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:

RaviRavi

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

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

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

# **Java HashMap**



Java **HashMap** class implements the Map interface which allows us to store key and value pair, where keys should be unique. If you try to insert the duplicate key, it will replace the element of the corresponding key. It is easy to perform operations using the key index like updation, deletion, etc. HashMap class is found in the java.util package.

HashMap in Java is like the legacy Hashtable class, but it is not synchronized. It allows us to store the null elements as well, but there should be only one null key. Since Java 5, it is denoted as HashMap<K,V>, where K stands for key and V for value. It inherits the AbstractMap class and implements the Map interface.

### **Points to remember**

* Java HashMap contains values based on the key.
* Java HashMap contains only unique keys.
* Java HashMap may have one null key and multiple null values.
* Java HashMap is non synchronized.
* Java HashMap maintains no order.
* The initial default capacity of Java HashMap class is 16 with a load factor of 0.75.

### **Hierarchy of HashMap class**

As shown in the above figure, HashMap class extends AbstractMap class and implements Map interface.

### **HashMap class declaration**

Let's see the declaration for java.util.HashMap class.

64M

1K

Hello Java Program for Beginners

1. **public** **class** HashMap<K,V> **extends** AbstractMap<K,V> **implements** Map<K,V>, Cloneable, Serializable

### **HashMap class Parameters**

Let's see the Parameters for java.util.HashMap class.

* **K**: It is the type of keys maintained by this map.
* **V**: It is the type of mapped values.

### **Constructors of Java HashMap class**

|  |  |
| --- | --- |
| **Constructor** | **Description** |
| HashMap() | It is used to construct a default HashMap. |
| HashMap(Map<? extends K,? extends V> m) | It is used to initialize the hash map by using the elements of the given Map object m. |
| HashMap(int capacity) | It is used to initializes the capacity of the hash map to the given integer value, capacity. |
| HashMap(int capacity, float loadFactor) | It is used to initialize both the capacity and load factor of the hash map by using its arguments. |

### **Methods of Java HashMap class**

|  |  |
| --- | --- |
| **Method** | **Description** |
| void clear() | It is used to remove all of the mappings from this map. |
| boolean isEmpty() | It is used to return true if this map contains no key-value mappings. |
| Object clone() | It is used to return a shallow copy of this HashMap instance: the keys and values themselves are not cloned. |
| Set entrySet() | It is used to return a collection view of the mappings contained in this map. |
| Set keySet() | It is used to return a set view of the keys contained in this map. |
| V put(Object key, Object value) | It is used to insert an entry in the map. |
| void putAll(Map map) | It is used to insert the specified map in the map. |
| V putIfAbsent(K key, V value) | It inserts the specified value with the specified key in the map only if it is not already specified. |
| V remove(Object key) | It is used to delete an entry for the specified key. |
| boolean remove(Object key, Object value) | It removes the specified values with the associated specified keys from the map. |
| V compute(K key, BiFunction<? super K,? super V,? extends V> remappingFunction) | It is used to compute a mapping for the specified key and its current mapped value (or null if there is no current mapping). |
| V computeIfAbsent(K key, Function<? super K,? extends V> mappingFunction) | It is used to compute its value using the given mapping function, if the specified key is not already associated with a value (or is mapped to null), and enters it into this map unless null. |
| V computeIfPresent(K key, BiFunction<? super K,? super V,? extends V> remappingFunction) | It is used to compute a new mapping given the key and its current mapped value if the value for the specified key is present and non-null. |
| boolean containsValue(Object value) | This method returns true if some value equal to the value exists within the map, else return false. |
| boolean containsKey(Object key) | This method returns true if some key equal to the key exists within the map, else return false. |
| boolean equals(Object o) | It is used to compare the specified Object with the Map. |
| void forEach(BiConsumer<? super K,? super V> action) | It performs the given action for each entry in the map until all entries have been processed or the action throws an exception. |
| V get(Object key) | This method returns the object that contains the value associated with the key. |
| V getOrDefault(Object key, V defaultValue) | It returns the value to which the specified key is mapped, or defaultValue if the map contains no mapping for the key. |
| boolean isEmpty() | This method returns true if the map is empty; returns false if it contains at least one key. |
| V merge(K key, V value, BiFunction<? super V,? super V,? extends V> remappingFunction) | If the specified key is not already associated with a value or is associated with null, associates it with the given non-null value. |
| V replace(K key, V value) | It replaces the specified value for a specified key. |
| boolean replace(K key, V oldValue, V newValue) | It replaces the old value with the new value for a specified key. |
| void replaceAll(BiFunction<? super K,? super V,? extends V> function) | It replaces each entry's value with the result of invoking the given function on that entry until all entries have been processed or the function throws an exception. |
| Collection<V> values() | It returns a collection view of the values contained in the map. |
| int size() | This method returns the number of entries in the map. |

### **Java HashMap Example**

Let's see a simple example of HashMap to store key and value pair.

1. **import** java.util.\*;
2. **public** **class** HashMapExample1{
3. **public** **static** **void** main(String args[]){
4. HashMap<Integer,String> map=**new** HashMap<Integer,String>();//Creating HashMap
5. map.put(1,"Mango");  //Put elements in Map
6. map.put(2,"Apple");
7. map.put(3,"Banana");
8. map.put(4,"Grapes");
10. System.out.println("Iterating Hashmap...");
11. **for**(Map.Entry m : map.entrySet()){
12. System.out.println(m.getKey()+" "+m.getValue());
13. }
14. }
15. }

**[Test it Now](https://www.javatpoint.com/opr/test.jsp?filename=HashMapExample1" \t "_blank)**

Iterating Hashmap...

1 Mango

2 Apple

3 Banana

4 Grapes

In this example, we are storing Integer as the key and String as the value, so we are using HashMap<Integer,String> as the type. The put() method inserts the elements in the map.

To get the key and value elements, we should call the getKey() and getValue() methods. The Map.Entry interface contains the getKey() and getValue() methods. But, we should call the entrySet() method of Map interface to get the instance of Map.Entry.

### **No Duplicate Key on HashMap**

You cannot store duplicate keys in HashMap. However, if you try to store duplicate key with another value, it will replace the value.

1. **import** java.util.\*;
2. **public** **class** HashMapExample2{
3. **public** **static** **void** main(String args[]){
4. HashMap<Integer,String> map=**new** HashMap<Integer,String>();//Creating HashMap
5. map.put(1,"Mango");  //Put elements in Map
6. map.put(2,"Apple");
7. map.put(3,"Banana");
8. map.put(1,"Grapes"); //trying duplicate key
10. System.out.println("Iterating Hashmap...");
11. **for**(Map.Entry m : map.entrySet()){
12. System.out.println(m.getKey()+" "+m.getValue());
13. }
14. }
15. }

**[Test it Now](https://www.javatpoint.com/opr/test.jsp?filename=HashMapExample2" \t "_blank)**

Iterating Hashmap...

1 Grapes

2 Apple

3 Banana

### **Java HashMap example to add() elements**

Here, we see different ways to insert elements.

1. **import** java.util.\*;
2. **class** HashMap1{
3. **public** **static** **void** main(String args[]){
4. HashMap<Integer,String> hm=**new** HashMap<Integer,String>();
5. System.out.println("Initial list of elements: "+hm);
6. hm.put(100,"Amit");
7. hm.put(101,"Vijay");
8. hm.put(102,"Rahul");
10. System.out.println("After invoking put() method ");
11. **for**(Map.Entry m:hm.entrySet()){
12. System.out.println(m.getKey()+" "+m.getValue());
13. }
15. hm.putIfAbsent(103, "Gaurav");
16. System.out.println("After invoking putIfAbsent() method ");
17. **for**(Map.Entry m:hm.entrySet()){
18. System.out.println(m.getKey()+" "+m.getValue());
19. }
20. HashMap<Integer,String> map=**new** HashMap<Integer,String>();
21. map.put(104,"Ravi");
22. map.putAll(hm);
23. System.out.println("After invoking putAll() method ");
24. **for**(Map.Entry m:map.entrySet()){
25. System.out.println(m.getKey()+" "+m.getValue());
26. }
27. }
28. }

Initial list of elements: {}

After invoking put() method

100 Amit

101 Vijay

102 Rahul

After invoking putIfAbsent() method

100 Amit

101 Vijay

102 Rahul

103 Gaurav

After invoking putAll() method

100 Amit

101 Vijay

102 Rahul

103 Gaurav

104 Ravi

### **Java HashMap example to remove() elements**

Here, we see different ways to remove elements.

1. **import** java.util.\*;
2. **public** **class** HashMap2 {
3. **public** **static** **void** main(String args[]) {
4. HashMap<Integer,String> map=**new** HashMap<Integer,String>();
5. map.put(100,"Amit");
6. map.put(101,"Vijay");
7. map.put(102,"Rahul");
8. map.put(103, "Gaurav");
9. System.out.println("Initial list of elements: "+map);
10. //key-based removal
11. map.remove(100);
12. System.out.println("Updated list of elements: "+map);
13. //value-based removal
14. map.remove(101);
15. System.out.println("Updated list of elements: "+map);
16. //key-value pair based removal
17. map.remove(102, "Rahul");
18. System.out.println("Updated list of elements: "+map);
19. }
20. }

Output:

Initial list of elements: {100=Amit, 101=Vijay, 102=Rahul, 103=Gaurav}

Updated list of elements: {101=Vijay, 102=Rahul, 103=Gaurav}

Updated list of elements: {102=Rahul, 103=Gaurav}

Updated list of elements: {103=Gaurav}

### **Java HashMap example to replace() elements**

Here, we see different ways to replace elements.

1. **import** java.util.\*;
2. **class** HashMap3{
3. **public** **static** **void** main(String args[]){
4. HashMap<Integer,String> hm=**new** HashMap<Integer,String>();
5. hm.put(100,"Amit");
6. hm.put(101,"Vijay");
7. hm.put(102,"Rahul");
8. System.out.println("Initial list of elements:");
9. **for**(Map.Entry m:hm.entrySet())
10. {
11. System.out.println(m.getKey()+" "+m.getValue());
12. }
13. System.out.println("Updated list of elements:");
14. hm.replace(102, "Gaurav");
15. **for**(Map.Entry m:hm.entrySet())
16. {
17. System.out.println(m.getKey()+" "+m.getValue());
18. }
19. System.out.println("Updated list of elements:");
20. hm.replace(101, "Vijay", "Ravi");
21. **for**(Map.Entry m:hm.entrySet())
22. {
23. System.out.println(m.getKey()+" "+m.getValue());
24. }
25. System.out.println("Updated list of elements:");
26. hm.replaceAll((k,v) -> "Ajay");
27. **for**(Map.Entry m:hm.entrySet())
28. {
29. System.out.println(m.getKey()+" "+m.getValue());
30. }
31. }
32. }

Initial list of elements:

100 Amit

101 Vijay

102 Rahul

Updated list of elements:

100 Amit

101 Vijay

102 Gaurav

Updated list of elements:

100 Amit

101 Ravi

102 Gaurav

Updated list of elements:

100 Ajay

101 Ajay

102 Ajay

### **Difference between HashSet and HashMap**

HashSet contains only values whereas HashMap contains an entry(key and value).

### **Java HashMap Example: Book**

1. **import** java.util.\*;
2. **class** Book {
3. **int** id;
4. String name,author,publisher;
5. **int** quantity;
6. **public** Book(**int** id, String name, String author, String publisher, **int** quantity) {
7. **this**.id = id;
8. **this**.name = name;
9. **this**.author = author;
10. **this**.publisher = publisher;
11. **this**.quantity = quantity;
12. }
13. }
14. **public** **class** MapExample {
15. **public** **static** **void** main(String[] args) {
16. //Creating map of Books
17. Map<Integer,Book> map=**new** HashMap<Integer,Book>();
18. //Creating Books
19. Book b1=**new** Book(101,"Let us C","Yashwant Kanetkar","BPB",8);
20. Book b2=**new** Book(102,"Data Communications & Networking","Forouzan","Mc Graw Hill",4);
21. Book b3=**new** Book(103,"Operating System","Galvin","Wiley",6);
22. //Adding Books to map
23. map.put(1,b1);
24. map.put(2,b2);
25. map.put(3,b3);
27. //Traversing map
28. **for**(Map.Entry<Integer, Book> entry:map.entrySet()){
29. **int** key=entry.getKey();
30. Book b=entry.getValue();
31. System.out.println(key+" Details:");
32. System.out.println(b.id+" "+b.name+" "+b.author+" "+b.publisher+" "+b.quantity);
33. }
34. }
35. }

**[Test it Now](https://www.javatpoint.com/opr/test.jsp?filename=MapExample" \t "_blank)**

Output:

1 Details:

101 Let us C Yashwant Kanetkar BPB 8

2 Details:

102 Data Communications and Networking Forouzan Mc Graw Hill 4

3 Details:

103 Operating System Galvin Wiley 6

# **Java LinkedHashMap class**



Java LinkedHashMap class is Hashtable and Linked list implementation of the Map interface, with predictable iteration order. It inherits HashMap class and implements the Map interface.

### **Points to remember**

* Java LinkedHashMap contains values based on the key.
* Java LinkedHashMap contains unique elements.
* Java LinkedHashMap may have one null key and multiple null values.
* Java LinkedHashMap is non synchronized.
* Java LinkedHashMap maintains insertion order.
* The initial default capacity of Java HashMap class is 16 with a load factor of 0.75.

### **LinkedHashMap class declaration**

Let's see the declaration for java.util.LinkedHashMap class.

1. **public** **class** LinkedHashMap<K,V> **extends** HashMap<K,V> **implements** Map<K,V>

### **LinkedHashMap class Parameters**

Let's see the Parameters for java.util.LinkedHashMap class.

* **K**: It is the type of keys maintained by this map.
* **V**: It is the type of mapped values.

### **Constructors of Java LinkedHashMap class**

|  |  |
| --- | --- |
| **Constructor** | **Description** |
| LinkedHashMap() | It is used to construct a default LinkedHashMap. |
| LinkedHashMap(int capacity) | It is used to initialize a LinkedHashMap with the given capacity. |
| LinkedHashMap(int capacity, float loadFactor) | It is used to initialize both the capacity and the load factor. |
| LinkedHashMap(int capacity, float loadFactor, boolean accessOrder) | It is used to initialize both the capacity and the load factor with specified ordering mode. |
| LinkedHashMap(Map<? extends K,? extends V> m) | It is used to initialize the LinkedHashMap with the elements from the given Map class m. |

### **Methods of Java LinkedHashMap class**

|  |  |
| --- | --- |
| **Method** | **Description** |
| V get(Object key) | It returns the value to which the specified key is mapped. |
| void clear() | It removes all the key-value pairs from a map. |
| boolean containsValue(Object value) | It returns true if the map maps one or more keys to the specified value. |
| Set<Map.Entry<K,V>> entrySet() | It returns a Set view of the mappings contained in the map. |
| void forEach(BiConsumer<? super K,? super V> action) | It performs the given action for each entry in the map until all entries have been processed or the action throws an exception. |
| V getOrDefault(Object key, V defaultValue) | It returns the value to which the specified key is mapped or defaultValue if this map contains no mapping for the key. |
| Set<K> keySet() | It returns a Set view of the keys contained in the map |
| protected boolean removeEldestEntry(Map.Entry<K,V> eldest) | It returns true on removing its eldest entry. |
| void replaceAll(BiFunction<? super K,? super V,? extends V> function) | It replaces each entry's value with the result of invoking the given function on that entry until all entries have been processed or the function throws an exception. |
| Collection<V> values() | It returns a Collection view of the values contained in this map. |

### **Java LinkedHashMap Example**

1. **import** java.util.\*;
2. **class** LinkedHashMap1{
3. **public** **static** **void** main(String args[]){
5. LinkedHashMap<Integer,String> hm=**new** LinkedHashMap<Integer,String>();
7. hm.put(100,"Amit");
8. hm.put(101,"Vijay");
9. hm.put(102,"Rahul");
11. **for**(Map.Entry m:hm.entrySet()){
12. System.out.println(m.getKey()+" "+m.getValue());
13. }
14. }
15. }

Output:100 Amit

101 Vijay

102 Rahul

### **Java LinkedHashMap Example: Key-Value pair**

1. **import** java.util.\*;
2. **class** LinkedHashMap2{
3. **public** **static** **void** main(String args[]){
4. LinkedHashMap<Integer, String> map = **new** LinkedHashMap<Integer, String>();
5. map.put(100,"Amit");
6. map.put(101,"Vijay");
7. map.put(102,"Rahul");
8. //Fetching key
9. System.out.println("Keys: "+map.keySet());
10. //Fetching value
11. System.out.println("Values: "+map.values());
12. //Fetching key-value pair
13. System.out.println("Key-Value pairs: "+map.entrySet());
14. }
15. }

Keys: [100, 101, 102]

Values: [Amit, Vijay, Rahul]

Key-Value pairs: [100=Amit, 101=Vijay, 102=Rahul]

### **Java LinkedHashMap Example:remove()**

1. **import** java.util.\*;
2. **public** **class** LinkedHashMap3 {
3. **public** **static** **void** main(String args[]) {
4. Map<Integer,String> map=**new** LinkedHashMap<Integer,String>();
5. map.put(101,"Amit");
6. map.put(102,"Vijay");
7. map.put(103,"Rahul");
8. System.out.println("Before invoking remove() method: "+map);
9. map.remove(102);
10. System.out.println("After invoking remove() method: "+map);
11. }
12. }

Output:

Before invoking remove() method: {101=Amit, 102=Vijay, 103=Rahul}

After invoking remove() method: {101=Amit, 103=Rahul}

### **Java LinkedHashMap Example: Book**

1. **import** java.util.\*;
2. **class** Book {
3. **int** id;
4. String name,author,publisher;
5. **int** quantity;
6. **public** Book(**int** id, String name, String author, String publisher, **int** quantity) {
7. **this**.id = id;
8. **this**.name = name;
9. **this**.author = author;
10. **this**.publisher = publisher;
11. **this**.quantity = quantity;
12. }
13. }
14. **public** **class** MapExample {
15. **public** **static** **void** main(String[] args) {
16. //Creating map of Books
17. Map<Integer,Book> map=**new** LinkedHashMap<Integer,Book>();
18. //Creating Books
19. Book b1=**new** Book(101,"Let us C","Yashwant Kanetkar","BPB",8);
20. Book b2=**new** Book(102,"Data Communications & Networking","Forouzan","Mc Graw Hill",4);
21. Book b3=**new** Book(103,"Operating System","Galvin","Wiley",6);
22. //Adding Books to map
23. map.put(2,b2);
24. map.put(1,b1);
25. map.put(3,b3);
27. //Traversing map
28. **for**(Map.Entry<Integer, Book> entry:map.entrySet()){
29. **int** key=entry.getKey();
30. Book b=entry.getValue();
31. System.out.println(key+" Details:");
32. System.out.println(b.id+" "+b.name+" "+b.author+" "+b.publisher+" "+b.quantity);
33. }
34. }
35. }

Output:

2 Details:

102 Data Communications & Networking Forouzan Mc Graw Hill 4

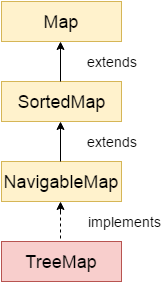
1 Details:

101 Let us C Yashwant Kanetkar BPB 8

3 Details:

103 Operating System Galvin Wiley 6

# **Java TreeMap class**



Java TreeMap class is a red-black tree based implementation. It provides an efficient means of storing key-value pairs in sorted order.

The important points about Java TreeMap class are:

* Java TreeMap contains values based on the key. It implements the NavigableMap interface and extends AbstractMap class.
* Java TreeMap contains only unique elements.
* Java TreeMap cannot have a null key but can have multiple null values.
* Java TreeMap is non synchronized.
* Java TreeMap maintains ascending order.

### **TreeMap class declaration**

Let's see the declaration for java.util.TreeMap class.

1. **public** **class** TreeMap<K,V> **extends** AbstractMap<K,V> **implements** NavigableMap<K,V>, Cloneable, Serializable

### **TreeMap class Parameters**

Let's see the Parameters for java.util.TreeMap class.

* **K**: It is the type of keys maintained by this map.
* **V**: It is the type of mapped values.

### **Constructors of Java TreeMap class**

|  |  |
| --- | --- |
| **Constructor** | **Description** |
| TreeMap() | It is used to construct an empty tree map that will be sorted using the natural order of its key. |
| TreeMap(Comparator<? super K> comparator) | It is used to construct an empty tree-based map that will be sorted using the comparator comp. |
| TreeMap(Map<? extends K,? extends V> m) | It is used to initialize a treemap with the entries from **m**, which will be sorted using the natural order of the keys. |
| TreeMap(SortedMap<K,? extends V> m) | It is used to initialize a treemap with the entries from the SortedMap **sm**, which will be sorted in the same order as **sm.** |

### **Methods of Java TreeMap class**

|  |  |
| --- | --- |
| **Method** | **Description** |
| Map.Entry<K,V> ceilingEntry(K key) | It returns the key-value pair having the least key, greater than or equal to the specified key, or null if there is no such key. |
| K ceilingKey(K key) | It returns the least key, greater than the specified key or null if there is no such key. |
| void clear() | It removes all the key-value pairs from a map. |
| Object clone() | It returns a shallow copy of TreeMap instance. |
| Comparator<? super K> comparator() | It returns the comparator that arranges the key in order, or null if the map uses the natural ordering. |
| NavigableSet<K> descendingKeySet() | It returns a reverse order NavigableSet view of the keys contained in the map. |
| NavigableMap<K,V> descendingMap() | It returns the specified key-value pairs in descending order. |
| Map.Entry firstEntry() | It returns the key-value pair having the least key. |
| Map.Entry<K,V> floorEntry(K key) | It returns the greatest key, less than or equal to the specified key, or null if there is no such key. |
| void forEach(BiConsumer<? super K,? super V> action) | It performs the given action for each entry in the map until all entries have been processed or the action throws an exception. |
| SortedMap<K,V> headMap(K toKey) | It returns the key-value pairs whose keys are strictly less than toKey. |
| NavigableMap<K,V> headMap(K toKey, boolean inclusive) | It returns the key-value pairs whose keys are less than (or equal to if inclusive is true) toKey. |
| Map.Entry<K,V> higherEntry(K key) | It returns the least key strictly greater than the given key, or null if there is no such key. |
| K higherKey(K key) | It is used to return true if this map contains a mapping for the specified key. |
| Set keySet() | It returns the collection of keys exist in the map. |
| Map.Entry<K,V> lastEntry() | It returns the key-value pair having the greatest key, or null if there is no such key. |
| Map.Entry<K,V> lowerEntry(K key) | It returns a key-value mapping associated with the greatest key strictly less than the given key, or null if there is no such key. |
| K lowerKey(K key) | It returns the greatest key strictly less than the given key, or null if there is no such key. |
| NavigableSet<K> navigableKeySet() | It returns a NavigableSet view of the keys contained in this map. |
| Map.Entry<K,V> pollFirstEntry() | It removes and returns a key-value mapping associated with the least key in this map, or null if the map is empty. |
| Map.Entry<K,V> pollLastEntry() | It removes and returns a key-value mapping associated with the greatest key in this map, or null if the map is empty. |
| V put(K key, V value) | It inserts the specified value with the specified key in the map. |
| void putAll(Map<? extends K,? extends V> map) | It is used to copy all the key-value pair from one map to another map. |
| V replace(K key, V value) | It replaces the specified value for a specified key. |
| boolean replace(K key, V oldValue, V newValue) | It replaces the old value with the new value for a specified key. |
| void replaceAll(BiFunction<? super K,? super V,? extends V> function) | It replaces each entry's value with the result of invoking the given function on that entry until all entries have been processed or the function throws an exception. |
| NavigableMap<K,V> subMap(K fromKey, boolean fromInclusive, K toKey, boolean toInclusive) | It returns key-value pairs whose keys range from fromKey to toKey. |
| SortedMap<K,V> subMap(K fromKey, K toKey) | It returns key-value pairs whose keys range from fromKey, inclusive, to toKey, exclusive. |
| SortedMap<K,V> tailMap(K fromKey) | It returns key-value pairs whose keys are greater than or equal to fromKey. |
| NavigableMap<K,V> tailMap(K fromKey, boolean inclusive) | It returns key-value pairs whose keys are greater than (or equal to, if inclusive is true) fromKey. |
| boolean containsKey(Object key) | It returns true if the map contains a mapping for the specified key. |
| boolean containsValue(Object value) | It returns true if the map maps one or more keys to the specified value. |
| K firstKey() | It is used to return the first (lowest) key currently in this sorted map. |
| V get(Object key) | It is used to return the value to which the map maps the specified key. |
| K lastKey() | It is used to return the last (highest) key currently in the sorted map. |
| V remove(Object key) | It removes the key-value pair of the specified key from the map. |
| Set<Map.Entry<K,V>> entrySet() | It returns a set view of the mappings contained in the map. |
| int size() | It returns the number of key-value pairs exists in the hashtable. |
| Collection values() | It returns a collection view of the values contained in the map. |

### **Java TreeMap Example**

1. **import** java.util.\*;
2. **class** TreeMap1{
3. **public** **static** **void** main(String args[]){
4. TreeMap<Integer,String> map=**new** TreeMap<Integer,String>();
5. map.put(100,"Amit");
6. map.put(102,"Ravi");
7. map.put(101,"Vijay");
8. map.put(103,"Rahul");
10. **for**(Map.Entry m:map.entrySet()){
11. System.out.println(m.getKey()+" "+m.getValue());
12. }
13. }
14. }

Output:100 Amit

101 Vijay

102 Ravi

103 Rahul

### **Java TreeMap Example: remove()**

1. **import** java.util.\*;
2. **public** **class** TreeMap2 {
3. **public** **static** **void** main(String args[]) {
4. TreeMap<Integer,String> map=**new** TreeMap<Integer,String>();
5. map.put(100,"Amit");
6. map.put(102,"Ravi");
7. map.put(101,"Vijay");
8. map.put(103,"Rahul");
9. System.out.println("Before invoking remove() method");
10. **for**(Map.Entry m:map.entrySet())
11. {
12. System.out.println(m.getKey()+" "+m.getValue());
13. }
14. map.remove(102);
15. System.out.println("After invoking remove() method");
16. **for**(Map.Entry m:map.entrySet())
17. {
18. System.out.println(m.getKey()+" "+m.getValue());
19. }
20. }
21. }

Output:

Before invoking remove() method

100 Amit

101 Vijay

102 Ravi

103 Rahul

After invoking remove() method

100 Amit

101 Vijay

103 Rahul

### **Java TreeMap Example: NavigableMap**

1. **import** java.util.\*;
2. **class** TreeMap3{
3. **public** **static** **void** main(String args[]){
4. NavigableMap<Integer,String> map=**new** TreeMap<Integer,String>();
5. map.put(100,"Amit");
6. map.put(102,"Ravi");
7. map.put(101,"Vijay");
8. map.put(103,"Rahul");
9. //Maintains descending order
10. System.out.println("descendingMap: "+map.descendingMap());
11. //Returns key-value pairs whose keys are less than or equal to the specified key.
12. System.out.println("headMap: "+map.headMap(102,**true**));
13. //Returns key-value pairs whose keys are greater than or equal to the specified key.
14. System.out.println("tailMap: "+map.tailMap(102,**true**));
15. //Returns key-value pairs exists in between the specified key.
16. System.out.println("subMap: "+map.subMap(100, **false**, 102, **true**));
17. }
18. }

descendingMap: {103=Rahul, 102=Ravi, 101=Vijay, 100=Amit}

headMap: {100=Amit, 101=Vijay, 102=Ravi}

tailMap: {102=Ravi, 103=Rahul}

subMap: {101=Vijay, 102=Ravi}

### **Java TreeMap Example: SortedMap**

1. **import** java.util.\*;
2. **class** TreeMap4{
3. **public** **static** **void** main(String args[]){
4. SortedMap<Integer,String> map=**new** TreeMap<Integer,String>();
5. map.put(100,"Amit");
6. map.put(102,"Ravi");
7. map.put(101,"Vijay");
8. map.put(103,"Rahul");
9. //Returns key-value pairs whose keys are less than the specified key.
10. System.out.println("headMap: "+map.headMap(102));
11. //Returns key-value pairs whose keys are greater than or equal to the specified key.
12. System.out.println("tailMap: "+map.tailMap(102));
13. //Returns key-value pairs exists in between the specified key.
14. System.out.println("subMap: "+map.subMap(100, 102));
15. }
16. }

headMap: {100=Amit, 101=Vijay}

tailMap: {102=Ravi, 103=Rahul}

subMap: {100=Amit, 101=Vijay}

### **What is difference between HashMap and TreeMap?**

|  |  |
| --- | --- |
| **HashMap** | **TreeMap** |
| 1) HashMap can contain one null key. | TreeMap cannot contain any null key. |
| 2) HashMap maintains no order. | TreeMap maintains ascending order. |

### **Java TreeMap Example: Book**

1. **import** java.util.\*;
2. **class** Book {
3. **int** id;
4. String name,author,publisher;
5. **int** quantity;
6. **public** Book(**int** id, String name, String author, String publisher, **int** quantity) {
7. **this**.id = id;
8. **this**.name = name;
9. **this**.author = author;
10. **this**.publisher = publisher;
11. **this**.quantity = quantity;
12. }
13. }
14. **public** **class** MapExample {
15. **public** **static** **void** main(String[] args) {
16. //Creating map of Books
17. Map<Integer,Book> map=**new** TreeMap<Integer,Book>();
18. //Creating Books
19. Book b1=**new** Book(101,"Let us C","Yashwant Kanetkar","BPB",8);
20. Book b2=**new** Book(102,"Data Communications & Networking","Forouzan","Mc Graw Hill",4);
21. Book b3=**new** Book(103,"Operating System","Galvin","Wiley",6);
22. //Adding Books to map
23. map.put(2,b2);
24. map.put(1,b1);
25. map.put(3,b3);
27. //Traversing map
28. **for**(Map.Entry<Integer, Book> entry:map.entrySet()){
29. **int** key=entry.getKey();
30. Book b=entry.getValue();
31. System.out.println(key+" Details:");
32. System.out.println(b.id+" "+b.name+" "+b.author+" "+b.publisher+" "+b.quantity);
33. }
34. }
35. }

Output:

1 Details:

101 Let us C Yashwant Kanetkar BPB 8

2 Details:

102 Data Communications & Networking Forouzan Mc Graw Hill 4

3 Details:

103 Operating System Galvin Wiley 6

# **Java Hashtable class**

Java Hashtable class implements a hashtable, which maps keys to values. It inherits Dictionary class and implements the Map interface.

### **Points to remember**

* A Hashtable is an array of a list. Each list is known as a bucket. The position of the bucket is identified by calling the hashcode() method. A Hashtable contains values based on the key.
* Java Hashtable class contains unique elements.
* Java Hashtable class doesn't allow null key or value.
* Java Hashtable class is synchronized.
* The initial default capacity of Hashtable class is 11 whereas loadFactor is 0.75.

### **Hashtable class declaration**

Let's see the declaration for java.util.Hashtable class.

1. **public** **class** Hashtable<K,V> **extends** Dictionary<K,V> **implements** Map<K,V>, Cloneable, Serializable

### **Hashtable class Parameters**

Let's see the Parameters for java.util.Hashtable class.

* **K**: It is the type of keys maintained by this map.
* **V**: It is the type of mapped values.

### **Constructors of Java Hashtable class**

|  |  |
| --- | --- |
| **Constructor** | **Description** |
| Hashtable() | It creates an empty hashtable having the initial default capacity and load factor. |
| Hashtable(int capacity) | It accepts an integer parameter and creates a hash table that contains a specified initial capacity. |
| Hashtable(int capacity, float loadFactor) | It is used to create a hash table having the specified initial capacity and loadFactor. |
| Hashtable(Map<? extends K,? extends V> t) | It creates a new hash table with the same mappings as the given Map. |

### **Methods of Java Hashtable class**

|  |  |
| --- | --- |
| **Method** | **Description** |
| void clear() | It is used to reset the hash table. |
| Object clone() | It returns a shallow copy of the Hashtable. |
| V compute(K key, BiFunction<? super K,? super V,? extends V> remappingFunction) | It is used to compute a mapping for the specified key and its current mapped value (or null if there is no current mapping). |
| V computeIfAbsent(K key, Function<? super K,? extends V> mappingFunction) | It is used to compute its value using the given mapping function, if the specified key is not already associated with a value (or is mapped to null), and enters it into this map unless null. |
| V computeIfPresent(K key, BiFunction<? super K,? super V,? extends V> remappingFunction) | It is used to compute a new mapping given the key and its current mapped value if the value for the specified key is present and non-null. |
| Enumeration elements() | It returns an enumeration of the values in the hash table. |
| Set<Map.Entry<K,V>> entrySet() | It returns a set view of the mappings contained in the map. |
| boolean equals(Object o) | It is used to compare the specified Object with the Map. |
| void forEach(BiConsumer<? super K,? super V> action) | It performs the given action for each entry in the map until all entries have been processed or the action throws an exception. |
| V getOrDefault(Object key, V defaultValue) | It returns the value to which the specified key is mapped, or defaultValue if the map contains no mapping for the key. |
| int hashCode() | It returns the hash code value for the Map |
| Enumeration<K> keys() | It returns an enumeration of the keys in the hashtable. |
| Set<K> keySet() | It returns a Set view of the keys contained in the map. |
| V merge(K key, V value, BiFunction<? super V,? super V,? extends V> remappingFunction) | If the specified key is not already associated with a value or is associated with null, associates it with the given non-null value. |
| V put(K key, V value) | It inserts the specified value with the specified key in the hash table. |
| void putAll(Map<? extends K,? extends V> t)) | It is used to copy all the key-value pair from map to hashtable. |
| V putIfAbsent(K key, V value) | If the specified key is not already associated with a value (or is mapped to null) associates it with the given value and returns null, else returns the current value. |
| boolean remove(Object key, Object value) | It removes the specified values with the associated specified keys from the hashtable. |
| V replace(K key, V value) | It replaces the specified value for a specified key. |
| boolean replace(K key, V oldValue, V newValue) | It replaces the old value with the new value for a specified key. |
| void replaceAll(BiFunction<? super K,? super V,? extends V> function) | It replaces each entry's value with the result of invoking the given function on that entry until all entries have been processed or the function throws an exception. |
| String toString() | It returns a string representation of the Hashtable object. |
| Collection values() | It returns a collection view of the values contained in the map. |
| boolean contains(Object value) | This method returns true if some value equal to the value exists within the hash table, else return false. |
| boolean containsValue(Object value) | This method returns true if some value equal to the value exists within the hash table, else return false. |
| boolean containsKey(Object key) | This method return true if some key equal to the key exists within the hash table, else return false. |
| boolean isEmpty() | This method returns true if the hash table is empty; returns false if it contains at least one key. |
| protected void rehash() | It is used to increase the size of the hash table and rehashes all of its keys. |
| V get(Object key) | This method returns the object that contains the value associated with the key. |
| V remove(Object key) | It is used to remove the key and its value. This method returns the value associated with the key. |
| int size() | This method returns the number of entries in the hash table. |

### **Java Hashtable Example**

1. **import** java.util.\*;
2. **class** Hashtable1{
3. **public** **static** **void** main(String args[]){
4. Hashtable<Integer,String> hm=**new** Hashtable<Integer,String>();
6. hm.put(100,"Amit");
7. hm.put(102,"Ravi");
8. hm.put(101,"Vijay");
9. hm.put(103,"Rahul");
11. **for**(Map.Entry m:hm.entrySet()){
12. System.out.println(m.getKey()+" "+m.getValue());
13. }
14. }
15. }

[**Test it Now**](https://www.javatpoint.com/opr/test.jsp?filename=TestCollection16)

Output:

103 Rahul

102 Ravi

101 Vijay

100 Amit

### **Java Hashtable Example: remove()**

1. **import** java.util.\*;
2. **public** **class** Hashtable2 {
3. **public** **static** **void** main(String args[]) {
4. Hashtable<Integer,String> map=**new** Hashtable<Integer,String>();
5. map.put(100,"Amit");
6. map.put(102,"Ravi");
7. map.put(101,"Vijay");
8. map.put(103,"Rahul");
9. System.out.println("Before remove: "+ map);
10. // Remove value for key 102
11. map.remove(102);
12. System.out.println("After remove: "+ map);
13. }
14. }

Output:

Before remove: {103=Rahul, 102=Ravi, 101=Vijay, 100=Amit}

After remove: {103=Rahul, 101=Vijay, 100=Amit}

### **Java Hashtable Example: getOrDefault()**

1. **import** java.util.\*;
2. **class** Hashtable3{
3. **public** **static** **void** main(String args[]){
4. Hashtable<Integer,String> map=**new** Hashtable<Integer,String>();
5. map.put(100,"Amit");
6. map.put(102,"Ravi");
7. map.put(101,"Vijay");
8. map.put(103,"Rahul");
9. //Here, we specify the if and else statement as arguments of the method
10. System.out.println(map.getOrDefault(101, "Not Found"));
11. System.out.println(map.getOrDefault(105, "Not Found"));
12. }
13. }

Output:

Vijay

Not Found

### **Java Hashtable Example: putIfAbsent()**

1. **import** java.util.\*;
2. **class** Hashtable4{
3. **public** **static** **void** main(String args[]){
4. Hashtable<Integer,String> map=**new** Hashtable<Integer,String>();
5. map.put(100,"Amit");
6. map.put(102,"Ravi");
7. map.put(101,"Vijay");
8. map.put(103,"Rahul");
9. System.out.println("Initial Map: "+map);
10. //Inserts, as the specified pair is unique
11. map.putIfAbsent(104,"Gaurav");
12. System.out.println("Updated Map: "+map);
13. //Returns the current value, as the specified pair already exist
14. map.putIfAbsent(101,"Vijay");
15. System.out.println("Updated Map: "+map);
16. }
17. }

Output:

Initial Map: {103=Rahul, 102=Ravi, 101=Vijay, 100=Amit}

Updated Map: {104=Gaurav, 103=Rahul, 102=Ravi, 101=Vijay, 100=Amit}

Updated Map: {104=Gaurav, 103=Rahul, 102=Ravi, 101=Vijay, 100=Amit}

### **Java Hashtable Example: Book**

1. **import** java.util.\*;
2. **class** Book {
3. **int** id;
4. String name,author,publisher;
5. **int** quantity;
6. **public** Book(**int** id, String name, String author, String publisher, **int** quantity) {
7. **this**.id = id;
8. **this**.name = name;
9. **this**.author = author;
10. **this**.publisher = publisher;
11. **this**.quantity = quantity;
12. }
13. }
14. **public** **class** HashtableExample {
15. **public** **static** **void** main(String[] args) {
16. //Creating map of Books
17. Map<Integer,Book> map=**new** Hashtable<Integer,Book>();
18. //Creating Books
19. Book b1=**new** Book(101,"Let us C","Yashwant Kanetkar","BPB",8);
20. Book b2=**new** Book(102,"Data Communications & Networking","Forouzan","Mc Graw Hill",4);
21. Book b3=**new** Book(103,"Operating System","Galvin","Wiley",6);
22. //Adding Books to map
23. map.put(1,b1);
24. map.put(2,b2);
25. map.put(3,b3);
26. //Traversing map
27. **for**(Map.Entry<Integer, Book> entry:map.entrySet()){
28. **int** key=entry.getKey();
29. Book b=entry.getValue();
30. System.out.println(key+" Details:");
31. System.out.println(b.id+" "+b.name+" "+b.author+" "+b.publisher+" "+b.quantity);
32. }
33. }
34. }

Output:

3 Details:

103 Operating System Galvin Wiley 6

2 Details:

102 Data Communications & Networking Forouzan Mc Graw Hill 4

1 Details:

101 Let us C Yashwant Kanetkar BPB 8