- Algorithm
- Apache Tomcat Server
- Collection Framework
- Collection programs
- Collections implementation
- Core Java
- Core Java Differences
- Core Java Tutorials
- Custom implementation of Data Structures
- Data Structure
- Date tutorials
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LinkedHashSet Custom implementation in java - How LinkedHashSet works internally with diagrams and full program

*You are here : **Home** / **Core Java Tutorials** / Data structures / Collection framework*

Contents of page :

- *1) Methods used in custom LinkedHashMap in java >*
- *2) Let's find out answer of few very **important** questions before proceeding >*
- *3) Full Program/SourceCode for implementing custom LinkedHashSet in java >*

- Generics
- Hashing
- Interview questions
- iText Pdf tutorial
- Java 7
- Java 8
- Java 9
- Java QUIZ
- JavaScript
- JDBC
- JUNIT
- JVM
- Level1 programs (beginners)
- Level2 programs (intermediate)
- Level3 programs (advanced)
- Linked List
- Linux
- Matrix programs
- MongoDB
- MongoDB Java
- MsSql
- MultiThreading
- MySql
- Notepad++
- Oracle

In this post i will be explaining **LinkedHashSet** custom implementation.

*1) Methods used in **custom LinkedHashSet** in java >*

public void **add**(E value)	Add objects in **setCustom**
public boolean **contains**(E obj)	Method returns true if **setCustom** contains the object.
public boolean **remove**(E obj)	Method removes object from **setCustom**.
public void **display**()	-Method displays all objects in setCustom. **-Insertion order is guaranteed**.

Most salient feature of **LinkedHashSet** is that it **maintains insertion order** of objects. We will be internally using LinkedHashMap.

Must read: Write a program to find out substring in given string.

*2) Let's find out answer of few very **important questions** before proceeding.*

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Q1. How LinkedHashSet implements **hashing?**

A. Method internally uses LinkedHashMap's hash method for hashing.

Q2. How **add method** works internally?

A.
```
public void add(E value){
        linkedHashMapCustom.put(value, null);
   }
```

Method internally uses LinkedHashMapCustom's put method for storing object.

Q3. How **contains method** works internally?

A.
```
public boolean contains(E obj){
        return linkedHashMapCustom.contains(obj) !=null ? true :false;
   }
```

Method internally uses LinkedHashMapCustom's contains method for storing object.

Q4. How **remove method** works internally?

A.
```
public boolean remove(E obj){
            return linkedHashMapCustom.remove(obj);
}
```

Method internally uses LinkedHashMapCustom's put remove for storing object.

REFER: LinkedHashSet Custom implementation - add, contains, remove Employee object.

3) Full Program/SourceCode for implementing custom LinkedHashSet in java >

```
package com.ankit;

/**
* @author AnkitMittal
* Copyright (c), AnkitMittal . All Contents are copyrighted and must not be reproduced in any form.
* This class provides custom implementation of LinkedHashSet(without using java api's- we will be using HashMapCustom)-
which allows does not allow you to store duplicate values.
* Note- implementation does not allow you to store null values.
* maintains insertion order.
* @param <K>
* @param <V>
*/
class LinkedHashSetCustom<E>{

   private LinkedHashMapCustom<E, Object> linkedHashMapCustom;

   public LinkedHashSetCustom(){
        linkedHashMapCustom=new LinkedHashMapCustom<>();
   }

   /**
    * add objects in LinkedHashSetCustom.
    */
   public void add(E value){
        linkedHashMapCustom.put(value, null);

   }

   /**
    * Method returns true if LinkedHashSetCustom contains the object.
    * @param key
    */
   public boolean contains(E obj){
        return linkedHashMapCustom.contains(obj) !=null ? true :false;
```

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```
  }

  /**
   * Method displays all objects in LinkedHashSetCustom.
   * insertion order is not guaranteed, for maintaining insertion order refer LinkedHashSet.
   */
  public void display(){
    linkedHashMapCustom.displaySet();
  }

  /**
   * Method removes object from setCustom.
   * insertion order is not guaranteed, for maintaining insertion order refer LinkedHashSet.
   * @param obj
   */
  public boolean remove(E obj){
    return linkedHashMapCustom.remove(obj);
  }

}


/** Copyright (c), AnkitMittal  JavaMadeSoEasy.com */
/**
 * @author AnkitMittal
 * Copyright (c), AnkitMittal . All Contents are copyrighted and must not be reproduced in any form.
 * This class provides custom implementation of LinkedHashMap(without using java api's)- which allows us to store data in key-
value pair form.
 * It maintains insertion order, uses DoublyLinkedList for doing so.
 * If key which already exists is added again, its value is overridden but insertion order does not change,
 * BUT, if key-value pair is removed and value is again added than insertion order changes(which is quite natural behaviour).
 * @param <K>
 * @param <V>
 */
class LinkedHashMapCustom<K, V> {

   private Entry<K,V>[] table;   //Array of Entry.
   private int capacity= 4;  //Initial capacity of HashMap
   private Entry<K,V> header; //head of the doubly linked list.
```

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```
private Entry<K,V> last; //last of the doubly linked list.

/*
 * before and after are used for maintaining insertion order.
 */
static class Entry<K, V> {
    K key;
    V value;
    Entry<K,V> next;
    Entry<K,V> before;
      Entry<K,V> after;

    public Entry(K key, V value, Entry<K,V> next){
        this.key = key;
        this.value = value;
        this.next = next;
    }
}


@SuppressWarnings("unchecked")
public LinkedHashMapCustom(){
   table = new Entry[capacity];
}



/**
 * Method allows you put key-value pair in LinkedHashMapCustom.
 * If the map already contains a mapping for the key, the old value is replaced.
 * Note: method does not allows you to put null key thought it allows null values.
 * Implementation allows you to put custom objects as a key as well.
 * Key Features: implementation provides you with following features:-
 *     >provide complete functionality how to override equals method.
 *  >provide complete functionality how to override hashCode method.
 * @param newKey
 * @param data
 */
public void put(K newKey, V data){
```

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```
  if(newKey==null)
      return;    //does not allow to store null.

  int hash=hash(newKey);

  Entry<K,V> newEntry = new Entry<K,V>(newKey, data, null);
  maintainOrderAfterInsert(newEntry);
   if(table[hash] == null){
    table[hash] = newEntry;
   }else{
      Entry<K,V> previous = null;
      Entry<K,V> current = table[hash];
      while(current != null){ //we have reached last entry of bucket.
      if(current.key.equals(newKey)){
          if(previous==null){  //node has to be insert on first of bucket.
                newEntry.next=current.next;
                table[hash]=newEntry;
                return;
          }
          else{
              newEntry.next=current.next;
              previous.next=newEntry;
              return;
          }
      }
      previous=current;
          current = current.next;
    }
    previous.next = newEntry;
   }
}


/**
 * below method helps us in ensuring insertion order of LinkedHashMapCustom after new key-value pair is added.
 */
private void maintainOrderAfterInsert(Entry<K, V> newEntry) {

  if(header==null){
      header=newEntry;
```

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```
        last=newEntry;
        return;
      }

      if(header.key.equals(newEntry.key)){
        deleteFirst();
        insertFirst(newEntry);
        return;
      }

      if(last.key.equals(newEntry.key)){
        deleteLast();
        insertLast(newEntry);
        return;
      }

      Entry<K, V> beforeDeleteEntry=    deleteSpecificEntry(newEntry);
      if(beforeDeleteEntry==null){
        insertLast(newEntry);
      }
      else{
        insertAfter(beforeDeleteEntry,newEntry);
      }


    }

    /**
     * below method helps us in ensuring insertion order of LinkedHashMapCustom, after deletion of key-value pair.
     */
    private void maintainOrderAfterDeletion(Entry<K, V> deleteEntry) {

      if(header.key.equals(deleteEntry.key)){
        deleteFirst();
        return;
      }

      if(last.key.equals(deleteEntry.key)){
        deleteLast();
        return;
```

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  - ▶ May (53)
  - ▶ April (109)

```
     }

     deleteSpecificEntry(deleteEntry);

  }

  /**
   * returns entry after which new entry must be added.
   */
  private void insertAfter(Entry<K, V> beforeDeleteEntry, Entry<K, V> newEntry) {
     Entry<K, V> current=header;
        while(current!=beforeDeleteEntry){
              current=current.after;  //move to next node.
        }

        newEntry.after=beforeDeleteEntry.after;
        beforeDeleteEntry.after.before=newEntry;
        newEntry.before=beforeDeleteEntry;
        beforeDeleteEntry.after=newEntry;

  }


  /**
   * deletes entry from first.
   */
  void deleteFirst(){

     if(header==last){ //only one entry found.
              header=last=null;
              return;
        }
        header=header.after;
        header.before=null;

  }

  /**
   * inserts entry at first.
```

- ▶ March (93)
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```
 */
void insertFirst(Entry<K, V> newEntry){

    if(header==null){ //no entry found
        header=newEntry;
        last=newEntry;
        return;
    }

    newEntry.after=header;
    header.before=newEntry;
    header=newEntry;

}

/**
 * inserts entry at last.
 */
void insertLast(Entry<K, V> newEntry){

    if(header==null){
        header=newEntry;
        last=newEntry;
        return;
    }
    last.after=newEntry;
    newEntry.before=last;
    last=newEntry;

}

/**
 * deletes entry from last.
 */
void deleteLast(){

    if(header==last){
        header=last=null;
        return;
```

```
      }

      last=last.before;
      last.after=null;
}


/**
 * deletes specific entry and returns before entry.
 */
private Entry<K, V> deleteSpecificEntry(Entry<K, V> newEntry){

      Entry<K, V> current=header;
      while(!current.key.equals(newEntry.key)){
            if(current.after==null){   //entry not found
                  return null;
            }
            current=current.after;  //move to next node.
      }

      Entry<K, V> beforeDeleteEntry=current.before;
      current.before.after=current.after;
      current.after.before=current.before;  //entry deleted
      return beforeDeleteEntry;
}


/**
 * Method returns value corresponding to key.
 * @param key
 */
public V get(K key){
   int hash = hash(key);
   if(table[hash] == null){
    return null;
   }else{
    Entry<K,V> temp = table[hash];
    while(temp!= null){
       if(temp.key.equals(key))
```

```
            return temp.value;
          temp = temp.next; //return value corresponding to key.
        }
        return null;   //returns null if key is not found.
       }
   }



   /**
    * Method removes key-value pair from HashMapCustom.
    * @param key
    */
   public boolean remove(K deleteKey){

     int hash=hash(deleteKey);

    if(table[hash] == null){
          return false;
    }else{
      Entry<K,V> previous = null;
      Entry<K,V> current = table[hash];

      while(current != null){ //we have reached last entry node of bucket.
         if(current.key.equals(deleteKey)){
             maintainOrderAfterDeletion(current);
             if(previous==null){  //delete first entry node.
                   table[hash]=table[hash].next;
                   return true;
             }
             else{
                   previous.next=current.next;
                  return true;
             }
         }
         previous=current;
           current = current.next;
        }
      return false;
    }
```

```
}


/**
 * Method displays all key-value pairs present in HashMapCustom.,
 * insertion order is not guaranteed, for maintaining insertion order refer linkedHashMapCustom.
 * @param key
 */
public void display(){

  Entry<K, V> currentEntry=header;
  while(currentEntry!=null){
     System.out.print("{"+currentEntry.key+"="+currentEntry.value+"}" +" ");
     currentEntry=currentEntry.after;
  }

}
/**
 * Method implements hashing functionality, which helps in finding the appropriate bucket location to store our data.
 * This is very important method, as performance of HashMapCustom is very much dependent on  this method's implementation.
 * @param key
 */
private int hash(K key){
   return Math.abs(key.hashCode()) % capacity;
}



/**
 * Method returns null if LinkedHashSetCustom does not contain object.
 * @param key
 */
public K contains(K key){
   int hash = hash(key);
   if(table[hash] == null){
    return null;
   }else{
    Entry<K,V> temp = table[hash];
    while(temp!= null){
            if(temp.key.equals(key))
                return key;
            temp = temp.next; //return value corresponding to key.
        }
        return null;   //returns null if key is not found.
       }
    }



    /**
     * Method displays all objects in LinkedHashSetCustom.
     * insertion order is maintained.
     * @param key
     */
    public void displaySet(){

       Entry<K, V> currentEntry=header;
       while(currentEntry!=null){
           System.out.print(currentEntry.key+" ");
           currentEntry=currentEntry.after;
       }

    }
}




/**
 * Main class- to test HashMap functionality.
 */
public class LinkedHashSetCustomApp {

    public static void main(String[] args) {
       LinkedHashSetCustom<Integer> linkedHashSetCustom = new LinkedHashSetCustom<Integer>();
       linkedHashSetCustom.add(21);
       linkedHashSetCustom.add(25);
       linkedHashSetCustom.add(30);
```

```
        linkedHashSetCustom.add(33);
        linkedHashSetCustom.add(35);

          System.out.println("LinkedHashSetCustom contains 21 ="+linkedHashSetCustom.contains(21));
          System.out.println("LinkedHashSetCustom contains 51 ="+linkedHashSetCustom.contains(51));

        System.out.print("Displaying LinkedHashSetCustom: ");
        linkedHashSetCustom.display();

        System.out.println("\n\n21 removed: "+linkedHashSetCustom.remove(21));
        System.out.println("22 removed: "+linkedHashSetCustom.remove(22));

        System.out.print("Displaying LinkedHashSetCustom: ");
        linkedHashSetCustom.display();

    }
}

/*Output

LinkedHashSetCustom contains 21 =true
LinkedHashSetCustom contains 51 =false
Displaying LinkedHashSetCustom: 21 25 30 33 35

21 removed: true
22 removed: false
Displaying LinkedHashSetCustom: 25 30 33 35

*/
```

Summary of article >

In this tutorial we learned how to create and implement own/custom **LinkedHashSet** in java with full program, diagram and examples to insert and retrieve values in it.

Having any doubt? or you you liked the tutorial! Please comment in below section.

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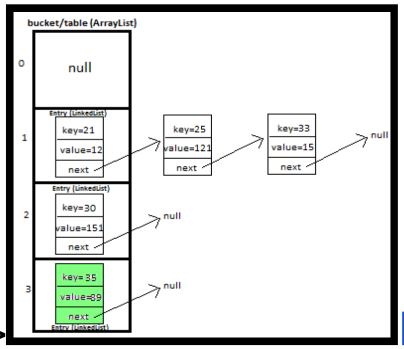
1 >

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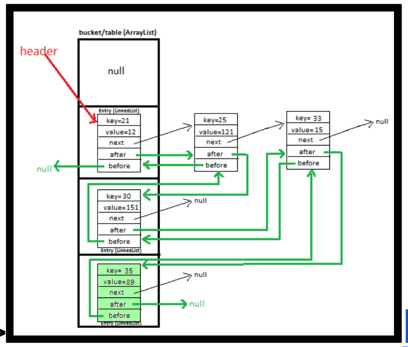
2 >

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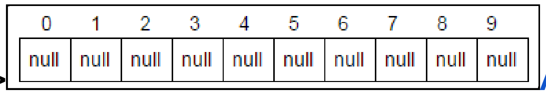
3 > 

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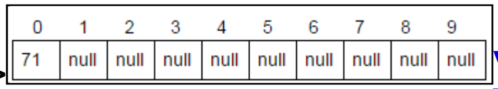
6 > 

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