Counting Sort

Counting Sort

- Assumes that the input consists of integers in a small range 1 to k, for some integer k.
- Runs in O(n + k) time.
 - k = O(n), the sort runs in $\theta(n)$ time.
- For each element x, the algorithm
 - First determines the number of elements less than x.
 - Then directly place the element into its correct position.

Example

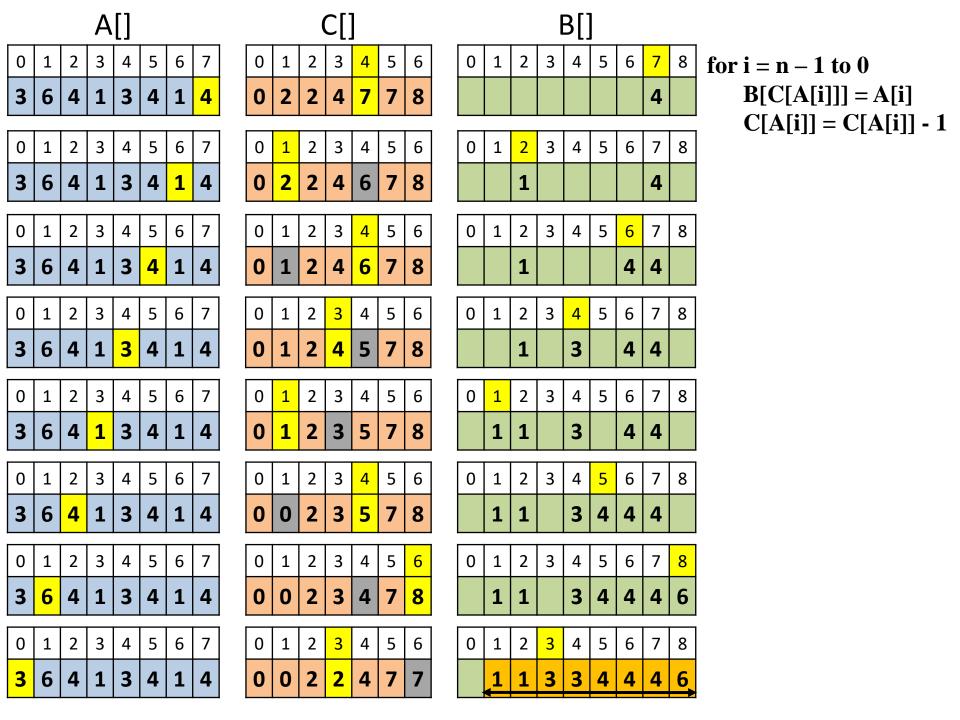
	0	1	2	3	4	5	6	7
A []	3	6	4	1	3	4	1	4

Compute frequency of k elements, i.e. array C.

						5	
C[]	0	2	0	2	3	0	1

Update C to store cumulative frequency.

	0	1	2	3	4	5	6
C[]	0	2	2	4	7	7	8



Algorithm

- Algorithm countingSort(A,n,k)
- Input: Array A, its size n, and the maximum integer k in the list.
- Output: The elements of A get sorted in increasing order.

```
1. for i = 0 to k
```

2.
$$C[i] = 0$$

3. for
$$i = 0$$
 to $n - 1$

4.
$$C[A[i]] = C[A[i]] + 1$$

5. for
$$i = 1$$
 to k

6.
$$C[i] = C[i] + C[i-1]$$

7. for
$$i = n - 1$$
 to 0

8.
$$B[C[A[i]]] = A[i]$$

9.
$$C[A[i]] = C[A[i]] - 1$$

10. for
$$i = 0$$
 to $n - 1$

11.
$$A[i] = B[i+1]$$

Thank You