

# Prefix Sum.

arr = { 5, 1, 8, 2, 4, 3, 2 }

preSum = { 5, 6, 14, 16, 20, 23, 25 }

$$\text{preSum}[i] = \text{arr}[i] + \text{preSum}[i-1];$$

① LeetCode Q.No. (1480) { Running Sum of 1D Array }

arr = { 1, 2, 3, 4 }

Ans → { 1, 3, 6, 10 }

# Need to Return prefix Sum.

② LeetCode Q.No. (303) { Range Sum Query Immutable }

nums = { -2, 0, 3, -5, 2, -1 }

Given → { 0, 2 }

Left index → 0, Right index → 2

Ans → { 1 }

Need to Return prefix Sum of this window.

{ 0, 5 } → Ans → { -3 }

{ 2, 5 } → Ans → { -1 }

1<sup>st</sup> Create Prefix Sum Array →

nums = { 5, 1, 8, 2, 4, 3, 2 }

pre = { 5, 6, 14, 16, 20, 23, 25 }

if (left == 0) → Ans → pre[right];

else → Ans → pre[right] - pre[left-1];

③ LeetCode Q.No. (724) { Find Pivot Index }

Ex ①

arr = { 1, 7, 3, 6, 5, 6 }

sum = 11

Pivot

sum = 11

Ex ②

{ 10, 99, 1, 2, 3, 4 }

sum = 10 pivot

sum = 10

Ex ③ arr = { 10, 1, 2, 3, -6 }

It is Pivot

sum = 0

Ex ④ arr = { 6, -3, -1, -2, 10 }

sum = 0

Pivot 0

$arr = \{ 1, 7, 3, 6, 5, 6 \}$   
 $pre = \{ 1, 8, 11, 17, 22, 28 \}$

$\rightarrow \text{leftSum} \Rightarrow pre[i-1]$        $\rightarrow \text{RightSum} = pre[n-1] - pre[i]$   
 if  $\text{leftSum} == \text{RightSum} \rightarrow \text{return } i$

$\Rightarrow \text{Code} \Rightarrow$ 

```

for (int i = 0 to i < n) {
    int leftSum = 0;
    if (i > 0) leftSum = pre[i-1];
    int RightSum = pre[n-1] - pre[i];
    if (leftSum == RightSum) return i;
}

```

T.C  $\Rightarrow O(n)$   
 S.C  $= O(n)$   
 $\hookrightarrow$  if you create new & prefix sum array  
 S.C  $= O(1)$   
 $\hookrightarrow$  If you make change in nums.

(4) LeetCode Q.No. (2540) Find the Score of All Prefixes of An Array.

$arr = \{ 7, 2, 10, 5, 3 \}$   
 $max \Rightarrow 7, 7, 10, 10, 10$   
 $ans[i] \Rightarrow arr[i] + max(0, i)$   
 $ans = \{ 14, 9, 20, 15, 13 \}$   
 Prefix Sum Ans  $\rightarrow \{ 14, 23, 43, 58, 71 \}$

$max = \text{Math.max}(max, arr[i])$   
 $\Rightarrow \text{Code} \Rightarrow$ 

```

max = 0;
for (int i = 0 to i < n) {
    max = Math.max(max, nums[i]);
    ans[i] = nums[i] + max;
    if (i > 0) {
        ans[i] += ans[i-1];
    }
}

```

(5) LeetCode Q.No. (238) Product of Array Except self. #Parse Interview Question  
# Without Using / \ Operation

Ex (1)  $arr = \{ 7, 2, 4, 3 \}$  Product = 168  
 Ans  $\rightarrow \{ 24, 84, 42, 56 \}$   
 $ans[i] = prod / arr[i]$   
 Brute force  $arr = \{ 7, 2, 4, 3 \}$   
 prod of 1 ~~prod of 1~~  $\rightarrow$  prod of this  $\rightarrow$  prod of this

Logic  
~~subProd =  $\{ 168, 24, 5, 42 \}$   
 $ans[i] = subProd / arr[i]$   
 $ans = \{ 7, 21, 42, 168 \}$~~  
 $pre[i] = pre[i-1] * arr[i-1];$   
 $suf[i] = suf[i+1] * arr[i+1];$

$pre = \{ 1, 7, 21, 42 \}$   
 $arr = \{ 7, 3, 2, 4 \}$   
 $suf = \{ 24, 8, 4, 1 \}$   
 $ans = \{ 24, 56, 84, 42 \}$   
 $ans[i] = pre[i] * suf[i];$



⇒ Code :- public int[] productExceptSelf(int[] nums) {

int n = nums.length;  
int pre = new int[n];

pre[0] = 1;

for (int i = 1 to i < n) {

pre[i] = ~~nums[i]~~ \* pre[i-1];

}

Best Method.

int suf = 1;

T.C ⇒  $O(n)$

for (int i = n-2 ; i ≥ 0 ; i--) {

S.C ⇒  $O(n)$

suf \*= ~~nums[i]~~;

pre[i] \*= suf;

}

return pre;

}

⑤ LeetCode Q.No. :- 2389

Longest Subsequences with limited sum

Ex :-

Given arr = { 4, 5, 2, 1, 2, 7 }

Queries = { 5, 10, 11 }

Sort, Prefix Sum, B.S.

Ans → { 3, 4, 4 }

1 ≤ 5

2 ≤ 5

1, 2 ≤ 5

2, 2 ≤ 5

1, 2, 2 ≤ 5 → Max Length ⇒ 3

4, 5, 2 ≤ 11

7, 4 ≤ 11

7, 2, 2 ≤ 11

4 ≤ 5

5, 2, 1, 2 ≤ 11 → Max Length ⇒ 4

5 ≤ 5

4, 1 ≤ 5

Logic :- arr = { 4, 5, 2, 1, 2, 7 }

↓ Sort

arr = { 1, 2, 2, 4, 5, 7 }

↓ Prefix Sum.

arr = { 1, 3, 5, 9, 14, 21 }

lo

mid

hi

Sort →  $n \log n$

Pre →  $n$

B.S →  $n \log n$

T.C ⇒  $O((n+n) \log n)$

if (arr[mid] > queries[i]) hi = mid - 1;

else {

ans[i] = max [ans[i], mid + 1];

lo = mid + 1;

Do this for every queries ele.

}

⑥ LeetCode Q.No. (1109)

Corporate Flight Bookings.

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Given arr = { {1, 4, 10}, {2, 3, 20}, {2, 5, 25} }  
n = 5

idx	0	1	2	3	4	
	1	2	3	4	5	{ idx+1 }
{1-4} ⇒ 10	10	10	10	10		
{2-3} ⇒ 20		20	20			
{2-5} ⇒ 25			25	25	25	25
Ans ⇒	10	55	55	35	25	

Brute force.

T.C ⇒  $O(n * n)$

\* Optimised using prefix sum.

idx	0	1	2	3	4	5	
	1	2	3	4	5		{ idx+1 }
{1-4} ⇒ 10	10					-10	
{2-3} ⇒ 20		20		-20			
{2-5} ⇒ 25			25				
Ans ⇒	10	45	0	-20	-10		
Prefix sum	10	55	55	35	25		

T.C ⇒  $O(m+n)$

⑦ LeetCode Q.No. (560)

Subarray Sum Equals k.

→ Famous.

arr = { 1, 2, 4, 3, 7, 8, -1 } k = 7

{1, 2, 4} ⇒ 7.  
 {4, 3} ⇒ 7.  
 {7} ⇒ 7.  
 {8, -1} ⇒ 7.

Ans (4)

# Brute Force.

Generating All Sub Arrays

T.C ⇒  $O(n^2)$

E.S ⇒  $O(1)$

\* Optimised Solution :- Prefix Sum & Hash Map.

→ map <ele, freq>

arr = { 1, 2, 4, 3, -3, 0, 7, 8, -1 } k = 7

pre = { 1, 3, 7, 10, 7, 7, 14, 22, 21 }

(14, 1)	(22, 1)
(7, 3)	(21, 1)
(3, 1)	
(1, 1)	

int rem = pre[i] - k;

T.C ⇒  $O(n)$

S.C ⇒  $O(n)$

Count



8 LeetCode Q.No. (2483) } Minimum Penalty for a Shop.

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customers = "Y<sup>1</sup>Y<sup>2</sup>N<sup>3</sup>Y<sup>4</sup>"

- 0 hours  $\rightarrow 0 + 3 = 3$
- 1 hours  $\rightarrow 0 + 2 = 2$
- 2 hours  $\rightarrow 0 + 1 = 1$
- 3 hours  $\rightarrow 1 + 1 = 2$
- 4 hours  $\rightarrow 1 + 0 = 1$

pre N =

0	0	0	1	1	
3	2	1	1	0	

suf Y =

penalty = { 3, 2, 1, 2, 1 }

Ans. = 1

min penalty = 1

return its first occurrence idx.