

CHANGE THE WORLD FROM HERE

# **Collections Framework**

CS 272 Software Development

**Professor Sophie Engle** Department of Computer Science

- Framework of built-in **data structures**
- Provides consistent interaction with all collections
- Provides **efficient** implementations
- Provides common algorithms (e.g. search, sort)
- Size is **flexible** and may grow or shrink over time

https://www.cs.usfca.edu/~cs272/javadoc/api/java.base/java/util/doc-files/coll-index.html

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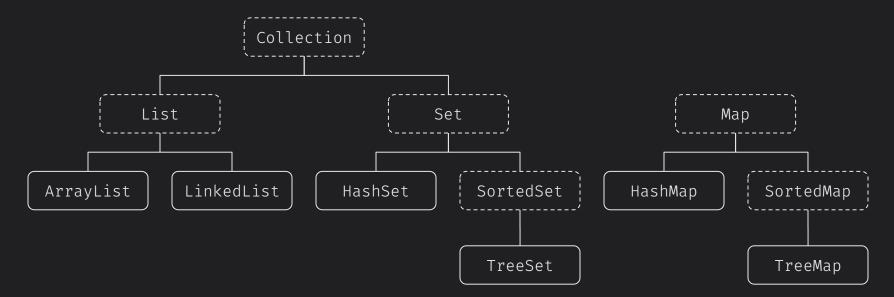


- A collection must contain elements of the **same type**\*
- Requires **objects** and not primitive types
  - Use Integer instead of int
  - Collections are objects which allows **nesting**
- Specify element type using Generics syntax
  Set<String> or HashMap<Integer, String>

https://docs.oracle.com/javase/tutorial/java/generics/index.html

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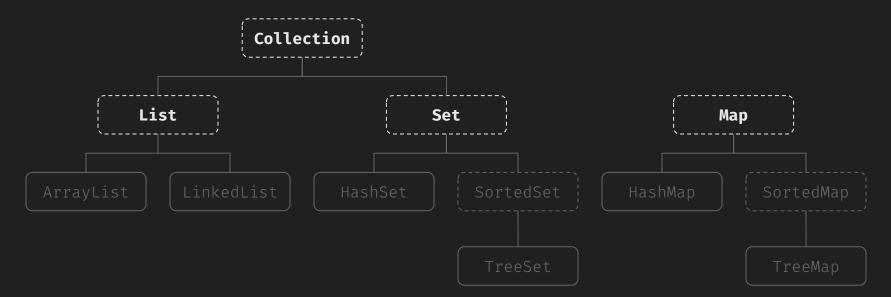
\*Simplified Framework

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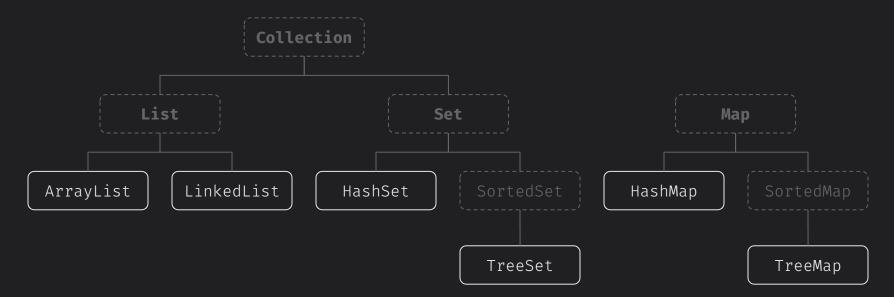
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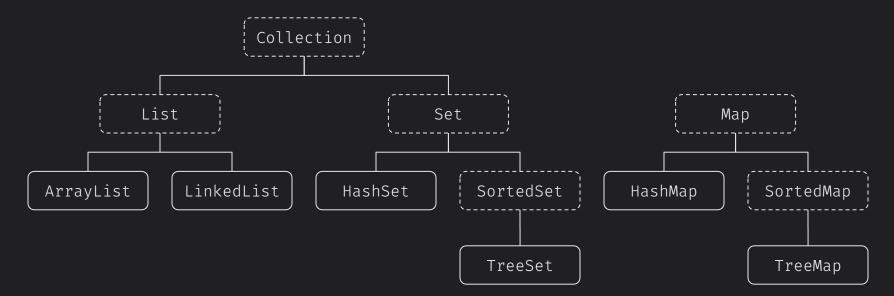




\*Simplified Framework

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### **Collection » List » ArrayList**

- Iteration is in **insertion** order
- Operations add(E e), get() and set() are **constant** time\* (fast)
- Operations add(int i, E e), remove(), and contains() are linear time (slow)
- Good **default** implementation

https://www.cs.usfca.edu/~cs272/javadoc/api/java.base/java/util/ArrayList.html

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### **Collection » List » LinkedList**

- Iteration is in **insertion** order
- Double-linked list, so operations adding or removing to front or back is **constant time** (fast)
- Operations that require an index (like getting or removing at an index) are linear time (slow)
- Choose if need to **insert** or **remove** elements at front

https://www.cs.usfca.edu/~cs272/javadoc/api/java.base/java/util/LinkedList.html

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### **Collection » Set » HashSet**

- Iteration is in **unsorted** order
  - Iteration order is not guaranteed Ο
  - Iteration order may change over time Ο
- Operations add(), remove(), and contains() are constant time (fast)
- Good default implementation

https://www.cs.usfca.edu/~cs272/javadoc/api/java.base/java/util/HashSet.html

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#### Set » SortedSet » TreeSet

- Iteration is in sorted order
  - Iteration order may change over time Ο
  - Can quickly navigate forward and backward Ο
- Operations add(), remove(), and contains() are log(n) time (decent)
- Only choose if need to maintain sorted order

https://www.cs.usfca.edu/~cs272/javadoc/api/java.base/java/util/TreeSet.html

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#### Map

- Must specify **key type** and **value type** HashMap<Integer, String>
- Keys must be **unique** and **immutable** String may be a key, ArrayList may not be a key
- Values may have **duplicates** and **may change** • String and ArrayList may be values

https://www.cs.usfca.edu/~cs272/javadoc/api/java.base/java/util/Map.html

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### Map » HashMap

- Iteration of keys is in **unsorted** order
  - Iteration order is not guaranteed Ο
  - Iteration order may change over time Ο
- Operations get() and put() are **constant time** (fast) igodol
- Good default implementation

https://www.cs.usfca.edu/~cs272/javadoc/api/java.base/java/util/HashMap.html

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#### Map » SortedMap » TreeMap

- Iteration of keys is in **sorted** order
  - Iteration order may change over time Ο
  - Can quickly navigate forward and backward Ο
- Operations get() and put() are log(n) time (decent) igodot
- Only choose if need to maintain sorted order

https://www.cs.usfca.edu/~cs272/javadoc/api/java.base/java/util/TreeMap.html

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### Collections Class

- Not to be confused with the **Collection** interface
- <u>Utility class of **static**</u> methods igodol
  - **Helper methods** like addAll() and copy() Ο
  - **Common operations** like binarySearch(), frequency(), reverse(), sort(), shuffle()

https://www.cs.usfca.edu/~cs272/javadoc/api/java.base/java/util/Collections.html

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## **Questions?**

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