

# Exam 2 – Time Complexity

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## Queue Operations

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Operation	ArrayDeque	LinkedList
add(e)	$O(1)^*$	$O(1)$
remove()	$O(1)$	$O(1)$
peek()	$O(1)$	$O(1)$
size()	$O(1)$	$O(1)$
isEmpty()	$O(1)$	$O(1)$
toString()	$O(n)$	$O(n)$

## Deque Operations

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Operation	ArrayDeque	LinkedList
addFirst(e)	$O(1)^*$	$O(1)$
addLast(e)	$O(1)^*$	$O(1)$
getFirst()	$O(1)$	$O(1)$
getLast()	$O(1)$	$O(1)$
removeFirst()	$O(1)$	$O(1)$
removeLast()	$O(1)$	$O(1)$
push(e)	$O(1)^*$	$O(1)$

Operation	ArrayDeque	LinkedList
pop()	$O(1)$	$O(1)$
peek()	$O(1)$	$O(1)$
size()	$O(1)$	$O(1)$
isEmpty()	$O(1)$	$O(1)$
toString()	$O(n)$	$O(n)$

## Set and SequencedSet Operations

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Operation	HashSet	LinkedHashSet
add(e)	$O(1)$ *	$O(1)$ *
remove(o)	$O(1)$	$O(1)$
contains(o)	$O(1)$	$O(1)$
size()	$O(1)$	$O(1)$
isEmpty()	$O(1)$	$O(1)$
toString()	$O(n)$	$O(n)$
iterating over the set	$O(n)$	$O(n)$
iterator()	$O(1)$	$O(1)$
the iterator's hasNext()	$O(1)$	$O(1)$
the iterator's next()	$O(1)$	$O(1)$
the iterator's remove()	$O(1)$	$O(1)$

## Map and SequencedMap Operations

Operation	HashMap	LinkedHashMap
put(k,v)	$O(1)$ *	$O(1)$ *
get(o)	$O(1)$	$O(1)$
getOrDefault(o,v)	$O(1)$	$O(1)$
remove(o)	$O(1)$	$O(1)$
containsKey(o)	$O(1)$	$O(1)$
containsValue(o)	$O(n)$	$O(n)$
size()	$O(1)$	$O(1)$
isEmpty()	$O(1)$	$O(1)$
toString()	$O(n)$	$O(n)$
keySet()	$O(1)$	$O(1)$
iterating over key set	$O(n)$	$O(n)$
values()	$O(1)$	$O(1)$
iterating over values	$O(n)$	$O(n)$
entrySet()	$O(1)$	$O(1)$
iterating over entry set	$O(n)$	$O(n)$

## Map.Entry Operations

Operation	Time Complexity
getKey()	$O(1)$
getValue()	$O(1)$