LEC 11

CSE 122

Encapsulation, Constructors, More Instance Methods

Questions during Class?

Raise hand or send here

sli.do #cse122

BEFORE WE START

Talk to your neighbors:
Dreading or looking forward to cold weather?

Music: Hunter/Miya's Playlist

Instructor Hunter Schafer / **Miya Natsuhara**

TAs

Ajay	Gaurav	Melissa
Andrew	Hilal	Noa
Anson	Hitesh	Parker
Anthony	Jake	Poojitha
Audrey	Jin	Samuel
Chloe	Joe	Sara
Colton	Joe	Simon
Connor	Karen	Sravani
Elizabeth	Kyler	Tan
Evelyn	Leon	Vivek

Lecture Outline

- Announcements
- Warm Up
- More Instance Methods
- Encapsulation
- Constructors

Announcements

- Several announcements were posted yesterday – read them thoroughly!
  - Announcements list
- Next week (11/7 - 11/11)
  - Reduced IPL staffing 11/7-11/10
  - 11/11 University Holiday (no lecture, IPL is closed)
  - Quiz 2 can be taken in quiz section on Tuesday *or* Thursday
- *Minimum* grade guarantees in syllabus

Lecture Outline

- Announcements
- **Warm Up** 
- More Instance Methods
- Encapsulation
- Constructors

Practice : Think

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What do p and p2 hold after the following code is executed?

```
Point p = new Point();
p.x = 3;
p.y = 10;
Point p2 = p;
p2.y = 100;
p = new Point();
p.y = -99;
```

A. p: (3, 10) p2: (3, 10)

B. p: (3, -99) p2: (3, 100)

C. p: (0, -99) p2: (3, 100)

D. p: (3, -99) p2: (0, 100)

E. p: (0, -99) p2: (3, 10)

Practice : Pair

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What do p and p2 hold after the following code is executed?

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p.x = 3;
p.y = 10;
Point p2 = p;
p2.y = 100;
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A. p: (3, 10) p2: (3, 10)

B. p: (3, -99) p2: (3, 100)

C. p: (0, -99) p2: (3, 100)

D. p: (3, -99) p2: (0, 100)

E. p: (0, -99) p2: (3, 10)

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- **More Instance Methods** 
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(Review) Client v. Implementor

We have been the *clients* of many objects this quarter!

Now we will become the *implementors* of our own objects!

Practice : Think

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What is the correct implementation of the `distanceFrom` instance method?

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

(A)
```
public double distanceFrom() {
    double xTerm = Math.pow(x - x, 2);
    double yTerm = Math.pow(y - y, 2);
    return Math.sqrt(xTerm + yTerm);
}
```

(B)
```
public static double distanceFrom(Point otherPoint) {
    double xTerm = Math.pow(otherPoint.x - x, 2);
    double yTerm = Math.pow(otherPoint.y - y, 2);
    return Math.sqrt(xTerm + yTerm);
}
```

(C)
```
public double distanceFrom(Point otherPoint) {
    double xTerm = Math.pow(otherPoint.x - x, 2);
    double yTerm = Math.pow(otherPoint.y - y, 2);
    return Math.sqrt(xTerm + yTerm);
}
```

(D)
```
public double distanceFrom(int otherX, int otherY) {
    double xTerm = Math.pow(otherX - x, 2);
    double yTerm = Math.pow(otherY - y, 2);
    return Math.sqrt(xTerm + yTerm);
}
```

Practice : Pair

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What is the correct implementation of the `distanceFrom` instance method?

(A)

```
public double distanceFrom() {
    double xTerm = Math.pow(x - x, 2);
    double yTerm = Math.pow(y - y, 2);
    return Math.sqrt(xTerm + yTerm);
}
```

(B)

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

```
public static double distanceFrom(Point otherPoint) {
    double xTerm = Math.pow(otherPoint.x - x, 2);
    double yTerm = Math.pow(otherPoint.y - y, 2);
    return Math.sqrt(xTerm + yTerm);
}
```

(C)

```
public double distanceFrom(Point otherPoint) {
    double xTerm = Math.pow(otherPoint.x - x, 2);
    double yTerm = Math.pow(otherPoint.y - y, 2);
    return Math.sqrt(xTerm + yTerm);
}
```

(D)

```
public double distanceFrom(int otherX, int otherY) {
    double xTerm = Math.pow(otherX - x, 2);
    double yTerm = Math.pow(otherY - y, 2);
    return Math.sqrt(xTerm + yTerm);
}
```

(PCM) toString

```
public String toString() {
    return "String representation of object";
}
```

The `toString()` method is automatically called whenever an object is treated like a `String`!

Why not write a `print()` method that prints out the String representation to the console?

Lecture Outline

- Announcements
- Warm Up
- More Instance Methods
- **Encapsulation**
- Constructors

(PCM) Encapsulation

Objects *encapsulate* state and expose behavior.

Encapsulation is hiding implementation details of an object from its clients.

Encapsulation provides *abstraction*.

(PCM) private

The `private` keyword is an *access modifier* (like `public`)

Fields declared `private` cannot be accessed by any code outside of the object.

We **always** want to encapsulate our objects' fields by declaring them `private`.

Accessors and Mutators

Declaring fields as private removes all access from the user.

If we want to give some back, we can define instance methods.

Accessors ("getters")	Mutators ("setters")
`getX()`	`setX(int newX)`
`getY()`	`setY(int newY)`
	`setLocation(int newX, int newY)`

(PCM) Encapsulation

Objects *encapsulate* state and expose behavior.

Encapsulation is hiding implementation details of an object from its clients.

Encapsulation provides *abstraction*.

Encapsulation also gives the implementor flexibility!

Encapsulation

While users can still access and modify our Point's fields with the instance methods we defined, *we have control of how they do so*.

Can only accept positive coordinate values

Can swap out our underlying implementation to use polar coordinates instead!

Lecture Outline

- Announcements
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- Encapsulation
- **Constructors** 

Constructors

Constructors are called when we first create a new instance of a class.

```
Point p = new Point();
```

If we don’t write any constructors, Java provides one that takes no parameters and just sets each field to its default value.

Constructor Syntax

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

this keyword

The `this` keyword refers to the current object in a method or constructor.

You can use it to refer to an object's fields

```
this.x, this.y
```

You can use it to refer to an object's instance methods

```
this.setX(newX)
```

Constructor Syntax

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

If we write *any* constructors, Java no longer provides one for us.

this keyword

The `this` keyword refers to the current object in a method or constructor.

You can use it to refer to an object's fields

```
this.x, this.y
```

You can use it to refer to an object's instance methods

```
this.setX(newX)
```

You can use it to call one constructor from another

```
this(0, 0)
```