LEC 14

CSE 122

Interfaces

Questions during Class?

Raise hand or send here

sli.do #cse122

BEFORE WE START

Talk to your neighbors:

What did you get up to during the long weekend? Anything other than sleeping?

Music: 122 24au Lecture Tunes

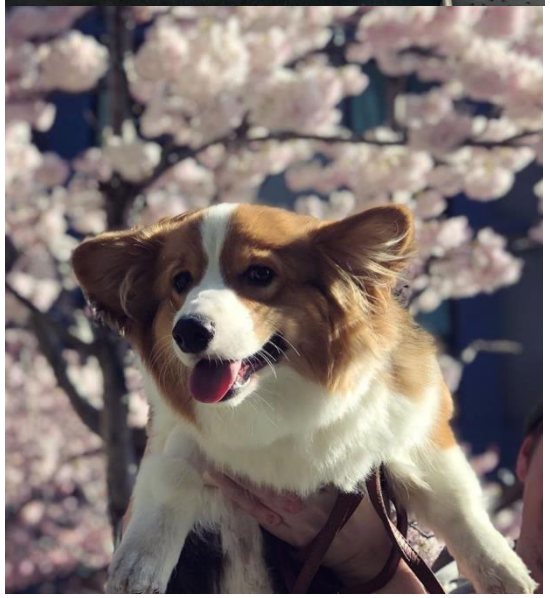
Instructors	Elba Garza and Miya Natsuhara			
TAs	Ayush	Heon	Harshitha	Aishah
	Andrew	Izak	Marcus	Ben
	Logan	Colin	Carson	Ivory
	Kyle	Jessica	Jack	Cady
	Maggie	Shivani	Connor	Diya
	Nicole H	Ken	Cora	Katharine
	Caleb	Mia	Hannah	
	Nicole W	Ashley	Leo	
	Jacob	Chaafen	Anya	

Lecture Outline

- Announcements
- Interfaces Review
- More Shapes!
- Comparable

Announcements

- Creative Project 2 (C2) due Thursday, November 14th
- Resubmission Cycle 5 (R5) out Thursday, November 14th
  - Eligible: **P1**, P2
- Programming Assignment 3 (P3) out Friday!
  - Due November 21st by 11:59 PM
- Quiz 2 Tuesday, November 9th
  - Practice Quiz coming out soon™ !
- Reminder on Final Exam:
  Thursday, December 12th 12:30-2:20 PM
- Gigi & Gumball visit on Monday, December 9th from 1:00-3:00 PM



Looping Back with Ken Yasuhara (ET&L)

- Consensus on good:
  - Pre-Class Work
  - IPL
  - In-class coding/activities
  - Your TAs!
  - Section Homeworks
- Possible improvements:
  - More practice resources for paper quizzes
  - Focus on the (code) quality
  - Possibly more work on paper in section

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Recall from L6: Wait, ADT? Interfaces?

- **Abstract Data Type (ADT)**: A *description of the idea* of a data structure including what operations are available on it and how those operations should behave. For example, the English explanation of what a list should be.

- **Interface**: Java construct that lets programmers *specify what methods a class should have*. For example the `List` interface in java.

- **Implementation:** *Concrete code* that meets the specified interface. For example, the `ArrayList` and `LinkedList` classes that implement the `List` interface.

Interfaces

Interfaces serve as a sort of "certificate"– in order for a class to implement an interface, it must fulfill the certificates requirements.

The certificates requirements are certain methods that the class must implement.

`Lists`

One ADT we've talked a lot about in this course is a list.

Within Java, there exists a `List` interface – its contract includes methods like:

`add`, `clear`, `contains`, `get`, `isEmpty`, `size`

There's also an `ArrayList` class (implementation)

To get the certificate, it must include all these methods (and any others the `List` interface specifies)

Interfaces vs. Implementation

Interfaces require certain methods, but they do not say anything about how those methods should be implemented – that's up to the class! 

`List` is an interface

- `ArrayList` is a class that implements the `List` interface
- `LinkedList` is a class that implements the `List` interface
- …

Why interfaces?

Flexibility

```
public static void method(Set<String> s) {…}
```

This method can accept either a:

- `HashSet<String>` or
- `TreeSet<String>` or
- Any other class that implements `Set` and whose element type is `String`!

Why interfaces?

Abstraction

Interfaces also support *abstraction*
(the separation of ideas from details)

Lecture Outline

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- **More Shapes!** 
- Comparable

Classes can Implement Multiple Interfaces

A class can implement multiple interfaces – it's like one person getting multiple certificates!

If a class implements an interface A and an interface B, it'll just have to include all of A's required methods along with all of B's required methods

Classes can Implement Multiple Interfaces

```
public interface Parallel {
    public int numParallelPairs();
}

public class Square implements Shape, Parallel {
    ...
        public int numParallelPairs() {
                return 2;
    }
}
```

But Square would have to implement:

- `getPerimeter`, `getArea` from Shape

  AND

- `numParallelPairs` from `Parallel`

An interface can `extend` another

You can have one interface extend another

So if `public interface A extends B`, then any class that implements A must include all the methods in A's interface and all the methods in B's interface

An interface can extend another

We can write another interface:

`Polygon` that `extends` `Shape`

`Make modifications such that:`

- `Square` is a `Polygon` (and `Shape`)
- `Triangle` is a `Polygon` (and `Shape`)
- `Circle` is a `Shape` (but not a `Polygon`)

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- **Comparable** 

Recall the Student / Course Example from Wed

Course stored a field

```
private List<Student> roster;
```

Why not use a Set to store the students?…

Seems like a great idea (no duplicates, not worried about keeping a specific order or indexing into it) but … Java reasons:

- HashSet won't work because of lack of hashCode( ) implementation
- TreeSet won't work because… what does it mean to "sort" Students?

Comparable

`TreeSet` uses an **interface** called `Comparable<E>` to know how to sort its elements!

Only has one required method:

```
public int compareTo(E other)
```

Its return value is:

- `< 0` if `this` is "less than" `other`
- `0` if `this` is equal to `other`
- `> 0` if `this` is "greater than" `other`