CISC 3115 TY2

Sorting and Searching

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Module Outline

- Concept of data structure
- Use data structures
  - List
  - Sorting and searching in lists
  - Stack
  - Queue and priority queue
  - Set and map

Outline of This Lecture

- Sorting and searching with List, ArrayList, and LinkedList
  - Review of the Comparator and Comparable interfaces
  - Collections and Arrays classes
  - Sorting
  - Searching

Review: Comparable and Comparator

- Searching and sorting require comparison
- The Comparable interface
- The Comparator interface

Review: The Comparator Interface

- Defined as,

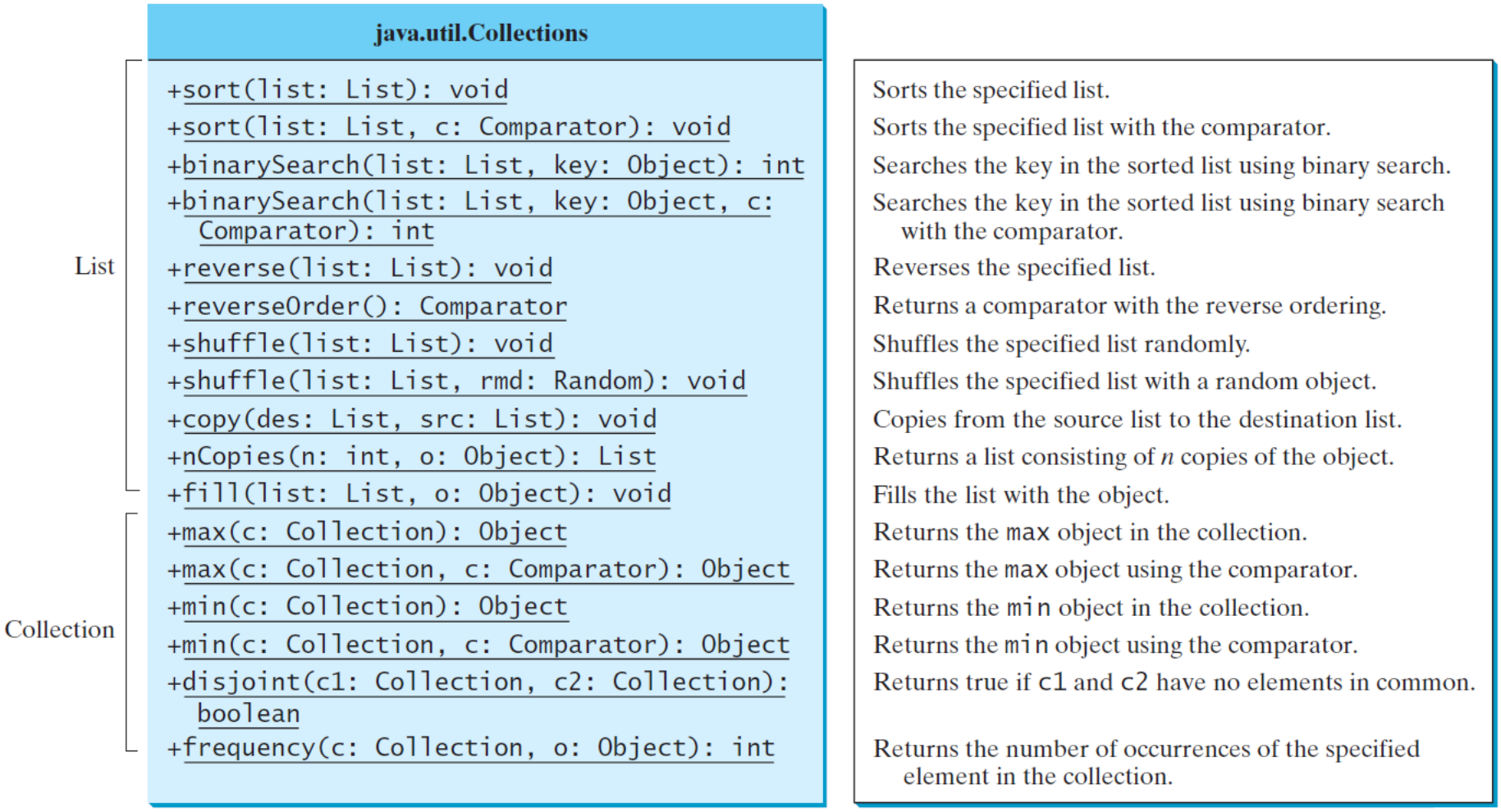
```
package java.util.Comparator;

public interface Comparator<T> {

        public int compare(T lhs, T rhs);

}
```

- The compare method: returns a negative value if lhs is less than rhs; a positive value if lhs is greater than rhs; and zero if they are equal.

Review: The Collections Class

- Recall previous lecture and examples
  - Comparable and Comparators
  - Example programs
- The Collections class contains various static methods
  - for operating on collections and maps,
  - for creating synchronized collection classes,
  - and for creating read-only collection classes

The Collections Class: Some Additional Methods



Sorting

- static <T extends Comparable<? super T>> void sort(List<T> list)
  - Sorts the specified list into ascending order (i.e., standard order), according to the natural ordering of its elements.
- static <T> void sort(List<T> list, Comparator<? super T> c)
  - Sorts the specified list according to the order induced by the specified comparator.

Sorting ArrayList, LinkedList, and arrays

- Examples
  - For lists, use Comparable, Comparator, and Collections
  - For arrays, use Comparable, Comparator, and Arrays
  - Question:
    - Which one is fast, sorting an ArrayList or sorting an LinkedList when the two lists are the same length, contain the same collections of values in the same order?

Questions?

- Sorting a list?
  - Key?
  - ArrayList vs LinkedList?
- "what is the most efficient way to sort 1 million 32-bit integers?"

Searching

- Sequential search
  - Iterate through the list, and find the key
  - On average, how many elements do we need to visit?
- Binary search
  - Java API provides binary search
    - Recall we implemented the binary search algorithm using recursion.
  - Requirement: a list must be sorted
  - On average, how many elements do we need to visit?

Searching: Examples

- Binary search on sorted lists
- Which one, ArrayList or LinkedList is more appropriate to do binary searches on lists?
  - Hint: which list is a “random access” list?
  - Compare computational time between binary search an ArrayList and a LinkedList

How about arrays?

- The Arrays class
- Sorting and binary search

Questions?

- Collections and Arrays
- Comparator and Comparable
- Sorting and searching lists and arrays
- Binary search on lists
  - What type of list should we select?