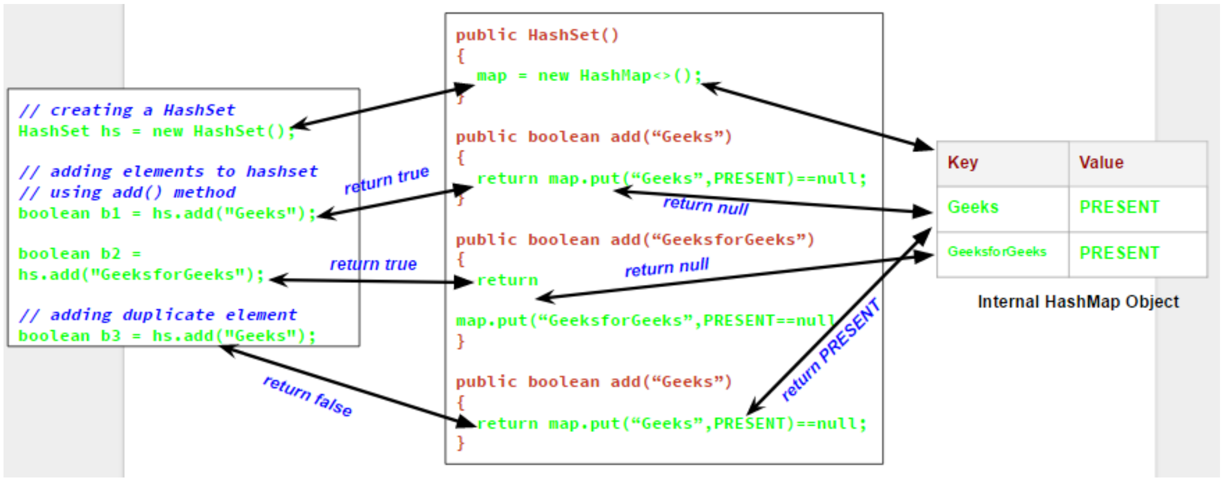
Internal working of Set/HashSet in Java

As we know that a set is a **well-defined** collection of distinct objects. Each member of a set is called an element of the set. So in other words, we can say that a **set will never contain duplicate elements**. But how in java Set interface implemented classes like HashSet, LinkedHashSet, TreeSet etc. achieve this uniqueness. In this post, we will discuss the hidden truth behind this uniqueness.

How HashSet works internally in Java?



```
// creating a HashSet
HashSet hs = new HashSet();

// adding elements to hashset
// using add() method
boolean b1 = hs.add("Geeks");

boolean b2 =
hs.add("GeeksforGeeks");

// adding duplicate element
boolean b3 = hs.add("Geeks");
```

```
public HashSet()
{
  map = new HashMap<>();
}

public boolean add("Geeks")
{
  return map.put("Geeks",PRESENT)==null;
}

public boolean add("GeeksforGeeks")
{
  return
map.put("GeeksforGeeks",PRESENT==null
}

public boolean add("Geeks")
{
  return map.put("Geeks",PRESENT)==null;
}
```

Key	Value
Geeks	PRESENT
GeeksforGeeks	PRESENT

We will understand this with an example.Let us see the output of the following program which try to add duplicate elements in a HashSet.

```
// Java program to demonstrate
// internal working of HashSet

import java.util.HashSet;

class Test
{
    public static void main(String args[])
    {
        // creating a HashSet
        HashSet hs = new HashSet();

        // adding elements to hashset
        // using add() method
        boolean b1 = hs.add("Geeks");
        boolean b2 = hs.add("GeeksforGeeks");

        // adding duplicate element
        boolean b3 = hs.add("Geeks");

        // printing b1, b2, b3
        System.out.println("b1 = "+b1);
        System.out.println("b2 = "+b2);
        System.out.println("b3 = "+b3);

        // printing all elements of hashset
        System.out.println(hs);

    }
}
```

Output:

```
b1 = true
b2 = true
b3 = false
[GeeksforGeeks, Geeks]
```

Now from the output, it is clear that when we try to add a duplicate element to a set using *add()* method, it returns *false*, and element is not added to hashset, as it is already present. Now the question comes, how *add()* method checks whether the set already contains the specified element or not. It will be more clear if we have a closer look on the *add()* method and default constructor in HashSet class.

```
// predefined HashSet class
public class HashSet
{
    // A HashMap object
    private transient HashMap map;

    // A Dummy value(PRESENT) to associate with an Object in the Map
    private static final Object PRESENT = new Object();

    // default constructor of HashSet class
    // It creates a HashMap by calling
    // default constructor of HashMap class
    public HashSet() {
        map = new HashMap<>();
    }

    // add method
    // it calls put() method on map object
    // and then compares it's return value with null
    public boolean add(E e) {
        return map.put(e, PRESENT)==null;
    }

    // Other methods in Hash Set
}
```

Now as you can see that whenever we create a HashSet, it internally creates a HashMap and if we insert an element into this HashSet using *add()* method, it actually call *put()* method on internally created HashMap object with element you have specified as it's key and constant Object called **"PRESENT"** as it's value. So we can say that **a Set achieves uniqueness internally through HashMap**. Now the whole story comes around how a HashMap and *put()* method internally works.

As we know in a HashMap each key is unique and when we call *put(Key, Value)* method, it returns the previous value associated with key, or *null* if there was no mapping for key. So in *add()* method we check the return value of map.put(key, value) method with *null* value.

1. If map.put(key, value) returns *null*, then the statement "map.put(e, PRESENT) == null" will return *true* and element is added to the HashSet(internally HashMap).
2. If map.put(key, value) returns old value of the key, then the statement "map.put(e, PRESENT) == null" will return *false* and element is not added to the HashSet(internally HashMap).

As LinkedHashSet extends HashSet, so it internally calls constructors of HashSet using super(). Similarly creating an object of TreeSet class internally creates object of Navigable Map as backing map.

Related Article : How HashMap internally works in Java.

This article is contributed by **Gaurav Miglani**. If you like GeeksforGeeks and would like to contribute, you can also write an article using contribute.geeksforgeeks.org or m your article to contribute@geeksforgeeks.org. See your article appearing on the GeeksforGeeks main page and help other Geeks.