|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Line No** | **Program Statement** | **Method** | | | | **Polymorphism** | | | **Encapsulation** | | | | | **Abstraction** | | | | **Total** |
| **Wrt** | **Npd** | **Nnp** | **Cm** | **Nol** | **Nor** | **Cp** | **Ngm** | **Nsm** | **Nga** | **Nsa** | **Ce** | **Nac** | **Nam** | **Ni** | **Ca** | **Tc** | |
| 1 | // Java program to illustrate the |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 2 | // concept of Abstraction |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 3 | abstract class Shape |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 4 | { |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 5 | String color; |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 6 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 7 | // these are abstract methods |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 8 | abstract double area(); |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 9 | public abstract String toString(); |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 10 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 11 | // abstract class can have constructor |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 12 | public Shape(String color) { |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 13 | System.out.println("Shape constructor called"); |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 14 | this.color = color; |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 15 | } |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 16 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 17 | // this is a concrete method |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 18 | public String getColor() { |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 19 | return color; |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 20 | } |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 21 | } |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 22 | class Circle extends Shape |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 23 | { |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 24 | double radius; |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 26 | public Circle(String color,double radius) { |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 27 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 28 | // calling Shape constructor |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 29 | super(color); |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 30 | System.out.println("Circle constructor called"); |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 31 | this.radius = radius; |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 32 | } |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 33 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 34 | @Override |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 35 | double area() { |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 36 | return Math.PI \* Math.pow(radius, 2); |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 37 | } |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 38 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 39 | @Override |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 40 | public String toString() { |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 41 | return "Circle color is " + super.color + |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 42 | "and area is : " + area(); |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 43 | } |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 44 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 45 | } |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 46 | class Rectangle extends Shape{ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 47 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 48 | double length; |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 49 | double width; |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 50 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 51 | public Rectangle(String color,double length,double width) { |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 52 | // calling Shape constructor |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 53 | super(color); |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 54 | System.out.println("Rectangle constructor called"); |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 55 | this.length = length; |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 56 | this.width = width; |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 57 | } |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 58 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 59 | @Override |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 60 | double area() { |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 61 | return length\*width; |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 62 | } |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 63 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 64 | @Override |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 65 | public String toString() { |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 66 | return "Rectangle color is " + super.color + |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 67 | "and area is : " + area(); |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 68 | } |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 69 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 70 | } |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 71 | public class Test |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 72 | { |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 73 | public static void main(String[] args) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 74 | { |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 75 | Shape s1 = new Circle("Red", 2.2); |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 76 | Shape s2 = new Rectangle("Yellow", 2, 4); |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 77 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 78 | System.out.println(s1.toString()); |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 79 | System.out.println(s2.toString()); |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 80 | } |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 81 | } |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| 82 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |