

Arrays - Prefix Sum

Cumulative Array

lets wait for 5 mins for people to
join in

8:37 P

8:38 P

$A[N]$

-3	6	2	4	5	1	2	8	-9	3
0	1	2	3	4	5	6	7	8	
wave									
wave									
wave									

Q queries

$[s, e]$

$\text{sum}(s, e) \equiv \text{Sum of all elements from } \text{index } s \text{ to index } e$

$\downarrow k'$

$\theta = 4$

$O(1)$

(A) $s = 1$ $e = 3$

$\star 12$

$O(n)$

(B) $s = 2$ $e = 7$

$\star 12$

(C) $s = 4$ $e = 8$

$\star 9$

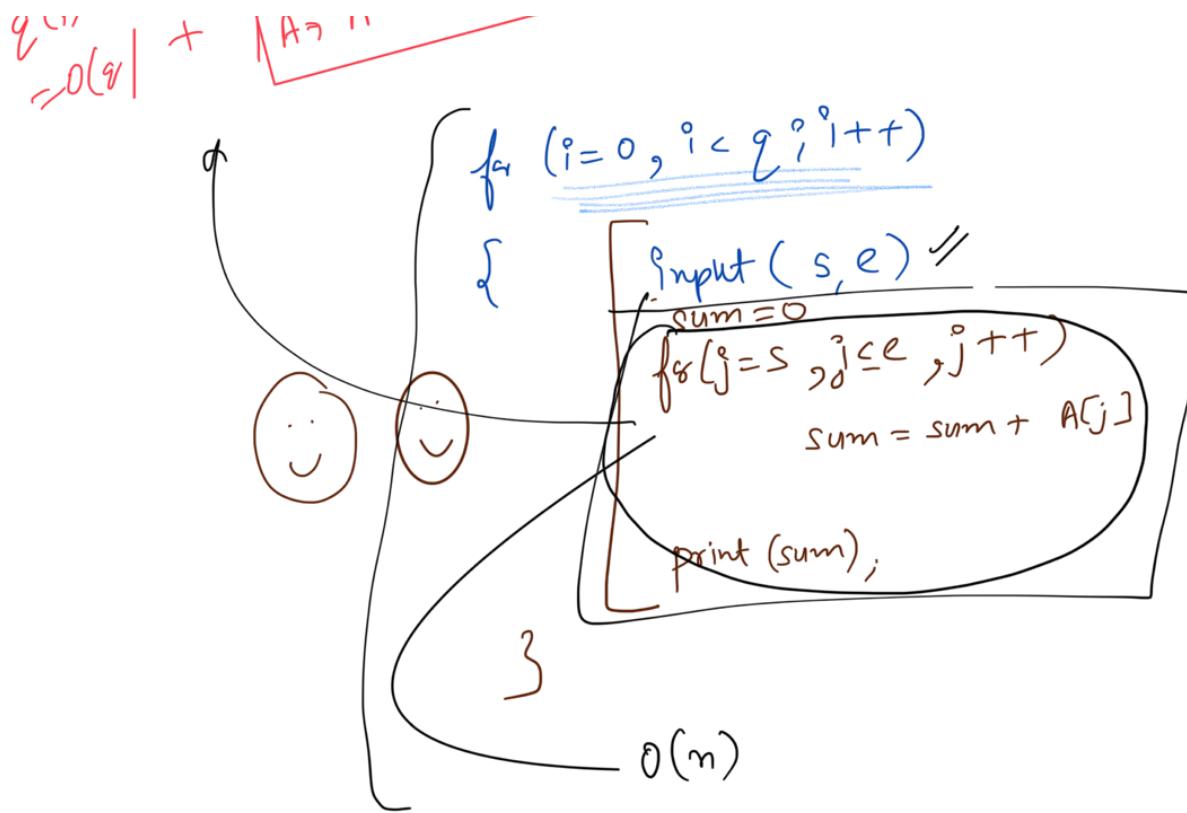
(D) $s = 0$ $e = 2$

$\star 5$

T.C = $O(\mathcal{E}^N)$

~ 1.7

$\downarrow A'$



$T.C = \cancel{O(qN)}$

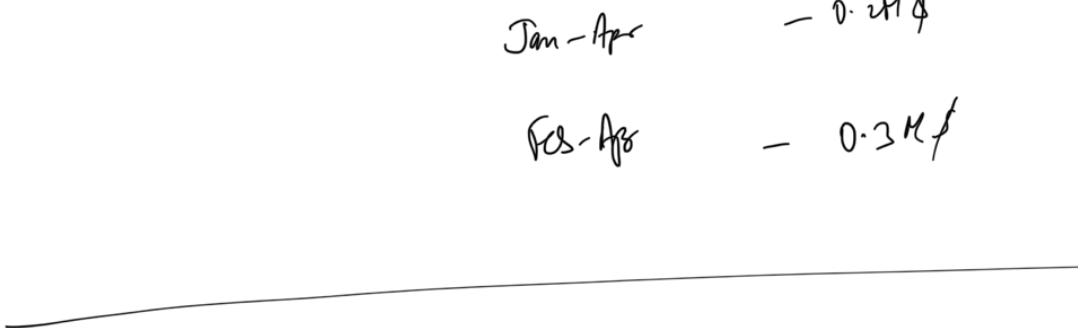
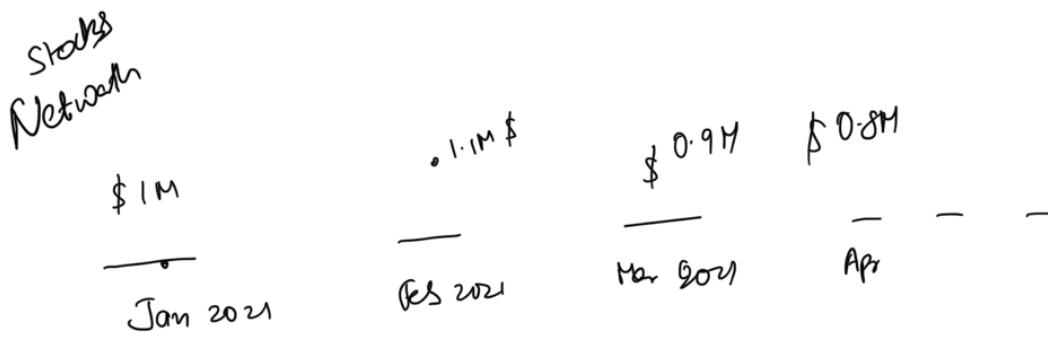
This diagram shows the cancellation of the term $O(qN)$. A blue arrow points from the term $O(qN)$ to a horizontal line with three parallel lines above it. A blue circle with a wavy line inside is positioned to the right of the cancellation line. A blue arrow points downwards from the cancellation area.

$\vdash N$

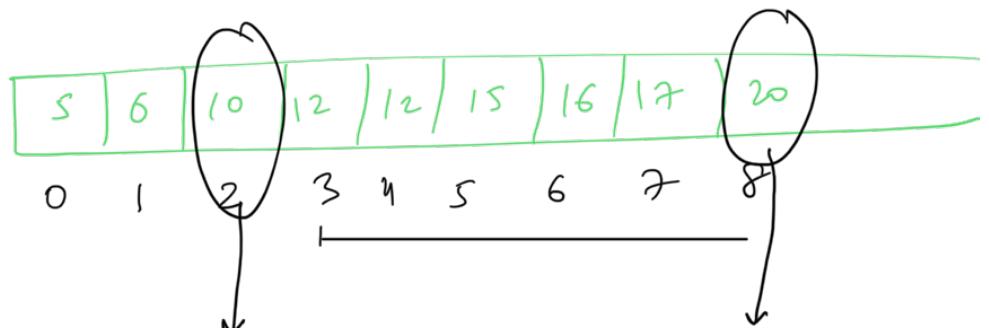
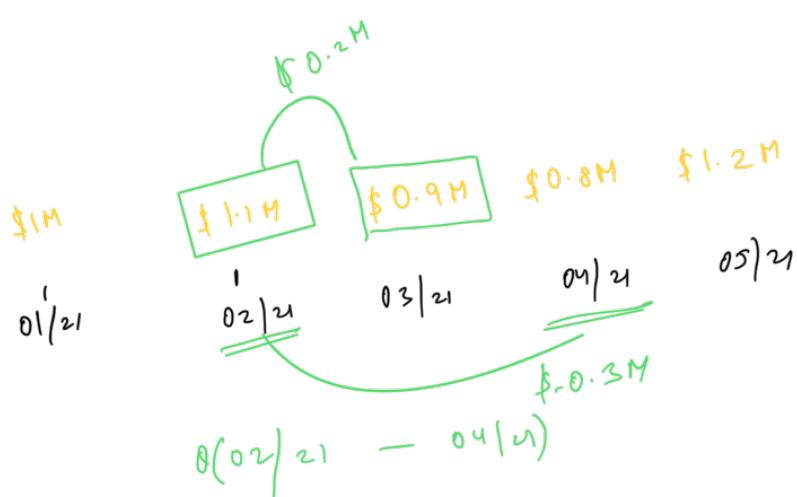
$O(n)$

$O(\varepsilon n)$

This diagram shows the simplification of time complexity terms. At the top, there is a dashed horizontal line with several short dashes. Below it, a solid horizontal line starts at the same point and extends further to the right. A blue arrow points from the label $\vdash N$ to the start of the solid line. To the right of the solid line, a curly brace groups the terms $O(n)$ and $O(\varepsilon n)$. A horizontal line with a single dash at its end is shown below the brace.



Dashboard \equiv Robinhood / Zerodha



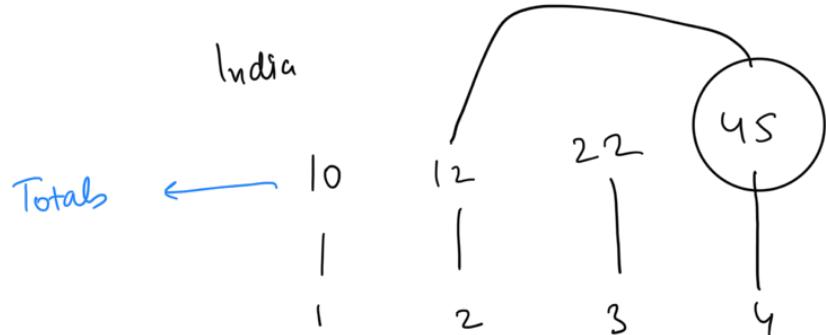
10^M

20^M

$$\text{Money} (3 - 8) = 20^M - 10^M$$

$$\text{Money} (M_1 - M_2)$$

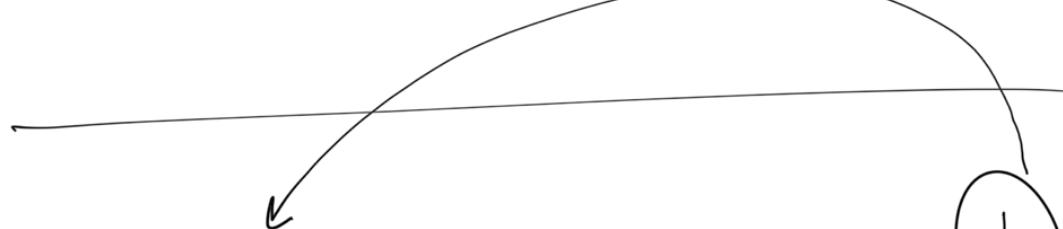
$$= M_2 (M_2) - M_1 (M_1 - 1)$$



$$1 - 4 \Rightarrow 45$$

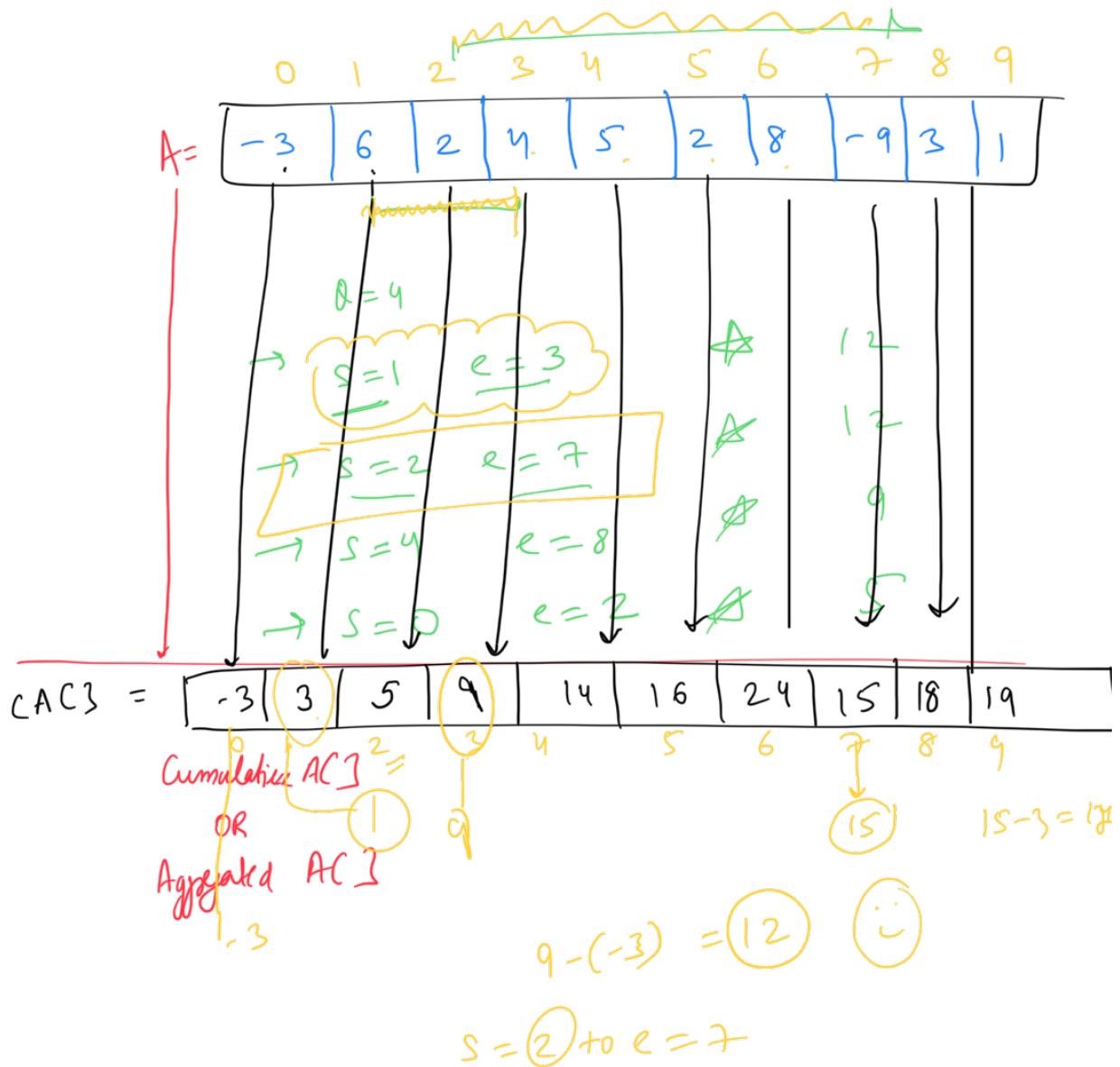
$$2 - 4 \Rightarrow 35$$

$$3 - 4 \Rightarrow 33$$



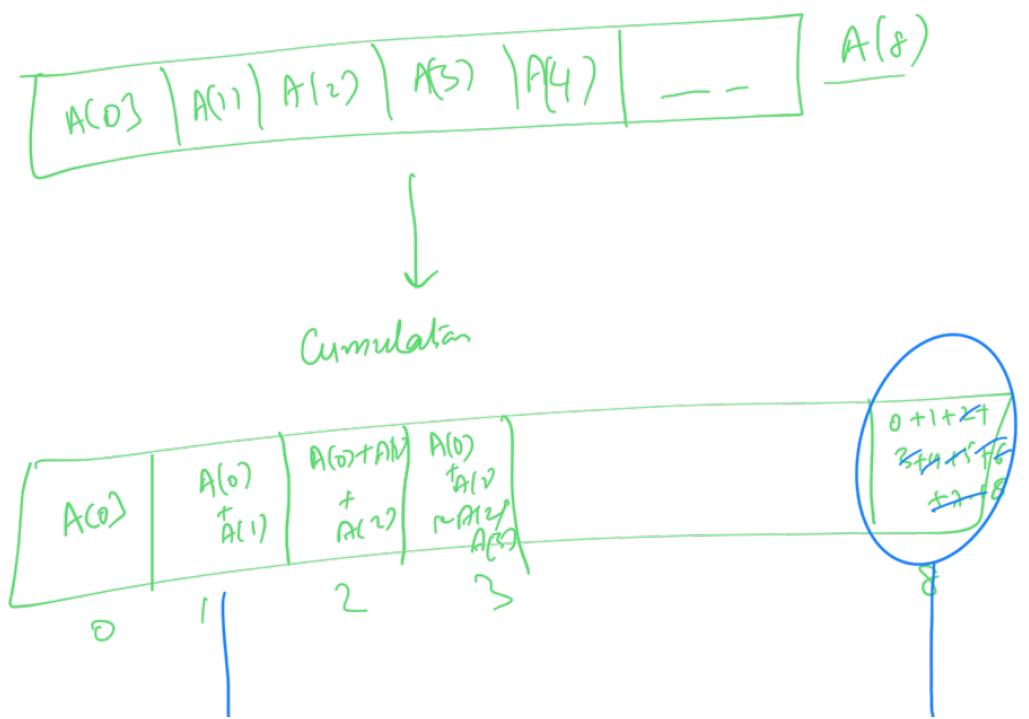
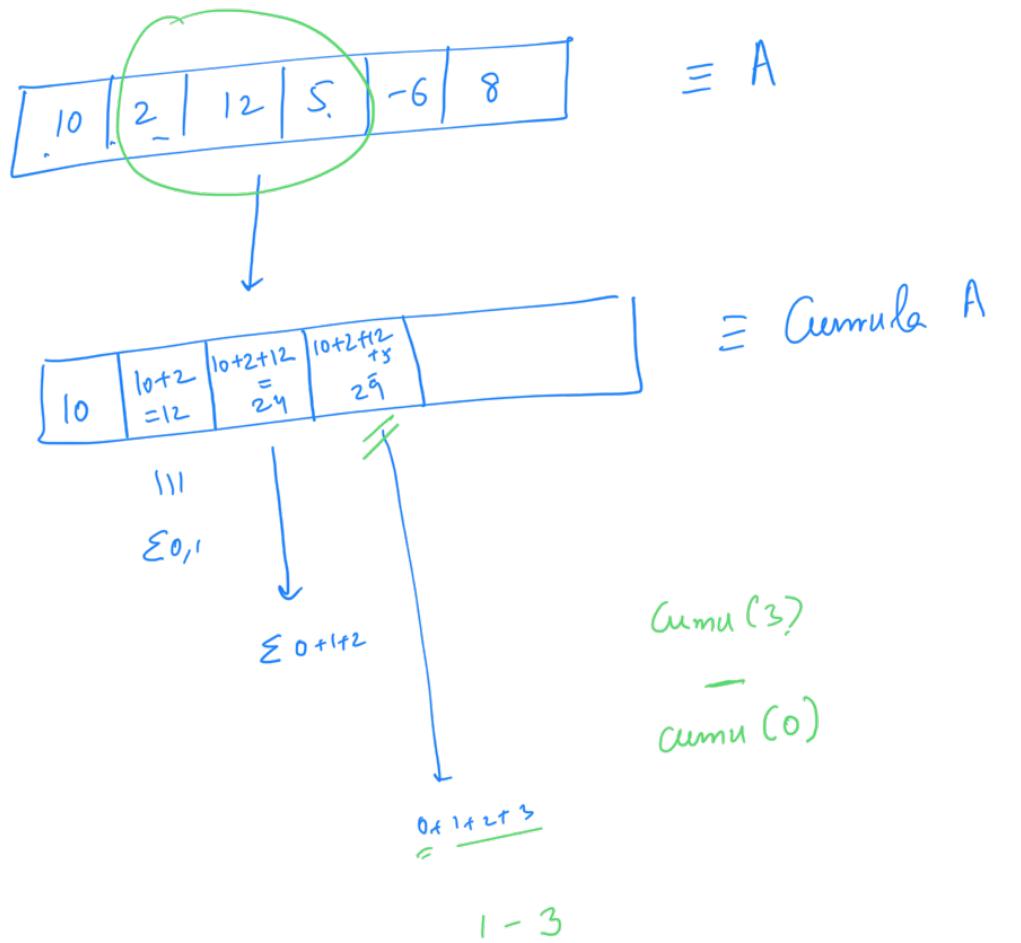
1 2 3 10

1
100



Money (2nd - 7th)

$$\text{Sum}(\text{Gain}(2) - 7) = \frac{\text{Sum}(0 - 7)}{\text{Sum}(0 - 1)}$$



$$\begin{array}{r}
 \text{2 to 8} \\
 A(2) + A(3) - - \quad \quad \quad A(8) \\
 \hline
 \text{---} \\
 \text{cumu}[8]
 \end{array}$$

$$\sum_{i=1}^n f(x_i) = \text{cumul}(8) - \text{cumul}(1)$$



$$1M = 10^6$$

$$A = \begin{bmatrix} 1 & 1 & 1 & 1 & x_1 & \dots & x_n & -1 & -1 & 1 & 1 & 1 \end{bmatrix}$$

Sum(727) to 157005)

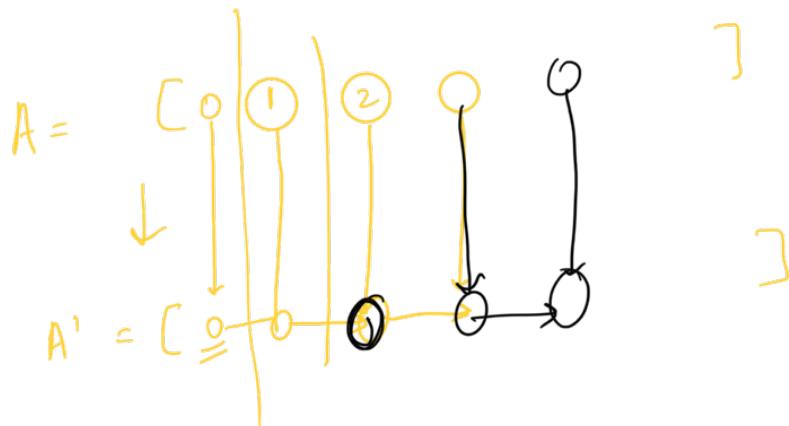
Ammu [157005]

Aug 26

0 - 15000

Amu [15000]





$A[N]$

`buildCumulativeA (A[N])`

$\left\{ \begin{array}{l} \cancel{A'[0]} = A[0] \quad // \text{cum}(0) = 0 \\ \text{for } (\underline{i=1} \text{ to } \underline{i < N}) \\ \left\{ \begin{array}{l} A'[i] = A'[i-1] + A[i] \\ \text{sum till } i-1 + \text{new val} \end{array} \right. \end{array} \right.$

T.C = $O(N)$ ←

T.C for constructing $\text{cumulative } A, A'$ from A, A

$= O(N)$

For every query
just spend $\underline{O(1)}$ time
 $\text{Sum}(i \text{ to } j) \leftarrow \text{cum}[j] - \text{cum}[i-1]$

$q \text{ queries} = O(q)$

Total T.C = $O(n) + O(q)$

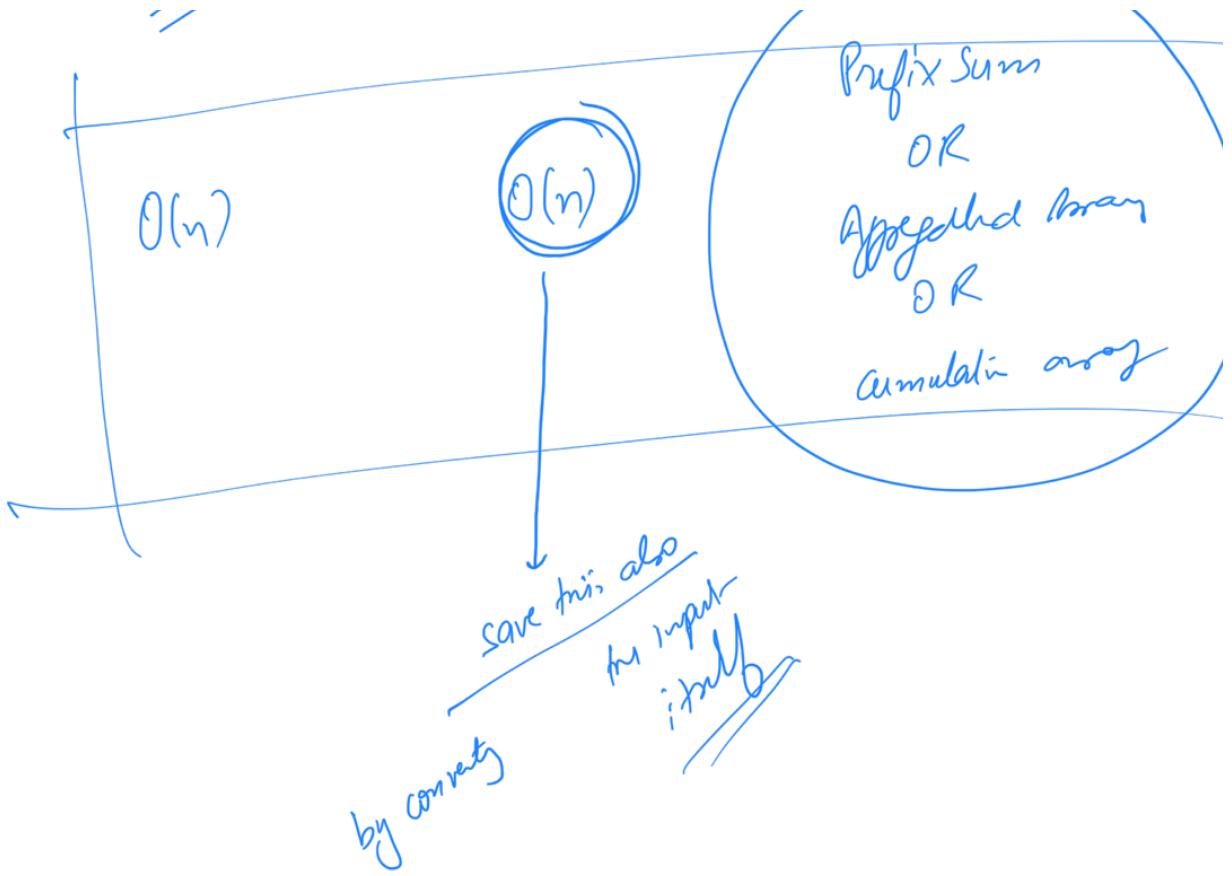


Input S.C Auxillary

$\underline{\underline{O(n)}}$

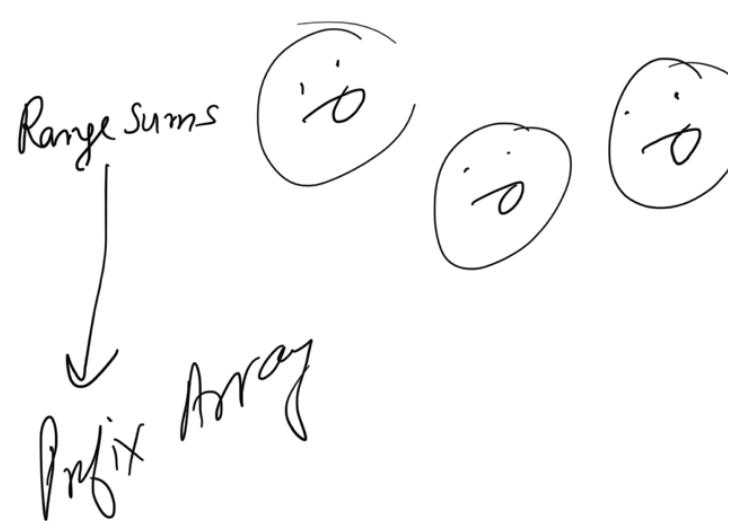
$\underline{\underline{O(1)}}$

Original Approach



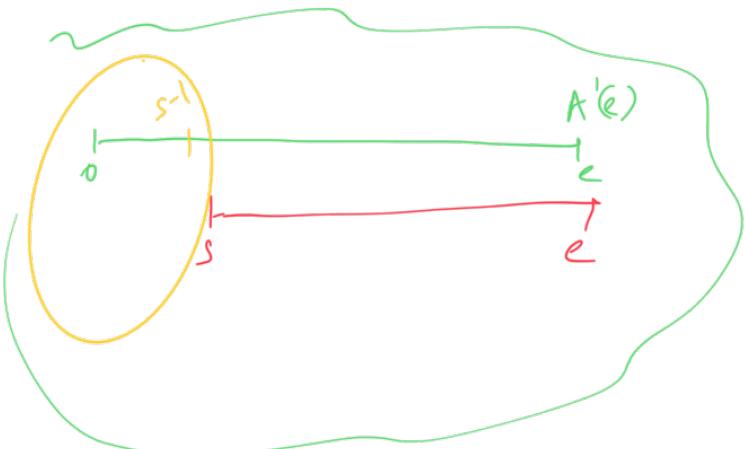
$$T.C = \frac{O(q)}{O(\max(q, n))} + O(N)$$

$$= T.C =$$



buildCummArray ($A[1:N]$)
 {
 $A'[0] = A[0]$
 $\text{for } i=1 \text{ to } N$
 $A'[i] = A'[i-1] + A[i]$
 }

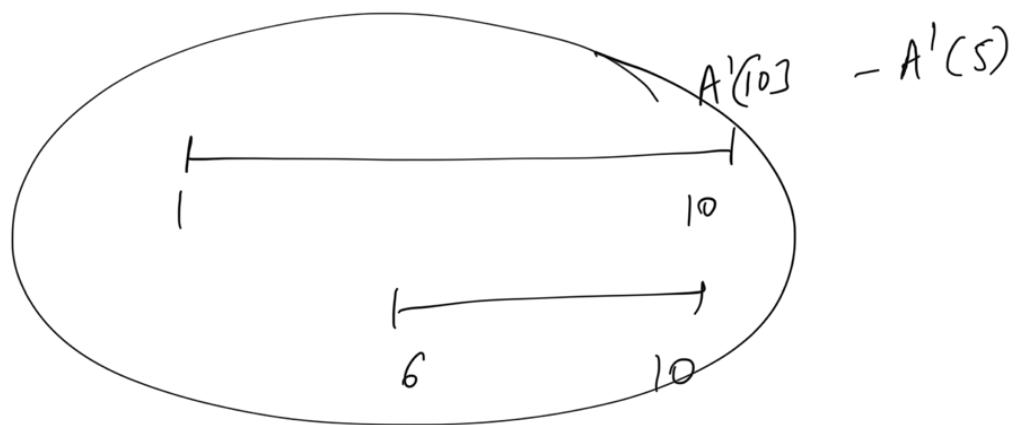
answerSumQuery (s, e)
 {
 $b[1] \leftarrow$
 $\text{if } (s == 0)$
 $\quad \text{return } A'[e]$
 $\text{return } A'[e] - A'[s-1]$



$\overline{1} \quad \overline{2} \quad \overline{3} \quad \overline{4} \quad \overline{5} \quad \overline{6} \quad \overline{7}$

6-10

(
—
10)



Amazon

Mirsoft

Apple

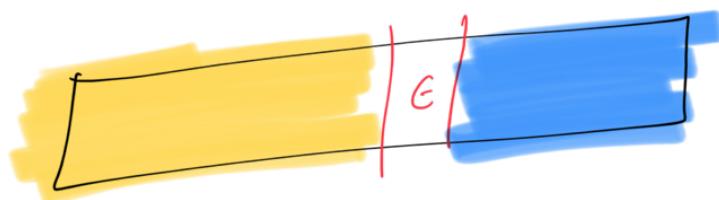
Mediamnet / Direct

(@)

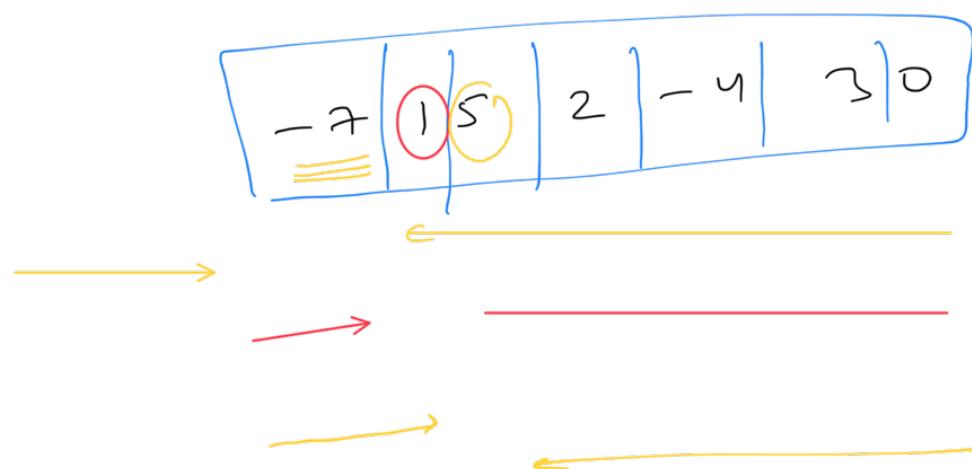
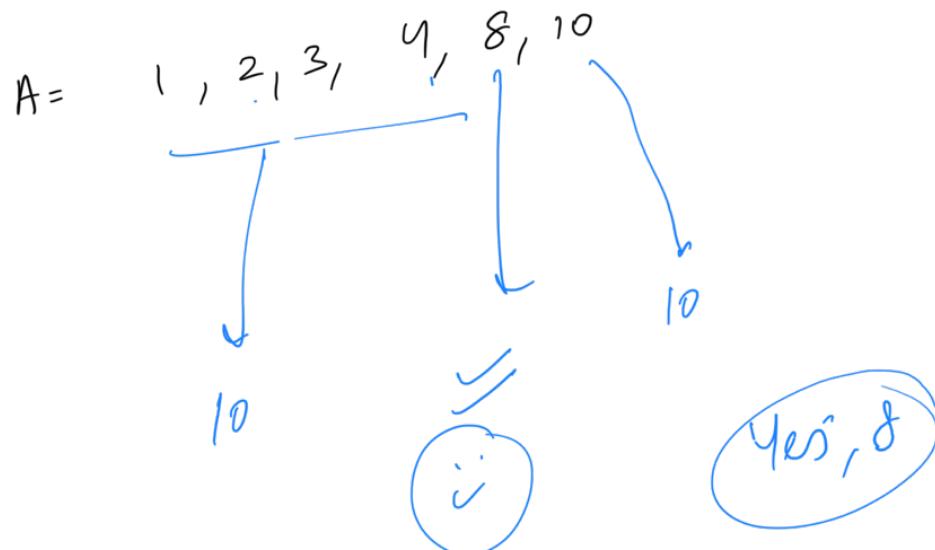
Array A

If there exists an equilibrium point
in the array

Equilibrium point



$$\text{Sum}(L) == \text{sum}(R)$$

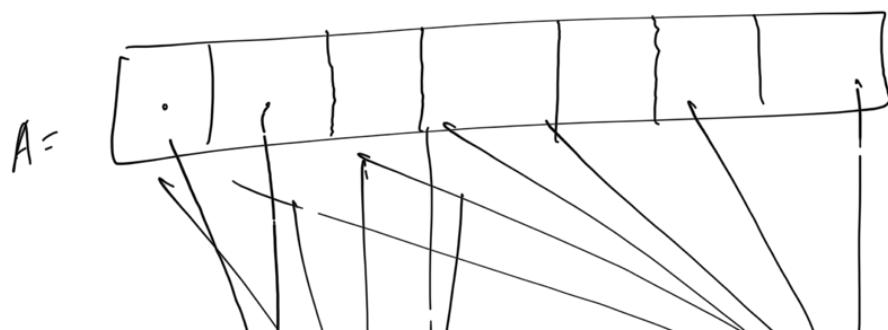
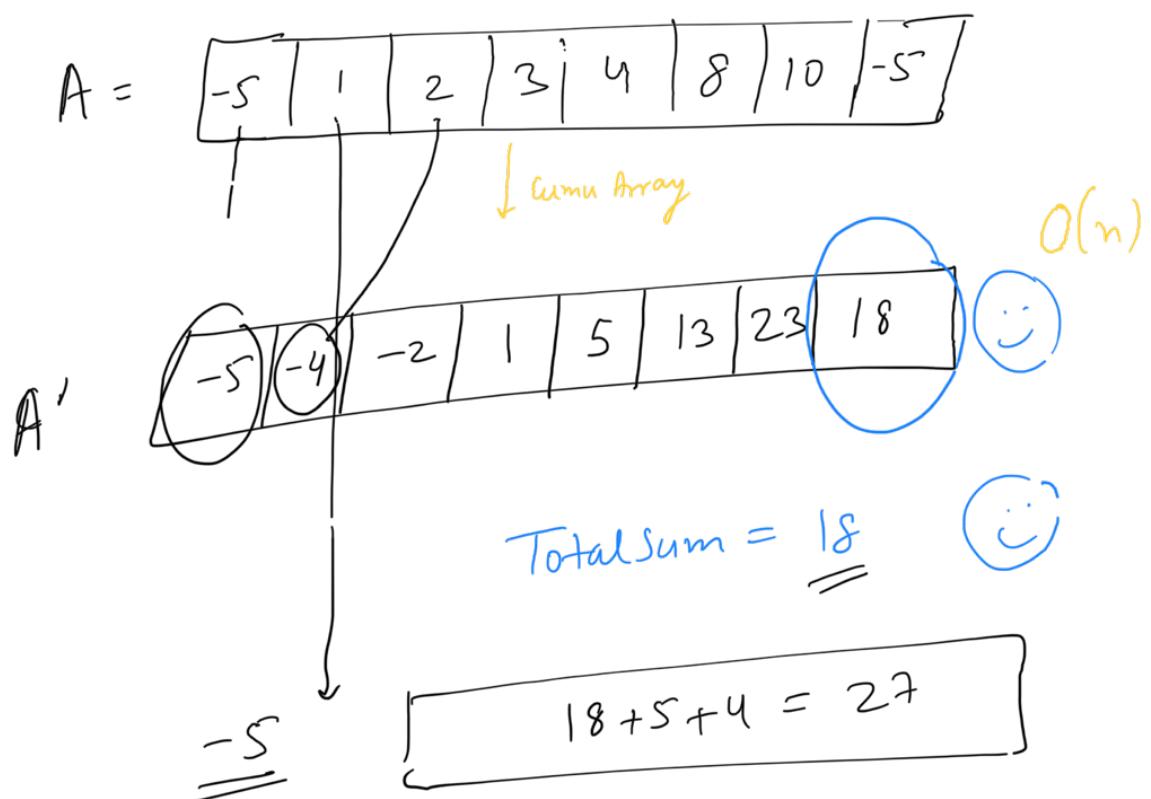


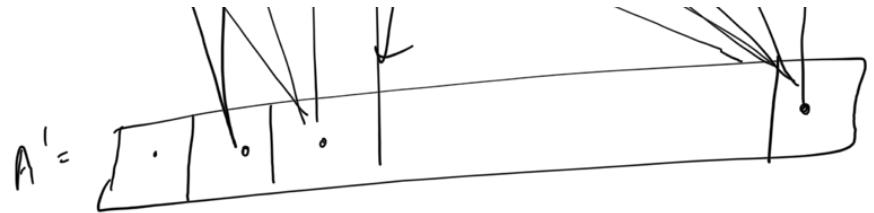
Range sum \equiv Prefixsum

 Three smiley faces are shown in a row, each enclosed in a small yellow circle.

$\text{sum} = 10$

 A wavy blue line points to the number 10. To the right, there is a double underline over the number 10.



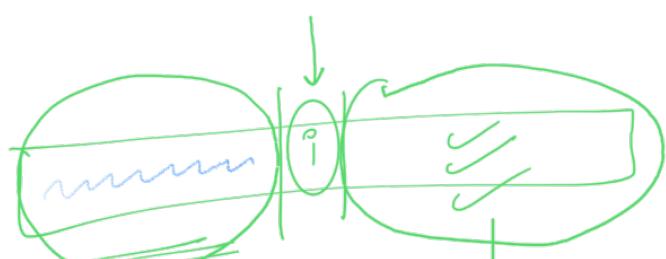
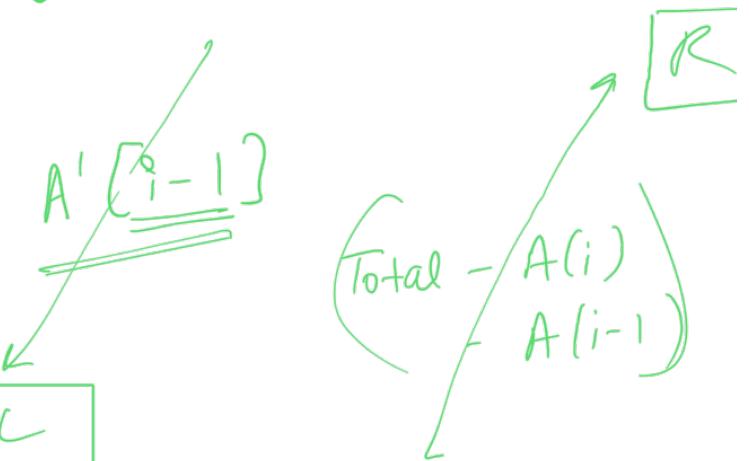


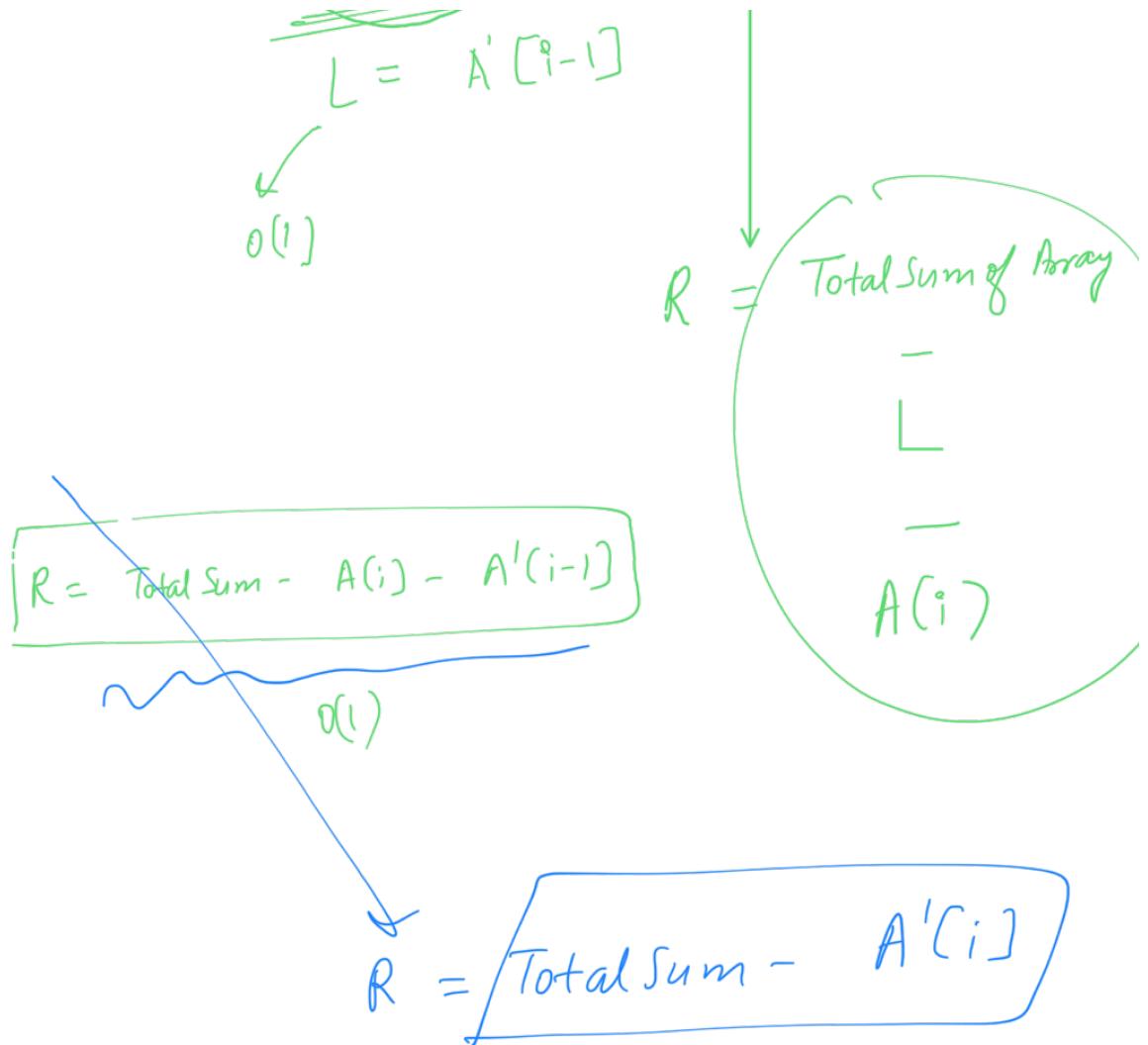
$$\textcircled{1} \quad A' = \boxed{S | \textcircled{2} | 5 | -2 | 6 | 4}$$

$$A' = \boxed{S | 7 | 12 | 10 | 16 | 20}$$

Total Sum = 20

$$0 \quad \boxed{\text{Total Sum} - L - \text{Myself}} = 20 - 0 - 5 \\ = 15$$





$\Theta(N) \leftarrow$ for ($i = 0$ to $N-1$)
 // check if ' i ' is an equilibrium pt

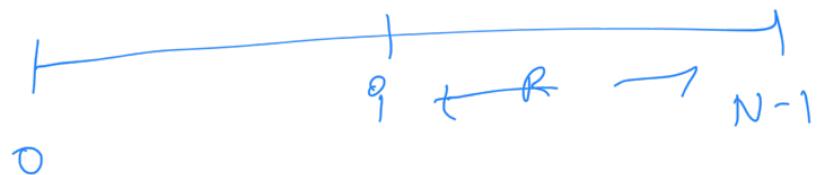
$\Theta(1)$

$\int \frac{\underline{\text{sum } L}}{\underline{\text{sum } R}} = A'[i-1]$
 $\int \frac{\underline{\text{sum } R}}{\underline{\text{sum } L}} = \frac{\text{Total Sum} - A[i]}{A'[i]}$

if ($\text{sum}R = \dots$ large value,
return TKUE

$$\begin{aligned} \text{sum}R &= T.S - A'[i] \\ \text{OR} \\ T.S - \text{Myval} - A'[i-1] &+ O(N) \\ &\quad \downarrow \\ &\quad \text{A}' \text{ creation} \\ &= O(N) \end{aligned}$$

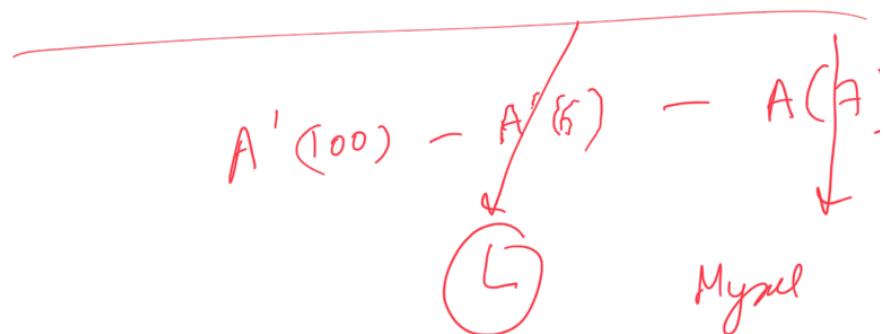
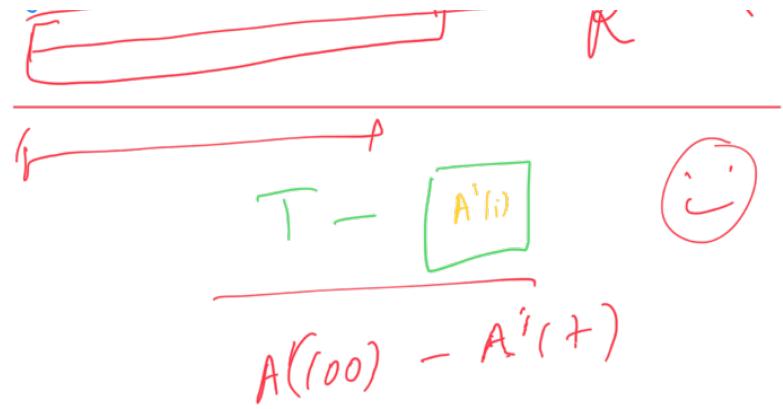
anyone is equal part



$$T.S = \sum_{i=0}^{N-1}$$

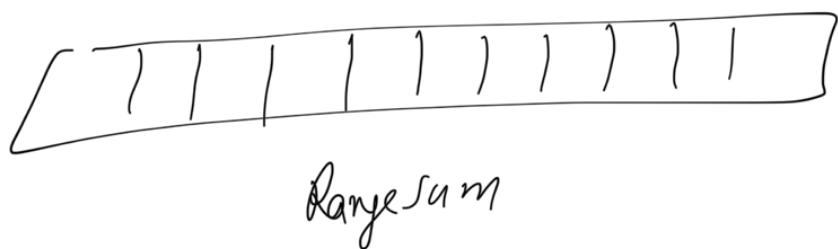
$$R = \sum_{j=1}^{N-1}$$

$$T = \sum_{i=0}^{N-1} \text{min}_{j=1}^i R_j$$



$T.S - L - \text{Myself}$

Mental Map = Summary



num[Σ]	Σ	Σ
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