Chapter 8
Lecture 8-3: toString, this

**reading:** 8.6 - 8.7
self-checks: #13-18, 20-21
exercises: #5, 9, 14
The `toString` method

reading: 8.6

self-check: #18, 20-21
exercises: #9, 14
Printing objects

• By default, Java doesn't know how to print objects:
  
  Point p = new Point(10, 7);
  System.out.println("p: " + p);  // p: Point@9e8c34

• We can print a better string (but this is cumbersome):
  
  System.out.println("p: (" + p.x + ", " + p.y + ")");

• We'd like to be able to print the object itself:
  
  // desired behavior
  System.out.println("p: " + p);  // p: (10, 7)
The `toString` method

- tells Java how to convert an object into a `String`:
  ```java
  Point p1 = new Point(7, 2);
  System.out.println("p1: " + p1);
  ```

- If you prefer, you can write `.toString()` explicitly.
  ```java
  System.out.println("p1: " + p1.toString());
  ```

- Every class has a `toString`, even if it isn't in your code.
  - The default is the class's name and a hex (base-16) number:
    ```java
    Point@9e8c34
    ```
**toString syntax**

```java
public String toString() {
    return code that returns a suitable String;
}
```

- The method name, return, parameters must match exactly.
- Example:
  ```java
  // Returns a String representing this Point.
  public String toString() {
      return "(" + x + ", " + y + ")";
  }
  ```
Client code

// This client program uses the Point class.
public class PointMain {
    public static void main(String[] args) {
        // create two Point objects
        Point p1 = new Point(7, 2);
        Point p2 = new Point(4, 3);

        // print each point
        System.out.println("p1: " + p1);
        System.out.println("p2: " + p2);

        // compute/print each point's distance from the origin
        System.out.println("p1's distance from origin: " + p1.distanceFromOrigin());
        System.out.println("p2's distance from origin: " + p1.distanceFromOrigin());

        // move p1 and p2 and print them again
        p1.translate(11, 6);
        p2.translate(1, 7);
        System.out.println("p1: " + p1);
        System.out.println("p2: " + p2);

        // compute/print distance from p1 to p2
        System.out.println("distance from p1 to p2: " + p1.distance(p2));
    }
}
The keyword `this`

reading: 8.7
this

• **this**: A reference to the implicit parameter.
  
  - *implicit parameter*: object on which a method is called

• **Syntax for using this:**
  
  - To refer to a field:
    
    `this.field`

  - To call a method:
    
    `this.method(parameters)`

  - To call a constructor from another constructor:
    
    `this(parameters)`
Variable names and scope

- Usually it is illegal to have two variables in the same scope with the same name.

  ```java
  public class Point {
      private int x;
      private int y;
      ...

      public void setLocation(int newX, int newY) {
          x = newX;
          y = newY;
      }
  }
  ```

- The parameters to `setLocation` are named `newX` and `newY` to be distinct from the object's fields `x` and `y`. 
Variable shadowing

- An instance method parameter can have the same name as one of the object's fields:

```java
// this is legal
public void setLocation(int x, int y) {
   ...
}
```

- Fields `x` and `y` are *shadowed* by parameters with same names.
- Any `setLocation` code that refers to `x` or `y` will use the parameter, not the field.
public class Point {
    private int x;
    private int y;
    ...
    public void setLocation(int x, int y) {
        this.x = x;
        this.y = y;
    }
}

• Inside the setLocation method,
  • When this.x is seen, the field x is used.
  • When x is seen, the parameter x is used.
Multiple constructors

- It is legal to have more than one constructor in a class.
- The constructors must accept different parameters.

```java
public class Point {
    private int x;
    private int y;

    public Point() {
        x = 0;
        y = 0;
    }

    public Point(int initialX, int initialY) {
        x = initialX;
        y = initialY;
    }

    // ...
}
```
Constructors and this

One constructor can call another using this:

```java
public class Point {
    private int x;
    private int y;

    public Point() {
        this(0, 0); // calls the (x, y) constructor
    }

    public Point(int x, int y) {
        this.x = x;
        this.y = y;
    }

    ...
}
```