**Notes Lecture 4**

**Example of Count Algorithm:**

Suppose we have the following input array:

Input array: [3, 1, 5, 3, 7, 1, 5]

Step 1: Finding the maximum value in the input array:

The maximum value in the input array is 7.

Step 2: Creating an auxiliary array of size max+1:

We create an auxiliary array of size 8 (i.e., max+1):

Auxiliary array: [0, 0, 0, 0, 0, 0, 0, 0]

Step 3: Counting the occurrences of each element in the input array:

We iterate through the input array and count the number of occurrences of each element:

Auxiliary array: [0, 2, 0, 2, 0, 2, 1, 0]

Explanation:

* The value 1 occurs twice in the input array.
* The value 3 occurs twice in the input array.
* The value 5 occurs twice in the input array.
* The value 7 occurs once in the input array.
* The other values (0, 2, 4, 6) do not occur in the input array.

Step 4: Computing the cumulative sum of the counts in the auxiliary array:

We compute the cumulative sum of the counts in the auxiliary array:

Auxiliary array: [0, 2, 2, 4, 4, 6, 7, 7]

Explanation:

* The first element (0) remains the same.
* The second element (2) is the sum of the first two elements (0+2).
* The third element (2) is the same as the previous element (2).
* The fourth element (4) is the sum of the previous two elements (2+2).
* The fifth element (4) is the same as the previous element (4).
* The sixth element (6) is the sum of the previous two elements (4+2).
* The seventh element (7) is the sum of the previous two elements (6+1).
* The eighth element (7) is the same as the previous element (7).

Step 5: Traversing the input array in reverse order and placing each element in its correct position in the output array:

We traverse the input array in reverse order and use the counts in the auxiliary array to place each element in its correct position in the output array:

Output array: [1, 1, 3, 3, 5, 5, 7]

Explanation:

* The value 5 occurs twice in the input array, so we place it in position 6 and decrement the count in the auxiliary array to 1.
* The value 1 occurs twice in the input array, so we place it in position 2 and decrement the count in the auxiliary array to 1.
* The value 7 occurs once in the input array, so we place it in position 7 and decrement the count in the auxiliary array to 0.
* The value 3 occurs twice in the input array, so we place it in position 4 and decrement the count in the auxiliary array to 1.
* The value 5 occurs once in the input array, so we place it in position 5 and decrement the count in the auxiliary array to 0.
* The value 1 occurs once in the input array, so we place it in position 1 and decrement the count in the auxiliary array to 0.
* The value 3 occurs once in the input array, so we place it in position 3 and decrement the count in the auxiliary array to 0.

**Finally**, we output the sorted array:

Sorted array: [1, 1, 3, 3, 5, 5, 7]