LAB – 4 – Inheritance and Packages

1. Create a **Person** class with private instance variables for the person's name and birth date. Add appropriate accessor methods for these variables. Then create a subclass **College Graduate** with private instance variables for the student's GPA and year of graduation and appropriate accessors for these variables. Include appropriate constructors for your classes. Then create a separate class with **main()** method that demonstrates your classes. Use keyword super appropriately.

Code :

```
import java.util.*;
class DOB {
int date;
int month;
int year;
}
class Person {
private String name;
private DOB dob = new DOB();
Person(){
name = "";
dob.date = 1;
dob.month = 1;
dob.year = 2001;
}
Person(int dt, int mth, int yr, String Name) {
name = Name;
dob.date = dt;
dob.month = mth;
dob.year = yr;
}
String getName() {
return name;
}
DOB getDOB() {
return dob;
}
}
class CollegeGraduate extends Person {
```

```java
private int yog;
private float gpa;
CollegeGraduate() {
super();
yog = 0;
gpa = 0;
}
CollegeGraduate(int dt, int mth, int yr, String Name, int YearOG, float GPA) {
super(dt, mth, yr, Name);
yog = YearOG;
gpa = GPA;
}
int getYOG() {
return yog;
}
float getGPA() {
return gpa;
}
void display() {
System.out.println("\nName = " + getName());
DOB dob = getDOB();
System.out.println("DOB = " + dob.date + "/" + dob.month + "/" + dob.year);
System.out.println("GPA = " + getGPA());
System.out.println("Year of graduation = " + getYOG());
}
}


public class lab4_1 {
public static void main(String[] args) {
Scanner sc = new Scanner(System.in);
System.out.println("Enter student details");
int dt, mth, yr, yog;
String Name;
float GPA;
System.out.print("Enter student's name: ");
Name = sc.next();
System.out.println("\nEnter student's Date of birth");
System.out.print("Date : ");
dt = sc.nextInt();
System.out.print("Month : ");
mth = sc.nextInt();
```

```
System.out.print("Year : ");
yr = sc.nextInt();
System.out.print("\nEnter student's GPA: ");
GPA = sc.nextFloat();
System.out.print("\nEnter student's year of graduation: ");
yog = sc.nextInt();
CollegeGraduate C = new CollegeGraduate(dt, mth, yr, Name, yog, GPA);
C.display();
}
}
```

Output :

```
C:\Users\HP\OneDrive - Manipal Academy of Higher Education\Desktop\java programs>javac lab4_1.java

C:\Users\HP\OneDrive - Manipal Academy of Higher Education\Desktop\java programs>java lab4_1
Enter student details
Enter student's name: Agasthya

Enter student's Date of birth
Date : 12
Month : 3
Year : 2004

Enter student's GPA: 9.7

Enter student's year of graduation: 2021

Name = Agasthya
DOB = 12/3/2004
GPA = 9.7
Year of graduation = 2021
```

2. Define a class Max with the following overloaded static methods

    a. max (which finds maximum among three integers and returns the maximum integer)
    b. max (which finds maximum among three floating point numbers and returns the maximum among them)
    c. max (which finds the maximum in an array and returns it)
    d. max (which finds the maximum in a matrix and returns the result)

Place this in a package called p1. Let this package be present in a folder called "myPackages", which is a folder in your present working directory (eg: c\student\3rdsem\mypackages\p1). Write a main method to use the methods of Max class in a package p1.

```
C:\Users\HP\OneDrive - Manipal Academy of Higher Education\Desktop\java programs\myPackages>cd ..

C:\Users\HP\OneDrive - Manipal Academy of Higher Education\Desktop\java programs>cd myPackages

C:\Users\HP\OneDrive - Manipal Academy of Higher Education\Desktop\java programs\myPackages>cd p1

C:\Users\HP\OneDrive - Manipal Academy of Higher Education\Desktop\java programs\myPackages\p1>dir
 Volume in drive C has no label.
 Volume Serial Number is F8E4-8CCE

 Directory of C:\Users\HP\OneDrive - Manipal Academy of Higher Education\Desktop\java programs\myPackages\p1

01-12-2021  02:48 PM    <DIR>          .
01-12-2021  02:48 PM    <DIR>          ..
01-12-2021  02:48 PM               674 Max.class
01-12-2021  01:46 PM               764 Max.java
               2 File(s)          1,438 bytes
               2 Dir(s)  50,749,628,416 bytes free
```

"java programs\myPackages\p1\Max.java" is the location of the package.

Code :

```java
package myPackages.p1;
public class Max {
    public static int max(int x, int y, int z) {
        int temp = x > y ? x : y;
        int result = z > temp ? z : temp ;
        return result;
    }
    public static float max(float x, float y, float z) {
        float temp = x > y ? x : y;
        float result = z > temp ? z : temp ;
        return result;
    }
    public static int max(int [] arr) {
        int maximum = 0;
        for (int i = 0; i < arr.length; i++) {
            if (arr[i] > maximum) {
                maximum = arr[i];
            }
        }
        return maximum;
    }
    public static int max(int [][] arr) {
        int maximum = 0;
        for (int i = 0; i < arr.length; i++) {
            for (int j = 0; j < arr[i].length; j++) {
                if (arr[i][j] > maximum) {
                    maximum = arr[i][j];
```

```
                    }
                }
            }
            return maximum;
        }
    }
}
```

Main method :

```
import myPackages.p1.Max;
import java.util.Scanner;

public class lab4_2 {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter 3 integers to get their maximum");
        int x = sc.nextInt();
        int y = sc.nextInt();
        int z = sc.nextInt();
        System.out.println("The maximum of the 3 integers is " +
Max.max(x, y, z));
        System.out.println("Enter 3 floating point integers to get their
maximum");
        float a = sc.nextFloat();
        float b = sc.nextFloat();
        float c = sc.nextFloat();
        System.out.println("The maximum of the 3 floating point integers is
" + Max.max(a, b, c));
        System.out.println("Enter the size of array");
        int n = sc.nextInt();
        int arr[] = new int[n];
        System.out.println("Enter the array elements");
        for (int i = 0; i < n; i++)
            arr[i] = sc.nextInt();
        System.out.println("The maximum of the array is " +
Max.max(arr));
        System.out.println("Enter the dimensions of the matrix");
        int p = sc.nextInt();
        int q = sc.nextInt();
        int matrix[][] = new int[p][q];
        System.out.println("Enter the matrix elements");
        for (int i = 0; i < p; i++)
```

```
            for (int j = 0; j < q; j++)
                matrix[i][j] = sc.nextInt();
        System.out.println("The maximum of the matrix is " +
Max.max(matrix));
    }
}
```

Output :

```
C:\Users\HP\OneDrive - Manipal Academy of Higher Education\Desktop\java programs>javac lab4_2.java

C:\Users\HP\OneDrive - Manipal Academy of Higher Education\Desktop\java programs>java lab4_2
Enter 3 integers to get their maximum
2
3
1
The maximum of the 3 integers is 3
Enter 3 floating point integers to get their maximum
2.34
4.23
3.42
The maximum of the 3 floating point integers is 4.23
Enter the size of array
5
Enter the array elements
67
87
23
91
45
The maximum of the array is 91
Enter the dimensions of the matrix
2
3
Enter the matrix elements
1
2
3
4
5
6
The maximum of the matrix is 6
```

3. Create an abstract class Figure with abstract method area and two integer dimensions. Create three more classes Rectangle, Triangle and Square which extend Figure and implement the area method. Show how the area can be computed dynamically during run time for Rectangle, Square and Triangle to achieve dynamic polymorphism. (Use the reference of Figure class to call the three different area methods)

Code :

```
import java.util.Scanner;
abstract class Figure {
    int dim1, dim2;
```

```java
        Figure(int x, int y) {
                dim1 = x;
                dim2 = y;
        }
        abstract int area();
}
class Rectangle extends Figure {
        Rectangle(int x, int y) {
                super(x, y);
        }
        int area() {
                return dim1 * dim2;
        }
}
class Triangle extends Figure {
        Triangle(int x, int y) {
                super(x, y);
        }
        int area() {
                return dim1 * dim2 / 2;
        }
}
class Square extends Figure {
        Square(int x) {
                super(x, x);
        }
        int area() {
                return dim1 * dim2;
        }
}
public class lab4_3 {
        public static void main(String[] args) {
                Scanner sc = new Scanner(System.in);
                Figure f;
                System.out.println("Enter the dimensions of rectangle");
                int dim1 = sc.nextInt();
                int dim2 = sc.nextInt();
                Rectangle r = new Rectangle(dim1, dim2);
                f = r;
                System.out.println("The area of the rectangle is " + f.area());
                System.out.println("Enter the base and height of triangle");
                int base = sc.nextInt();
```

```java
            int height = sc.nextInt();
            Triangle t = new Triangle(base, height);
            f = t;
            System.out.println("The area of the triangle is " + f.area());
            System.out.println("Enter the dimension of square");
            int side = sc.nextInt();
            Square s = new Square(side);
            f = s;
            System.out.println("The area of the square is " + f.area());
        }
}
```

Output :

```
C:\Users\HP\OneDrive - Manipal Academy of Higher Education\Desktop\java programs>javac lab4_3.java

C:\Users\HP\OneDrive - Manipal Academy of Higher Education\Desktop\java programs>java lab4_3
Enter the dimensions of rectangle
2
3
The area of the rectangle is 6
Enter the base and height of triangle
4
3
The area of the triangle is 6
Enter the dimension of square
5
The area of the square is 25
```

****