BEFORE WE START

**Talk to your neighbors:**

What plans do you have for Spring break? Going anywhere fun?

Music: [122 24sp Lecture Tunes](#)
Lecture Outline

• Announcements

• Optional

• Recap of Collections

• Dumb Data Structures

• Collections
Announcements

- Resubmission Cycle 5 (R5) out; due May 21st by 11:59 PM
- Programming Assignment 3 (P3) out tonight!
  - Due May 23rd by 11:59 PM
- Quiz 2 Thursday, May 21st
- Reminder on Final Exam: Thursday, June 6th 8:30 – 10:20 AM
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Optional

Optional is a Java class that is used to handle situations where a value is sometimes there.

- A variable that can sometimes be initialized
- Optional<String> keepPlaying = Optional.empty();
- Optional<Integer> maxValue = Optional.of(-1);

Like a collection, Optional uses <> to denote the type it contains..
- e.g., Optional<String>, Optional<Integer>, Optional<Point>
## Optional Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optional.empty()</td>
<td>Creates an empty Optional object</td>
</tr>
<tr>
<td>Optional.of(...)</td>
<td>Creates an Optional object holding the object it’s given</td>
</tr>
<tr>
<td>isEmpty()</td>
<td>Returns true if there is no value stored, and false otherwise</td>
</tr>
<tr>
<td>isPresent()</td>
<td>Returns true if there is a value stored, and false otherwise</td>
</tr>
<tr>
<td>get()</td>
<td>Returns the stored object from the Optional (if one is stored; otherwise throws a NoSuchElementException)</td>
</tr>
</tbody>
</table>

The Optional class has more than just these methods, but these are what you’ll need to focus on for this class!
Optional Methods

isEmpty(), isPresent(), and get() are called like normal instance methods (on an actual instance of Optional).

Optional.of(...) and Optional.empty() are called differently
(Like the Math class methods)
Why Optional?

Using Optional can help programmers avoid NullPointerExceptions by making it explicit when a variable may or may not contain a value.

• Remember – null refers to the absence of an object!

There are other Optional methods (that you should explore in your own time if you’re interested) that can be really useful to cleanly work with data that may or may not be present.
Let’s add two more methods to Course.java:

```java
public void setCourseEvalLink(String url)

public Optional<String> getCourseEvalLink()
```

The link to the evaluations for a course doesn’t usually exist until the last few weeks of the quarter. What if a client calls getCourseEvalLink before one is set up?

Optional to the rescue!
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Goal for Today

Review some of the data structures we’ve talked about this quarter

Understand how Java organizes them with interfaces
Collections: What *classes* have we seen so far?

...  
Array,  
ArrayList,  
Linked List,  
Stack,  
HashSet & HashMap,  
TreeSet & TreeMap
Collections: What *interfaces* have we seen so far?

... 

Set, 
Queue, 
List, 
Comparable
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Dumb Data Structures

We’re going to create our own versions of these classes so we can dig into how they all relate to each other!

BUT they’re going to be real dumb.

If you want to get a sense of how they’re actually implemented, go take CSE 123!
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IntCollection Relationships

- IntQueue
  - implements DumbLinkedIntList
  - extends DumbArrayIntList

- IntList
  - implements DumbLinkedIntList
  - implements DumbArrayIntList

- IntSet
  - implements DumbHashIntSet
  - implements DumbTreeIntSet

- IntCollection