N MEHALA
Department of Computer Science and Engineering

Input tokens

- **Token**: A unit of user input, separated by whitespace.
  - A Scanner splits a file's contents into tokens.

- If an input file contains the following:

```
23   3.14
  "John Smith"
```

The Scanner can interpret the tokens as the following types:

Token	Type(s)
23	int, double, String
3.14	double, String
"John	String
Smith"	String

Files and input cursor

- Consider a file numbers.txt that contains this text:

```
308.2
  14.9 7.4  2.8

3.9 4.7   -15.4
  2.8
```

- A Scanner views all input as a stream of characters:

```
308.2\n  14.9 7.4  2.8\n\n3.9 4.7   -15.4\n  2.8\n
^
```

- **input cursor**: The current position of the Scanner.

Consuming tokens

- **consuming input**: Reading input and advancing the cursor.
  - Calling `nextDouble` etc. moves the cursor past the current token.

```
308.2\n   14.9 7.4  2.8\n\n3.9
4.7   -
15.4\n  2.8\n
```

```
double x = input.nextDouble();
// 308.2
```

```
308.2\n   14.9 7.4  2.8\n\n3.9
4.7   -
```

File input question

- Recall the input file numbers.txt:

```
308.2
   14.9 7.4  2.8
3.9 4.7    -15.4
    2.8
```

- Write a program that reads the first 5 values from the file and prints them along with their sum.

```
number = 308.2
number = 14.9
number = 7.4
number = 2.8
number = 3.9
Sum = 337.2
```

File input answer

```
// Displays the first 5 numbers in the given file,
// and displays their sum at the end.

import java.io.*;     // for File
import java.util.*;   // for Scanner

public class Echo {
    public static void main(String[] args)
            throws FileNotFoundException {
        Scanner input = new Scanner(new
   File("numbers.txt"));
        double sum = 0.0;
        for (int i = 1; i <= 5; i++) {
            double next = input.nextDouble();
            System.out.println("number = " + next);
            sum = sum + next;
        }
        System.out.printf("Sum = %.1f\n", sum);
    }
}
```

`Scanner` exceptions

- `InputMismatchException`
  - You read the wrong type of token (e.g. read `"hi"` as `int`).
- `NoSuchElementException`
  - You read past the end of the input.

Reading an entire file

- Suppose we want our program to process the entire file.

  (It should work no matter how many values are in the file.)

```
number = 308.2
number = 14.9
number = 7.4
number = 2.8
number = 3.9
number = 4.7
number = -15.4
number = 2.8
Sum = 329.3
```

Testing for valid input

- `Scanner` methods to see what the next token will be:

Method	Description
`hasNext()`	returns `true` if there are any more tokens of input to read *(always true for console input)*
`hasNextInt()`	returns `true` if there is a next token and it can be read as an `int`
`hasNextDouble()`	returns `true` if there is a next token and it can be read as a `double`

- These methods do not consume input; they just give information about the next token.
  - Useful to see what input is coming, and to avoid crashes.

File input question 2

- Modify the `Echo` program to process the entire file:

  (It should work no matter how many values are in the file.)

```
number = 308.2
number = 14.9
number = 7.4
number = 2.8
number = 3.9
number = 4.7
number = -15.4
number = 2.8
Sum = 329.3
```

File input answer 2

```
// Displays each number in the given file,
// and displays their sum at the end.
import java.io.*;      // for File
import java.util.*;    // for Scanner
public class Echo {
    public static void main(String[] args)
            throws FileNotFoundException {
        Scanner input = new Scanner(new
   File("numbers.txt"));
        double sum = 0.0;
        while (input.hasNextDouble()) {
            double next = input.nextDouble();
            System.out.println("number = " + next);
            sum = sum + next;
        }
        System.out.printf("Sum = %.1f\n", sum);
    }
}
```

File input question 3

- Modify the `Echo` program to handle files that contain non-numeric tokens (by skipping them).
- For example, it should produce the same output as before when given this input file, `numbers2.txt`:

```
308.2  hello
   14.9 7.4  bad stuff   2.8

3.9 4.7  oops  -15.4
:-)     2.8  @#*($&
```

File input answer 3

```
// Displays each number in the given file,
// and displays their sum at the end.
import java.io.*;      // for File
import java.util.*;    // for Scanner
public class Echo2 {
    public static void main(String[] args)
            throws FileNotFoundException {
        Scanner input = new Scanner(new File("numbers2.txt"));
        double sum = 0.0;
        while (input.hasNext()) {
            if (input.hasNextDouble()) {
                double next = input.nextDouble();
                System.out.println("number = " + next);
                sum = sum + next;
            } else {
                input.next();   // throw away the bad token
            }
     }
        System.out.printf("Sum = %.1f\n", sum);
    }
}
```

Weather question

- Write a program that reads in temperatures and outputs the coldest and warmest temps.

Weather.txt file data

```
16.2   23.5
  19.1 7.4
22.8

18.5  -1.8 14.9
```

PARTIAL SOLUTION


```
public static void main(String[] args) throws FileNotFoundException{
Scanner input = new Scanner(new File("weather.txt"));
double max=0;
double min=0;
   while(input.hasNextDouble()){
      double current = input.nextDouble();
     if (current < min){
        min = current;
     }
      if (current > max){
            max = current;
        }
     }
System.out.println("The coldest temp in data set was " + min);
   System.out.println("The warmest temp in data set was " + max);
}
```

Writing to a File

- We will use a **`PrintWriter`** object to write to a file

Writing to a File

- The out field of the System class is a **`PrintWriter`** object associated with the console
  - We will associate our **`PrintWriter`** with a file now

```
PrintWriter fout = new PrintWriter("output.txt");
fout.println(29.95);

fout.println("Hello, World!");
```

- This will print the exact same information as with **`System.out`** (except to a file “output.txt”)!

Closing a File

- Only main difference is that we have to close the file stream when we are done writing

- If we do not, not all output will written

- At the end of output, call `close()`

```
fout.close();
```

Closing a File

- Why?
  - When you call **`print()`** and/or **`println()`**, the output is actually written to a buffer. When you close or flush the output, the buffer is written to the file
  - The slowest part of the computer is hard drive operations – much more efficient to write once instead of writing repeated times

File Locations

- When determining a file name, the default is to place in the same directory as your .class files
- If we want to define other place, use an absolute path (e.g. c:\My Documents)

```
in  = new
   FileReader("c:\\homework\\input.dat");
```

Sample Program

- Two things to notice:
  - Have to import from java.io
  - I/O requires us to catch checked exceptions
    - **`java.io.IOException`**

Java Output Review

- CONSOLE:

```
System.out.print("To the screen");
```

- FILE:

```
PrintWriter fout =
  new PrintWriter(new File("output.txt");
fout.print("To a file");
```

THANK YOU

Dr. N MEHALA

Department of Computer Science and Engineering

mehala@pes.edu

Naming conventions

- ***Package names***: start with lowercase letter
  - E.g. java.util, java.net, java.io . . .
- ***Class names***: start with uppercase letter
  - E.g. File, Math . . .
  - avoid name conflicts with packages
  - avoid name conflicts with standard keywords in java system
- ***Variable***, ***field and method names***: start with lowercase letter
  - E.g. x, out, abs . . .
- ***Constant names***: all uppercase letters
  - E.g. PI . . .
- ***Multi-word names***: capitalize the first letter of each word after the first one
  - E.g. helloWorldApp, getName . . .
- ***Exception class names***: (1) start with uppercase letter (2) end with "Exception" with normal exception and "Error" with fatal exception
  - E.g. OutOfMemoryError, FileNotFoundException

Accessor and Mutator Methods

Accessor Methods

- ***Accessor methods are used to return the values of instance fields.***
- ***Accessor methods do not receive any parameter***
- ***Accessor methods are defined according to the type of the instance fields [One Accessor method for each instance field]***
- ***Accessor methods should have public scope***
- ***General Form of declaring Accessor Method:***

```
<return type>  get<InstanceField>( )
{
return InstanceField;
}
```

Insert get word before field name

<return type> should be the type of instance field

Example

```
class Student
{
private String name;
private String idno;
private int age;
private double amount;
```

Define Accessor Methods for

All the instance fields

```
// accessor method for name
public String getName()
{
return name;
}
// accessor method for idno
public String getIdno()
{
return name;
}
// accessor method for age
public int getAge()
{
return name;
}
// accessor method for amount
public double getAmount()
{
return name;
}    .....
} // End of class Student
```

Mutator Methods

- ***Mutator methods are used to set the values of instance fields.***
- ***Mutator methods have return type as void and receives the parameter of type of instance field***
- ***Mutator methods are defined according to the type of the instance fields [One mutator method for each instance field]***
- ***Mutator methods should have public scope***
- ***General Form of declaring Mutator Method:***

```
void  set<InstanceField>(<type> parameterName )
{


}
```

Type should be type of instance field

Insert set word before field name

<return type> should be void

Example

```
class Student
{
private String name;
private String idno;
private int age;
private double amount;
```

Define Mutator Methods for

All the instance fields

```
// mutator method for name
public void setName(String name)
{
this.name = name;
}
// mutator method for idno
public void setIdno(String idno)
{
this.idno = idno;
}
// mutator method for age
public void setAge(int age)
{
this.age = age;
}
// mutator method for amount
public voide setAmount(double amount)
{
This.amount = amount;
}    .....
} // End of class Student
```

Exercise

An instructor of a class wants to record following items of information for each student of a class of 80 students:

1. *Name of student*
2. *Id no of each student*
3. *Three test marks for three subjects namely "OOP" ,"Data Structures" and "Software Engineering" [Use 2-Dimensional array 3 * 3 to hold the values. Row index indicates subjects and column index indicates test values]*

Supply the following operations :

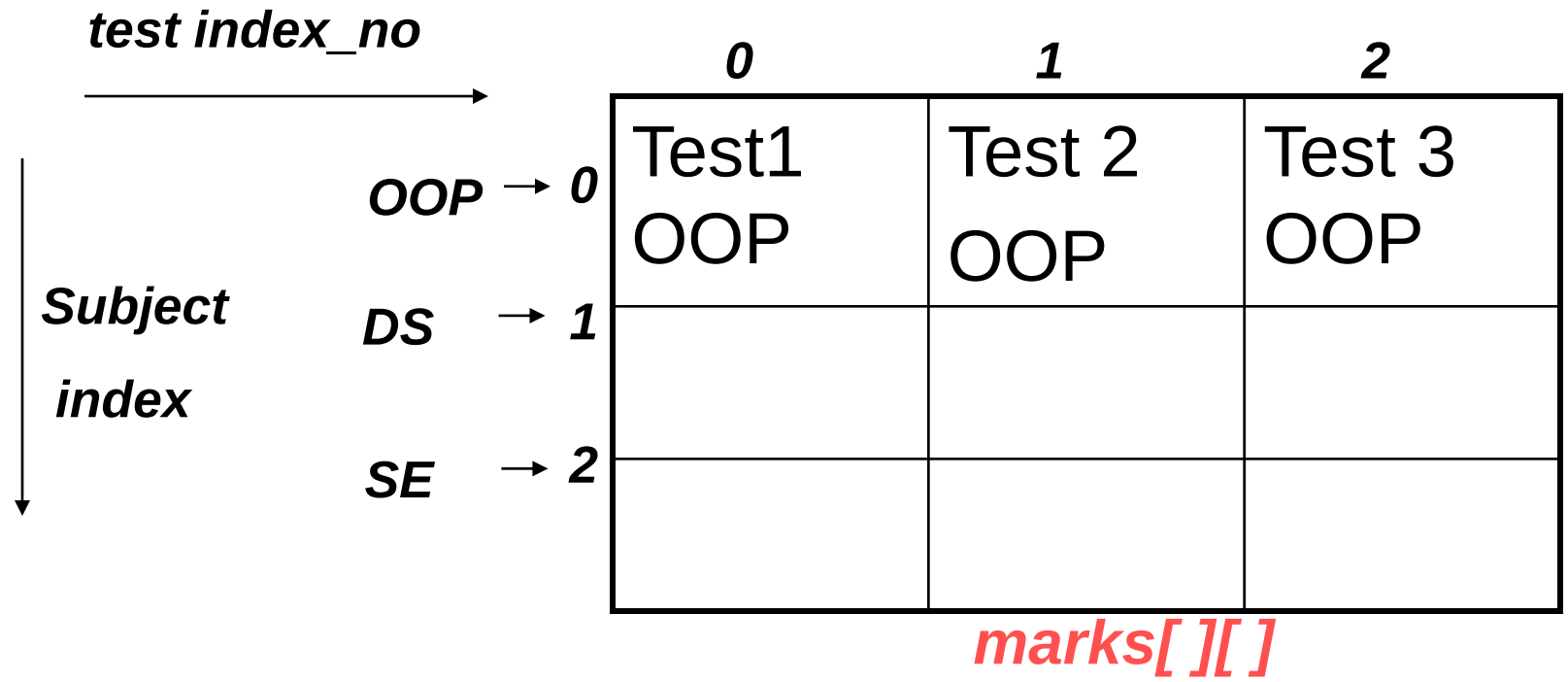
1. *Accessor methods for name and idno fields*
2. *Acessor method for retrieving/getting a particular test value for given subject and test*
3. *Acessor method for retrieving/getting all test values for given subject*
4. *Acessor method for retrieving/getting all subject scores for a given test_no*

Exercise cont….

5. Supply the mutator operations for all the four mentioned cases

6. Supply a method for getting student with highest for a given subject

7. Supply a method for getting student with highest for a given test_no



Example cont..

```
public class Student
{
private String name;
private String idno;
private double[][] marks;

Student(String name, String idno)
{
this.idno = idno;
this.name = name;
marks = new double[3][3];
}
```

Instance Fields

Constructor

```
// Acessor Methods for name and idno
public String getName()
{
return name;
}
public String getIdno()
{
return idno;
}
```

```
// Mutator method for name and idno
public void setName(String name)
{
this.name = name;
}
public void setIdno(String idno)
{
this.idno = idno;
}
```

```
// Accessor method for getting marks for a given subject and testno
public double getTestmarks(int subject,int test_no)
{
return marks[subject-1][test_no-1];
}

// Accessor method for getting all test marks for a given subject
public double[] getSubjectMarks(int subject)
{
double scores[] = new double[3];
scores[0] = marks[subject-1][0];
scores[1] = marks[subject-1][1];
scores[2] = marks[subject-1][2];
return scores;
}
```

```
// Accessor method for getting  all subject marks for a given test

public double[] getTestMarksForAllSubjects(int test_no)
{
double scores[] = new double[3];
scores[0] = marks[0][test_no-1];
scores[1] = marks[1][test_no-1];
scores[2] = marks[2][test_no-1];
return scores;
}

// Accessor Method for all test scores
public double[][] getAllTestMarks()
{
return marks;
}
```

```
// Mutator method for setting marks for a given subject and testno
public void setTestmarks(int subject,int test_no, double value)
{
marks[subject-1][test_no-1] = value;
}

// Mutator method for setting all test marks for a given subject
public void setSubjectMarks(int subject, double[] scores)
{
marks[subject-1][0] = scores[0] ;
marks[subject-1][1] = scores[1] ;
marks[subject-1][2] = scores[2] ;
}
```

```
// Mutator method for setting  all subject marks for a given test
public void setTestMarksForAllSubjects(int test_no, double[] scores)
{
marks[0][test_no-1] = scores[0];
marks[1][test_no-1] = scores[1];
marks[2][test_no-1] = scores[2];
}

// Mutator Method for all test scores
public void setAllTestMarks(double[][] scores)
{
marks = scores;
}
```

Rest Methods Take Home Exercise

Immutable class

- *Class whose object's state can not be changed after creation is immutable.*
- *State of Object -→ Instance field Values*
- *If an object's attribute's values can not be changed after creation then that object is also immutable*
- *Example : String class*
- *Alternatively if an object's state can be changed after creation then that object is mutable object and class is mutable class e.g StringBuffer*

How to make a class immutable

- ***Define instance fields as private and do not supply any mutator method***

```
class Box
{
private double length;
private double length;
private double length;
Box(double l, double b, double h)
{
…
}
double area()
{
……..
}
} // End of Box classs
```

Box class is Immutable

What's the Advatage of Immutable class

Their Object references can be freely shared among many clients without any risk

Example 2 Immutable class

```
class Triangle
{
// Instance fields
private double a,b,c;
// Constructor Methods
Triangle(double a)
{
}
Triangle(double a,double b)
{
}
Triangle(double a,double
b,double c)
{
}
// Accessor Method for side1
double getA()
{
}
// Accessor Method for side2
double getB()
{
}
// Accessor Method for side3
double getC()
{
}
// Method for computing area
double area()
{
}
// Method for computing perimeter
double perimeter()
{
}
}// End of Triangle class
```

THANK YOU

Dr. N MEHALA

Department of Computer Science and Engineering

mehala@pes.edu