

A photograph of four students in a library setting. A young man in a grey t-shirt is smiling and looking at a laptop. A young woman with glasses is looking at the laptop. Another young woman is looking at a book. A young man is looking at the laptop. They are all sitting at a table. Bookshelves are visible in the background.

Collections

Sorting – Comparable and Comparator

Collections

Java 11 (1Z0-819)

Working with Arrays and Collections

- ✓ Use generics, including wildcards
- ✓ Use a Java array and List, Set, Map and Deque collections, including convenience methods



Sort collections and arrays using Comparator and Comparable interfaces

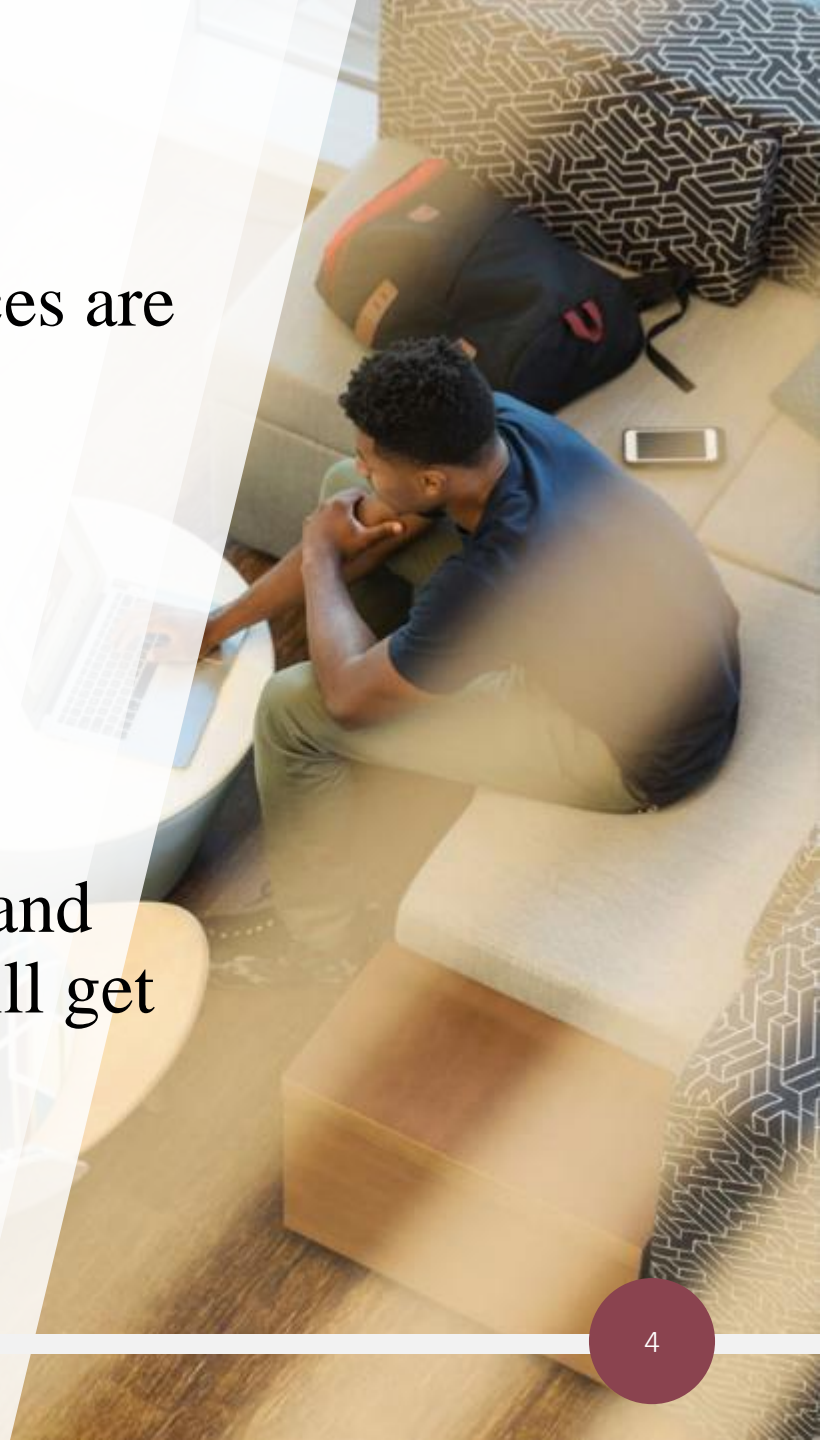
Sorting

- Both collections and arrays can be sorted and searched using methods in the API.
- The *Collections* class is a utility class i.e. a class which consists exclusively of static methods, used for operating on collections.
- The *Arrays* class is also a utility class; the *Arrays* class however, operates on native arrays only ([] syntax).
- One can convert an array (of reference types) to a *List* using the *Arrays.asList* method. The returned *List* can then be passed to useful methods that exist in the *Collections* class.



Comparable and *Comparator* interfaces

- The *Comparable*<T> and *Comparator*<T> interfaces are used for comparing objects of similar type.
- Both are functional interfaces.
- Sorting is a classic example where they are used.
- *java.lang.Comparable* and *java.util.Comparator*
- Note: if you add an object of a class to e.g. *TreeSet* and the class does NOT implement *Comparable*, you will get a *ClassCastException*.



Comparable interface

- The *Comparable*<*T*> interface defines one method:
 - *int compareTo(T that)*
- Given that you implement the *compareTo()* method in the class itself, you already have access to its state using the “*this*” reference. Thus, you can compare “*this*” to the object passed in (“*that*” above).
- *Comparable* defines the “natural ordering”. For *Integer* this ascending numeric order (1, 2, 3 etc..); for *String*’s it is alphabetic order (“A”, “B”, “C” etc..).
 - Note: *TreeSet* would sort *Strings* according to Unicode: numbers before letters, uppercase letters before lowercase letters (“null”).



Comparable interface

- *compareTo* logic : return an *int* value based on the following:
 - return a positive number if the current object is larger than the object passed in
 - return 0 if the current object is equivalent to the object passed in
 - return a negative number if the current object is smaller than the object passed in
- This logic can be delegated to existing types (*String*, *Integer*) that already have implemented *Comparable*. In other words, if you are comparing *Integer*'s you can delegate.



Comparable - *compareTo()* and *equals()* consistency.

- When are 2 objects equal?
 - *compareTo()* – returns 0
 - *equals()* – returns *true*
- API: “The natural ordering for a class C is said to be *consistent with equals* if and only if $e1.compareTo(e2) == 0$ has the same boolean value as $e1.equals(e2)$ for every $e1$ and $e2$ of class C”.
- We are “strongly recommended” to keep our *Comparable* classes consistent with equals because “sorted sets (or sorted maps)...behave strangely” otherwise. [API]



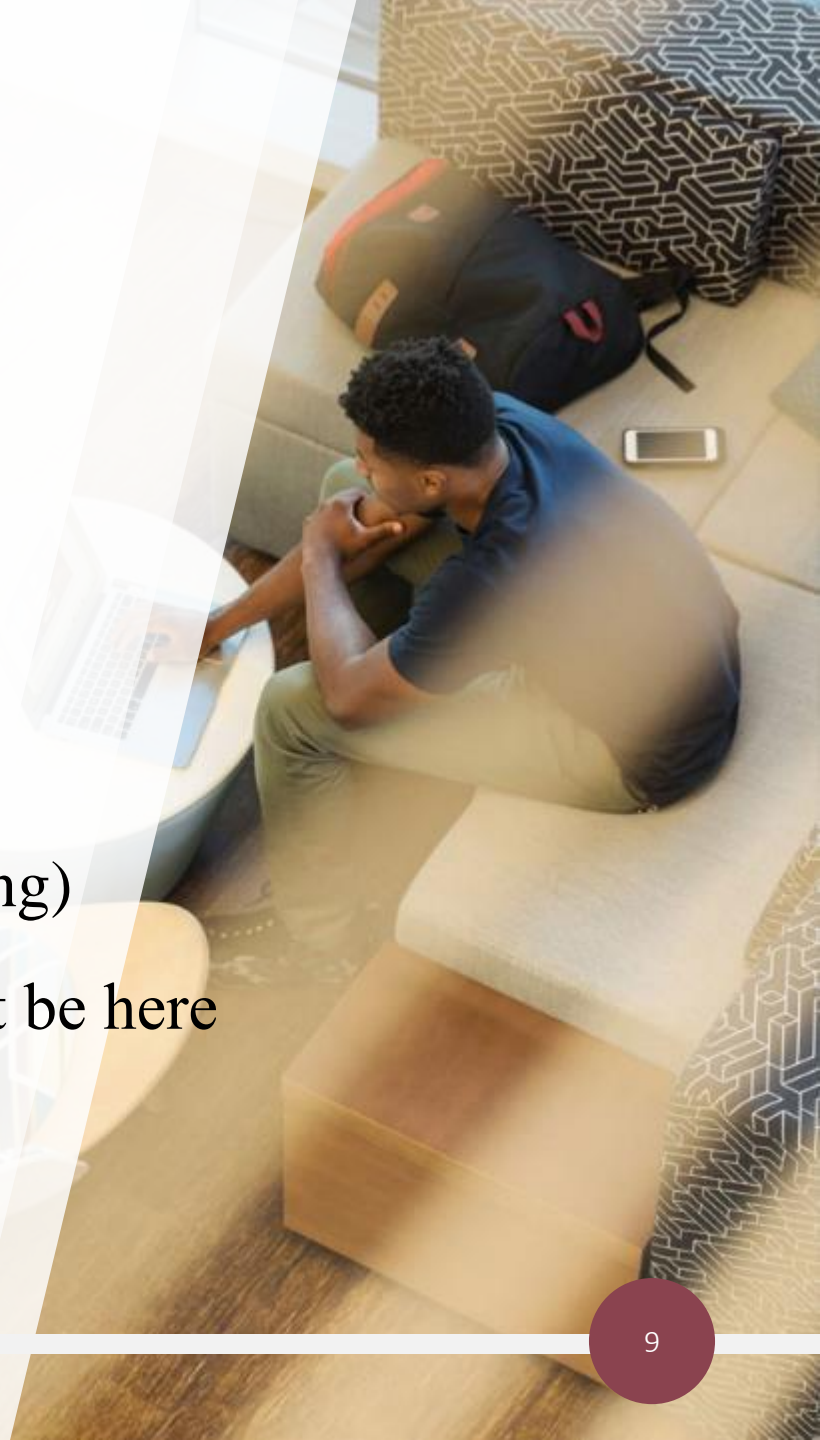
Comparator interface

- What if the objects we wanted to sort did not implement *Comparable* or if we wanted to sort in several different ways? Answer: *Comparator*.
- *Comparator* is also a functional interface:
 - *int compare(T o1, T o2)*
- The logic internally is the same as for *compareTo()*.
- Typically, this is coded externally to the class whose objects we are comparing so we need to compare 2 objects.
 - as *Comparable* is coded internally to the class, we just need the one/other object we want to compare to '*this*' object



How to remember the differences?

- *Comparator* - “**T**wo out of three ain’t bad”
 - “*Comparator* takes **t**wo” args but not the “**T**o” method
 - `int compare(T o1, T o2)`
 - `ORE = Comparator` and `compare()`
- *Comparable*
 - if *Comparator* takes 2 then this takes 1 (natural ordering)
 - as *Comparator* does not have the “To” method, it must be here
 - `int compareTo(T o)`
 - `LEO = Comparable` and `compareTo()`



binarySearch()

- *binarySearch()* requires a sorted *List*.
- As with *sort()*, if you don't want natural order, you can pass in a comparator.

