LEC 11

CSE 122

Encapsulation, Constructors, More Instance Methods

BEFORE WE START

Talk to your neighbors:

Favorite flavor to pair with chocolate?
Coffee? Orange? Caramel? Strawberry? Matcha?

Instructors: Ido Avnon

TAs: Abby Williams
Chloë Mi Cartier
Connor Sun
Cynthia Pan
Katharine Zhang
Marcus Sanches
Rohini Arangam

Questions during Class?

Raise hand or send here

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Lecture Outline

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

Announcements

- Culminating Project 2 (C2) due tomorrow, Thursday July 30th
  - Programming Project will be released on Friday, focused on OOP
- *Minimum* grade guarantees in Syllabus
  - Minimum grade calculator tool
- Quiz 1 was last week, we have some quiz makeups to administer then we'll be releasing grades
  - Grades will be released ~Friday

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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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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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}
```

Abstraction

The separation of ideas from details, meaning that we can use something without knowing exactly how it works.

You were able use the `Scanner` class without understanding how it works internally!

Client v. Implementor

We have been the clients of many objects this quarter!

Now we will become the implementors of our own objects!

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toString

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

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

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

Wait: Why not write a `print()` method that prints out the String representation to the console? All `toString()` does is return a String!

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Encapsulation

Objects **encapsulate** state and expose behavior.

Encapsulation is hiding implementation details of an object from its clients. (Clients = chaos, y'all.)

Encapsulation provides *abstraction*.

private

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

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

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)`

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!

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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;
}
```

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)`