→ Counting Sort

arr → 1, 1, 1, 2, 7, 5, 3

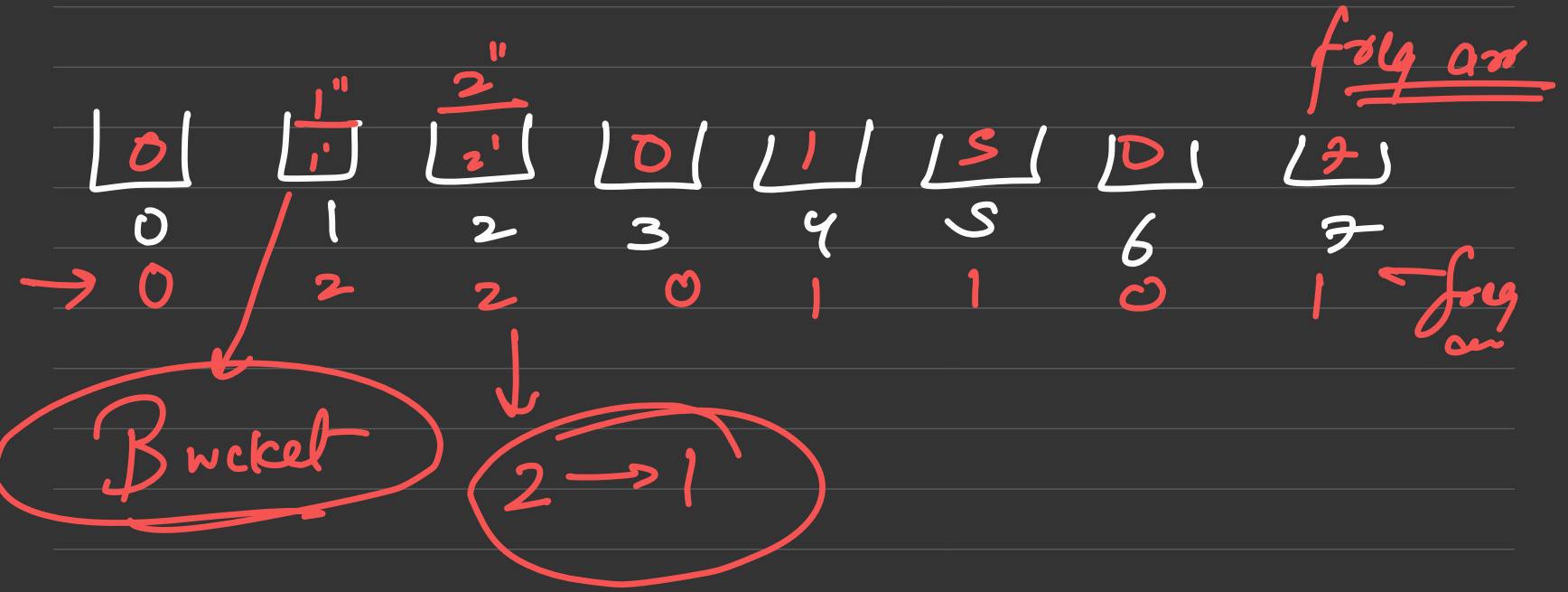
1 1 2 2 4 5 7 ← sorted array

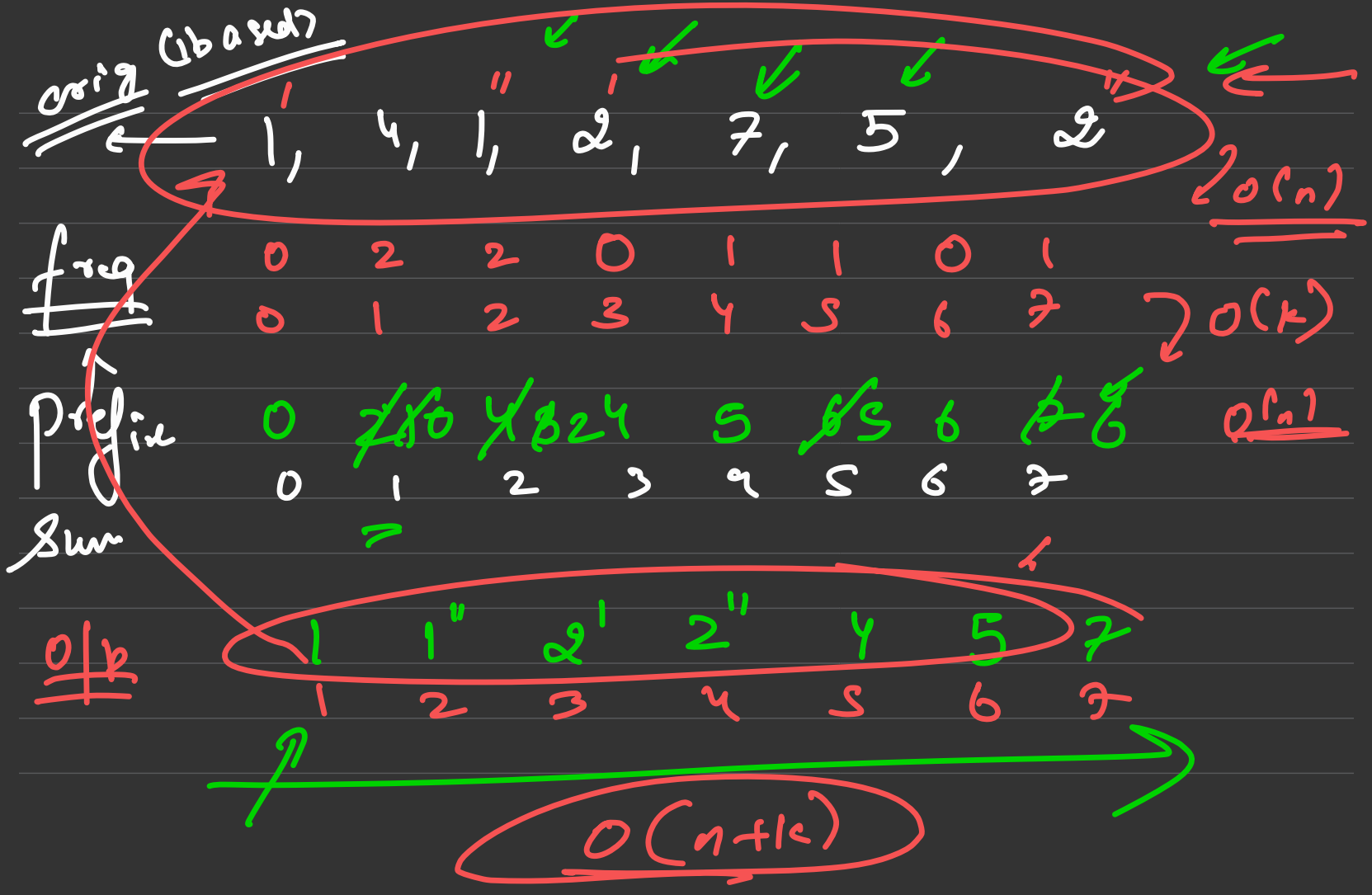
freq → 0 2 2 0 1 1 0 1

0 1 2 3 4 5 6 7 ← idx

arr ↑ ↑ ↑ ↑ ↑

1', 4, 1'', 2', 7, 5, 2''




orig (1 based)
1, 4, 1, 2, 7, 5, 2
O(n)
freq
0 2 2 0 1 1 0 1
0 1 2 3 4 5 6 7
O(k)
prefix sum
0 0 2 4 5 5 6 6
0 1 2 3 4 5 6 7
O(n)
O/P
1 1 2 2 4 5 7
1 2 3 4 5 6 7
O(n+k)

Prefix [i] → represents correct pos of the last unplaced i.

TC → O(n+k) XXX if value of k is too high

SC → O(n+k)

Stability - Yes

In place → No

$k = max - min$

$max > 10^9$

min -> -2

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

-2 -> 0
-1 -> 1
0 -> 2
1 -> 3
2 -> 4

el - min_el <- new_idx

-2 - (-2) -> 0
-1 - (-2) -> 1

0 - (-2) -> 2
1 - (-2) -> 3

Radix Sort

→ Counting Sort

k^{th} digit

170, 45, 95, 90, 802, 24, 2, 66

170
45
75
90
802
24
2
66

after sorting on pos

170
90
802
2
24
45
75
66

→

802
2
24
45
66
170
75
90

→

2
24
45
66
75
90
170
802

$O(d(n+d))$

$d \to$ digits in the max element

802

$(802/10)\ \%\ 10$

$\hookrightarrow 0$

$80\%10 \to 0$

$$\left((1\,2\,4\,9\,6\,5)/100 \right) \bigcirc_{10}$$

$$(1\,2\,4\,9)\ \bigcirc_{10} \rightarrow 9$$

Q → Given an array of floating pt nos, sort the array.

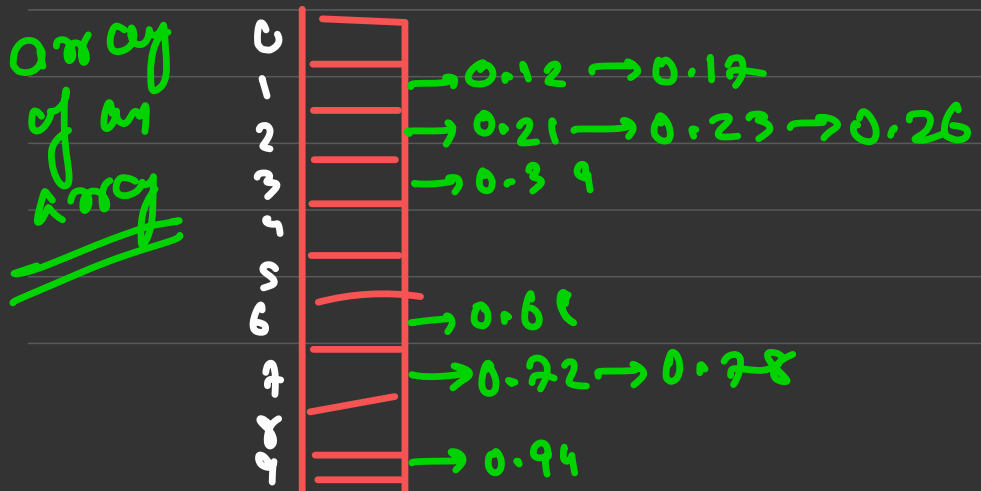
a[i] ∈ [0.0, 1.0]

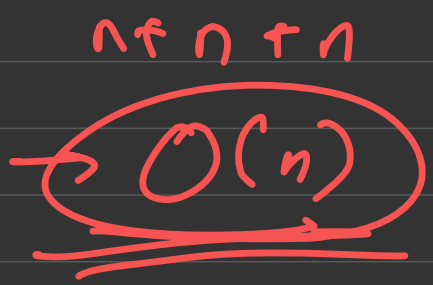
n

$n \leq 10^6$

[0.0 – 1.0] → In bucket based on the first value after decimal

0.94, 0.78, 0.72, 0.39, 0.68, 0.21, 0.23, 0.26, 0.12, 0.17



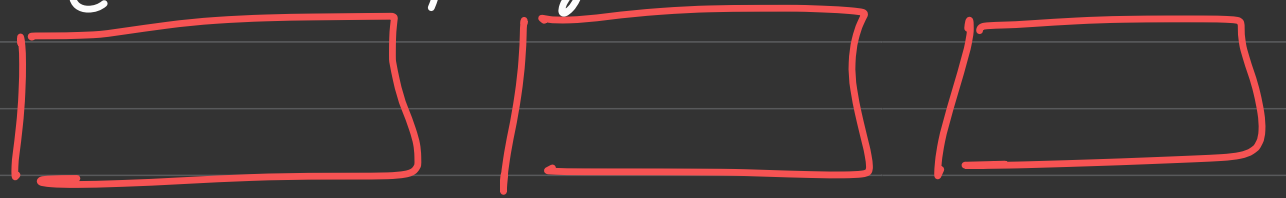


9.8, 0.6, 10.1, 1.9, 3.07, 3.04, 5.0, 8.0, 4.8, 2.6

↳ n → no of buckets (Define it)

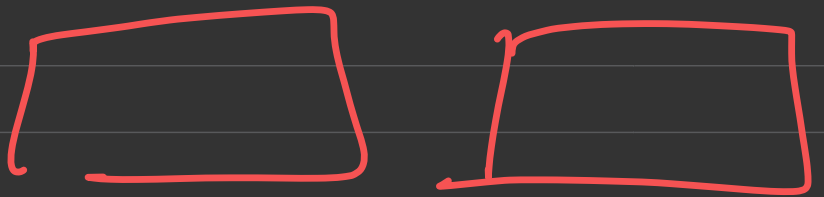
range → (max - min)/n → 1.9

bi → (a[i] - min)/range



n=5

Insertion sort



9.8 - 0.6

9.2

1.9

4