Classes and Objects in Java

Basics of Classes in Java

Contents

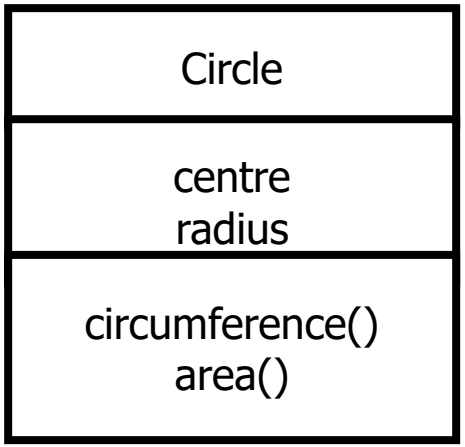
- Introduce to classes and objects in Java.
- Understand how some of the OO concepts learnt so far are supported in Java.
- Understand important features in Java classes.

Introduction

- Java is a true OO language and therefore the underlying structure of all Java programs is classes.
- Anything we wish to represent in Java must be encapsulated in a class that defines the "state" and "behaviour" of the basic program components known as objects.
- Classes create objects and objects use methods to communicate between them. They provide a convenient method for packaging a group of logically related data items and functions that work on them.
- A class essentially serves as a template for an object and behaves like a basic data type "int". It is therefore important to understand how the fields and methods are defined in a class and how they are used to build a Java program that incorporates the basic OO concepts such as encapsulation, inheritance, and polymorphism.

Classes

- A *class* is a collection of *fields* (data) and *methods* (procedure or function) that operate on that data.



Classes

- A *class* is a collection of *fields* (data) and *methods* (procedure or function) that operate on that data.
- The basic syntax for a class definition:

```
class ClassName [extends
SuperClassName]
{
        [fields declaration]
        [methods declaration]
}
```

- Bare bone class – no fields, no methods

```
public class Circle {
    // my circle class
}
```

Adding Fields: Class Circle with fields

- Add *fields*

```
public class Circle {
      public double x, y;  // centre coordinate
      public double r;     //  radius of the circle

}
```

- The fields (data) are also called the *instance* varaibles.

Adding Methods

- A class with only data fields has no life. Objects created by such a class cannot respond to any messages.
- Methods are declared inside the body of the class but immediately after the declaration of data fields.
- The general form of a method declaration is:

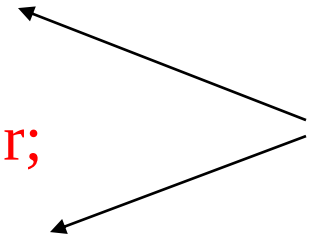
```
type MethodName (parameter-list)
{
        Method-body;
}
```

Adding Methods to Class Circle

```
public class Circle {

    public double x, y; // centre of the circle
    public double r;    // radius of circle

    //Methods to return circumference and area
    public double circumference() {
                return 2*3.14*r;
    }
    public double area() {
                return 3.14 * r * r;
    }
}
```



Data Abstraction

- Declare the Circle class, have created a new data type – Data Abstraction

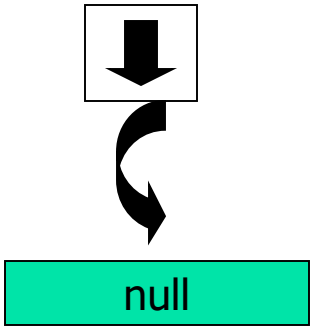
- Can define variables (objects) of that type:

```
Circle  aCircle;
Circle  bCircle;
```

Class of Circle cont.

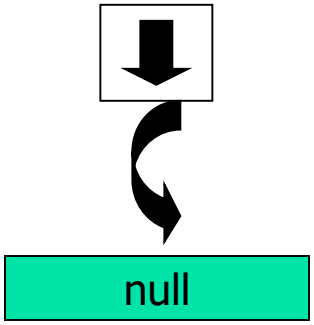
- aCircle, bCircle simply refers to a Circle object, not an object itself.

aCircle



Points to nothing (Null Reference)

bCircle

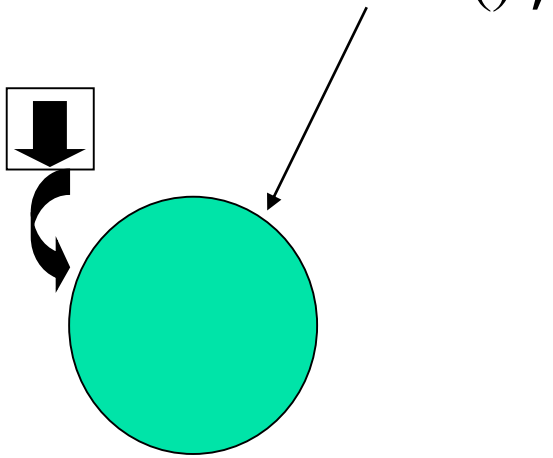


Points to nothing (Null Reference)

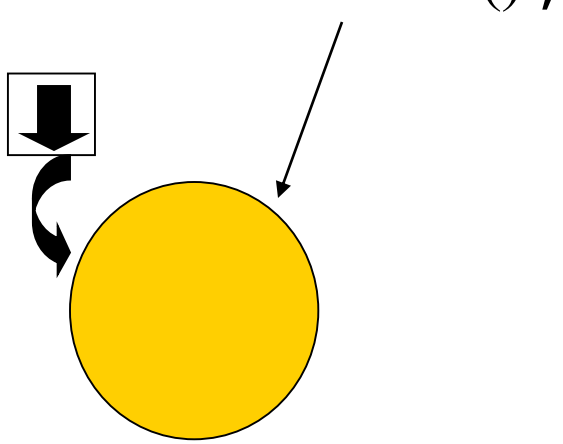
Creating objects of a class

- Objects are created dynamically using the *new* keyword.
- aCircle and bCircle refer to Circle objects

aCircle = new Circle() ;



bCircle = new Circle() ;



Creating objects of a class

```
aCircle = new Circle();
bCircle = new Circle() ;

bCircle = aCircle;
```

Creating objects of a class

```
aCircle = new Circle();
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bCircle = aCircle;
```
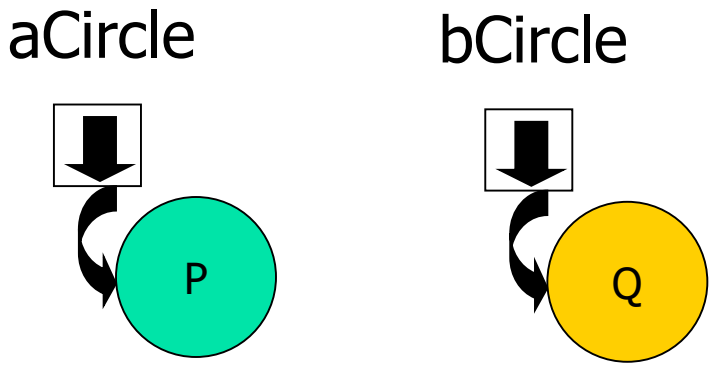
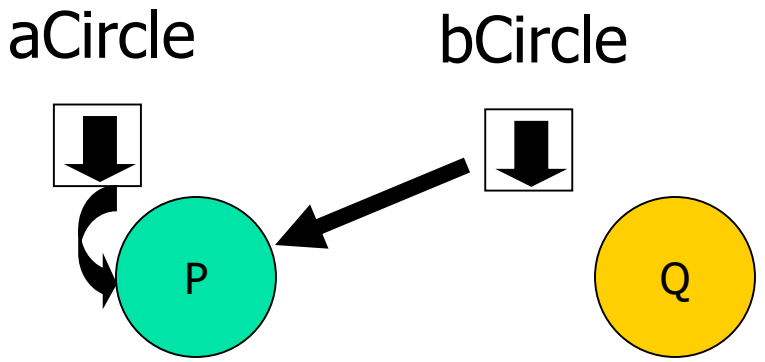
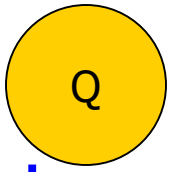

Before Assignment



Before Assignment



Automatic garbage collection

- The object 

does not have a reference and cannot be used in future.

- The object becomes a candidate for automatic garbage collection.

- Java automatically collects garbage periodically and releases the memory used to be used in the future.

Accessing Object/Circle Data

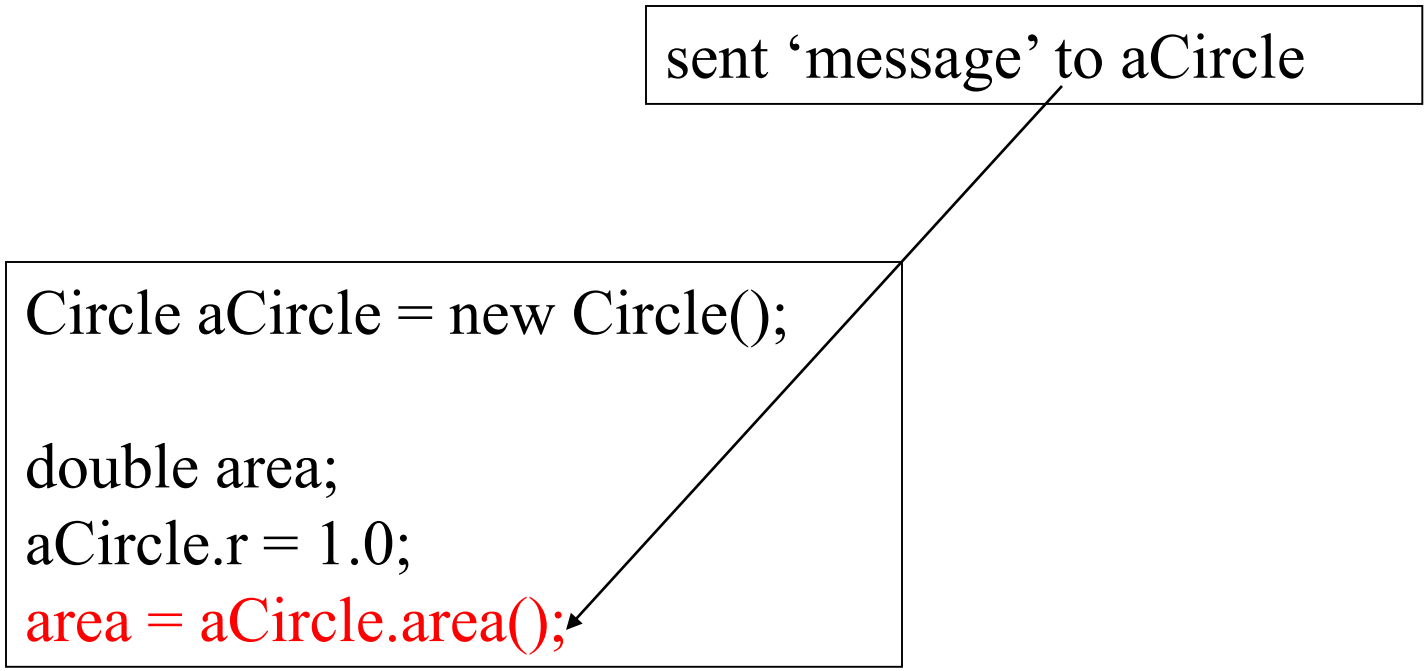
- Similar to C syntax for accessing data defined in a structure.

ObjectName.VariableName
ObjectName.MethodName(parameter-list)

```
Circle aCircle = new Circle();

aCircle.x = 2.0 // initialize center and radius
aCircle.y = 2.0
aCircle.r = 1.0
```

Executing Methods in Object/Circle

- Using Object Methods:



Using Circle Class

```
// Circle.java:  Contains both Circle class and its user class
//Add Circle class code here
class MyMain
{
	public static void main(String args[])
	{
		Circle aCircle;  // creating reference
		aCircle = new Circle(); // creating object
		aCircle.x = 10;  // assigning value to data field
		aCircle.y = 20;
		aCircle.r = 5;
		double area = aCircle.area(); // invoking method
		double circumf = aCircle.circumference();
		System.out.println("Radius="+aCircle.r+" Area="+area);
		System.out.println("Radius="+aCircle.r+" Circumference ="+circumf);
	}
}
```

```
[raj@mundroo]%: java MyMain
Radius=5.0 Area=78.5
Radius=5.0 Circumference =31.400000000000002
```

Summary

- Classes, objects, and methods are the basic components used in Java programming.
- We have discussed:
  - How to define a class
  - How to create objects
  - How to add data fields and methods to classes
  - How to access data fields and methods to classes