

$$\begin{array}{r} 3 \\ 136 \\ \hline 40 \end{array} \quad \begin{array}{r} 30 \\ 43 \\ \hline 51 \end{array} \quad \begin{array}{r} 38 \\ 60 \\ 69 \\ \hline 85 \end{array}$$

B.F: $O(nm)$

b.s. on rows: $O(n \cdot \log(m))$

b.s. on cols: $O(m \cdot \log(n))$

TC: $O(n+m)$
AS: $O(1)$

(key, value)

Hashmap

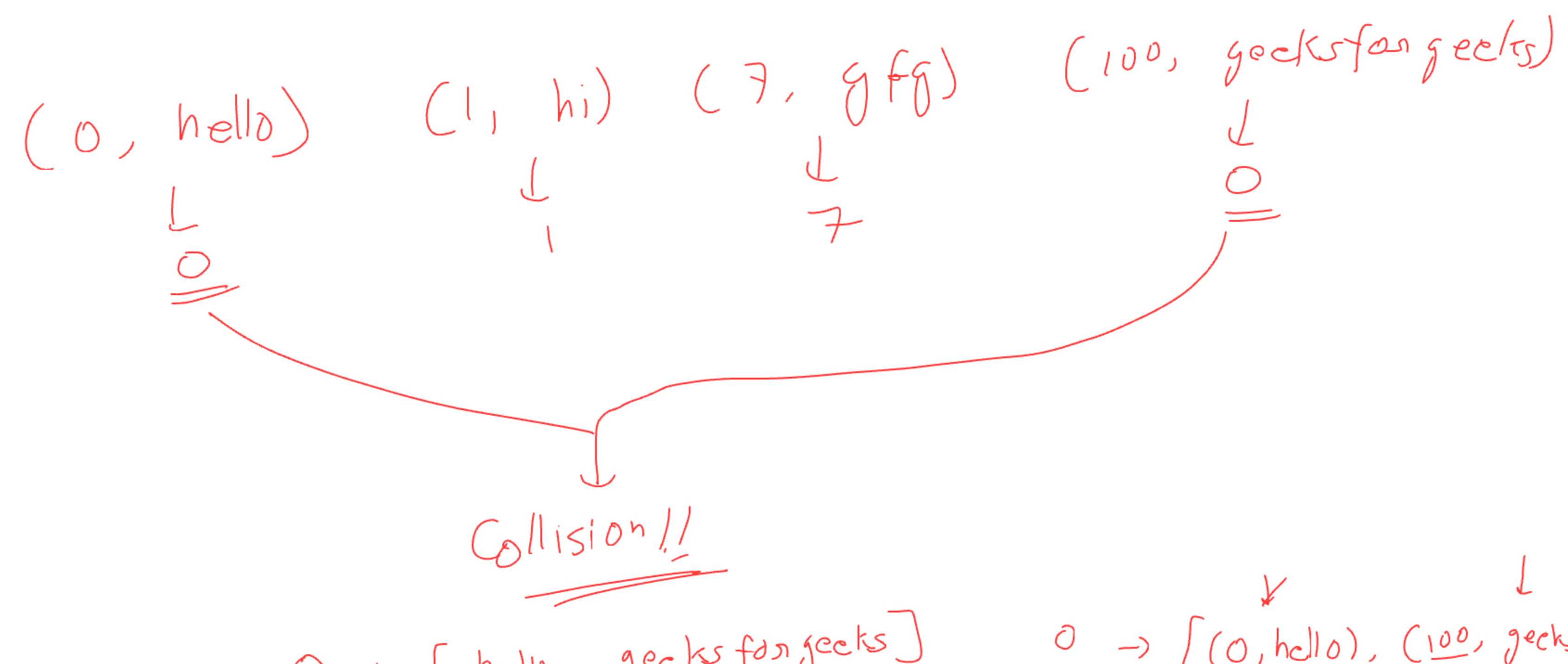
- 0 -> (0, hello)
- 1 -> (1, hi)
- 7 -> (7, gfg)
- 2 -> (100, geeksforgeeks)



prime no. -> 101

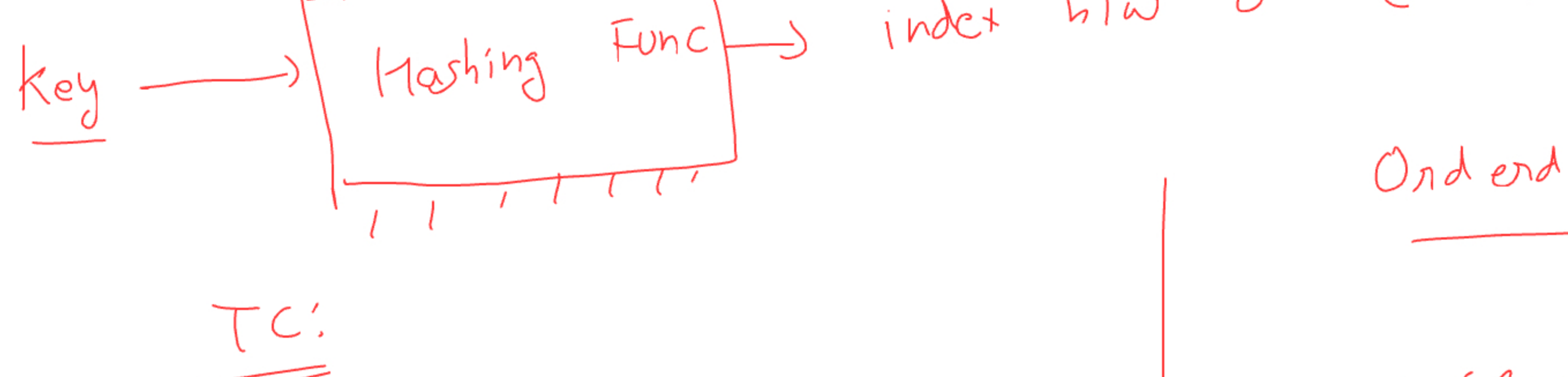
key % 20 -> [0 ... 19]

No. of keys can be infinite but the underlying is finite.



- 0 -> [hello, geeksforgeeks]
- 1 -> [hi]
- 2
- 3
- 7 -> [gfg]
- ...
- 19

- 0 -> [(0, hello), (100, geeksforgeeks)]
- 1 -> [(1, hi)]
- ...
- 7 -> [(7, gfg)]
- ...
- 19



TC:

- Insert: $O(1)$
- Delete: $O(1)$ avg. / $O(n)$ worst-case
- Search: $O(1)$ avg. / $O(n)$ worst-case

Ordered - Maps

- $O(\log n)$
- $O(\log n)$
- $O(\log n)$

string key

"hello"

"abc"

"c b a d"

"a b c d"

$$[2 \times 3^7 + 1 \times 3^7 + 0 \times 3^7 + 3 \times 3^7] \dots$$

i: [0 ... n-1]

sum = 0
j: [i ... n-1]
sum += arr[j]
if (sum == 0)
return true

TC: $O(n^2)$

AS: $O(1)$

- 4, 2, -3, 1, 6

$$sum = 4 + 2 + (-3) + 1 + 6 = 10$$

- arr: [4, 2, -3, 1, 6]
- prefSum: [4, 6, 3, 4, 10]

$O(n \log n)$

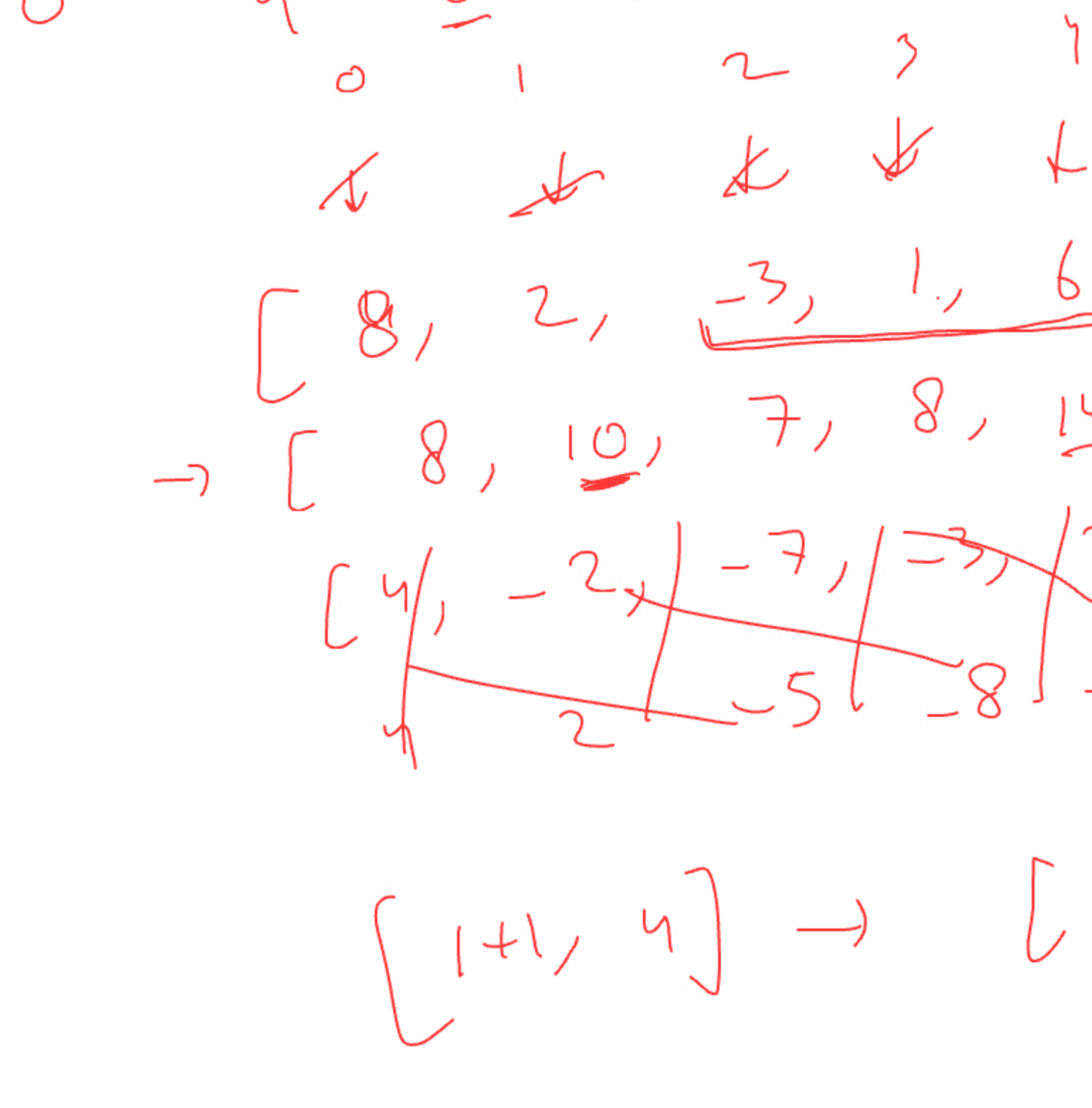
- 4, 2, -3, 1, 6

set
4, 6, 3

$$sum = 4 + 2 + (-3) + 1 + 6 = 10$$

TC: $O(n)$
AS: $O(n)$

- 4, -1, 3, 4, 6



$$sum = 8 + 2 + (-3) + 1 + 6 = 14$$

sum	idx
8	0
3	1
6	2
10	3
14	4

- [1+1, 4] -> [2, 4]

- [1, 0, 0, 1, 0, 1, 1]

- [1, -1, -1, 1, -1, 1, 1]
- [1, 0, -1, 0]

- (0, -1)
- (0, 3)
- (0, 5)
- (1, 6)
- (2, 3)
- (2, 5)
- (3, 4)
- (4, 5)

cnt = 1

- [1, -1, -1, 1, -1, 1, 1]

sum freq

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

sum =

$$neg = 1 + 2 + 1 + 3 + 1 = 8$$

TC: $O(n)$
AS: $O(n)$

geeksforgeeks

- 2 -> ge, ek, ks, sf, fo
- 3 -> eks
- 4 -> eksf
- 5 -> eksfo
- 6 -> eksfor
- 7 -> eksfor
- 8 -> eksfor

for i -> (0 -> n-1):
set s
for j -> (i -> n-1):

TC: $O(n^2)$
AS: $O(1)$

- 0 1 2 3 4 5 6 7 8 9 10 11
- g e e k s f o r g e e k s

isPresent

- g -> true
- e -> true
- k -> true
- s -> true
- f -> true
- o -> true
- r -> true

[right - left + 1]

TC: $O(n)$
AS: $O(1)$