

JAVA ASSIGNMENT 5

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AIML B

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Q. Write Menu Driven program to calculate the Area and Volume of the selected Shape

- Create classes as Circle, Rectangle, Square, Sphere, Cylinder, and Pyramid.
- Create Shape as abstract class with showShape(String shape) as non-abstract method, while calculateShape() and calculatePerimeter() as abstract method.
- Create Volume as an interface with calculateVolume() as an abstract method.
- Get input from users for measurements of shapes.

CODE:

```
//SAMEER KHATWANI
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// Main.java
import java.util.Scanner;
public class Main {
    // Main function
    public static void main(String[] args) {
        // Add your name, PRN, and Batch details in comments here
        Scanner scanner = new Scanner(System.in);
        // Menu-driven program
        while (true) {
            System.out.println("\nSelect a shape:");
            System.out.println("1. Circle");
            System.out.println("2. Rectangle");
            System.out.println("3. Square");
            System.out.println("4. Sphere");
            System.out.println("5. Cylinder");
            System.out.println("6. Pyramid");
            System.out.println("0. Exit");
            int choice = scanner.nextInt();
            switch (choice) {
                case 1:
                    calculateCircleAreaAndPerimeter();
                    break;
                case 2:
                    calculateRectangleAreaAndPerimeter();
                    break;
                case 3:
                    calculateSquareAreaAndPerimeter();
                    break;
                case 4:
                    calculateSphereAreaAndVolume();
                    break;
                case 5:
```

```

        calculateCylinderAreaAndVolume();
        break;
    case 6:
        calculatePyramidAreaAndVolume();
        break;
    case 0:
        System.out.println("Ending program... So long comrade!");
        System.exit(0);
    default:
        System.out.println("Invalid choice. Please try again.");
    }
}

// Function to calculate the area and perimeter of a circle
private static void calculateCircleAreaAndPerimeter() {
    Circle circle = new Circle();
    circle.showShape("Circle");
    circle.getInput();
    double area = circle.calculateShape();
    double perimeter = circle.calculatePerimeter();
    System.out.println("Area: " + area);
    System.out.println("Perimeter: " + perimeter);
}

// Function to calculate the area and perimeter of a rectangle
private static void calculateRectangleAreaAndPerimeter() {
    Rectangle rectangle = new Rectangle();
    rectangle.showShape("Rectangle");
    rectangle.getInput();
    double area = rectangle.calculateShape();
    double perimeter = rectangle.calculatePerimeter();
    System.out.println("Area: " + area);
    System.out.println("Perimeter: " + perimeter);
}

// Function to calculate the area and perimeter of a square
private static void calculateSquareAreaAndPerimeter() {
    Square square = new Square();
    square.showShape("Square");
    square.getInput();
    double area = square.calculateShape();
    double perimeter = square.calculatePerimeter();
    System.out.println("Area: " + area);
    System.out.println("Perimeter: " + perimeter);
}

// Function to calculate the area and volume of a sphere
private static void calculateSphereAreaAndVolume() {
    Sphere sphere = new Sphere();
    sphere.showShape("Sphere");
    sphere.getInput();
    double area = sphere.calculateShape();
    double volume = sphere.calculateVolume();
}

```

```

        System.out.println("Surface Area: " + area);
        System.out.println("Volume: " + volume);
    }
    // Function to calculate the area and volume of a cylinder
    private static void calculateCylinderAreaAndVolume() {
        Cylinder cylinder = new Cylinder();
        cylinder.showShape("Cylinder");
        cylinder.getInput();
        double area = cylinder.calculateShape();
        double volume = cylinder.calculateVolume();
        System.out.println("Surface Area: " + area);
        System.out.println("Volume: " + volume);
    }
    // Function to calculate the area and volume of a pyramid
    private static void calculatePyramidAreaAndVolume() {
        Pyramid pyramid = new Pyramid();
        pyramid.showShape("Pyramid");
        pyramid.getInput();
        double area = pyramid.calculateShape();
        double volume = pyramid.calculateVolume();
        System.out.println("Surface Area: " + area);
        System.out.println("Volume: " + volume);
    }
}

```

```

// Shape.java
public abstract class Shape {
    // Non-abstract method
    public void showShape(String shape) {
        System.out.println("Selected shape: " + shape);
    }
    // Abstract methods to be implemented by subclasses
    public abstract double calculateShape();
    public abstract double calculatePerimeter();
}

```

```
// Circle.java
import java.util.*;
public class Circle extends Shape implements Volume {
    private double radius;
    @Override
    public double calculateShape() {
        return Math.PI * Math.pow(radius, 2);
    }
    @Override
    public double calculatePerimeter() {
        return 2 * Math.PI * radius;
    }
    @Override
    public double calculateVolume() {
        // Volume calculation for a 3D circle (sphere) is not included for simplicity
        return 0;
    }
    // Function to get input from the user
    public void getInput() {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter the radius of the circle: ");
        this.radius = scanner.nextDouble();
    }
}
```

```
// Cylinder.java
import java.util.Scanner;
public class Cylinder extends Shape implements Volume {
    private double radius;
    private double height;
    @Override
    public double calculateShape() {
        return 2 * Math.PI * radius * (radius + height);
    }
    @Override
    public double calculatePerimeter() {
        // Perimeter calculation for a 3D shape is not applicable
        return 0;
    }
    @Override
    public double calculateVolume() {
        return Math.PI * Math.pow(radius, 2) * height;
    }
    // Function to get input from the user
    public void getInput() {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter the radius of the cylinder: ");
        this.radius = scanner.nextDouble();
        System.out.print("Enter the height of the cylinder: ");
        this.height = scanner.nextDouble();
    }
}
```

```

// Pyramid.java
import java.util.Scanner;
public class Pyramid extends Shape implements Volume {
    private double baseLength;
    private double baseWidth;
    private double height;
    @Override
    public double calculateShape() {
        // Surface area of a pyramid
        return baseLength * baseWidth + 0.5 * baseLength * Math.sqrt(Math.pow(baseWidth / 2,
2) + Math.pow(height, 2))
            + 0.5 * baseWidth * Math.sqrt(Math.pow(baseLength / 2, 2) + Math.pow(height,
2));
    }
    @Override
    public double calculatePerimeter() {
        // Perimeter calculation for a 3D shape is not applicable
        return 0;
    }
    @Override
    public double calculateVolume() {
        return (1.0 / 3.0) * baseLength * baseWidth * height;
    }
    // Function to get input from the user
    public void getInput() {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter the base length of the pyramid: ");
        this.baseLength = scanner.nextDouble();
        System.out.print("Enter the base width of the pyramid: ");
        this.baseWidth = scanner.nextDouble();
        System.out.print("Enter the height of the pyramid: ");
        this.height = scanner.nextDouble();
    }
}

```

```
// Rectangle.java
import java.util.Scanner;
public class Rectangle extends Shape {
    private double length;
    private double width;
    @Override
    public double calculateShape() {
        return length * width;
    }
    @Override
    public double calculatePerimeter() {
        return 2 * (length + width);
    }
    // Function to get input from the user
    public void getInput() {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter the length of the rectangle: ");
        this.length = scanner.nextDouble();
        System.out.print("Enter the width of the rectangle: ");
        this.width = scanner.nextDouble();
    }
}
```

```
// Sphere.java
import java.util.Scanner;
public class Sphere extends Shape implements Volume {
    private double radius;
    @Override
    public double calculateShape() {
        return 4 * Math.PI * Math.pow(radius, 2);
    }
    @Override
    public double calculatePerimeter() {
        // Perimeter calculation for a 3D shape is not applicable
        return 0;
    }
    @Override
    public double calculateVolume() {
        return (4.0 / 3.0) * Math.PI * Math.pow(radius, 3);
    }
    // Function to get input from the user
    public void getInput() {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter the radius of the sphere: ");
        this.radius = scanner.nextDouble();
    }
}
```

```
// Square.java
import java.util.Scanner;
public class Square extends Shape {
    private double side;
    @Override
    public double calculateShape() {
        return Math.pow(side, 2);
    }
    @Override
    public double calculatePerimeter() {
        return 4 * side;
    }
    // Function to get input from the user
    public void getInput() {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter the side length of the square: ");
        this.side = scanner.nextDouble();
    }
}
```

```
// Volume.java
public interface Volume {
    // Abstract method to be implemented by classes
    double calculateVolume();
}
```

OUTPUTS:

CIRCLE

```
Select a shape:
1. Circle
2. Rectangle
3. Square
4. Sphere
5. Cylinder
6. Pyramid
0. Exit
1
Selected shape: Circle
Enter the radius of the circle: 3
Area: 28.274333882308138
Perimeter: 18.84955592153876
```


RECTANGLE

```
Select a shape:
1. Circle
2. Rectangle
3. Square
4. Sphere
5. Cylinder
6. Pyramid
0. Exit
2
Selected shape: Rectangle
Enter the length of the rectangle: 3
Enter the width of the rectangle: 3
Area: 9.0
Perimeter: 12.0
```

SQUARE

```
Select a shape:
1. Circle
2. Rectangle
3. Square
4. Sphere
5. Cylinder
6. Pyramid
0. Exit
3
Selected shape: Square
Enter the side length of the square: 4
Area: 16.0
Perimeter: 16.0
```

SPHERE

```
Select a shape:
1. Circle
2. Rectangle
3. Square
4. Sphere
5. Cylinder
6. Pyramid
0. Exit
4
Selected shape: Sphere
Enter the radius of the sphere: 3
Surface Area: 113.09733552923255
Volume: 113.09733552923254
```

CYLINDER

```
Select a shape:
1. Circle
2. Rectangle
3. Square
4. Sphere
5. Cylinder
6. Pyramid
0. Exit
5
Selected shape: Cylinder
Enter the radius of the cylinder: 3
Enter the height of the cylinder: 4
Surface Area: 131.94689145077132
Volume: 113.09733552923255
```

PYRAMID

```
Select a shape:
1. Circle
2. Rectangle
3. Square
4. Sphere
5. Cylinder
6. Pyramid
0. Exit
6
Selected shape: Pyramid
Enter the base length of the pyramid: 4
Enter the base width of the pyramid: 4
Enter the height of the pyramid: 3
Surface Area: 30.42220510185596
Volume: 16.0
```

Github Repo:

<https://github.com/samv28/PIJ>