



Collection **List**

Rawlabs Academy

List

- The `List` interface provides a way to **store** and **ordered collection**.
- It is a **child interface** of `Collection`
- It is an ordered collection of object in which **duplicate values** can be stored.
- Since `List` preserves the insertion order, it allows **positional access** and **insertion of elements**.

Methods

List

```
List.java
☐ Inherited members (⌘F12) ☐ Anonymous Classes (⌘I) ☐ Lambdas (⌘L) 
List
  add(E): boolean ↑Collection
  add(int, E): void
  addAll(Collection<? extends E>): boolean ↑Collection
  addAll(int, Collection<? extends E>): boolean
  clear(): void ↑Collection
  contains(Object): boolean ↑Collection
  containsAll(Collection<?>): boolean ↑Collection
  copyOf(Collection<? extends E>): List<E>
  equals(Object): boolean ↑Collection
  get(int): E
  hashCode(): int ↑Collection
  indexOf(Object): int
  isEmpty(): boolean ↑Collection
  iterator(): Iterator<E> ↑Collection
  lastIndexOf(Object): int
  listIterator(): ListIterator<E>
  listIterator(int): ListIterator<E>
  of(): List<E>
  of(E): List<E>
  of(E, E): List<E>
  of(E, E, E): List<E>
  of(E, E, E, E): List<E>
  of(E, E, E, E, E): List<E>
  of(E, E, E, E, E, E): List<E>
  of(E, E, E, E, E, E, E): List<E>
  of(E, E, E, E, E, E, E, E): List<E>
  of(E, E, E, E, E, E, E, E, E): List<E>
  of(E, E, E, E, E, E, E, E, E, E): List<E>
  of(E...): List<E>
  remove(int): E
  remove(Object): boolean ↑Collection
  removeAll(Collection<?>): boolean ↑Collection
```

List

Hierarchy























Abstract Collection

It is used to implement an unmodifiable collection, for which one need to only extend this

AbstractCollection

class and implement only the iterator and the size methods.

```
AbstractCollection.java
☐ Inherited members (⌘F12) ☐ Anonymous Classes (⌘I) ☐ Lambdas (⌘L) 
▼   AbstractCollection
  (m) ? AbstractCollection()
  (m)  add(E): boolean ↑Collection
  (m)  addAll(Collection<? extends E>): boolean ↑Collection
  (m)  clear(): void ↑Collection
  (m)  contains(Object): boolean ↑Collection
  (m)  containsAll(Collection<?>): boolean ↑Collection
  (m)  finishToArray(T[], Iterator<?>): T[]
  (m)  hugeCapacity(int): int
  (m)  isEmpty(): boolean ↑Collection
  (m)  iterator(): Iterator<E> ↑Collection
  (m)  remove(Object): boolean ↑Collection
  (m)  removeAll(Collection<?>): boolean ↑Collection
  (m)  retainAll(Collection<?>): boolean ↑Collection
  (m)  size(): int ↑Collection
  (m)  toArray(): Object[] ↑Collection
  (m)  toArray(T[]): T[] ↑Collection
  (m)  toString(): String ↑Object
  (f)  MAX_ARRAY_SIZE: int = Integer.MAX_VALUE - 8
```

AbstractList

This class provides a skeletal implementation of the `List` interface to minimize the effort required to implement this interface backed by Random Access data store (such an array). For sequential access data (such as linked list), `AbstractSequentialList` should be used in preference to this class.

```
AbstractList.java
☐ Inherited members (⌘F12) ☐ Anonymous Classes (⌘I) ☐ Lambdas (⌘L) 
AbstractList
  m ? AbstractList()
  m ? add(E): boolean ↑AbstractCollection
  m ? add(int, E): void ↑List
  m ? addAll(int, Collection<? extends E>): boolean ↑List
  m ? clear(): void ↑AbstractCollection
  m ? equals(Object): boolean ↑Object
  m ? get(int): E ↑List
  m ? hashCode(): int ↑Object
  m ? indexOf(Object): int ↑List
  m ? iterator(): Iterator<E> ↑AbstractCollection
  m ? lastIndexOf(Object): int ↑List
  m ? listIterator(): ListIterator<E> ↑List
  m ? listIterator(int): ListIterator<E> ↑List
  m ? outOfBoundsMsg(int): String
  m ? rangeCheckForAdd(int): void
  m ? remove(int): E ↑List
  m ? removeRange(int, int): void
  m ? set(int, E): E ↑List
  m ? subList(int, int): List<E> ↑List
  m ? subListRangeCheck(int, int, int): void
  f ? modCount: int = 0
  > ? Itr
  > ? ListItr
```

ArrayList

It provides us with **dynamic arrays** in java. Though, it may be slower than standard arrays but can be helpful in programs where **lots of manipulation** in the array needed.

40	55	63	17	22	68	89	97	89
0	1	2	3	4	5	6	7	8

<- Array Indices

Array Length = 9

First Index = 0

Last Index = 8

```
ArrayList.java
Inherited members (%F12) Anonymous Classes (%I) Lambdas (%L)
ArrayList
ArrayList()
ArrayList(Collection<? extends E>)
ArrayList(int)
add(E): boolean ↑AbstractList
add(E, Object[], int): void
add(int, E): void ↑AbstractList
addAll(Collection<? extends E>): boolean ↑AbstractCollection
addAll(int, Collection<? extends E>): boolean ↑AbstractList
batchRemove(Collection<?>, boolean, int, int): boolean
checkForComodification(int): void
checkInvariants(): void
clear(): void ↑AbstractList
clone(): Object ↑Object
contains(Object): boolean ↑AbstractCollection
elementAt(Object[], int): E
elementData(int): E
ensureCapacity(int): void
equals(Object): boolean ↑AbstractList
equalsArrayList(ArrayList<?>): boolean
equalsRange(List<?>, int, int): boolean
fastRemove(Object[], int): void
forEach(Consumer<? super E>): void ↑Iterable
get(int): E ↑AbstractList
grow(): Object[]
grow(int): Object[]
hashCode(): int ↑AbstractList
hashCodeRange(int, int): int
hugeCapacity(int): int
indexOf(Object): int ↑AbstractList
indexOfRange(Object, int, int): int
isClear(long[], int): boolean
isEmpty(): boolean ↑AbstractCollection
```

ArrayList

Work



LinkedList

- **LinkedList** consists of nodes where each node contains data and a reference to the next node in the list
- Unlike an array, data is not stored in one contiguous block of memory and does not have a fixed size
- Instead, it consists of multiple blocks of memory at different addresses



```
LinkedList
m LinkedList()
m LinkedList(Collection<? extends E>)
m add(E): boolean ↑AbstractList
m add(int, E): void ↑AbstractSequentialList
m addAll(Collection<? extends E>): boolean ↑AbstractCollection
m addAll(int, Collection<? extends E>): boolean ↑AbstractSequentialList
m addFirst(E): void ↑Deque
m addLast(E): void ↑Deque
m checkElementIndex(int): void
m checkPositionIndex(int): void
m clear(): void ↑AbstractList
m clone(): Object ↑Object
m contains(Object): boolean ↑AbstractCollection
m descendingIterator(): Iterator<E> ↑Deque
m element(): E ↑Deque
m get(int): E ↑AbstractSequentialList
m getFirst(): E ↑Deque
m getLast(): E ↑Deque
m indexOf(Object): int ↑AbstractList
m isElementIndex(int): boolean
m isPositionIndex(int): boolean
m lastIndexOf(Object): int ↑AbstractList
m linkBefore(E, Node<E>): void
m linkFirst(E): void
m linkLast(E): void
m listIterator(int): ListIterator<E> ↑AbstractSequentialList
m node(int): Node<E>
m offer(E): boolean ↑Deque
m offerFirst(E): boolean ↑Deque
m offerLast(E): boolean ↑Deque
m outOfBoundsMsg(int): String
m peek(): E ↑Deque
```

Representation **ArrayList** vs **LinkedList**



Array representation



ArrayList Example

```
public class Main {  
    public static void main(String[] args) {  
        List<String> addresses = new ArrayList<>();  
        addresses.add("Milan");  
        addresses.add("London");  
        addresses.add("Guatemala");  
        addresses.add("London");  
  
        System.out.println(addresses.get(2));  
    }  
}
```

LinkedList Example

```
public class Main {  
    public static void main(String[] args) {  
        List<String> addresses = new LinkedList<>();  
        addresses.add("Milan");  
        addresses.add("London");  
        addresses.add("Guatemala");  
        addresses.add("London");  
  
        System.out.println(addresses.get(2));  
    }  
}
```

Immutable List Example

```
public class Main {  
    public static void main(String[] args) {  
        List<String> addresses = new LinkedList<>();  
        var immutableAddresses = Collections.unmodifiableList(addresses);  
        immutableAddresses.add("Texas");  
        addresses.add("Milan");  
        addresses.add("London");  
        addresses.add("Guatemala");  
        addresses.add("London");  
  
        System.out.println(addresses.get(2));  
    }  
}
```

Stack

- The `Stack` class represents a **last-in-first-out** (LIFO) stack of objects
- It extends class `Vector` with 5 operations that allow a vector to be treated as a stack
- The usual **push** and **pop** operations are provided, as well as a method to peek at the top item on the stack, a method to test for whether the stack is empty, and a method to search the stack for an item and discover how far it is from the top
- A more complete and consistent set of LIFO stack operations is provided by the `Deque` **interface** and its implementations, which should be used in preference to this class.



Stack Example

```
public class Main {  
    public static void main(String[] args) {  
        Stack<String> addresses = new Stack<>();  
        addresses.push("Milan");  
        addresses.push("London");  
        addresses.push("Guatemala");  
        addresses.push("London");  
  
        System.out.println(addresses.pop());  
    }  
}
```

Task - **Array Merge**

Make a program to combine 2 arrays, then insert several objects into the array in the middle with the index entered.

Task - **Play with Parking Area**

It is known that there is a parking lot that only contains 1 motorcycle in each row. Make a program to manage the parking lot so that it fills the farthest parking lot with the parking gate first and the motorbike closest to the parking gate can exit first.