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Inheritance

Collections Revisited

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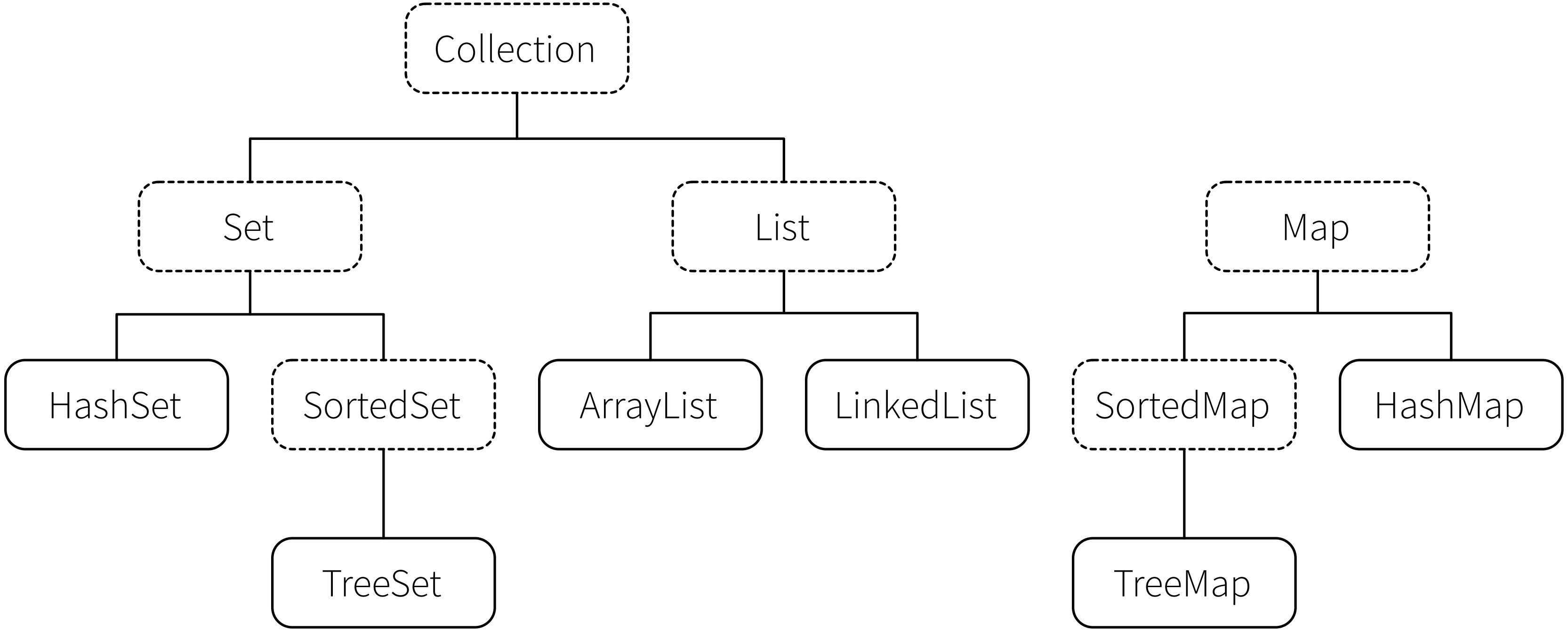
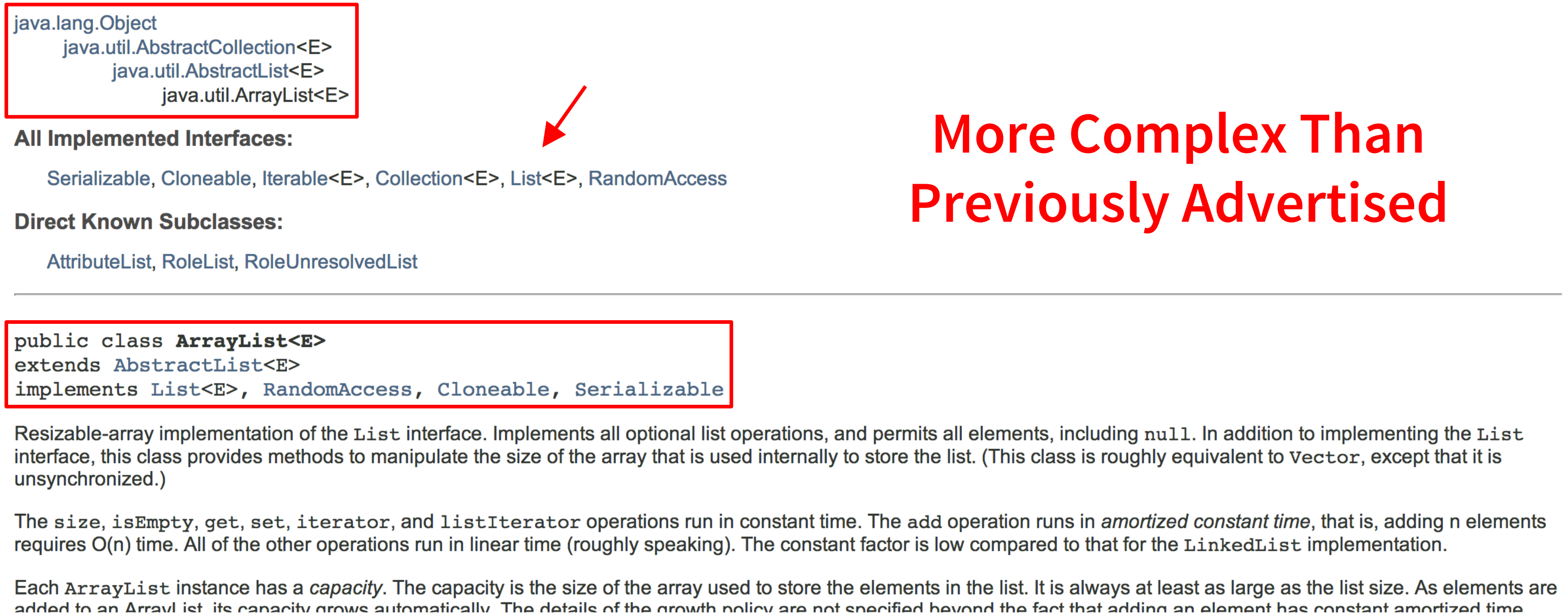
Collection Framework*



*Abbreviated Framework

`ArrayList` Revisited



java.lang.Object
    java.util.AbstractCollection<E>
        java.util.AbstractList<E>
            java.util.ArrayList<E>

All Implemented Interfaces:

Serializable, Cloneable, Iterable<E>, Collection<E>, List<E>, RandomAccess

Direct Known Subclasses:

AttributeList, RoleList, RoleUnresolvedList

```
public class ArrayList<E>
extends AbstractList<E>
implements List<E>, RandomAccess, Cloneable, Serializable
```

Resizable-array implementation of the `List` interface. Implements all optional list operations, and permits all elements, including `null`. In addition to implementing the `List` interface, this class provides methods to manipulate the size of the array that is used internally to store the list. (This class is roughly equivalent to `Vector`, except that it is unsynchronized.)

The `size`, `isEmpty`, `get`, `set`, `iterator`, and `listIterator` operations run in constant time. The `add` operation runs in *amortized constant time*, that is, adding n elements requires O(n) time. All of the other operations run in linear time (roughly speaking). The constant factor is low compared to that for the `LinkedList` implementation.

Each `ArrayList` instance has a *capacity*. The capacity is the size of the array used to store the elements in the list. It is always at least as large as the list size. As elements are added to an ArrayList, its capacity grows automatically. The details of the growth policy are not specified beyond the fact that adding an element has constant amortized time

More Complex Than Previously Advertised

https://docs.oracle.com/javase/8/docs/api/java/util/ArrayList.html

`ArrayList` Revisited

- Interface **`Collection`** extends the **`Iterable`** interface
- Interface **`List`** extends **`Collection`**
- Class **`AbstractCollection`** implements **`Collection`**
- Class **`AbstractList`** extends **`AbstractCollection`** and implements **`List`** (and hence **`Collection`**)
- Class **`ArrayList`** extends **`AbstractList`** and implements other interfaces on top of **`List`** and **`Collection`**

https://docs.oracle.com/javase/8/docs/api/java/util/ArrayList.html

`Collection` Interface

- Root of collection hierarchy is an interface!
- Includes methods such as `add()`, `clear()`, `contains()`, `remove()`, `size()`, `toArray()`
- Method `iterator()` inherited from `Iterable`
  - Allows any collection to be used in for-each loops

https://docs.oracle.com/javase/8/docs/api/java/util/Collection.html

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`List` Interface

- Extends `Collection` interface
  - And thus also inherits from `Iterable`
- Adds positional methods to get, insert, modify, or remove elements by position
- Adds ability to create a sublist

https://docs.oracle.com/javase/8/docs/api/java/util/List.html

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`AbstractCollection` Class

- An abstract class that implements `Collection`
- Optional methods all throw an unsupported operation exception (discussed later)
- Provides skeleton implementations of other methods except `iterator()` and `size()`

https://docs.oracle.com/javase/8/docs/api/java/util/AbstractCollection.html

`AbstractList` Class

- An abstract class that extends `AbstractCollection` and implements `List` (and hence `Collection`)
- Optional methods still throw exceptions
- Provides iterator implementations for any list
- Provides skeletal implementations for all except `get()` and `size()` from `AbstractCollection`

https://docs.oracle.com/javase/8/docs/api/java/util/AbstractList.html

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Unsupported Operations

- `Collections` class has methods to create ***unmodifiable*** versions of each collection type
  - Throws `UnsupportedOperationException` to prevent modification operation
- Same exception thrown by implementations that do not support ***optional*** methods in hierarchy

https://docs.oracle.com/javase/8/docs/api/java/lang/UnsupportedOperationException.html

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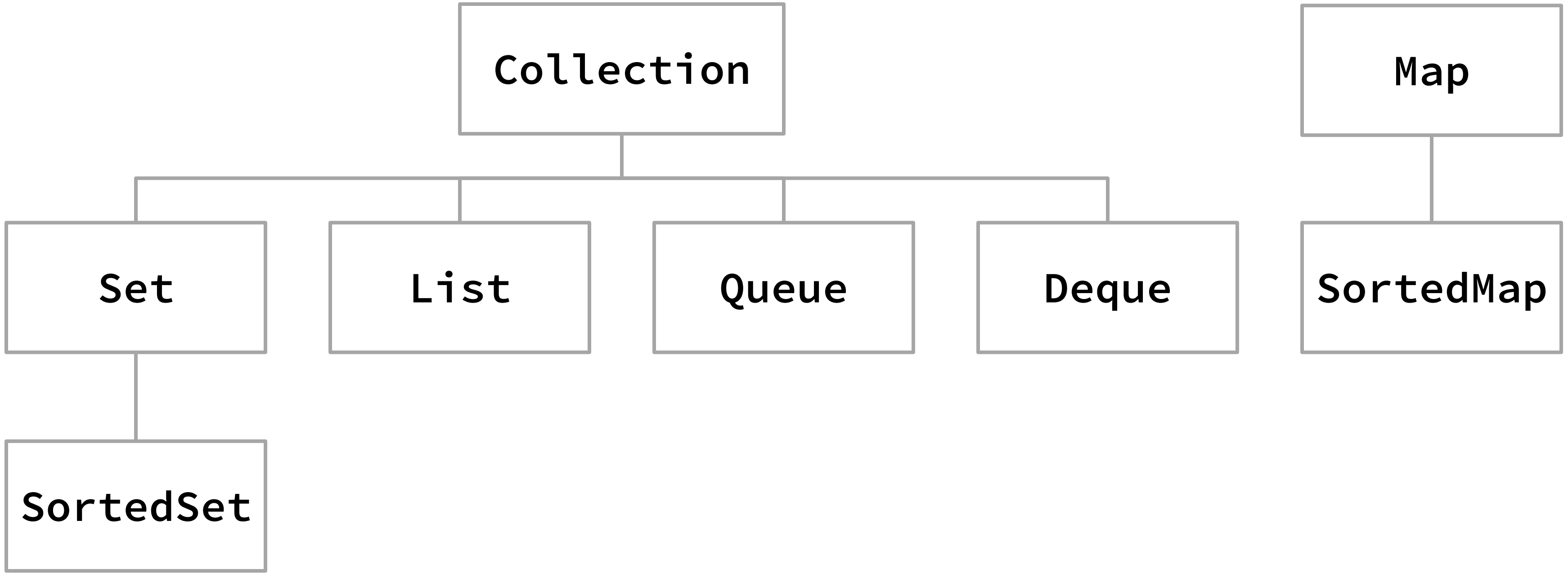
Core Interface Hierarchy



http://docs.oracle.com/javase/tutorial/collections/interfaces/index.html

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Abstract Classes

- Implement interfaces in Collection hierarchy and provide basic implementations where possible
- Includes `AbstractCollection`, `AbstractMap`, `AbstractList`, `AbstractSequentialList`, `AbstractSet`, and `AbstractQueue`
- Usually what is extended by actual implementations

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