



CSE 215L: Programming language II Lab

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Sec: 06

Lab - 06 [Introduction to OOP], Spring-2021

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Objective:

- OOP in Java
- Class Definition in Java
- Creating Instances of a Class
- UML class and Instance Diagrams

Class & Instances

In Java, a class is a definition of objects of the same kind. In other words, a class is a blueprint, template, or prototype that defines and describes the static attributes and dynamic behaviors common to all objects of the same kind.

An instance is the realization of a particular item of a class. In other words, an instance is an instantiation of a class. All the instances of a class have similar properties, as described in the class definition.

A class can be visualized as a three-compartment box, as illustrated:

1. *Name* (or identity): identifies the class.
2. *Variables* (or attribute, state, field): contains the *attributes* of the class.
3. *Methods* (or behaviors, function, operation): contains the *dynamic behaviors* of the class.

The followings figure shows a few examples of classes:

Name
Attributes
Dynamic Behaviours

A class is a 3 compartment box

The followings figure shows a few examples of classes.

Student	Circle	SoccerPlayer	Car
name gpa	radius color	name number xLocation yLocation	plateNumber xLocation yLocation speed
getName() setGpa()	getRadius() getArea()	run() jump() kickBall()	move() park() accelerate()
Examples of classes			

The following figure shows two instances of the class Student, identified as "paul" and "peter".

Name	paul:Student
Variables	name="Paul Lee" gpa=3.5
Methods	getName() setGpa()

Name	peter:Student
Variables	name="Peter Tan" gpa=3.9
Methods	getName() setGpa()

Two instances - paul and peter - of the class Student

An OOP Example:

Class Definition

Circle
-radius:double=1.0
-color:String="red"
+getRadius():double
+getColor():String
+getArea():double

Instances

c1:Circle	c2:Circle	c3:Circle
-radius=2.0 -color="blue"	-radius=2.0 -color="red"	-radius=1.0 -color="red"
+getRadius() +getColor() +getArea()	+getRadius() +getColor() +getArea()	+getRadius() +getColor() +getArea()

```
/*
 * The Circle class models a circle with a radius and color.
 */
public class Circle { // Save as "Circle.java"
    // Private instance variables
    private double radius;
    private String color;

    // Constructors (overloaded)
    public Circle() { // 1st Constructor
        radius = 1.0;
        color = "red";
    }
    public Circle(double r) { // 2nd Constructor
        radius = r;
        color = "red";
    }
    public Circle(double r, String c) { // 3rd Constructor
        radius = r;
        color = c;
    }

    // Public methods
    public double getRadius() {
        return radius;
    }
    public String getColor() {
        return color;
    }
    public double getArea() {
        return radius * radius * Math.PI;
    }
}
```

TestCircle.java

We shall now write another class called TestCircle, which uses the Circle class. The TestCircle class has a main() method and can be executed.

```
1 /*
2  * A Test Driver for the "Circle" class
3  */
4 public class TestCircle { // Save as "TestCircle.java"
5     public static void main(String[] args) { // Program entry point
6         // Declare and Construct an instance of the Circle class called c1
7         Circle c1 = new Circle(2.0, "blue"); // Use 3rd constructor
8         System.out.println("The radius is: " + c1.getRadius()); // use dot operator to
9     invoke member methods
10    System.out.println("The color is: " + c1.getColor());
11    System.out.printf("The area is: %.2f%n", c1.getArea());
12
13    // Declare and Construct another instance of the Circle class called c2
14    Circle c2 = new Circle(2.0); // Use 2nd constructor
15    System.out.println("The radius is: " + c2.getRadius());
16    System.out.println("The color is: " + c2.getColor());
17    System.out.printf("The area is: %.2f%n", c2.getArea());
18
19    // Declare and Construct yet another instance of the Circle class called c3
20    Circle c3 = new Circle(); // Use 1st constructor
21    System.out.println("The radius is: " + c3.getRadius());
22    System.out.println("The color is: " + c3.getColor());
23    System.out.printf("The area is: %.2f%n", c3.getArea());
24 }
```

Compile TestCircle.java into TestCircle.class.

Task: Implement the following class and test its methods

