TRINITY INTERNATIONAL COLLEGE

(Tribhuvan University Affiliated)

Lab Assignment 1.2: Advance Java Programming

Submitted By: **Submitted to:**

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Date:

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Unit- #1.2

1) An array is called balanced if it's even numbered elements (a[0], a[2], etc.) are even and its odd numbered elements (a[1], a[3], etc.) are odd. Write a function named balanced that accepts an array of integers which returns 1 if the array is balanced and returns 0 otherwise. [2075]

⇨ Elaboration of question,
Examples:
{2, 3, 6, 7} is balanced since a[0] and a[2] are even, a[1] and a[3] are odd.
{6, 7, 2, 3, 12} is balanced since a[0], a[2] and a[4] are even, a[1] and a[3] are odd.
{7, 15, 2, 3} is not balanced since a[0] is odd.

Program:

```
package  Q1_ArrayBalance
public class ArrayBalance
{
    static int[] array = {6, 7, 2, 3, 12};

    public static void main(String[] arr)
    {
            System.out.println(isBalanced(array));
    }
    public static int isBalanced(int[] a)
    {
        int count = 1;
        for(int i = 0; i<array.length; i+=2)
        {
            if(a[i]%2 != 0)
            {
                count = 0;
                break;
            }
        }
        for(int j = 1;j< array.length; j+=2 )
        {
            if(a[j]%2 == 0)
            {
                count = 0;
                break;
            }
        }
            return count;
    }
}
```

Output:

```
ArrayBalance
"C:\Program Files\Java\jdk-13.0.2\bin\j
1

Process finished with exit code 0
```

2) Write an object-oriented program to find area and perimeter of rectangle. [2073, 2074]

⇨

Program

```
package Q2_AreaAndPerimeterOfRectangle;
public class AreaAndPerimeterOfRectangle
{
    private double l,b;
    public AreaAndPerimeterOfRectangle(double l,double b)
    {
        this.l=l;
        this.b =b;
    }
    public static void main(String[] args)
    {
        AreaAndPerimeterOfRectangle r = new
                        AreaAndPerimeterOfRectangle(5,10);

       System.out.println("The area of Rectangle with
                           length "+ r.l + " & breadth " +
                           r.b +" is: " +
                           r.areaOfRectangle());

       System.out.println("The perimeter of Rectangle with
                           length " +r.l + " & breadth " +
                           r.b +" is: "
                           r.perimeterOfRectangle())
   }
   public double areaOfRectangle()
    {
        return l*b;
    }

   public double perimeterOfRectangle()
    {
        return 2*(l+b);
    }
}
```

Output:

```
AreaAndPerimeterOfRectangle
"C:\Program Files\Java\jdk-13.0.2\bin\java.exe" -Didea.launcher.port=55413 "
The area of Rectangle with length 5.0 & breadth 10.0 is: 50.0
The perimeter of Rectangle with length 5.0 & breadth 10.0 is: 30.0

Process finished with exit code 0
```

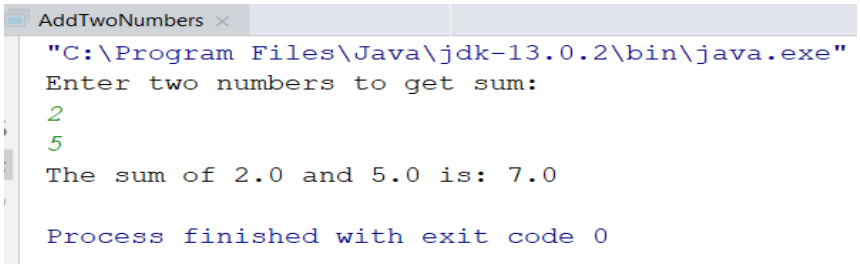
3) Write a program to input and add two numbers using static methods (procedural programming).

⇨

Program:

```
package Q3_AddTwoNumbers;

import java.util.Scanner;

public class AddTwoNumbers
{
    public static void main(String[] args)
    {
        System.out.println("Enter two numbers to get sum:");
        Scanner in = new Scanner(System.in);
        double num1= in.nextDouble();
        double num2= in.nextDouble();

        System.out.println("The sum of "+ num1 +" and "+ num2
                           + " is: "+
                           sumOfTwoNumbers(num1,num2));
    }

    public static double sumOfTwoNumbers(double num1,double
                                         num2)
    {
        return num1+num2;
    }

}
```

Output:



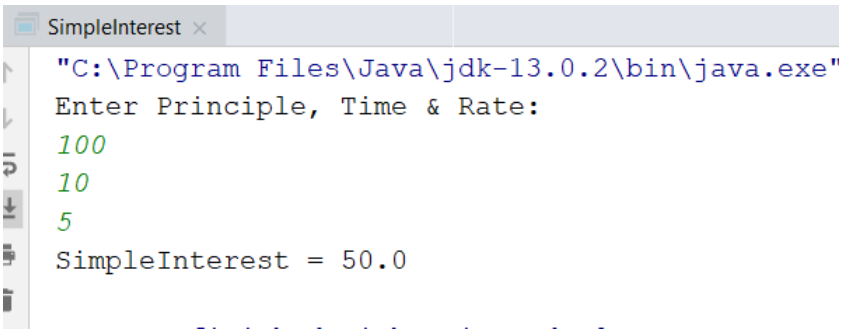
4) Write a program to input principle, time and rate, then calculate simple interest using static methods.

⇨

Program:

```
package Q4_SimpleInterest;

import java.util.Scanner;

public class SimpleInterest
{
    public static void main(String[] args)
    {
        System.out.println("Enter Principle, Time &
                            Rate:");
        Scanner in = new Scanner(System.in);
        double p = in.nextDouble();
        double t = in.nextDouble();
        double r = in.nextDouble();

        System.out.println("SimpleInterest = " +
                            simpleInterestCalc(p,t,r));
    }
    public static double simpleInterestCalc(double p,
                                             double t,
                                             double r)
    {
        return (p*t*r)/100;
    }
}
```

Output:



5) Write both procedural and object-oriented programs to calculate the area of a
   a) Circle
   b) Square
   c) Rectangle
   d) Sphere

⇨ Procedural:

a) Circle

Program:

```
package Q5_a_AreaOfCircleProcedural;

import java.util.Scanner;

public class Circle
{
    public static void main(String[] args)
    {
        System.out.println("Enter the radius of a
                            circle:");
        Scanner in = new Scanner(System.in);
        double radius = in.nextDouble();
        System.out.println("The area of a Circle with "+
                           radius + " is: "+
                           areaOfCircle(radius));
    }

    public static double areaOfCircle(double r)
    {
        return Math.PI*r*r;
    }
}
```

Output:

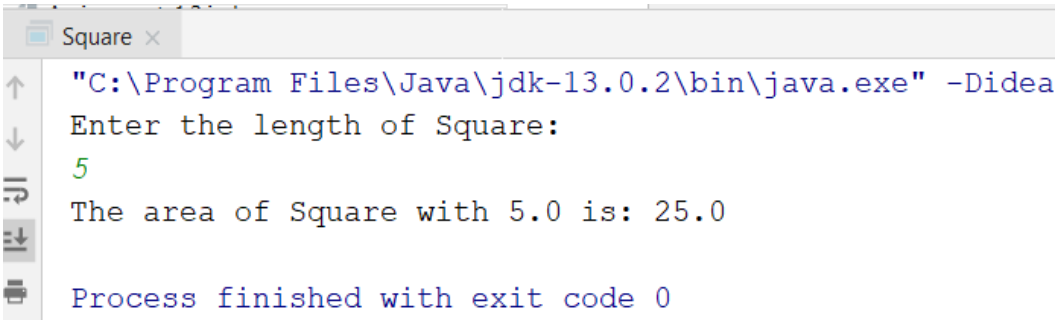
```
Circle
"C:\Program Files\Java\jdk-13.0.2\bin\java.exe" -Didea.
Enter the radius of a circle:
5
The area of a Circle with 5.0 is: 78.53981633974483

Process finished with exit code 0
```

b) Square

Program:

```
package Q5_b_AreaOfSquareProcedural;

import java.util.Scanner;

public class Square
{
    public static void main(String[] args)
    {
        System.out.println("Enter the length of Square:
                           ");
        Scanner in = new Scanner(System.in);
        double length = in.nextDouble();
        System.out.println("The area of Square with " +
                           length + " is: "+
                           areaOfSquare(length));
    }
    public static double areaOfSquare(double l)
    {
        return l*l;
    }
}
```

Output:



c) Rectangle:

Program

```
package Q5_c_AreaOfRectangleProcedural;

import java.util.Scanner;

public class Rectangle
{
    public static void main(String[] args)
    {
        System.out.println("Enter the length and breadth
                            of rectangle: ");
         Scanner in = new Scanner(System.in);
         double length = in. nextDouble();
         double breadth = in.nextDouble();
         System.out.println("The area Rectangle with
                     length " +length + " and
                     breadth " +breadth+ " is: "+
                     areaOfRectangle(length,breadth));
       }

       public static double areaOfRectangle(double l,
                                            double b)
       {
           return l*b;
       }
  }
```

Output:

```
Rectangle
"C:\Program Files\Java\jdk-13.0.2\bin\java.exe" -Didea.launcher.p
Enter the length and breadth of rectangle:
5
6
The area of Rectangle with length 5.0 and breadth 6.0 is: 30.0

Process finished with exit code 0
```

d) Sphere:

Program

```
package Q5_d_AreaOfSphereProcedural;

import java.util.Scanner;

public class Sphere
{
    public static void main(String[] args)
    {
        System.out.println("Enter the radius of
                            Sphere: ");
        Scanner in = new Scanner(System.in);
        double radius = in.nextDouble();
        System.out.println("The area of Sphere with
                            radius " + radius + " is:
                            "+ areaOfSphere(radius));
    }
    public static double areaOfSphere(double r)
    {
        return 4*Math.PI*r*r;
    }
}
```

Output:

```
Sphere
"C:\Program Files\Java\jdk-13.0.2\bin\java.exe" -Didea.la
Enter the radius of Sphere:
5
The area of Sphere with radius 5.0 is: 314.1592653589793

Process finished with exit code 0
```

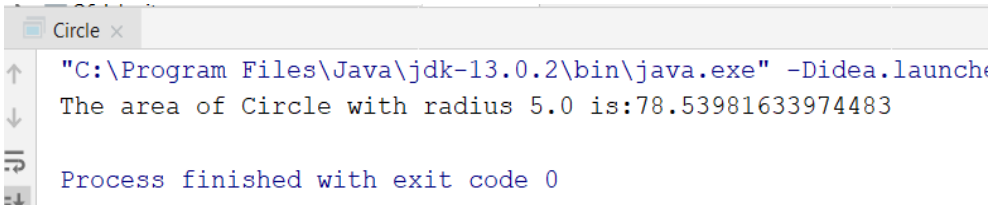
⇨ Object-oriented:

a) Circle

Program:

```
package Q5_a_AreaOfCircleObjectOriented;

public class Circle
{
    private double r;
    public Circle(double r)
    {
        this.r=r;
    }
    public static void main(String[] args)
    {
        Circle c = new Circle(5);
        System.out.println("The area of Circle with
                           radius "+ c.r + " is:" +
                           c.areaOfSquare());
    }
    public double areaOfSquare()
    {
        return Math.PI*r*r;
    }
}
```

Output:



b) Square

Program:

```
package Q5_b_AreaOfSquareObjectOriented;

public class Square
{
    private double l;
    public Square(double l)
    {
        this.l = l;
    }

    public static void main(String[] args)
    {
        Square s = new Square(5);
        System.out.println("The area of Square with
                           length "+ s.l + " is: "+
                           s.areaOfSquare());
    }

    public double areaOfSquare()
    {
        return l*l;
    }
}
```

Output:

```
Square
"C:\Program Files\Java\jdk-13.0.2\bin\java.exe"
The area of Square with length 5.0 is: 25.0
```

c) Rectangle

Program:

```
package Q5_c_AreaOfRectangleObjectOriented;

public class Rectangle
{
    private double l,b;
    public Rectangle(double l,double b)
    {
        this.l=l;
        this.b =b;
    }

    public static void main(String[] args)
    {
        Rectangle r = new Rectangle(5,10);
        System.out.println("The area of Rectangle with
                           length " +r.l + " & breadth
                           " + r.b +" is: " +
                           r.areaOfRectangle());
    }

    public double areaOfRectangle()
    {
        return l*b;
    }
}
```

Output:

```
Rectangle (1)
"C:\Program Files\Java\jdk-13.0.2\bin\java.exe" -Didea.launcher
The area of Rectangle with length 5.0 & breadth 10.0 is: 50.0

Process finished with exit code 0
```

d) Sphere

Program:

```
package Q5_d_AreaOfSphereObjectOriented;

public class Sphere
{
    private double r;
    public Sphere(double r)
    {
        this.r = r;
    }
    public static void main(String[] args)
    {
        Sphere s = new Sphere(5);
        System.out.println("The area of Sphere with
                           radius " + s.r + " is: "+
                           s.areaOfSphere());
    }
    public double areaOfSphere()
    {
        return 4*Math.PI*r*r;
    }
}
```

Output:

```
Sphere (1) ×
"C:\Program Files\Java\jdk-13.0.2\bin\java.exe" -Didea.launch
The area of Sphere with radius 5.0 is: 314.1592653589793

Process finished with exit code 0
```

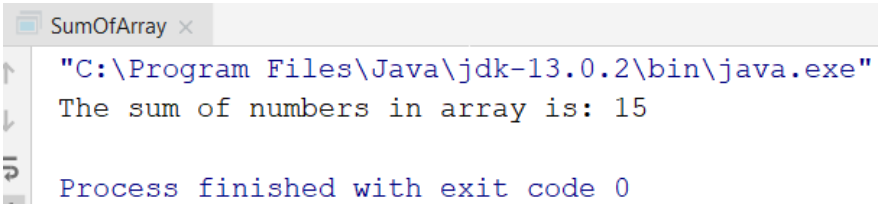
6) Write a static method to calculate the sum of a one-dimensional array.

⇨

Program:

```
package Q6_SumOf1DArray;

public class SumOfArray
{
    public static void main(String[] args)
    {
        int []a = {1,2,3,4,5};
        System.out.println("The sum of numbers in array
                            is: "+ sum(a));
    }
    public static int sum(int []data)
    {
        int sum =0;
        for(int i = 0; i<data.length; i++)
        {
            sum +=data[i];
        }
        return sum;
    }
}
```

Output:



7) Write a static method to calculate the average of a one-dimensional array.

⇨

Program

```
package Q7_AverageOf1DArray;

public class AverageOfArray
{
    public static void main(String[] args)
    {
        int []a = {1,2,3,4,5};
        System.out.println("The average of numbers in
array is: "+ average(a));
    }

    public static int average(int []data)
    {

        int sum =0;
        for(int i = 0; i<data.length; i++)
        {
            sum +=data[i];
        }
        return sum/data.length;
    }
}
```

Output:

```
AverageOfArray
"C:\Program Files\Java\jdk-13.0.2\bin\java.exe"
The average of numbers in array is: 3

Process finished with exit code 0
```

8) Create a class with static methods to calculate the sum, difference and product of two matrices (represented by 2D arrays). The methods must return the resulting matrices.
⇨

Program

```
package Q8_2DArrays;

import java.util.Scanner;

public class TwoDArrayDemo
{
    public static void main(String[] args)
    {
        int [][] firstMatrix= new int[3][3];
        int [][] secondMatrix = new int[3][3];
        int [][] result = new int [3][3];

        Scanner in = new Scanner(System.in);
        //Taking input for 1st Matrix
        System.out.println("Enter values of first 3 by 3
                            matrix");
        for (int i =0 ; i<3; i++)
        {
            for (int j =0; j<3; j++)
            {
                firstMatrix[i][j] = in.nextInt();
            }
        }

        //Taking input for second Matrix
        System.out.println("Enter Values of second 3 by
                           3 matrix");
        for (int i =0 ; i<3; i++)
        {
            for (int j =0; j<3; j++)
            {
                secondMatrix[i][j] = in.nextInt();
            }
        }


        result = calculateSum(firstMatrix,secondMatrix);
        System.out.println("The result of Matrix
                            addition is:");
        displayMatrix(result);

        result =
          calculateDifference(firstMatrix,secondMatrix);

        System.out.println("The result of difference
                            between two matrices is:");
        displayMatrix(result);
```

```
        result=calculateProduct(firstMatrix,secondMatrix
                                );
         System.out.println("The result of Matrix
                             Multiplication is:");
         displayMatrix(result);
    }
   public static int[][] calculateSum(int[][]firstMatrix
                               , int [][]secondMatrix)
    {
        int [][] sum = new int[3][3];

        for(int i = 0 ; i<3; i++)
        {
            for(int j =0; j<3; j++)
            {
                sum[i][j] = firstMatrix[i][j]+
                            secondMatrix[i][j];
            }
        }
        return sum;
    }
   public static int[][] calculateDifference(
                            int [][]firstMatrix,
                            int [][]secondMatrix)
    {
        int [][] difference = new int[3][3];

        for(int i = 0 ; i<3; i++)
        {
            for(int j =0; j<3; j++)
            {
                difference[i][j] = firstMatrix[i][j]-
                                   secondMatrix[i][j];
            }
        }
        return difference;
    }

  public static int[][] calculateProduct(
                                    int[][] firstMatrix,
                                    int[][]secondMatrix)
    {
        int mul[][]=new int[3][3];

        for(int i=0;i<3;i++)
        {
            for(int j=0;j<3;j++)
            {
                mul[i][j]=0;

                for(int k=0;k<3;k++)
                {
```

```
                        mul[i][j]+=firstMatrix[i][k]*
                                   secondMatrix[k][j];
                    }
                }
            }
            return mul;
        }-
        //Display the result in a  Matrix form
        public static void displayMatrix(int [][] result)
        {
            for(int i = 0; i<3; i++)
            {
                for (int j = 0; j<3; j++)
                {
                    System.out.print(result[i][j]+" ");
                }
                System.out.println();
            }
        }
}
```

Output:

```
TwoDArrayDemo
"C:\Program Files\Java\jdk-13.0.2\bin\java.exe" -Dide
Enter values of first 3 by 3 matrix
1 2 3
4 5 6
7 8 9
Enter Values of second 3 by 3 matrix
1 2 3
4 5 6
7 8 9
The result of Matrix addition is:
2 4 6
8 10 12
14 16 18
The result of difference between two matrices is:
0 0 0
0 0 0
0 0 0
The result of Matrix Multiplication is:
30 36 42
66 81 96
102 126 150

Process finished with exit code 0
```

9) Write a program to demonstrate encapsulation.

⇨

Program

```
package Q9_Encapsulation;

public class EncapsulationDemo
{
    public static void main(String[] args)
    {
        Student s = new Student();
        s.setRollno(16);
        s.setName("Dipendra");
        System.out.println("Roll no.: " + s. getRollno()
                           );
        System.out.println("Name: "+ s.getName());
    }
 }
class Student
{
    private int rollno;
    private String name;
    public int getRollno()
    {
        return rollno;
    }
    public void setRollno(int rollno)
    {
        this.rollno = rollno;
    }

    public String getName()
    {
        return name;
    }
    public void setName(String name)
    {
        this.name = name;
    }
}
```

Output:

```
EncapsulationDemo
"C:\Program Files\Java\jdk-13.0.2\bin\
Roll no.: 16
Name: Dipendra

Process finished with exit code 0
```

10) Write a program to demonstrate inheritance.

⇨

Program

```
package Q10_Inheritance;

public class InheritanceDemo
{
    public static void main(String[] args)
    {
       Polygon pol =new Polygon();
       Rectangle rec = new Rectangle();
       Triangle tri = new Triangle();

       rec. setValues(10,10);
       System.out.println("Rec:"+rec.areaOfRectangel());
       tri.setValues(10, 10);
       System.out.println("Tri: "+tri.areaOfTriangle());
    }
}
class Polygon
{
    protected int width ;
    protected int height;

    protected void setValues(int a, int b)
    {
        width = a;
        height = b;
    }
}
class Rectangle  extends Polygon
{
    int areaOfRectangel()
    {
        return (width*height);
    }
}

class Triangle extends Polygon
{
    double areaOfTriangle()
    {
        return (width*height)/2;
    }
}
```

output:

```
InheritanceDemo
"C:\Program Files\Java\jdk-13.0.2\bin\
Rec: 100
Tri: 50.0

Process finished with exit code 0
```

11) Write a program to demonstrate polymorphism using non-abstract class as parent.

⇨

Program

```
package Q11_PolymorphismUsingNonAbstractClass;

class Shape
{
    public double area()
    {
        return 0;
    }
}
class Square extends Shape
{
    private double l;
    public Square(double l)
    {
        this.l = l;
    }
    public double area()
    {
        return l*l;
    }
}

public class PolymorphismUsingNonAbstractClass
{
    public static void main(String[] args)
    {
        Shape s =new Square(5);
        System.out.println("Area of Square: "+ s.area());
    }
}
```

output:

```
PolymorphismUsingNonAbstractClass
"C:\Program Files\Java\jdk-13.0.2\bin\java.
Area od Square: 25.0

Process finished with exit code 0
```

12) Write a program to demonstrate polymorphism using abstract class as parent.

⇨

Program:

```
package Q12_PolymorphismUsingAbstractClass;

abstract class Shape
{
    public abstract double area();
}

class Square extends Shape
{
    private double l;
    public Square(double l)
    {
        this.l = l;
    }
    public double area()
    {
        return l*l;
    }
}

public class PolymorphismUsingAbstractClass
{
    public static void main(String[] args)
    {
        Shape s = new Square(5);
        System.out.println("Area of Square:"+ s.area());
    }
}
```

Output:

```
PolymorphismUsingAbstractClass
"C:\Program Files\Java\jdk-13.0.2\bir
Area of Squeare: 25.0

Process finished with exit code 0
```

13) Write a program to demonstrate polymorphism using interface as parent.

⇨

Program

```
package Q13_PolymorphismUsingInterface;

interface Shape
{
    double area();
}
class Square implements Shape
{
    public double l;
    public Square(double l)
    {
        this.l = l;
    }
    @Override     public double area()
    {
        return l * l;
    }
}
class Circle implements Shape
{
    public double r;
    public Circle(double r)
    {
        this.r = r;
    }
    @Override     public double area()
    {
        return Math.PI * r * r;
    }
}
public class PolymorphismUsingInterface
{
    public static void main(String[] args)
    {
        Shape[] shapes = new Shape[]
                {
                    new Square(5),
                    new Circle(1),
                    new Square(10),
                    new Circle(2)
                };
        for(Shape s : shapes)
            System.out.println(s.area());
    }
}
```

Output:

```
PolymorphismUsingInterface
"C:\Program Files\Java\jdk-13.0.2\bin
25.0
3.141592653589793
100.0
12.566370614359172

Process finished with exit code 0
```

14) Write a program to create two classes Circle and Square, with appropriate fields and methods, in a package name shape. Create a separate class ShapeDemo to test the classes.

⇨

Program

```
package Q14_ShapeDemo;

class Circle
{
    private double radius;

    public double getRadius()
    {
        return radius;
    }
    public void setRadius(double radius)
    {
        this.radius = radius;
    }
    public double areaOfCircle()
    {
        return Math.PI*radius*radius;
    }
}

class Square
{
    private double length;

    public double getLength()
    {
        return length;
    }

    public void setLength(double length)
    {
        this.length = length;
    }
    public double areaOfSquare()
    {
        return length*length;
    }
}

public class ShapeDemo
{
    public static void main(String[] args)
    {
        Circle c = new Circle();
        Square s = new Square();
        c.setRadius(5);
        s.setLength(5);


        System.out.println("The area of Circle with
```

```
                                radius " + c.getRadius() + "
                                is: "+ c.areaOfCircle());
        System.out.println("The area of Square with
                                length" + s.getLength() + "
                                is: "+ s.areaOfSquare());
    }
}
```

output: