Merge function of Merge sort

Given two sorted arrays, the task is to merge them in a sorted manner.
Examples:

> **Input**: arr1[] = { 1, 3, 4, 5}, arr2[] = {2, 4, 6, 8}
> **Output**: arr3[] = {1, 2, 3, 4, 4, 5, 6, 8}
> **Input**: arr1[] = { 5, 8, 9}, arr2[] = {4, 7, 8}
> **Output**: arr3[] = {4, 5, 7, 8, 8, 9}

Method 1 (O(n1 * n2) Time and O(n1+n2) Extra Space)

1. Create an array arr3[] of size n1 + n2.
2. Copy all n1 elements of arr1[] to arr3[]
3. Traverse arr2[] and one by one insert elements (like insertion sort) of arr3[] to arr1[]. This step take O(n1 * n2) time.

We have discussed implementation of above method in Merge two sorted arrays with O(1) extra space

Method 2 (O(n1 + n2) Time and O(n1 + n2) Extra Space)
The idea is to use Merge function of Merge sort.

1. Create an array arr3[] of size n1 + n2.
2. Simultaneously traverse arr1[] and arr2[].
    - Pick smaller of current elements in arr1[] and arr2[], copy this smaller element to next position in arr3[] and move ahead in arr3[] and the array whose element is picked.
3. If there are remaining elements in arr1[] or arr2[], copy them also in arr3[].

Below image is a dry run of the above approach:

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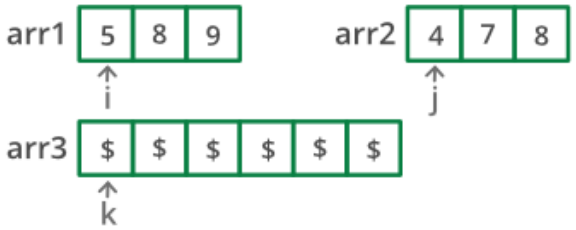
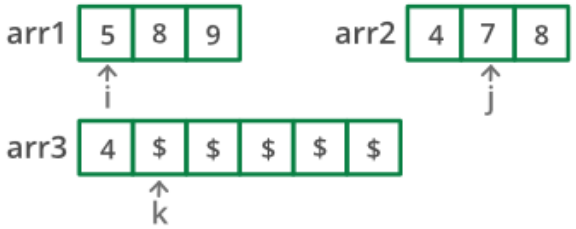
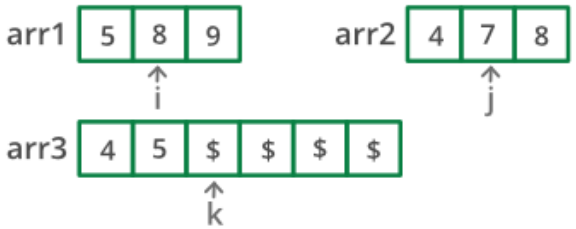
Initially:



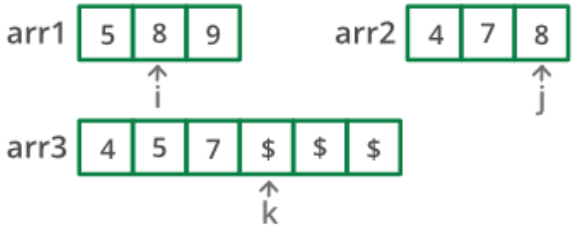
Step 1:



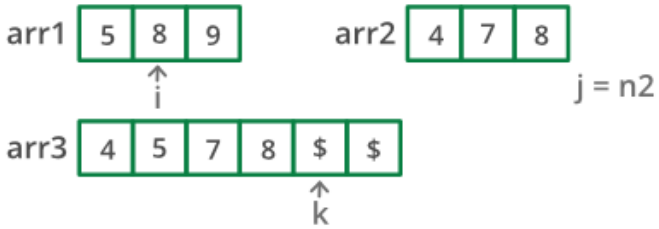
Step 2:

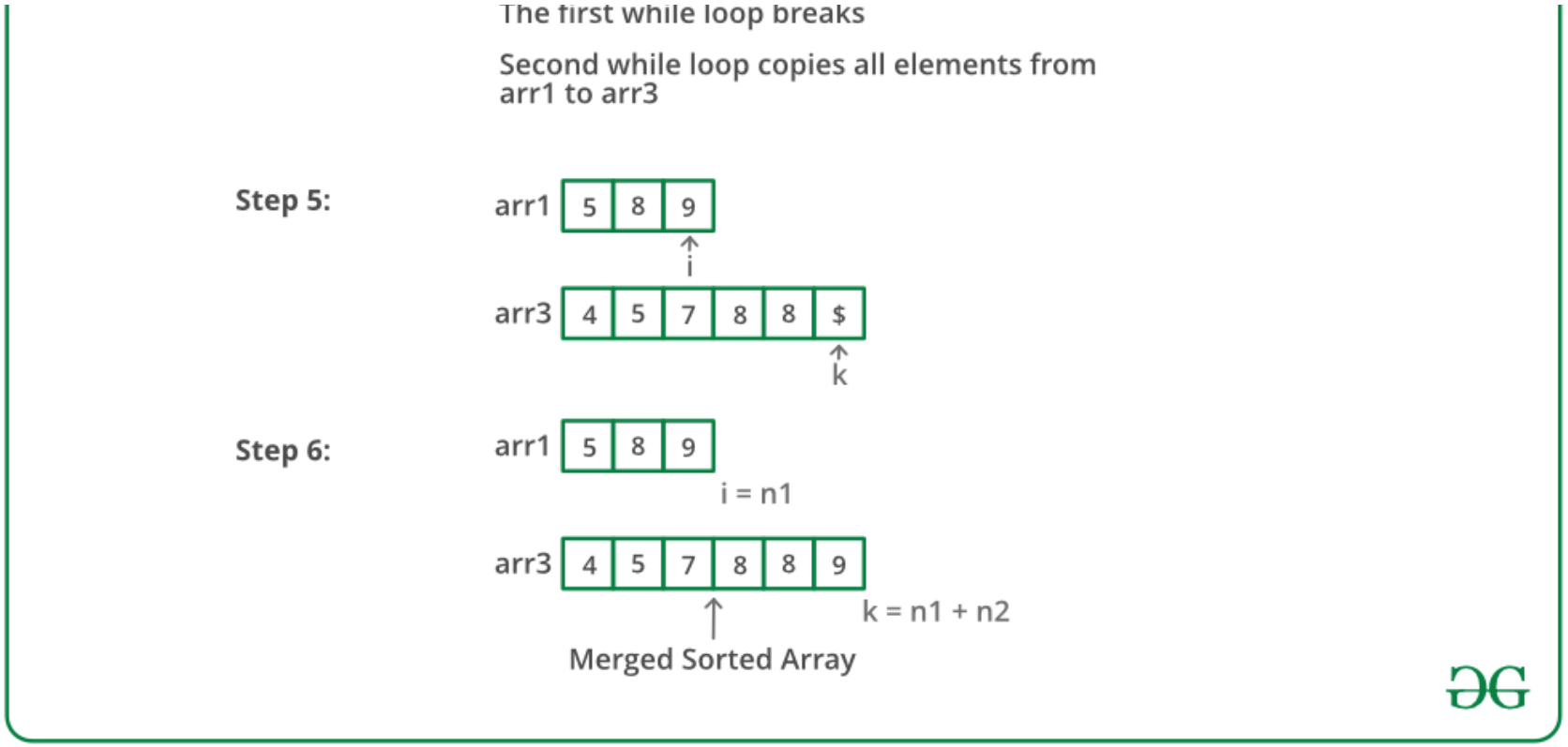


Step 3:



Step 4:





Below is the implementation of the above approach:

C++ Java

```
// Java program to merge two sorted arrays
import java.util.*;
```

```java
import java.lang.*;
import java.io.*;

class MergeTwoSorted
{
    // Merge arr1[0..n1-1] and arr2[0..n2-1]
    // into arr3[0..n1+n2-1]
    public static void mergeArrays(int[] arr1, int[] arr2, int n1,
                                   int n2, int[] arr3)
    {
        int i = 0, j = 0, k = 0;

        // Traverse both array
        while (i<n1 && j <n2)
        {
            // Check if current element of first
            // array is smaller than current element
            // of second array. If yes, store first
            // array element and increment first array
            // index. Otherwise do same with second array
            if (arr1[i] < arr2[j])
                arr3[k++] = arr1[i++];
            else
                arr3[k++] = arr2[j++];
        }

        // Store remaining elements of first array
        while (i < n1)
            arr3[k++] = arr1[i++];
```

```
        // Store remaining elements of second array
        while (j < n2)
            arr3[k++] = arr2[j++];
    }

    public static void main (String[] args)
    {
        int[] arr1 = {1, 3, 5, 7};
        int n1 = arr1.length;

        int[] arr2 = {2, 4, 6, 8};
        int n2 = arr2.length;

        int[] arr3 = new int[n1+n2];

        mergeArrays(arr1, arr2, n1, n2, arr3);

        System.out.println("Array after merging");
        for (int i=0; i < n1+n2; i++)
            System.out.print(arr3[i] + " ");
    }
}

/* This code is contributed by Mr. Somesh Awasthi */
```

Output:

```
Array after merging
1 2 3 4 5 6 7 8
```

Time Complexity : O(n1 + n2)
Auxiliary Space : O(n1 + n2)

2. Print the keys of the map.

Below is the implementation of above approach.

CPP Java

```
// Java program to merge two sorted arrays
//using maps
import java.io.*;
import java.util.*;

class GFG {

    // Function to merge arrays
    static void mergeArrays(int a[], int b[], int n, int m)
    {

        // Declaring a map.
```

```
    // using map as a inbuilt tool
    // to store elements in sorted order.
    Map<Integer,Boolean> mp = new TreeMap<Integer,Boolean>();

    // Inserting values to a map.
    for(int i = 0; i < n; i++)
    {
        mp.put(a[i], true);
    }
    for(int i = 0;i < m;i++)
    {
        mp.put(b[i], true);
    }

    // Printing keys of the map.
    for (Map.Entry<Integer,Boolean> me : mp.entrySet())
    {
        System.out.print(me.getKey() + " ");
    }
}

// Driver Code
public static void main (String[] args)
{
    int a[] = {1, 3, 5, 7}, b[] = {2, 4, 6, 8};
    int size = a.length;
    int size1 = b.length;

    // Function call
```

```
            mergeArrays(a, b, size, size1);
        }
    }

    // This code is contributed by rag2127
```

Output:

```
1 2 3 4 5 6 7 8
```

Time Complexity: O(nlog(n) + mlog(m))
Auxiliary Space: O(N)