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Title of the Experiment (Abstract Classes)

Experiment No. ____06______ **Date :** __24/12/20_____

Problem Statement:

Design an abstract class Car to have carName, chassiNum, modelName as member variables and add two abstract methods, startCar and operateSteering . Inherit MarutiCar and BmwCar from Car class and override the two abstract methods in their own unique way. Design a driver class to have driver name, gender and age as data members and add a method driveCar with abstract class reference variable as argument and invoke the two basic operations namely, startCar and operateStearing and demonstrate run-time polymorphism.

Objectives of the Experiment:

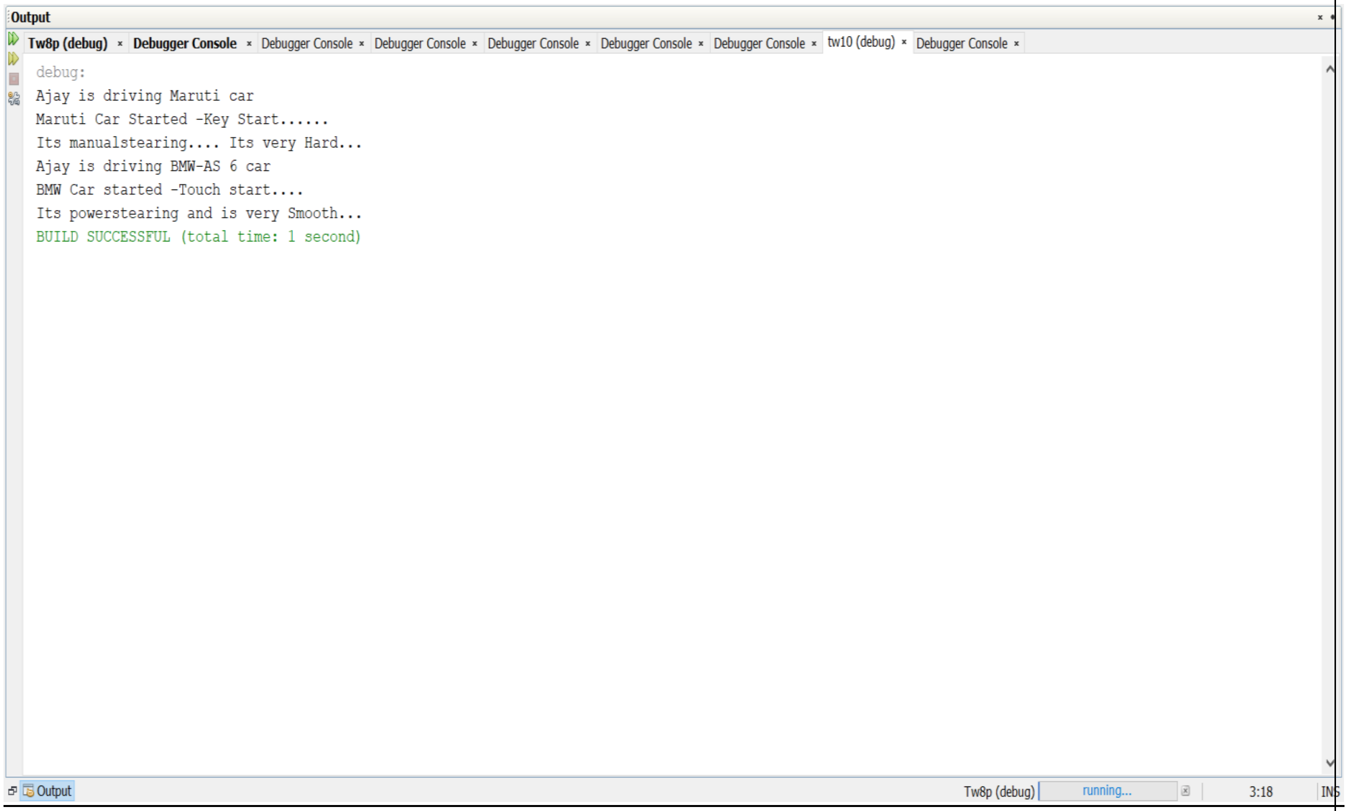
1. Learn declaration and initialization of variables and implementation of Run-time Polymorphism in Java.
2. Understand the use of Run-time Polymorphism in a real-life application.
3. Learn the usage of Looping constructs and control statements.
4. Learn to Display the result in a readable/proper format.

Problem Source Code:

```
package termwork_6;

publicclass termwork_6 {

publicstaticvoid main(String[] args) {

        MarutiCar c=new MarutiCar(22,"Maruti","Maruti 800",10001023);
        BMWCar c1=new BMWCar(125,"BMW-AS 6","BMW",1233422);
        Driver d=new Driver("Ajay","Male",24);
        d.driveCar(c);
        d.driveCar(c1);
        }
}


abstractclass Car {
        String carName, model;
        long chassNumber;
        public Car(String carName, String model, long chassNumber) {
                        this.carName = carName;
                        this.model = model;
                        this.chassNumber = chassNumber;
        }
```

```
		publicabstractvoid startCar();
		publicabstractvoid operateStearing();
	}
	class MarutiCar extends Car {
		float mileage;
		public MarutiCar(float mileage, String carName, String model, long chassNumber) {
			super(carName, model, chassNumber);
			this.mileage = mileage;
		}
		publicvoid startCar(){ System.out.println("Maruti Car Started -Key Start......"); }
		publicvoid operateStearing() { System.out.println("Its manualstearing.... Its very Hard..."); }
	}
	class BMWCar extends Car{
		float horsePower;
		public BMWCar(float horsePower, String carName, String model, long chassNumber) {
			super(carName, model, chassNumber);
			this.horsePower = horsePower;
		}
		publicvoid startCar(){ System.out.println("BMW Car started -Touch start...."); }
		publicvoid operateStearing(){ System.out.println("Its powerstearing and is very Smooth...");
	}
	}
	class Driver {
		String name, gender;
		int age;
		public Driver(String name, String gender, int age) {
			this.name = name;
			this.gender = gender;
			this.age = age;
		}
		publicvoid driveCar(Car c){
			System.out.println(name + " is driving "+c.carName+" car ");
			c.startCar();
			c.operateStearing();
		}
	}
```

Output:



```
debug:
Ajay is driving Maruti car
Maruti Car Started -Key Start......
Its manualstearing.... Its very Hard...
Ajay is driving BMW-AS 6 car
BMW Car started -Touch start....
Its powerstearing and is very Smooth...
BUILD SUCCESSFUL (total time: 1 second)
```

Outcomes of the Experiment:

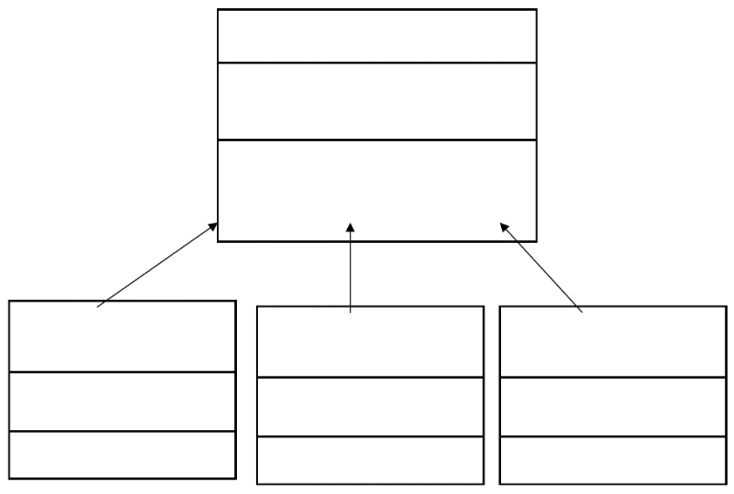
1. Able to Demonstrate the use of Run-time Polymorphism in solving real-life problems.
2. Identify appropriate variables and their types
3. Identify appropriate looping constructs (for)
4. Check if one loop will suffice or use nesting
5. Identify the control statements needed to meet the problem requirements.

Conclusion:

From the given problem statement, we could identify the necessary variables of appropriate type, and looping/control statements and the necessary program logic. The program was written in Eclipse IDE by creating a project. We understood the usage of the IDE in typing the code, debugging, running the program and observing the output. We also understood the use of built-in class System and its method println to display the result. The program was executed for two sets of input and result obtained were verified to be correct and recorded.

Practice Problem Statement:

Implement the following inheritance hierarchy.



Problem Source Code:

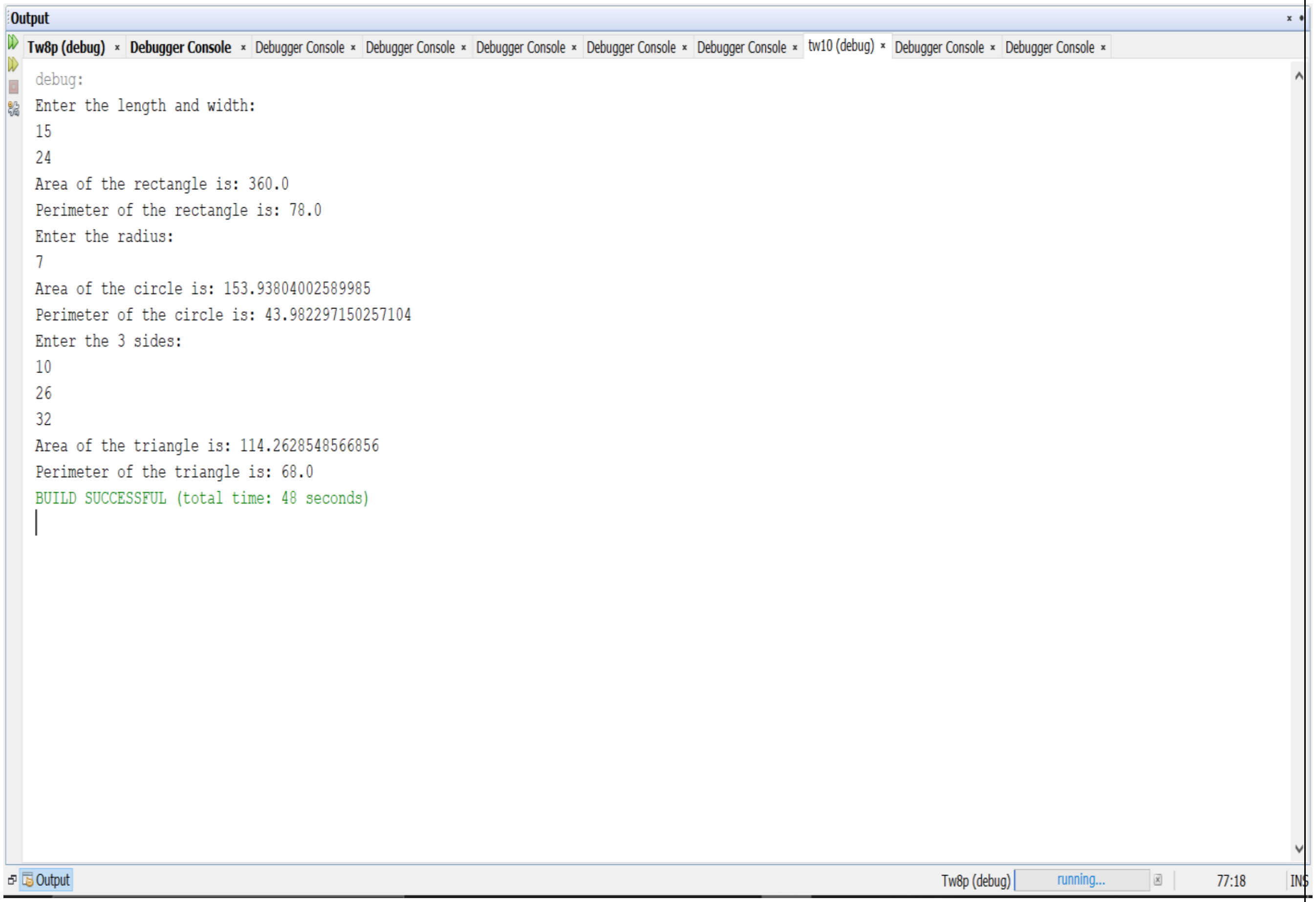
```
package termwork_6_pp1;
import java.util.Scanner;

abstractclass Shape{
        double area;
        double perimeter;
        String type;

        abstractvoid computeArea();
        abstractvoid computePerimeter();
}

class Rectangle extends Shape{
        double length, width;

        Rectangle(){
                Scanner in = new Scanner(System.in);
                System.out.println("Enter the length and width: ");
                length = in.nextDouble();
                width = in.nextDouble();
        }

        void computeArea() {
                area = length * width;
                System.out.println("Area of the rectangle is: " + area);
        }

        void computePerimeter() {
```

```
		perimeter = 2 * (length + width);
		System.out.println("Perimeter of the rectangle is: " + perimeter);
	}
}

class Circle extends Shape{
	double radius;

	Circle(){
		Scanner in = new Scanner(System.in);
		System.out.println("Enter the radius: ");
		radius = in.nextDouble();
	}

	void computeArea() {
		area = Math.PI * radius * radius;
		System.out.println("Area of the circle is: " + area);
	}

	void computePerimeter() {
		perimeter = 2 * Math.PI * radius;
		System.out.println("Perimeter of the circle is: " + perimeter);
	}
}

class Triangle extends Shape{
	double a, b, c, s;

	Triangle(){
		Scanner in = new Scanner(System.in);
		System.out.println("Enter the 3 sides: ");
		a = in.nextDouble();
		b = in.nextDouble();
		c = in.nextDouble();
	}

	void computeArea() {
		s = (a + b + c) / 2.0;
		area = Math.sqrt(s * (s-a) * (s-b) * (s-c));
		System.out.println("Area of the triangle is: " + area);
	}

	void computePerimeter() {
		perimeter = a + b + c;
		System.out.println("Perimeter of the triangle is: " + perimeter);
	}
}
```

```
publicclass Tw6_pp1 {

	publicstaticvoid main(String[] args) {
		// TODO Auto-generated method stub
		Rectangle r = new Rectangle();
		r.computeArea();
		r.computePerimeter();

		Circle c = new Circle();
		c.computeArea();
		c.computePerimeter();

		Triangle t = new Triangle();
		t.computeArea();
		t.computePerimeter();
	}

}
```

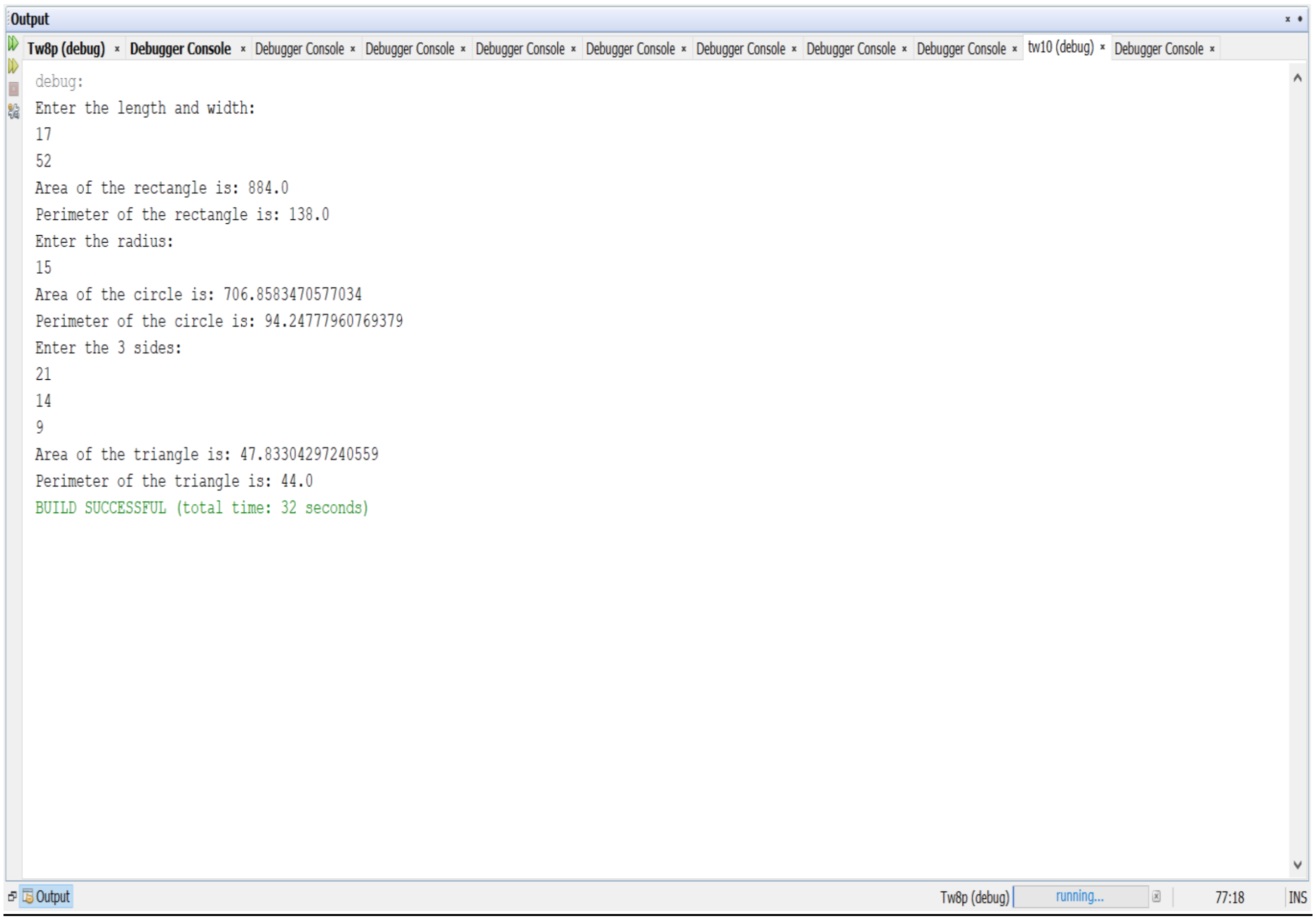
Output:

Case 1:



```
debug:
Enter the length and width:
15
24
Area of the rectangle is: 360.0
Perimeter of the rectangle is: 78.0
Enter the radius:
7
Area of the circle is: 153.93804002589985
Perimeter of the circle is: 43.982297150257104
Enter the 3 sides:
10
26
32
Area of the triangle is: 114.2628548566856
Perimeter of the triangle is: 68.0
BUILD SUCCESSFUL (total time: 48 seconds)
```

Case2:



```
debug:
Enter the length and width:
17
52
Area of the rectangle is: 884.0
Perimeter of the rectangle is: 138.0
Enter the radius:
15
Area of the circle is: 706.8583470577034
Perimeter of the circle is: 94.24777960769379
Enter the 3 sides:
21
14
9
Area of the triangle is: 47.83304297240559
Perimeter of the triangle is: 44.0
BUILD SUCCESSFUL (total time: 32 seconds)
```