A collections framework is a unified architecture for representing and manipulating collections. All collections frameworks contain the following −

**Interfaces** − These are abstract data types that represent collections. Interfaces allow collections to be manipulated independently of the details of their representation. In object-oriented languages, interfaces generally form a hierarchy.

**Implementations, i.e., Classes** − These are the concrete implementations of the collection interfaces. In essence, they are reusable data structures.

**Algorithms** − These are the methods that perform useful computations, such as searching and sorting, on objects that implement collection interfaces. The algorithms are said to be polymorphic: that is, the same method can be used on many different implementations of the appropriate collection interface.

In addition to collections, the framework defines several map interfaces and classes. Maps store key/value pairs. Although maps are not *collections* in the proper use of the term, but they are fully integrated with collections.

## The Collection Interfaces

The collections framework defines several interfaces. This section provides an overview of each interface −

|  |  |
| --- | --- |
| **Sr.No.** | **Interface & Description** |
| 1 | [The Collection Interface](https://www.tutorialspoint.com/java/java_collection_interface.htm)  This enables you to work with groups of objects; it is at the top of the collections hierarchy. |
| 2 | [The List Interface](https://www.tutorialspoint.com/java/java_list_interface.htm)  This extends **Collection** and an instance of List stores an ordered collection of elements. |
| 3 | [The Set](https://www.tutorialspoint.com/java/java_set_interface.htm)  This extends Collection to handle sets, which must contain unique elements. |
| 4 | [The SortedSet](https://www.tutorialspoint.com/java/java_sortedset_interface.htm)  This extends Set to handle sorted sets. |
| 5 | [The Map](https://www.tutorialspoint.com/java/java_map_interface.htm)  This maps unique keys to values. |
| 6 | [The Map.Entry](https://www.tutorialspoint.com/java/java_mapentry_interface.htm)  This describes an element (a key/value pair) in a map. This is an inner class of Map. |
| 7 | [The SortedMap](https://www.tutorialspoint.com/java/java_sortedmap_interface.htm)  This extends Map so that the keys are maintained in an ascending order. |
| 8 | [The Enumeration](https://www.tutorialspoint.com/java/java_enumeration_interface.htm)  This is legacy interface defines the methods by which you can enumerate (obtain one at a time) the elements in a collection of objects. This legacy interface has been superceded by Iterator. |

## The Collection Classes

Java provides a set of standard collection classes that implement Collection interfaces. Some of the classes provide full implementations that can be used as-is and others are abstract class, providing skeletal implementations that are used as starting points for creating concrete collections.

The standard collection classes are summarized in the following table −

|  |  |
| --- | --- |
| **Sr.No.** | **Class & Description** |
| 1 | **AbstractCollection**  Implements most of the Collection interface. |
| 2 | **AbstractList**  Extends AbstractCollection and implements most of the List interface. |
| 3 | **AbstractSequentialList**  Extends AbstractList for use by a collection that uses sequential rather than random access of its elements. |
| 4 | [LinkedList](https://www.tutorialspoint.com/java/java_linkedlist_class.htm)  Implements a linked list by extending AbstractSequentialList. |
| 5 | [ArrayList](https://www.tutorialspoint.com/java/java_arraylist_class.htm)  Implements a dynamic array by extending AbstractList. |
| 6 | **AbstractSet**  Extends AbstractCollection and implements most of the Set interface. |
| 7 | [HashSet](https://www.tutorialspoint.com/java/java_hashset_class.htm)  Extends AbstractSet for use with a hash table. |
| 8 | [LinkedHashSet](https://www.tutorialspoint.com/java/java_linkedhashset_class.htm)  Extends HashSet to allow insertion-order iterations. |
| 9 | [TreeSet](https://www.tutorialspoint.com/java/java_treeset_class.htm)  Implements a set stored in a tree. Extends AbstractSet. |
| 10 | **AbstractMap**  Implements most of the Map interface. |
| 11 | [HashMap](https://www.tutorialspoint.com/java/java_hashmap_class.htm)  Extends AbstractMap to use a hash table. |
| 12 | [TreeMap](https://www.tutorialspoint.com/java/java_treemap_class.htm)  Extends AbstractMap to use a tree. |
| 13 | [WeakHashMap](https://www.tutorialspoint.com/java/java_weakhashmap_class.htm)  Extends AbstractMap to use a hash table with weak keys. |
| 14 | [LinkedHashMap](https://www.tutorialspoint.com/java/java_linkedhashmap_class.htm)  Extends HashMap to allow insertion-order iterations. |
| 15 | [IdentityHashMap](https://www.tutorialspoint.com/java/java_identityhashmap_class.htm)  Extends AbstractMap and uses reference equality when comparing documents. |

The following legacy classes defined by java.util

|  |  |
| --- | --- |
| **Sr.No.** | **Class & Description** |
| 1 | [Vector](https://www.tutorialspoint.com/java/java_vector_class.htm)  This implements a dynamic array. It is similar to ArrayList, but with some differences. |
| 2 | [Stack](https://www.tutorialspoint.com/java/java_stack_class.htm)  Stack is a subclass of Vector that implements a standard last-in, first-out stack. |
| 3 | [Dictionary](https://www.tutorialspoint.com/java/java_dictionary_class.htm)  Dictionary is an abstract class that represents a key/value storage repository and operates much like Map. |
| 4 | [Hashtable](https://www.tutorialspoint.com/java/java_hashtable_class.htm)  Hashtable was part of the original java.util and is a concrete implementation of a Dictionary. |
| 5 | [Properties](https://www.tutorialspoint.com/java/java_properties_class.htm)  Properties is a subclass of Hashtable. It is used to maintain lists of values in which the key is a String and the value is also a String. |
| 6 | [BitSet](https://www.tutorialspoint.com/java/java_bitset_class.htm)  A BitSet class creates a special type of array that holds bit values. This array can increase in size as needed. |

## Collection Interface

The Collection interface is the interface which is implemented by all the classes in the collection framework. It declares the methods that every collection will have. In other words, we can say that the Collection interface builds the foundation on which the collection framework depends.

Some of the methods of Collection interface are Boolean add ( Object obj), Boolean addAll ( Collection c), void clear(), etc. which are implemented by all the subclasses of Collection interface.

## List Interface

List interface is the child interface of Collection interface. It inhibits a list type data structure in which we can store the ordered collection of objects. It can have duplicate values.

List interface is implemented by the classes ArrayList, LinkedList, Vector, and Stack.

To instantiate the List interface, we must use :

1. List <data-type> list1= **new** ArrayList();
2. List <data-type> list2 = **new** LinkedList();
3. List <data-type> list3 = **new** Vector();
4. List <data-type> list4 = **new** Stack();

There are various methods in List interface that can be used to insert, delete, and access the elements from the list.

The classes that implement the List interface are given below.

## ArrayList

The ArrayList class implements the List interface. It uses a dynamic array to store the duplicate element of different data types. The ArrayList class maintains the insertion order and is non-synchronized. The elements stored in the ArrayList class can be randomly accessed. Consider the following example.

1. **import** java.util.\*;
2. **class** TestJavaCollection1{
3. **public** **static** **void** main(String args[]){
4. ArrayList<String> list=**new** ArrayList<String>();//Creating arraylist
5. list.add("Ravi");//Adding object in arraylist
6. list.add("Vijay");
7. list.add("Ravi");
8. list.add("Ajay");
9. //Traversing list through Iterator
10. Iterator itr=list.iterator();
11. **while**(itr.hasNext()){
12. System.out.println(itr.next());
13. }
14. }
15. }

Output:

Ravi

Vijay

Ravi

Ajay

## LinkedList

LinkedList implements the Collection interface. It uses a doubly linked list internally to store the elements. It can store the duplicate elements. It maintains the insertion order and is not synchronized. In LinkedList, the manipulation is fast because no shifting is required.

Consider the following example.

1. **import** java.util.\*;
2. **public** **class** TestJavaCollection2{
3. **public** **static** **void** main(String args[]){
4. LinkedList<String> al=**new** LinkedList<String>();
5. al.add("Ravi");
6. al.add("Vijay");
7. al.add("Ravi");
8. al.add("Ajay");
9. Iterator<String> itr=al.iterator();
10. **while**(itr.hasNext()){
11. System.out.println(itr.next());
12. }
13. }
14. }

Output:

Ravi

Vijay

Ravi

Ajay

## Vector

Vector uses a dynamic array to store the data elements. It is similar to ArrayList. However, It is synchronized and contains many methods that are not the part of Collection framework.

Consider the following example.

1. **import** java.util.\*;
2. **public** **class** TestJavaCollection3{
3. **public** **static** **void** main(String args[]){
4. Vector<String> v=**new** Vector<String>();
5. v.add("Ayush");
6. v.add("Amit");
7. v.add("Ashish");
8. v.add("Garima");
9. Iterator<String> itr=v.iterator();
10. **while**(itr.hasNext()){
11. System.out.println(itr.next());
12. }
13. }
14. }

Output:

Ayush

Amit

Ashish

Garima

## Stack

The stack is the subclass of Vector. It implements the last-in-first-out data structure, i.e., Stack. The stack contains all of the methods of Vector class and also provides its methods like boolean push(), boolean peek(), boolean push(object o), which defines its properties.

Consider the following example.

1. **import** java.util.\*;
2. **public** **class** TestJavaCollection4{
3. **public** **static** **void** main(String args[]){
4. Stack<String> stack = **new** Stack<String>();
5. stack.push("Ayush");
6. stack.push("Garvit");
7. stack.push("Amit");
8. stack.push("Ashish");
9. stack.push("Garima");
10. stack.pop();
11. Iterator<String> itr=stack.iterator();
12. **while**(itr.hasNext()){
13. System.out.println(itr.next());
14. }
15. }
16. }

Output:

Ayush

Garvit

Amit

Ashish

## Queue Interface

Queue interface maintains the first-in-first-out order. It can be defined as an ordered list that is used to hold the elements which are about to be processed. There are various classes like PriorityQueue, Deque, and ArrayDeque which implements the Queue interface.

Queue interface can be instantiated as:

1. Queue<String> q1 = **new** PriorityQueue();
2. Queue<String> q2 = **new** ArrayDeque();

There are various classes that implement the Queue interface, some of them are given below.

## **PriorityQueue**

The PriorityQueue class implements the Queue interface. It holds the elements or objects which are to be processed by their priorities. PriorityQueue doesn't allow null values to be stored in the queue.

Consider the following example.

1. **import** java.util.\*;
2. **public** **class** TestJavaCollection5{
3. **public** **static** **void** main(String args[]){
4. PriorityQueue<String> queue=**new** PriorityQueue<String>();
5. queue.add("Amit Sharma");
6. queue.add("Vijay Raj");
7. queue.add("JaiShankar");
8. queue.add("Raj");
9. System.out.println("head:"+queue.element());
10. System.out.println("head:"+queue.peek());
11. System.out.println("iterating the queue elements:");
12. Iterator itr=queue.iterator();
13. **while**(itr.hasNext()){
14. System.out.println(itr.next());
15. }
16. queue.remove();
17. queue.poll();
18. System.out.println("after removing two elements:");
19. Iterator<String> itr2=queue.iterator();
20. **while**(itr2.hasNext()){
21. System.out.println(itr2.next());
22. }
23. }
24. }

Output:

head:Amit Sharma

head:Amit Sharma

iterating the queue elements:

Amit Sharma

Raj

JaiShankar

Vijay Raj

after removing two elements:

Raj

Vijay Raj

## Deque Interface

Deque interface extends the Queue interface. In Deque, we can remove and add the elements from both the side. Deque stands for a double-ended queue which enables us to perform the operations at both the ends.

Deque can be instantiated as:

1. Deque d = **new** ArrayDeque();

## ArrayDeque

ArrayDeque class implements the Deque interface. It facilitates us to use the Deque. Unlike queue, we can add or delete the elements from both the ends.

ArrayDeque is faster than ArrayList and Stack and has no capacity restrictions.

Consider the following example.

1. **import** java.util.\*;
2. **public** **class** TestJavaCollection6{
3. **public** **static** **void** main(String[] args) {
4. //Creating Deque and adding elements
5. Deque<String> deque = **new** ArrayDeque<String>();
6. deque.add("Gautam");
7. deque.add("Karan");
8. deque.add("Ajay");
9. //Traversing elements
10. **for** (String str : deque) {
11. System.out.println(str);
12. }
13. }
14. }

Output:

Gautam

Karan

Ajay

## Set Interface

Set Interface in Java is present in java.util package. It extends the Collection interface. It represents the unordered set of elements which doesn't allow us to store the duplicate items. We can store at most one null value in Set. Set is implemented by HashSet, LinkedHashSet, and TreeSet.

Set can be instantiated as:

1. Set<data-type> s1 = **new** HashSet<data-type>();
2. Set<data-type> s2 = **new** LinkedHashSet<data-type>();
3. Set<data-type> s3 = **new** TreeSet<data-type>();

## HashSet

HashSet class implements Set Interface. It represents the collection that uses a hash table for storage. Hashing is used to store the elements in the HashSet. It contains unique items.

Consider the following example.

1. **import** java.util.\*;
2. **public** **class** TestJavaCollection7{
3. **public** **static** **void** main(String args[]){
4. //Creating HashSet and adding elements
5. HashSet<String> set=**new** HashSet<String>();
6. set.add("Ravi");
7. set.add("Vijay");
8. set.add("Ravi");
9. set.add("Ajay");
10. //Traversing elements
11. Iterator<String> itr=set.iterator();
12. **while**(itr.hasNext()){
13. System.out.println(itr.next());
14. }
15. }
16. }

Output:

Vijay

Ravi

Ajay

## LinkedHashSet

LinkedHashSet class represents the LinkedList implementation of Set Interface. It extends the HashSet class and implements Set interface. Like HashSet, It also contains unique elements. It maintains the insertion order and permits null elements.

Consider the following example.

1. **import** java.util.\*;
2. **public** **class** TestJavaCollection8{
3. **public** **static** **void** main(String args[]){
4. LinkedHashSet<String> set=**new** LinkedHashSet<String>();
5. set.add("Ravi");
6. set.add("Vijay");
7. set.add("Ravi");
8. set.add("Ajay");
9. Iterator<String> itr=set.iterator();
10. **while**(itr.hasNext()){
11. System.out.println(itr.next());
12. }
13. }
14. }

Output:

Ravi

Vijay

Ajay

## SortedSet Interface

SortedSet is the alternate of Set interface that provides a total ordering on its elements. The elements of the SortedSet are arranged in the increasing (ascending) order. The SortedSet provides the additional methods that inhibit the natural ordering of the elements.

The SortedSet can be instantiated as:

1. SortedSet<data-type> set = **new** TreeSet();

## TreeSet

Java TreeSet class implements the Set interface that uses a tree for storage. Like HashSet, TreeSet also contains unique elements. However, the access and retrieval time of TreeSet is quite fast. The elements in TreeSet stored in ascending order.

Consider the following example:

1. **import** java.util.\*;
2. **public** **class** TestJavaCollection9{
3. **public** **static** **void** main(String args[]){
4. //Creating and adding elements
5. TreeSet<String> set=**new** TreeSet<String>();
6. set.add("Ravi");
7. set.add("Vijay");
8. set.add("Ravi");
9. set.add("Ajay");
10. //traversing elements
11. Iterator<String> itr=set.iterator();
12. **while**(itr.hasNext()){
13. System.out.println(itr.next());
14. }
15. }
16. }

Output:

Ajay

Ravi

Vijay