

Radix Sort
Count pairs in array whose sum is divisible by K
Nth number whose sum of digit is multiple of 10
Coin Change BFS Approach
Given two arrays count all pairs whose sum is an odd number
Find maximum xor of k elements in an array
Maximum absolute difference in an array
Program to find the last two digits of x^y
Partition an array of non-negative integers into two subsets such that average of both the subsets is equal
Count substrings that contain all vowels SET 2
Count rotations of N which are Odd and Even
New Algorithm to Generate Prime Numbers from 1 to Nth Number
Sum of the series 1^1 + 2^2 + 3^3 + + n^n using recursion
Find the sum of digits of a number at even and odd places
Count of integers of length N and value less than K such that they contain digits only from the given set
Check for balanced parentheses in an expression O(1) space O(N^2) time complexity
Complexity Analysis of Binary Search
Find the minimum number of operations required to make all array elements equal
Create new linked list from two given linked list with greater element at each node
Count number of ways to reach a given score in a Matrix

Counting Sort

Counting sort is a sorting technique based on keys between a specific range. It works by counting the number of objects having distinct key values (kind of hashing). Then doing some arithmetic to calculate the position of each object in the output sequence.

Let us understand it with the help of an example.

For simplicity, consider the data in the range 0 to 9.

Input data: 1, 4, 1, 2, 7, 5, 2

1) Take a count array to store the count of each unique object.

Index:	0	1	2	3	4	5	6	7	8	9
Count:	0	2	2	0	1	1	0	1	0	0

2) Modify the count array such that each element at each index stores the sum of previous counts.

Index:	0	1	2	3	4	5	6	7	8	9
Count:	0	2	4	4	5	6	6	7	7	7

The modified count array indicates the position of each object in the output sequence.

3) Output each object from the input sequence followed by decreasing its count by 1.

Process the input data: 1, 4, 1, 2, 7, 5, 2. Position of 1 is 2. Put data 1 at index 2 in output. Decrease count by 1 to place next data 1 at an index 1 smaller than this index.

Recommended: Please solve it on “*PRACTICE*” first, before moving on to the solution.

Following is implementation of counting sort.

C++ C Java Python C# PHP

```
// Java implementation of Counting Sort
class CountingSort
{
    void sort(char arr[])
    {
        int n = arr.length;

        // The output character array that will have sorted arr
        char output[] = new char[n];

        // Create a count array to store count of inividul
        // characters and initialize count array as 0
        int count[] = new int[256];
        for (int i=0; i<256; ++i)
            count[i] = 0;

        // store count of each character
        for (int i=0; i<n; ++i)
            ++count[arr[i]];

        // Change count[i] so that count[i] now contains actual
        // position of this character in output array
        for (int i=1; i<256; ++i)
            count[i] += count[i-1];

        // Build the output character array
        // To make it stable we are operating in reverse order.
        for (int i = n-1; i>=0; i--)
        {
            output[count[arr[i]]-1] = arr[i];
            --count[arr[i]];
        }
    }
}
```

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- Count number of ways to get Odd Sum

XOR of all the elements in the given range [L, R]

Find the minimum number of elements that should be removed to make an array good

Find the smallest positive number missing from an unsorted array | Set 3

Find sub-arrays from given two arrays such that they have equal sum

Count of all possible values of X such that $A \% X = B$

Find a triplet in an array whose sum is closest to a given number

Card Shuffle Problem | TCS Digital Advanced Coding Question

Append a digit in the end to make the number equal to the length of the remaining string

Find XOR of numbers from the range [L, R]

Print path from root to all nodes in a Complete Binary Tree

```
// Copy the output array to arr, so that arr now
// contains sorted characters
for (int i = 0; i < n; ++i)
    arr[i] = output[i];
}

// Driver method
public static void main(String args[])
{
    CountingSort ob = new CountingSort();
    char arr[] = {'g', 'e', 'e', 'k', 's', 'f', 'o',
                 'r', 'g', 'e', 'e', 'k', 's'
    };

    ob.sort(arr);

    System.out.print("Sorted character array is ");
    for (int i=0; i<arr.length; ++i)
        System.out.print(arr[i]);

    }
}
/*This code is contributed by Rajat Mishra */
```

Output:

Sorted character array is eeeefgkkorss

Time Complexity: $O(n+k)$ where n is the number of elements in input array and k is the range of input.

Auxiliary Space: $O(n+k)$

The problem with the previous counting sort was that we could not sort the elements if we have negative numbers in it. Because there are no negative array indices. So what we do is, we find the minimum element and we will store count of that minimum element at zero index.

C++

Java



```
// Counting sort which takes negative numbers as well
import java.util.*;
```

```
class GFG
{
    static void countSort(int[] arr)
    {
        int max = Arrays.stream(arr).max().getAsInt();
        int min = Arrays.stream(arr).min().getAsInt();
        int range = max - min + 1;
        int count[] = new int[range];
        int output[] = new int[arr.length];
        for (int i = 0; i < arr.length; i++)
        {
            count[arr[i] - min]++;
        }

        for (int i = 1; i < count.length; i++)
        {
            count[i] += count[i - 1];
        }

        for (int i = arr.length - 1; i >= 0; i--)
        {
            output[count[arr[i] - min] - 1] = arr[i];
            count[arr[i] - min]--;
        }

        for (int i = 0; i < arr.length; i++)
        {
            arr[i] = output[i];
        }
    }

    static void printArray(int[] arr)
    {
        for (int i = 0; i < arr.length; i++)
        {
            System.out.print(arr[i] + " ");
        }
        System.out.println("");
    }
}
```

Most visited in Sorting

Comparison among Bubble Sort, Selection Sort and Insertion Sort

Amazon Internship Interview Experience

Count the triplets such that $A[i] < B[j] < C[k]$

Greatest contiguous sub-array of size K

Sort an array without changing position of negative numbers

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```
// Driver code
public static void main(String[] args)
{
    int[] arr = {-5, -10, 0, -3, 8, 5, -1, 10};
    countSort(arr);
    printArray(arr);
}

// This code is contributed by princiRaj1992
```

Output:

```
-10 -5 -3 -1 0 5 8 10
```

Points to be noted:

1. Counting sort is efficient if the range of input data is not significantly greater than the number of objects to be sorted. Consider the situation where the input sequence is between range 1 to 10K and the data is 10, 5, 10K, 5K.
2. It is not a comparison based sorting. Its running time complexity is $O(n)$ with space proportional to the range of data.
3. It is often used as a sub-routine to another sorting algorithm like radix sort.
4. Counting sort uses a partial hashing to count the occurrence of the data object in $O(1)$.
5. Counting sort can be extended to work for negative inputs also.

Exercise:

1. Modify above code to sort the input data in the range from M to N.
2. Is counting sort stable and online?
3. Thoughts on parallelizing the counting sort algorithm.

Counting Sort | GeeksforGeeks

For simplicity, consider data in range of 0 to 9

1	4	1	2	7	5	2
---	---	---	---	---	---	---

Index : 0 1 2 3 4 5 6 7 8 9

0	2	4	4	5	6	6	7	7	7
---	---	---	---	---	---	---	---	---	---

Since we have seven input we create an array with seven places

Snapshots:

For simplicity, consider data in range of 0 to 9

1	4	1	2	7	5	2
---	---	---	---	---	---	---

↑

Index : 0 1 2 3 4 5 6 7 8 9

0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---

Count each element in the given array and place the count at the appropriate index.

For simplicity, consider data in range of 0 to 9

1	4	1	2	7	5	2
---	---	---	---	---	---	---

↑

Index : 0 1 2 3 4 5 6 7 8 9

0	2	0	0	1	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---

For simplicity, consider data in range of 0 to 9

Modify the count array by adding the previous counts.


For simplicity, consider data in range of 0 to 9

		1	4	1	2	7	5	2		
Index :	0	1	2	3	4	5	6	7	8	9
	0	2	4	0	1	1	0	1	0	0

$2 + 2$

For simplicity, consider data in range of 0 to 9

			1	4	1	2	7	5	2	
Index :	0	1	2	3	4	5	6	7	8	9
	0	2	4	4	1	1	0	1	0	0


 $4 + 0$

For simplicity, consider data in range of 0 to 9

	1	4	1	2	7	5	2			
Index :	0	1	2	3	4	5	6	7	8	9
	0	0	4	4	4	6	6	7	7	7

Places : 1 2 3 4 5 6 7

1	1			4		
---	---	--	--	---	--	--

For simplicity, consider data in range of 0 to 9

		1	4	1	2	7	5	2		
Index :	0	1	2	3	4	5	6	7	8	9
	0	0	2	4	4	5	6	6	7	7

Places :	1	2	3	4	5	6	7
	1	1	2	2	4	5	7

Quiz on Counting Sort

Coding Practice for Sorting

Other Sorting Algorithms on GeeksforGeeks/GeeksQuiz

Selection Sort, Bubble Sort, Insertion Sort, Merge Sort, Heap Sort, QuickSort, Radix Sort, Counting Sort, Bucket Sort, ShellSort, Comb Sort, PeggionHole Sorting

This article is compiled by [Aashish Barnwal](#). Please write comments if you find anything incorrect, or you want to share more information about the topic discussed above.

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