ArrayBlockingQueue Class in Java

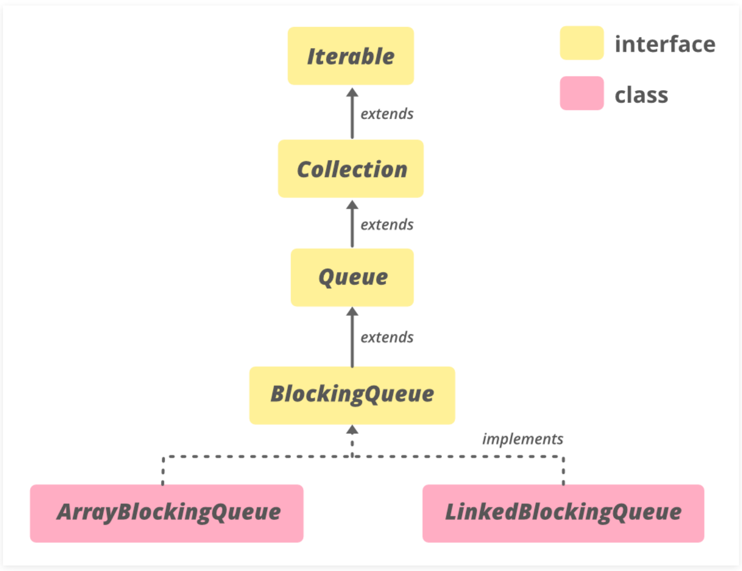
Difficulty Level : Expert Last Updated : 03 Jan, 2022

ArrayBlockingQueue class is a bounded blocking queue backed by an array. By bounded, it means that the size of the Queue is fixed. Once created, the capacity cannot be changed. Attempts to put an element into a full queue will result in the operation blocking. Similarly attempts to take an element from an empty queue will also be blocked. Boundness of the ArrayBlockingQueue can be achieved initially bypassing capacity as the parameter in the constructor of ArrayBlockingQueue. This queue orders elements **FIFO (first-in-first-out)**. It means that the head of this queue is the oldest element of the elements present in this queue.

The tail of this queue is the newest element of the elements of this queue. The newly inserted elements are always inserted at the tail of the queue, and the queue retrieval operations obtain elements at the head of the queue.

This class and its iterator implement all of the optional methods of the **Collection** and **Iterator** interfaces. This class is a member of the Java Collections Framework.

The Hierarchy of ArrayBlockingQueue



This class extends AbstractQueue<E> and implements **Serializable**, **Iterable<E>**, **Collection<E>**, BlockingQueue<E>, Queue<E> interfaces.

Declaration

public class ArrayBlockingQueue<E> extends AbstractQueue<E> implements BlockingQueue<E>, Serializable

Here, **E** is the type of elements stored in the collection.

Constructors of ArrayBlockingQueue

Here, **capacity** is the size of the array blocking queue.

1. ArrayBlockingQueue(int capacity): Creates an ArrayBlockingQueue with the given (fixed) capacity and default access policy.

ArrayBlockingQueue<E> abq = new ArrayBlockingQueue<E>(int capacity);

2. ArrayBlockingQueue(int capacity, boolean fair): Creates an ArrayBlockingQueue with the given (fixed) capacity and the specified access policy. If the fair value is if true then queue accesses for threads blocked on insertion or removal, are processed in FIFO order; if false the access order is unspecified.

ArrayBlockingQueue<E> abq = new ArrayBlockingQueue<E>(int capacity, boolean fair);

3. ArrayBlockingQueue(int capacity, boolean fair, Collection c): Creates an ArrayBlockingQueue with the given (fixed) capacity, the specified access policy and initially containing the elements of the given collection, added in traversal order of the collection's iterator. If the fair value is if true then queue accesses for threads blocked on insertion or removal, are processed in FIFO order; if false the access order is unspecified.

ArrayBlockingQueue<E> abq = new ArrayBlockingQueue<E>(int capacity, boolean fair, Col lection c);

Example:

```
// Java program to demonstrate
// ArrayBlockingQueue(int initialCapacity)
// constructor
```

```
import java.util.concurrent.ArrayBlockingQueue;

public class ArrayBlockingQueueDemo {

    public static void main(String[] args)
    {
        // define capacity of ArrayBlockingQueue
        int capacity = 15;

        // create object of ArrayBlockingQueue
        // using ArrayBlockingQueue(int initialCapacity) constructor
        ArrayBlockingQueue<Integer> abq = new ArrayBlockingQueue<Integer>(capac

        // add  numbers
        abq.add(1);
        abq.add(2);
        abq.add(3);

        // print queue
        System.out.println("ArrayBlockingQueue:" + abq);
    }
}
```

Output:

```
ArrayBlockingQueue:[1, 2, 3]
```

Basic Operations

1. Adding Elements

The add(E e) method inserts the element passed as a parameter to the method at the tail of this queue. If adding the element exceeds the capacity of the queue then the method will throw an **IllegalStateException**. This method returns true if adding of the element is successful else it will throw an IllegalStateException.

```
// Java Program to Demonstrate adding
// elements to an ArrayBlockingQueue.

import java.util.concurrent.ArrayBlockingQueue;
```

```
public class AddingElementsExample {

    public static void main(String[] args)
    {
        // define capacity of ArrayBlockingQueue
        int capacity = 15;

        // create object of ArrayBlockingQueue
        ArrayBlockingQueue<Integer> abq = new ArrayBlockingQueue<Integer>(capac

        // add  numbers
        abq.add(1);
        abq.add(2);
        abq.add(3);

        // print queue
        System.out.println("ArrayBlockingQueue:" + abq);
    }
}
```

Output

```
ArrayBlockingQueue:[1, 2, 3]
```

2. Removing Elements

The remove(Object o) method removes a single instance of the specified element from this queue if it is present. We can say that method removes an element e such that o.equals(e) if this queue contains one or more such elements. Remove() method returns true if this queue contained the specified element which we want to remove.

```
// Java program to demonstrate removal of
// elements from an AbstractQueue

import java.util.concurrent.ArrayBlockingQueue;

public class RemovingElementsExample {

    public static void main(String[] args)
    {
        // define capacity of ArrayBlockingQueue
        int capacity = 15;

        // create object of ArrayBlockingQueue
        ArrayBlockingQueue<Integer> abq = new ArrayBlockingQueue<Integer>(capac

        // add  numbers
        abq.add(1);
        abq.add(2);
        abq.add(3);

        // print queue
        System.out.println("ArrayBlockingQueue:" + abq);

        // remove 223
        boolean response = abq.remove(2);

        // print Queue
        System.out.println("Removal of 2 :" + response);

        // print Queue
        System.out.println("queue contains " + abq);

        // remove all the elements
        abq.clear();

        // print queue
        System.out.println("ArrayBlockingQueue:" + abq);
    }
}
```

Output

```
ArrayBlockingQueue:[1, 2, 3]
Removal of 2 :true
queue contains [1, 3]
ArrayBlockingQueue:[]
```

3. Accessing Elements

The peek() method provided by the **Queue** interface is used to return the head of the queue. It retrieves but does not remove, the head of this queue. If the queue is empty then this method returns null.

```
// Java program to demonstrate accessing
// elements of ArrayBlockingQueue

import java.util.concurrent.ArrayBlockingQueue;

public class AccessingElementsExample {

    public static void main(String[] args)
    {
        // Define capacity of ArrayBlockingQueue
        int capacity = 5;

        // Create object of ArrayBlockingQueue
        ArrayBlockingQueue<Integer> queue = new ArrayBlockingQueue<Integer>(cap

        // Add element to ArrayBlockingQueue
        queue.add(23);
        queue.add(32);
        queue.add(45);
        queue.add(12);

        // Print queue after adding numbers
        System.out.println("After adding numbers queue is ");
        System.out.println(queue);

        // Print head of queue using peek() method
        System.out.println("Head of queue " + queue.peek());
    }
}
```

Output

```
After adding numbers queue is
[23, 32, 45, 12]
Head of queue 23
```

4. Traversing

The iterator() method of **ArrayBlockingQueue** class is used to returns an iterator of the same elements as this queue in a proper sequence. The elements returned from this method contains elements in order from first(head) to last(tail). The returned iterator is weakly consistent.

```
// Java Program to Demonstrate iterating
// over ArrayBlockingQueue.

import java.util.concurrent.ArrayBlockingQueue;
import java.util.*;

public class TraversingExample {

    public static void main(String[] args)
    {
        // Define capacity of ArrayBlockingQueue
        int capacity = 5;
        // Create object of ArrayBlockingQueue
        ArrayBlockingQueue<String> queue = new ArrayBlockingQueue<String>(capac

        // Add 5 elements to ArrayBlockingQueue
        queue.offer("User");
        queue.offer("Employee");
        queue.offer("Manager");
        queue.offer("Analyst");
        queue.offer("HR");

        // Print queue
        System.out.println("Queue is " + queue);

        // Call iterator() method and Create an iterator
        Iterator iteratorValues = queue.iterator();

        // Print elements of iterator
        System.out.println("\nThe iterator values:");
        while (iteratorValues.hasNext()) {
            System.out.println(iteratorValues.next());
        }
    }
}
```

Output

```
Queue is [User, Employee, Manager, Analyst, HR]

The iterator values:
User
Employee
Manager
Analyst
HR
```

Methods of ArrayBlockingQueue

Here, **E** is the type of elements held in this collection

METHOD	DESCRIPTION
add(E e)	Inserts the specified element at the tail of this queue if it is possible to do so immediately without exceeding the queue’s capacity, returning true upon success and throwing an IllegalStateException if this queue is full.

METHOD	DESCRIPTION
clear()	Atomically removes all of the elements from this queue.
contains(Object o)	Returns true if this queue contains the specified element.
drainTo(Collection<? super E> c)	Removes all available elements from this queue and adds them to the given collection.
drainTo(Collection<? super E> c, int maxElements)	Removes at most the given number of available elements from this queue and adds them to the given collection.
forEach(Consumer<? super E> action)	Performs the given action for each element of the Iterable until all elements have been processed or the action throws an exception.
iterator()	Returns an iterator over the elements in this queue in the proper sequence.
offer(E e)	Inserts the specified element at the tail of this queue if it is possible to do so immediately without exceeding the queue's capacity, returning true upon success and false if this queue is full.
offer(E e, long timeout, TimeUnit unit)	Inserts the specified element at the tail of this queue, waiting up to the specified wait time for space to become available if the queue is full.
put(E e)	Inserts the specified element at the tail of this queue, waiting for space to become available if the queue is full.
remainingCapacity()	Returns the number of additional elements that this queue can ideally (in the absence of memory or resource constraints) accept without blocking.
remove(Object o)	Removes a single instance of the specified element from this queue, if it is present.
removeAll(Collection<?> c)	Removes all of this collection's elements that are also contained in the specified collection (optional operation).
removeIf(Predicate<? super E> filter)	Removes all of the elements of this collection that satisfy the given predicate.
retainAll(Collection<?> c)	Retains only the elements in this collection that are contained in the specified collection (optional operation).

METHOD	DESCRIPTION
size()	Returns the number of elements in this queue.
spliterator()	Returns a Spliterator over the elements in this queue.
toArray()	Returns an array containing all of the elements in this queue, in proper sequence.
toArray(T[] a)	Returns an array containing all of the elements in this queue, in proper sequence; the runtime type of the returned array is that of the specified array.

Methods declared in class java.util.AbstractQueue

METHOD	DESCRIPTION
addAll(Collection<? extends E> c)	Adds all of the elements in the specified collection to this queue.
element()	Retrieves, but does not remove, the head of this queue.
remove()	Retrieves and removes the head of this queue.

Methods declared in class java.util.AbstractCollection

METHOD	DESCRIPTION
containsAll (Collection<?> c)	Returns true if this collection contains all of the elements in the specified collection.
isEmpty()	Returns true if this collection contains no elements.
toString()	Returns a string representation of this collection.

Methods declared in interface java.util.concurrent.BlockingQueue

METHOD	DESCRIPTION

METHOD	DESCRIPTION
poll(long timeout, TimeUnit unit)	Retrieves and removes the head of this queue, waiting up to the specified wait time if necessary for an element to become available.
take()	Retrieves and removes the head of this queue, waiting if necessary until an element becomes available.

Methods declared in interface java.util.Collection

METHOD	DESCRIPTION
addAll(Collection<? extends E> c)	Adds all of the elements in the specified collection to this collection (optional operation).
containsAll (Collection<?> c)	Returns true if this collection contains all of the elements in the specified collection.
equals(Object o)	Compares the specified object with this collection for equality.
hashCode()	Returns the hash code value for this collection.
isEmpty()	Returns true if this collection contains no elements.
parallelStream()	Returns a possibly parallel Stream with this collection as its source.
stream()	Returns a sequential Stream with this collection as its source.
toArray (IntFunction<T[]> generator)	Returns an array containing all of the elements in this collection, using the provided generator function to allocate the returned array.

Methods declared in interface java.util.Queue

METHOD	DESCRIPTION
element()	Retrieves, but does not remove, the head of this queue.
peek()	Retrieves, but does not remove, the head of this queue, or returns null if this queue is empty.
poll()	Retrieves and removes the head of this queue, or returns null if this queue is empty.

METHOD	DESCRIPTION
remove()	Retrieves and removes the head of this queue.

Conclusion: ArrayBlockingQueue is generally used in a **thread-safe** environment where you want to block two or more operating on a single resource, allowing only one thread. Also, we can block a thread using the capacity bounding factor.

Reference: https://docs.oracle.com/en/java/javase/11/docs/api/java.base/java/util/concurrent/ArrayBlockingQueue.html