
Java Collections Framework

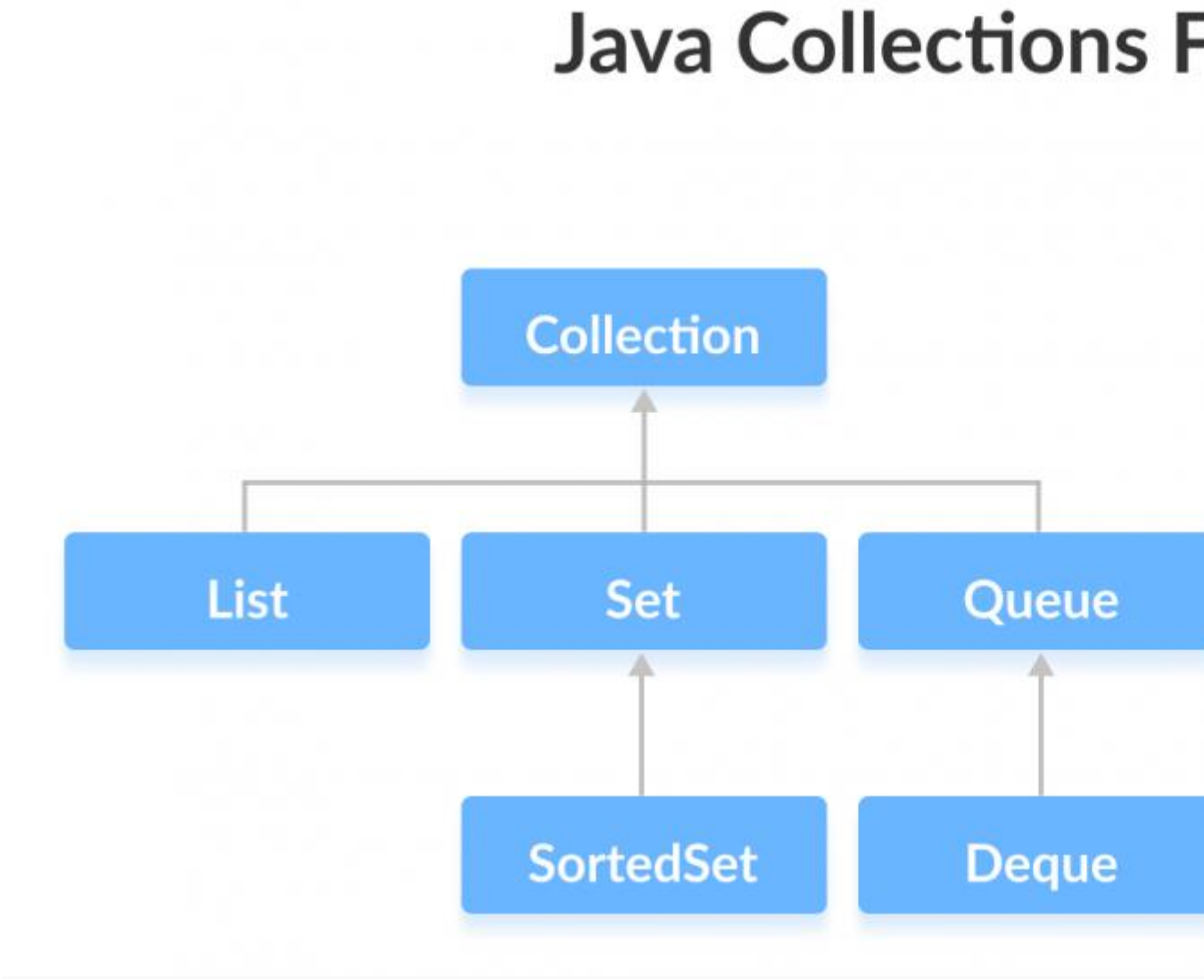
In this tutorial, we will learn about different interfaces of the Java collections framework.

The Java **collections** framework provides a set of interfaces and classes to implement various data structures and algorithms.

For example, the `LinkedList` class of the collections framework provides the implementation of the doubly-linked list data structure.

Interfaces of Collections FrameWork

The Java collections framework provides various interfaces. These interfaces include several methods to perform different operations on collections.



We will learn about these interfaces, their subinterfaces, and implementation in various classes in detail in the later chapters. Let's learn about the commonly used interfaces in brief in this tutorial.

Java Collection Interface

The `Collection` interface is the root interface of the collections framework hierarchy.

Java does not provide direct implementations of the `Collection` interface but provides implementations of its subinterfaces like `List`, `Set`, and `Queue`. To learn more, visit: Java Collection Interface

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Collections Framework Vs. Collection Interface

People often get confused between the collections framework and `Collection` Interface.

The `Collection` interface is the root interface of the collections framework. The framework includes other interfaces as well: `Map` and `Iterator`. These interfaces may also have subinterfaces.

Subinterfaces of the Collection Interface

As mentioned earlier, the `Collection` interface includes subinterfaces that are implemented by Java classes.

All the methods of the `Collection` interface are also present in its subinterfaces.

Here are the subinterfaces of the `Collection` Interface:

List Interface

The `List` interface is an ordered collection that allows us to add and remove elements like an array. To learn more, visit Java List Interface

Set Interface

The `Set` interface allows us to store elements in different sets similar to the set in mathematics. It cannot have duplicate elements. To learn more, visit Java Set Interface

Queue Interface

The `Queue` interface is used when we want to store and access elements in **First In, First Out** manner. To learn more, visit Java Queue Interface

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Java Map Interface

In Java, the `Map` interface allows elements to be stored in **key/value** pairs. Keys are unique names that can be used to access a particular element in a map. And, each key has a single value associated with it. To learn more, visit Java Map Interface

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Java Iterator Interface

In Java, the `Iterator` interface provides methods that can be used to access elements of collections. To learn more, visit Java Iterator Interface

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Why the Collections Framework?

The Java collections framework provides various data structures and algorithms that can be used directly. This has two main advantages:

- We do not have to write code to implement these data structures and algorithms manually.
- Our code will be much more efficient as the collections framework is highly optimized.

Moreover, the collections framework allows us to use a specific data structure for a particular type of data. Here are a few examples,

- If we want our data to be unique, then we can use the `Set` interface provided by the collections framework.
- To store data in **key/value** pairs, we can use the `Map` interface.
- The `ArrayList` class provides the functionality of resizable arrays.

Example: ArrayList Class of Collections

Before we wrap up this tutorial, let's take an example of the ArrayList class of the collections framework.

The `ArrayList` class allows us to create resizable arrays. The class implements the `List` interface (which is a subinterface of the `Collection` interface).

```
// The Collections framework is defined in the java.util packageimport java.util.ArrayList;

class Main {

    public static void main(String[] args){

        ArrayList<String> animals = new ArrayList<>();
```

```
        // Add elements
        animals.add("Dog");
        animals.add("Cat");
        animals.add("Horse");

        System.out.println("ArrayList: " + animals);
    }
}
```

Output:

```
ArrayList: [Dog, Cat, Horse]
```

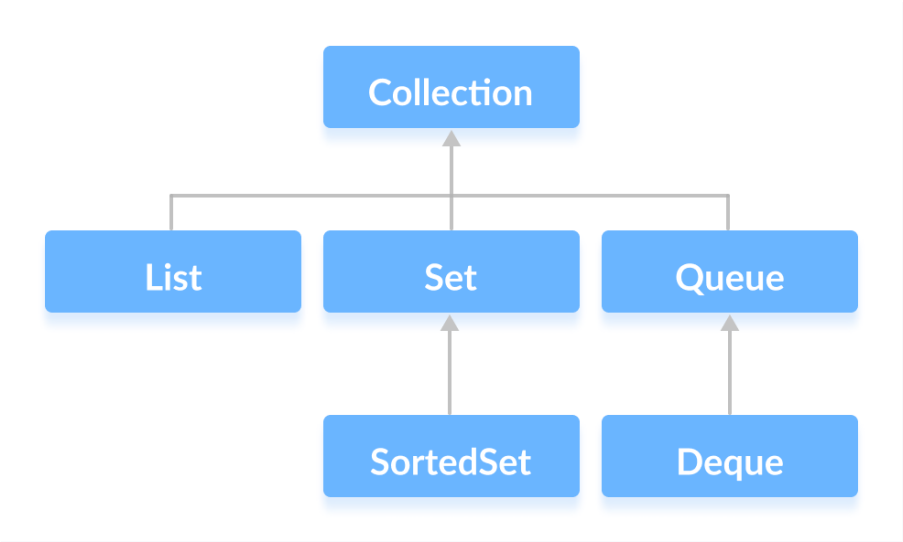
Java Collection Interface

In this tutorial, we will learn about the Java Collection interface and its subinterfaces.

The `Collection` interface is the root interface of the Java collections framework.

There is no direct implementation of this interface. However, it is implemented through its subinterfaces like `List`, `Set`, and `Queue`.

For example, the `ArrayList` class implements the `List` interface which is a subinterface of the `Collection` Interface.



Subinterfaces of Collection

As mentioned above, the `Collection` interface includes subinterfaces that are implemented by various classes in Java.

1. List Interface

The `List` interface is an ordered collection that allows us to add and remove elements like an array. To learn more, visit: Java List Interface.

2. Set Interface

The `Set` interface allows us to store elements in different sets similar to the set in mathematics. It cannot have duplicate elements. To learn more, visit: Java Set Interface.

3. Queue Interface

The `Queue` interface is used when we want to store and access elements in **First In, First Out(FIFO)** manner. To learn more, visit: Java Queue Interface.

Methods of Collection

The `Collection` interface includes various methods that can be used to perform different operations on objects. These methods are available in all its subinterfaces.

- `add()` - inserts the specified element to the collection

- `size()` - returns the size of the collection
- `remove()` - removes the specified element from the collection
- `iterator()` - returns an iterator to access elements of the collection
- `addAll()` - adds all the elements of a specified collection to the collection
- `removeAll()` - removes all the elements of the specified collection from the collection
- `clear()` - removes all the elements of the collection

Java List

In this tutorial, we will learn about the List interface in Java and its methods.

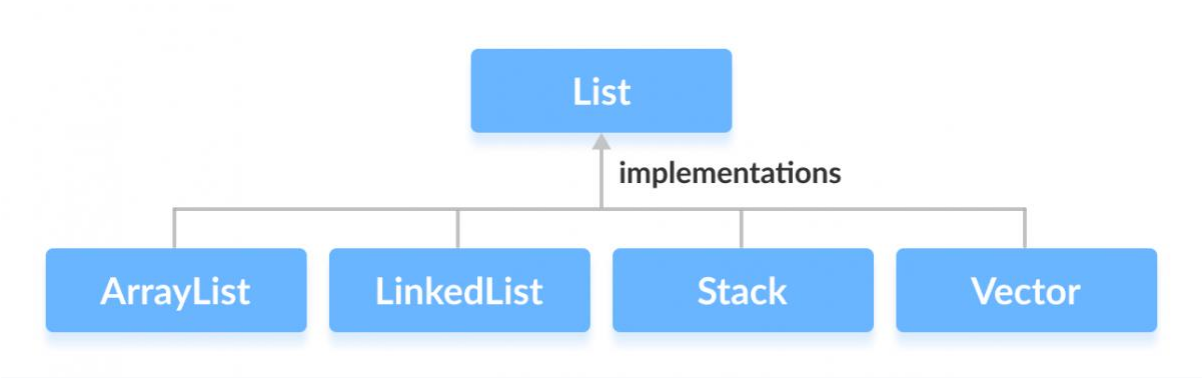
In Java, the `List` interface is an ordered collection that allows us to store and access elements sequentially. It extends the `Collection` interface.

Classes that Implement List

Since `List` is an interface, we cannot create objects from it.

In order to use functionalities of the `List` interface, we can use these classes:

- ArrayList
- LinkedList
- Vector
- Stack



These classes are defined in the Collections framework and implement the `List` interface.

How to use List?

In Java, we must import `java.util.List` package in order to use `List`.

```
// ArrayList implementation of List

List<String> list1 = new ArrayList<>();

// LinkedList implementation of List

List<String> list2 = new LinkedList<>();
```

Here, we have created objects `list1` and `list2` of classes `ArrayList` and `LinkedList`. These objects can use the functionalities of the `List` interface.

Methods of List

The `List` interface includes all the methods of the `Collection` interface. Its because `Collection` is a super interface of `List`.

Some of the commonly used methods of the `Collection` interface that's also available in the `List` interface are:

- `add()` - adds an element to a list
- `addAll()` - adds all elements of one list to another
- `get()` - helps to randomly access elements from lists

- `iterator()` - returns iterator object that can be used to sequentially access elements of lists
- `set()` - changes elements of lists
- `remove()` - removes an element from the list
- `removeAll()` - removes all the elements from the list
- `clear()` - removes all the elements from the list (more efficient than `removeAll()`)
- `size()` - returns the length of lists
- `toArray()` - converts a list into an array
- `contains()` - returns `true` if a list contains specified element

Implementation of the List Interface

1. Implementing the ArrayList Class

```
import java.util.List;import java.util.ArrayList;

class Main {


    public static void main(String[] args) {

        // Creating list using the ArrayList class

        List<Integer> numbers = new ArrayList<>();


        // Add elements to the list

        numbers.add(1);

        numbers.add(2);

        numbers.add(3);

        System.out.println("List: " + numbers);


        // Access element from the list

        int number = numbers.get(2);

        System.out.println("Accessed Element: " + number);
```

```
        // Remove element from the list
        int removedNumber = numbers.remove(1);
        System.out.println("Removed Element: " + removedNumber);
    }
}
```

Output

```
List: [1, 2, 3]
Accessed Element: 3
Removed Element: 2
```

To learn more about `ArrayList`, visit Java ArrayList.

2. Implementing the LinkedList Class

```
import java.util.List;import java.util.LinkedList;
class Main {

    public static void main(String[] args) {
        // Creating list using the LinkedList class
        List<Integer> numbers = new LinkedList<>();

        // Add elements to the list
        numbers.add(1);
        numbers.add(2);
        numbers.add(3);
        System.out.println("List: " + numbers);

        // Access element from the list
        int number = numbers.get(2);
        System.out.println("Accessed Element: " + number);

        // Using the indexOf() method
        int index = numbers.indexOf(2);
```

```
        System.out.println("Position of 3 is " + index);


        // Remove element from the list
        int removedNumber = numbers.remove(1);
        System.out.println("Removed Element: " + removedNumber);
    }
}
```

Output

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

Accessed Element: 3

Position of 3 is 1

Removed Element: 2
```

To learn more about `LinkedList`, visit Java LinkedList.

Java List vs. Set

Both the `List` interface and the `Set` interface inherits the `Collection` interface. However, there exists some difference between them.

- Lists can include duplicate elements. However, sets cannot have duplicate elements.
- Elements in lists are stored in some order. However, elements in sets are stored in groups like sets in mathematics.

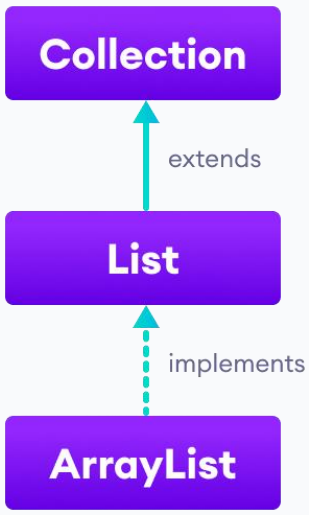
Now that we know what `List` is, we will see its implementations in `ArrayList` and `LinkedList` classes in detail in the next tutorials.

Java ArrayList Class

In this tutorial, we will learn about the ArrayList class in Java. We will learn about different operations and methods of the arraylist with the help of examples.

The `ArrayList` class of the Java collections framework provides the functionality of **resizable-arrays**.

It implements the `List` interface.



Java ArrayList Implementation

Java ArrayList Vs Array

In Java, we need to declare the size of an array before we can use it. Once the size of an array is declared, it's hard to change it.

To handle this issue, we can use the `ArrayList` class. It allows us to create resizable arrays.

Unlike arrays, arraylists can automatically adjust its capacity when we add or remove elements from it. Hence, arraylists are also known as **dynamic arrays**.

Creating an ArrayList

Before using `ArrayList`, we need to import the `java.util.ArrayList` package first. Here is how we can create arraylists in Java:

```
ArrayList<Type> arrayList= new ArrayList<>();
```

Here, `Type` indicates the type of an arraylist. For example,

```
// create Integer type arraylist
ArrayList<Integer> arrayList = new ArrayList<>();
// create String type arraylist
ArrayList<String> arrayList = new ArrayList<>();
```

In the above program, we have used `Integer` not int. It is because we cannot use primitive types while creating an arraylist. Instead, we have to use the corresponding wrapper classes.

Here, `Integer` is the corresponding wrapper class of `int`. To learn more, visit the Java wrapper class.

Example: Create ArrayList in Java

```
import java.util.ArrayList;
class Main {
  public static void main(String[] args){

    // create ArrayList
    ArrayList<String> languages = new ArrayList<>();

    // Add elements to ArrayList
    languages.add("Java");
    languages.add("Python");
    languages.add("Swift");
    System.out.println("ArrayList: " + languages);
  }
}
```

Output

```
ArrayList: [Java, Python, Swift]
```

In the above example, we have created an `ArrayList` named `languages`.

Here, we have used the `add()` method to add elements to the arraylist. We will learn more about the `add()` method later in this tutorial.

Note: We can also create an arraylist using the `List` interface. It's because the `ArrayList` class implements the `List` interface.

```
List<String> list = new ArrayList<>();
```

Basic Operations on ArrayList

The `ArrayList` class provides various methods to perform different operations on arraylists. We will look at some commonly used arraylist operations in this tutorial:

- Add elements
- Access elements
- Change elements
- Remove elements

---

1. Add Elements to an ArrayList

To add a single element to the arraylist, we use the `add()` method of the `ArrayList` class. For example,

```
import java.util.ArrayList;

class Main {

  public static void main(String[] args){

    // create ArrayList

    ArrayList<String> languages = new ArrayList<>();
```

```
    // add() method without the index parameter
    languages.add("Java");
    languages.add("C");
    languages.add("Python");
    System.out.println("ArrayList: " + languages);

    // add() method with the index parameter
    languages.add(1, "JavaScript");
    System.out.println("Updated ArrayList: " + languages);
  }
}
```

Output

```
ArrayList: [Java, C, Python]
Updated ArrayList: [Java, JavaScript, C, Python]
```

In the above example, we have created an `ArrayList` named `languages`. Here, we have used the `add()` method to add elements to `languages`.

Notice the statement,

```
languages.add(1, "JavaScript");
```

Here, we have used the **index number** parameter. It is an optional parameter that specifies the position where the new element is added.

To learn more, visit the Java ArrayList add().

We can also add elements of a collection to an arraylist using the Java ArrayList addAll() method.

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2. Access ArrayList Elements

To access an element from the arraylist, we use the `get()` method of the `ArrayList` class. For example,

```
import java.util.ArrayList;

class Main {

  public static void main(String[] args) {

    ArrayList<String> animals = new ArrayList<>();


    // add elements in the arraylist

    animals.add("Cat");

    animals.add("Dog");

    animals.add("Cow");

    System.out.println("ArrayList: " + animals);


    // get the element from the arraylist

    String str = animals.get(1);

    System.out.print("Element at index 1: " + str);

  }

}
```

Output

```
ArrayList: [Cat, Dog, Cow]

Element at index 1: Dog
```

In the above example, we have used the `get()` method with parameter `1`. Here, the method returns the element at **index 1**.

To learn more, visit the Java ArrayList get().

We can also access elements of the `ArrayList` using the `iterator()` method. To learn more, visit Java ArrayList iterator().

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3. Change ArrayList Elements

To change element of the arraylist, we use the `set()` method of the `ArrayList` class. For example,

```
import java.util.ArrayList;

class Main {

  public static void main(String[] args) {

    ArrayList<String> languages = new ArrayList<>();


    // add elements in the array list

    languages.add("Java");

    languages.add("Kotlin");

    languages.add("C++");

    System.out.println("ArrayList: " + languages);


    // change the element of the array list

    languages.set(2, "JavaScript");

    System.out.println("Modified ArrayList: " + languages);

  }

}
```

Output

```
ArrayList: [Java, Kotlin, C++]

Modified ArrayList: [Java, Kotlin, JavaScript]
```

In the above example, we have created an `ArrayList` named `languages`. Notice the line,

```
language.set(2, "JavaScript");
```

Here, the `set()` method changes the element at **index 2** to `JavaScript`.

To learn more, visit the Java ArrayList set().

---

4. Remove ArrayList Elements

To remove an element from the arraylist, we can use the `remove()` method of the `ArrayList` class. For example,

```
import java.util.ArrayList;

class Main {

  public static void main(String[] args) {

    ArrayList<String> animals = new ArrayList<>();


    // add elements in the array list

    animals.add("Dog");

    animals.add("Cat");

    animals.add("Horse");

    System.out.println("ArrayList: " + animals);


    // aemove element from index 2

    String str = animals.remove(2);

    System.out.println("Updated ArrayList: " + animals);

    System.out.println("Removed Element: " + str);

  }

}
```

Output

```
ArrayList: [Dog, Cat, Horse]

Updated ArrayList: [Dog, Cat]

Removed Element: Horse
```

Here, the `remove()` method takes the **index number** as the parameter. And, removes the element specified by the **index number**.

To learn more, visit the Java ArrayList remove().

We can also remove all the elements from the arraylist at once. To learn more, visit

- Java ArrayList removeAll()
- Java ArrayList clear()

Methods of ArrayList Class

In previous section, we have learned about the `add()`, `get()`, `set()`, and `remove()` method of the `ArrayList` class.

Besides those basic methods, here are some more `ArrayList` methods that are commonly used.

Methods	Descriptions
size()	Returns the length of the arraylist.
sort()	Sort the arraylist elements.
clone()	Creates a new arraylist with the same element, size, and capacity.
contains()	Searches the arraylist for the specified element and returns a boolean result.
ensureCapacity()	Specifies the total element the arraylist can contain.
isEmpty()	Checks if the arraylist is empty.
indexOf()	Searches a specified element in an arraylist and returns the index of the element.

If you want to learn about all the different methods of arraylist, visit Java ArrayList methods.

Iterate through an ArrayList

We can use the Java for-each loop to loop through each element of the arraylist. For example,

```
import java.util.ArrayList;

class Main {

  public static void main(String[] args) {
```

```
    // creating an array list
    ArrayList<String> animals = new ArrayList<>();
    animals.add("Cow");
    animals.add("Cat");
    animals.add("Dog");
    System.out.println("ArrayList: " + animals);

    // iterate using for-each loop
    System.out.println("Accessing individual elements:  ");

    for (String language : animals) {
      System.out.print(language);
      System.out.print(", ");
    }
  }
}
```

Output

```
ArrayList: [Cow, Cat, Dog]
Accessing individual elements:
Cow, Cat, Dog,
```

ArrayList To Array Conversion

We can convert the `ArrayList` into an array using the `toArray()` method. For example,

```
import java.util.ArrayList;
class Main {
  public static void main(String[] args) {
    ArrayList<String> languages = new ArrayList<>();
```

```
    // add elements in the array list
    languages.add("Java");
    languages.add("Python");
    languages.add("C++");
    System.out.println("ArrayList: " + languages);

    // create a new array of String type
    String[] arr = new String[languages.size()];

    // convert ArrayList into an array
    languages.toArray(arr);
    System.out.print("Array: ");

    // access elements of the array
    for (String item : arr) {
      System.out.print(item + ", ");
    }
  }
}
```

Output

```
ArrayList: [Java, Python, C++]
Array: Java, Python, C++,
```

In the above example, we have created an arraylist named `languages`. Notice the statement,

```
languages.toArray(arr);
```

Here, the `toArray()` method converts the arraylist into an array and stores it in `arr`. To learn more, visit Java ArrayList toArray().

Java Array to ArrayList Conversion

We can also convert the array into an arraylist. For that, we use the `asList()` method of the `Arrays` class.

To use `asList()`, we must import the `java.util.Arrays` package first. For example,

```
import java.util.ArrayList;import java.util.Arrays;

class Main {

  public static void main(String[] args) {


    // create an array of String type

    String[] arr = { "Java", "Python", "C++" };

    System.out.print("Array: ");


    // print array

    for (String str : arr) {

      System.out.print(str);

      System.out.print(" ");

    }


    // create an ArrayList from an array

    ArrayList<String> languages = new ArrayList<>(Arrays.asList(arr));

    System.out.println("\nArrayList: " + languages);

  }

}
```

Output

```
Array: Java Python C++

ArrayList: [Java, Python, C++]
```

In the above program, we first created an array `arr` of the `String` type. Notice the expression,

```
Arrays.asList(arr)
```

Here, the `asList()` method converts the array into an arraylist.

Note: We can also use the `Arrays.asList()` method to create and initialize the arraylist in a single line. For example,

```
 // create and initialize arraylist

ArrayList<String> animals = new ArrayList<>(Arrays.asList("Cat", "Cow", "Dog"));
```

ArrayList to String Conversion

We can use the `toString()` method of the `ArrayList` class to convert an arraylist into a string. For example,

```
import java.util.ArrayList;

class Main {

  public static void main(String[] args) {

    ArrayList<String> languages = new ArrayList<>();


    // add elements in the ArrayList

    languages.add("Java");

    languages.add("Python");

    languages.add("Kotlin");

    System.out.println("ArrayList: " + languages);


    // convert ArrayList into a String

    String str = languages.toString();

    System.out.println("String: " + str);

  }

}
```

Output

```
ArrayList: [Java, Python, Kotlin]
```

```
String: [Java, Python, Kotlin]
```

Here, the `toString()` method converts the whole arraylist into a single string.

Java Vector

In this tutorial, we will learn about the Vector class and how to use it. We will also learn how it is different from the ArrayList class, and why we should use array lists instead.

The `Vector` class is an implementation of the `List` interface that allows us to create resizable-arrays similar to the ArrayList class.

Java Vector vs. ArrayList

In Java, both `ArrayList` and `Vector` implements the `List` interface and provides the same functionalities. However, there exist some differences between them.

The `Vector` class synchronizes each individual operation. This means whenever we want to perform some operation on vectors, the `Vector` class automatically applies a lock to that operation.

It is because when one thread is accessing a vector, and at the same time another thread tries to access it, an exception called `ConcurrentModificationException` is generated. Hence, this continuous use of lock for each operation makes vectors less efficient.

However, in array lists, methods are not synchronized. Instead, it uses the `Collections.synchronizedList()` method that synchronizes the list as a whole.

> **Note:** It is recommended to use `ArrayList` in place of `Vector` because vectors are not threadsafe and are less efficient.

Creating a Vector

Here is how we can create vectors in Java.

```
Vector<Type> vector = new Vector<>();
```

Here, `Type` indicates the type of a linked list. For example,

```
// create Integer type linked list

Vector<Integer> vector= new Vector<>();

// create String type linked list

Vector<String> vector= new Vector<>();
```

Methods of Vector

The `Vector` class also provides the resizable-array implementations of the `List` interface (similar to the `ArrayList` class). Some of the `Vector` methods are:

Add Elements to Vector

- `add(element)` - adds an element to vectors
- `add(index, element)` - adds an element to the specified position
- `addAll(vector)` - adds all elements of a vector to another vector

For example,

```
import java.util.Vector;

class Main {

    public static void main(String[] args) {

        Vector<String> mammals= new Vector<>();


        // Using the add() method

        mammals.add("Dog");

        mammals.add("Horse");
```

```
        // Using index number
        mammals.add(2, "Cat");
        System.out.println("Vector: " + mammals);

        // Using addAll()
        Vector<String> animals = new Vector<>();
        animals.add("Crocodile");

        animals.addAll(mammals);
        System.out.println("New Vector: " + animals);
    }
}
```

Output

```
Vector: [Dog, Horse, Cat]
New Vector: [Crocodile, Dog, Horse, Cat]
```

Access Vector Elements

- `get(index)` - returns an element specified by the index
- `iterator()` - returns an iterator object to sequentially access vector elements

For example,

```
import java.util.Iterator;import java.util.Vector;
class Main {
    public static void main(String[] args) {
        Vector<String> animals= new Vector<>();
        animals.add("Dog");
        animals.add("Horse");
        animals.add("Cat");
```

```
        // Using get()
        String element = animals.get(2);
        System.out.println("Element at index 2: " + element);

        // Using iterator()
        Iterator<String> iterate = animals.iterator();
        System.out.print("Vector: ");
        while(iterate.hasNext()) {
            System.out.print(iterate.next());
            System.out.print(", ");
        }
    }
}
```

Output

```
Element at index 2: Cat
Vector: Dog, Horse, Cat,
```

Remove Vector Elements

- `remove(index)` - removes an element from specified position
- `removeAll()` - removes all the elements
- `clear()` - removes all elements. It is more efficient than `removeAll()`

For example,

```
import java.util.Vector;
class Main {
    public static void main(String[] args) {
        Vector<String> animals= new Vector<>();
        animals.add("Dog");
```

```
        animals.add("Horse");
        animals.add("Cat");

        System.out.println("Initial Vector: " + animals);

        // Using remove()
        String element = animals.remove(1);
        System.out.println("Removed Element: " + element);
        System.out.println("New Vector: " + animals);

        // Using clear()
        animals.clear();
        System.out.println("Vector after clear(): " + animals);
    }
}
```

Output

```
Initial Vector: [Dog, Horse, Cat]
Removed Element: Horse
New Vector: [Dog, Cat]
Vector after clear(): []
```

Others Vector Methods

Methods	Descriptions
`set()`	changes an element of the vector
`size()`	returns the size of the vector
`toArray()`	converts the vector into an array

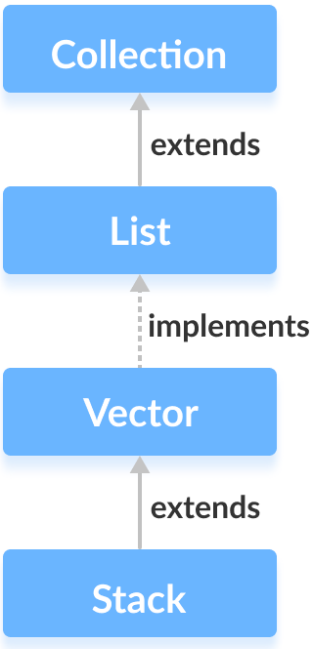
`toString()`	converts the vector into a String
`contains()`	searches the vector for specified element and returns a boolean result

Java Stack Class

In this tutorial, we will learn about the Java Stack class and its methods with the help of examples.

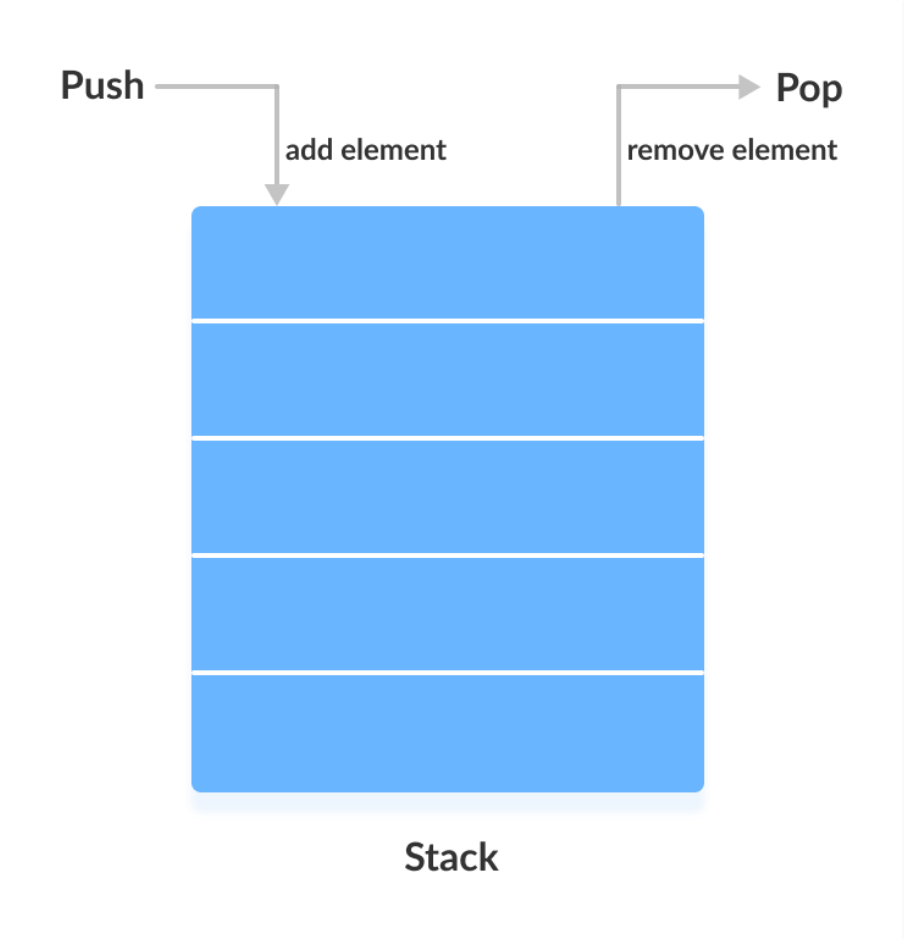
The Java collections framework has a class named `Stack` that provides the functionality of the stack data structure.

The `Stack` class extends the `Vector` class.



Stack Implementation

In stack, elements are stored and accessed in **Last In First Out** manner. That is, elements are added to the top of the stack and removed from the top of the stack.



Creating a Stack

In order to create a stack, we must import the `java.util.Stack` package first. Once we import the package, here is how we can create a stack in Java.

```
Stack<Type> stacks = new Stack<>();
```

Here, `Type` indicates the stack's type. For example,

```
// Create Integer type stack

Stack<Integer> stacks = new Stack<>();

// Create String type stack

Stack<String> stacks = new Stack<>();
```

Stack Methods

Since `Stack` extends the `Vector` class, it inherits all the methods `Vector`. To learn about different `Vector` methods, visit Java Vector Class.

Besides these methods, the `Stack` class includes 5 more methods that distinguish it from `Vector`.

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push() Method

To add an element to the top of the stack, we use the `push()` method. For example,

```
import java.util.Stack;

class Main {

    public static void main(String[] args) {

        Stack<String> animals= new Stack<>();


        // Add elements to Stack

        animals.push("Dog");

        animals.push("Horse");

        animals.push("Cat");


        System.out.println("Stack: " + animals);

    }

}
```

Output

```
Stack: [Dog, Horse, Cat]
```

---

pop() Method

To remove an element from the top of the stack, we use the `pop()` method. For example,

```
import java.util.Stack;

class Main {

    public static void main(String[] args) {

        Stack<String> animals= new Stack<>();


        // Add elements to Stack

        animals.push("Dog");

        animals.push("Horse");

        animals.push("Cat");

        System.out.println("Initial Stack: " + animals);


        // Remove element stacks

        String element = animals.pop();

        System.out.println("Removed Element: " + element);

    }

}
```

Output

```
Initial Stack: [Dog, Horse, Cat]

Removed Element: Cat
```

---

peek() Method

The `peek()` method returns an object from the top of the stack. For example,

```
import java.util.Stack;

class Main {

    public static void main(String[] args) {
```

```
        Stack<String> animals= new Stack<>();


        // Add elements to Stack
        animals.push("Dog");
        animals.push("Horse");
        animals.push("Cat");
        System.out.println("Stack: " + animals);


        // Access element from the top
        String element = animals.peek();
        System.out.println("Element at top: " + element);


    }
}
```

Output

```
Stack: [Dog, Horse, Cat]
Element at top: Cat
```

---

search() Method

To search an element in the stack, we use the `search()` method. It returns the position of the element from the top of the stack. For example,

```
import java.util.Stack;
class Main {
    public static void main(String[] args) {
        Stack<String> animals= new Stack<>();


        // Add elements to Stack
        animals.push("Dog");
        animals.push("Horse");
```

```
        animals.push("Cat");
        System.out.println("Stack: " + animals);

        // Search an element
        int position = animals.search("Horse");
        System.out.println("Position of Horse: " + position);
    }
}
```

Output

```
Stack: [Dog, Horse, Cat]
Position of Horse: 2
```

---

empty() Method

To check whether a stack is empty or not, we use the `empty()` method. For example,

```
import java.util.Stack;
class Main {
    public static void main(String[] args) {
        Stack<String> animals= new Stack<>();

        // Add elements to Stack
        animals.push("Dog");
        animals.push("Horse");
        animals.push("Cat");
        System.out.println("Stack: " + animals);

        // Check if stack is empty
        boolean result = animals.empty();
        System.out.println("Is the stack empty? " + result);
```

```
    }
}
```

Output

```
Stack: [Dog, Horse, Cat]

Is the stack empty? false
```

Use ArrayDeque Instead of Stack

The `Stack` class provides the direct implementation of the stack data structure. However, it is recommended not to use it. Instead, use the `ArrayDeque` class (implements the `Deque` interface) to implement the stack data structure in Java.

To learn more, visit:

- Java ArrayDeque
- Why use Deque over Stack?
