

# Rajalakshmi Engineering College

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## 2024\_28\_III\_OOPS Using Java Lab

### REC\_2028\_OOPS using Java\_Week 6\_CY

Attempt : 1  
Total Mark : 40  
Marks Obtained : 40

#### Section 1 : Coding

##### 1. Problem Statement

A painter needs to determine the cost to paint different shapes based on their surface area. The program should be designed to handle the area of a sphere and calculate the total painting cost using the following formulas:

Area of sphere:  $\text{Area} = 4 * \pi * r^2$  where  $\pi = 3.14$   
Total painting cost:  $\text{Cost} = \text{cost per square meter} * \text{area of sphere}$

The program will consist of three classes:

Shape class: This class should set the shape type and radius.  
Area class: This class should extend Shape to calculate the area.  
Cost class: This class should extend Area to calculate the total painting cost.

##### ***Input Format***

The input consists of a string representing the shape type, a double value

representing the radius, and another double value representing the cost per square meter on each line.

### ***Output Format***

For a valid shape type of "Sphere":

- The first line prints: "Area of Sphere is: <calculated\_area>" rounded to two decimal places.
- The second line prints: "Cost to paint the shape is: <total\_painting\_cost>" rounded to two decimal places.

For any other shape types, print: "Invalid type".

Refer to the sample output for formatting specifications.

### ***Sample Test Case***

Input: Sphere

3.4

5.8

Output: Area of Sphere is: 145.19

Cost to paint the shape is: 842.12

### ***Answer***

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

```
class Shape {
```

```
    protected String type;
```

```
    protected double radius;
```

```
    public Shape() {}
```

```
    public void setShape(String type, java.util.Scanner scanner) {
```

```
        this.type = type;
```

```
        this.radius = scanner.nextDouble();
```

```
    }
```

```
}
```

```
class Area extends Shape {
```

```
    protected double area;
```

```

    public void calculateArea() {
        if (type.equals("Sphere")) {
            area = 4 * 3.14 * radius * radius;
        } else {
            area = -1;
        }
    }
}

```

```

class Cost extends Area {
    private double costPerSqMeter;
    private double totalCost;

    public void setCost(double costPerSqMeter) {
        this.costPerSqMeter = costPerSqMeter;
    }

    public void calculateCost() {
        if (area == -1) {
            System.out.print("Invalid type");
        } else {
            totalCost = costPerSqMeter * area;
            System.out.printf("Area of Sphere is: %.2f ", area);
            System.out.printf("Cost to paint the shape is: %.2f", totalCost);
        }
    }
}
// You are using Java

```

```

public class Main {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        String s = scanner.next();
        Cost shape = new Cost();
        shape.setShape(s, scanner);
        double costToPaint = scanner.nextDouble();
        shape.calculateArea();
        shape.setCost(costToPaint);
        shape.calculateCost();
    }
}

```

```
}
```

**Status :** Correct

**Marks :** 10/10

## 2. Problem Statement

Arun wants to calculate the age gap between the grandfather and the son and determine the father's age after 5 years.

Your task is to assist him in developing a program using three classes: GrandFather, Father, and Son, where the GrandFather stores the grandfather's age, the Father extends GrandFather to include the father's age and calculates his age after 5 years, and Son extends Father to include the son's age and calculate the age difference between the grandfather and the son.

### ***Input Format***

The input consists of three integers representing the ages of the grandfather, father, and son, one per line.

### ***Output Format***

The first line of output prints "Grandfather and son's age gap:" followed by an integer representing the age gap between the grandfather and the son, ending with "years".

The second line prints "Father's Age:" followed by an integer representing the father's age after 5 years, ending with "years".

Refer to the sample output for formatting specifications.

### ***Sample Test Case***

Input: 50

30

3

Output: Grandfather and son's age gap: 47 years

Father's Age: 35 years

### **Answer**

```
import java.util.Scanner;

class GrandFather {
    protected int grandfatherAge;

    public void setGrandfatherAge(int grandfatherAge) {
        this.grandfatherAge = grandfatherAge;
    }
}

class Father extends GrandFather {
    protected int fatherAge;

    public void setFatherAge(int fatherAge) {
        this.fatherAge = fatherAge;
    }

    public int calculateFatherAgeAfter5Years() {
        return fatherAge + 5;
    }
}

class Son extends Father {
    private int sonAge;

    public void setSonAge(int sonAge) {
        this.sonAge = sonAge;
    }

    public int calculateGrandfatherSonAgeDifference() {
        return grandfatherAge - sonAge;
    }

    public void displayDetails() {
        int ageGap = calculateGrandfatherSonAgeDifference();
        int fatherFutureAge = calculateFatherAgeAfter5Years();
        System.out.printf("Grandfather and son's age gap: %d years ", ageGap);
        System.out.printf("Father's Age: %d years", fatherFutureAge);
    }
}
```

```

public class Main {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        Son son = new Son();

        int grandfatherAge = scanner.nextInt();
        son.setGrandfatherAge(grandfatherAge);

        int fatherAge = scanner.nextInt();
        son.setFatherAge(fatherAge);

        int sonAge = scanner.nextInt();
        son.setSonAge(sonAge);

        System.out.println("Grandfather and son's age gap: "+
            son.calculateGrandfatherSonAgeDifference() + " years");

        int fatherAgeAfter5Years = son.calculateFatherAgeAfter5Years();
        System.out.println("Father's Age: " + fatherAgeAfter5Years + " years");
    }
}

```

**Status :** Correct

**Marks :** 10/10

### 3. Problem Statement

Adams has a reputation company with a great number of employees. He must calculate the salary weekly according to the hourly rate and working hours. Create a program to define a class Employee with attributes name and hourly rate. Create a subclass HourlyEmployee that calculates the weekly salary based on the number of hours worked.

(The first 40 hours are based on the regular hour rate. If the work hours are greater than 40 then the work wage is 1.5 times the hourly rate)

Note: Use Math(Math.max, Math.min) functions .

Example

Input:

Chris

10

45

Output:

Weekly Salary: Rs.475.00

Explanation:

Calculation:

The first 40 hours are paid normally:  $40 \times 10 = 400.00$  The extra 5 hours are paid at 1.5 times the hourly rate:  $5 \times (10 \times 1.5) = 5 \times 15 = 75.00$  Total salary:  $400.00 + 75.00 = 475.00$

### ***Input Format***

The first line of input consists of a string that represents the name of the employee.

The second line consists of a double value that represents the rate for an hour.

The last line consists of an integer that represents the total hours worked.

### ***Output Format***

The output displays the total salary of the employee, where salary is rounded to two decimal places in the format: "Weekly Salary: Rs.<double value>".

Refer to the sample output for formatting specifications.

### ***Sample Test Case***

Input: Dave

10.0

40

Output: Weekly Salary: Rs.400.00

### ***Answer***

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

```

import java.text.DecimalFormat;

// You are using Java
class Employee {
    protected String name;
    protected double hourlyRate;

    public Employee(String name, double hourlyRate) {
        this.name = name;
        this.hourlyRate = hourlyRate;
    }
}

class HourlyEmployee extends Employee {
    private int hoursWorked;

    public HourlyEmployee(String name, double hourlyRate, int hoursWorked) {
        super(name, hourlyRate);
        this.hoursWorked = hoursWorked;
    }

    public double calculateWeeklySalary() {
        int regularHours = Math.min(hoursWorked, 40);
        int overtimeHours = Math.max(0, hoursWorked - 40);

        double regularPay = regularHours * hourlyRate;
        double overtimePay = overtimeHours * (hourlyRate * 1.5);

        return regularPay + overtimePay;
    }

    public void displayWeeklySalary() {
        double totalSalary = calculateWeeklySalary();
        System.out.printf("Weekly Salary: Rs.%.2f", totalSalary);
    }
}

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

        String name = scanner.nextLine();
        double hourlyRate = scanner.nextDouble();
    }
}

```



```
int hoursWorked = scanner.nextInt();

HourlyEmployee employee = new HourlyEmployee(name, hourlyRate,
hoursWorked);

double weeklySalary = employee.calculateWeeklySalary();
DecimalFormat df = new DecimalFormat("#.00");
String formattedSalary = df.format(weeklySalary);
System.out.println("Weekly Salary: Rs." + formattedSalary);
scanner.close();
}
}
```

**Status :** Correct

**Marks : 10/10**

#### 4. Problem Statement

Teena's retail store has implemented a Loyalty Points System to reward customers based on their spending. The program calculates and displays the loyalty points based on whether the customer is a regular or a premium customer.

For regular customers (class Customer), the loyalty points are calculated as:

$\text{Loyalty points} = \text{amount spent} / 10$

For premium customers (class PremiumCustomer, which inherits from Customer), the loyalty points are calculated as:

$\text{Loyalty points} = 2 * (\text{amount spent} / 10)$

The program should use method overriding for premium customers to calculate their loyalty points. The method that needs to be overridden is calculateLoyaltyPoints in the Customer class.

#### ***Input Format***

The first line of input consists of an integer representing the amount spent by the customer.

The second line consists of a string representing the premium customer status:

- "yes" if the customer is a premium customer.
- "no" if the customer is not a premium customer.

### ***Output Format***

The output should display the loyalty points earned based on the amount spent and the customer type.

Refer to the sample output for formatting specifications.

### ***Sample Test Case***

Input: 50

yes

Output: 10

### ***Answer***

```
import java.util.Scanner;

class Customer {
    protected int amountSpent;

    public Customer() {
    }

    public int calculateLoyaltyPoints(int amountSpent) {
        this.amountSpent = amountSpent;
        return amountSpent / 10;
    }
}

class PremiumCustomer extends Customer {

    public PremiumCustomer() {
        super();
    }

    @Override
    public int calculateLoyaltyPoints(int amountSpent) {
        this.amountSpent = amountSpent;
```

```
        return 2 * (amountSpent / 10);
    }
}

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

        int amountSpent = scanner.nextInt();

        String isPremium = scanner.next().toLowerCase();

        Customer customer;

        if (isPremium.equals("yes")) {
            customer = new PremiumCustomer();
        } else {
            customer = new Customer();
        }

        int loyaltyPoints = customer.calculateLoyaltyPoints(amountSpent);

        System.out.println(loyaltyPoints);
    }
}
```

**Status :** Correct

**Marks :** 10/10