

LEC 12

CSE 122

Interfaces

BEFORE WE START

Slido vote & chat with neighbors:

What is your favorite smoked food

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Questions during Class?

Raise hand or send here

sli.do #cse122



Lecture Outline

- **Announcements** 
- Interface Review
- More Shapes!
- Comparable

Announcements

- Resubmission Cycle 4 (R4) due Tuesday, Aug 11st
 - Eligible Assignments: C1, P1
- Quiz 2 Thursday, Aug 13th
 - Practice Quiz coming later today!
- Final Exams on Aug 19th and Aug 21st
 - Day 1 topics: Code Tracing, Debugging, Stacks & Queues
 - Day 2 topics: Conceptual, Nested Collections, OOP

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Recall: Abstraction

```
1  /*
2  * Copyright (c) 2003, 2022, Oracle and/or its affiliates. All rights reserved.
3  * DO NOT ALTER OR REMOVE COPYRIGHT NOTICES OR THIS FILE HEADER.
4  *
5  * This code is free software; you can redistribute it and/or modify it
6  * under the terms of the GNU General Public License version 2 only, as
7  * published by the Free Software Foundation. Oracle designates this
8  * particular file as subject to the "Classpath" exception as provided
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10 *
11 * This code is distributed in the hope that it will be useful, but WITHOUT
12 * ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or
13 * FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License
14 * version 2 for more details (a copy is included in the LICENSE file that
15 * accompanied this code).
16 *
17 * You should have received a copy of the GNU General Public License version
18 * 2 along with this work; if not, write to the Free Software Foundation,
19 * Inc., 51 Franklin St, Fifth Floor, Boston, MA 02110-1301 USA.
20 *
21 * Please contact Oracle, 500 Oracle Parkway, Redwood Shores, CA 94065 USA
22 * or visit www.oracle.com if you need additional information or have any
23 * questions.
24 */
25
26 package java.util;
27
28 import java.io.*;
29 import java.math.*;
30 import java.nio.*;
31 import java.nio.channels.*;
32 import java.nio.charset.*;
33 import java.nio.file.Path;
34 import java.nio.file.Files;
35 import java.text.*;
36 import java.text.spi.NumberFormatProvider;
37 import java.util.function.Consumer;
38 import java.util.regex.*;
39 import java.util.stream.Stream;
40 import java.util.stream.StreamSupport;
41 import sun.util.locale.provider.LocaleProviderAdapter;
42 import sun.util.locale.provider.ResourceBundleBasedAdapter;
43
44 /**
45  * A simple text scanner which can parse primitive types and strings using
46  * regular expressions.
```

VS

A Scanner gets text
input and turns it
into data.

Recall from L4: 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.

```
List<String> myList = new ArrayList<>();
```

Interfaces

Interfaces serve as a sort of “contract”—in order for a class to implement an interface, it must fulfill the contract requirements.

The contract 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`, `indexOf`

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?

```
public static void fill(WaterBottle w) {...}
```

This method only accepts a WaterBottle!

```
public static void fill(Jar j) {...}
```

```
public static void fill(MeasuringCup m) {...}
```

```
public static void fill(Tub t) {...}
```

Why interfaces?

Flexibility



```
public static void fill(Container c) {...}
```

This method can accept either a:

- WaterBottle
- Jar
- MeasuringCup
- Tub or
- Any other class that implements Container!

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



```
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`!

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Classes can Implement Multiple Interfaces

A class can implement multiple interfaces – it's like one person signing multiple contracts!

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

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**

- “**Polygon** is a **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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Recall comparing Items from Friday...

ShoppingCart stored a field

```
private Set<Item> items;
```

Which we implemented with a TreeSet after writing

```
public int compareTo(Item other)
```

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

Only has one required method:

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