23.10 Concurrent Collections

In Chapter 16, we introduced various collections from the Java Collections API. We also mentioned that you can obtain *synchronized* versions of those collections to allow only one thread at a time to access a collection that might be shared among several threads. The collections from the `java.util.concurrent` package are specifically designed and optimized for sharing collections among multiple threads.

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Figure 23.22 lists the many concurrent collections in package `java.util.concurrent`. The entries for `ConcurrentHashMap` and `LinkedBlockingQueue` are shown in **bold** because these are by far the most frequently used concurrent collections. Like the collections introduced in Chapter 16, the concurrent collections were enhanced in Java SE 8 to support lambdas. However, rather than providing methods to support streams, the concurrent collections provide their own implementations of various stream-like operations—e.g., `ConcurrentHashMap` has methods `forEach`, `reduce` and `search`—that are designed and optimized for concurrent collections that are shared among threads. For more information on the concurrent collections, visit

```
http://docs.oracle.com/javase/8/docs/api/java/util/co
```

Collection	Description
`ArrayBlockingQueue`	A fixed-size queue that supports the producer/consumer relationship—possibly with many producers and consumers.
`ConcurrentHashMap`	**A hash-based map (similar to the `HashMap` introduced in Chapter 16) that allows an arbitrary number of reader threads and a limited number of writer threads. This and the `LinkedBlockingQueue` are by far the most frequently used concurrent collections.**
`ConcurrentLinkedDeque`	A concurrent linked-list implementation of a double-ended queue.
`ConcurrentLinkedQueue`	A concurrent linked-list implementation of a queue that can grow dynamically.
`ConcurrentSkipListMap`	A concurrent map that is sorted by its keys.
`ConcurrentSkipListSet`	A sorted concurrent set.
`CopyOnWriteArrayList`	A thread-safe `ArrayList`. Each operation that modifies the collection first creates a new copy of the contents. Used when the collection is traversed much more frequently than the collection's contents are modified.
`CopyOnWriteArraySet`	A set that's implemented using `CopyOnWriteArrayList`.
`DelayQueue`	A variable-size queue containing `Delayed` objects. An object can be removed only after its delay has expired.
`LinkedBlockingDeque`	A double-ended blocking queue implemented as a linked list that can optionally be fixed in size.

`LinkedBlockingQueue`	**A blocking queue implemented as a linked list that can optionally be fixed in size. This and the `ConcurrentHashMap` are by far the most frequently used concurrent collections.**
`LinkedTransferQueue`	A linked-list implementation of interface `TransferQueue`. Each producer has the option of waiting for a consumer to take an element being inserted (via method `transfer`) or simply placing the element into the queue (via method `put`). Also provides overloaded method `tryTransfer` to immediately transfer an element to a waiting consumer or to do so within a specified timeout period. If the transfer cannot be completed, the element is not placed in the queue. Typically used in applications that pass messages between threads.
`PriorityBlockingQueue`	A variable-length priority-based blocking queue (like a `PriorityQueue`).
`SynchronousQueue`	[For experts.] A blocking queue implementation that does not have an internal capacity. Each insert operation by one thread must wait for a remove operation from another thread and vice versa.

Fig. 23.22

Concurrent collections summary (package `java.util.concurrent`).