



# Prefix Sum

(Introduction to Problem Solving I)

Rough Work

arr  $\rightarrow$

4	3	2	7	6	-2
0	1	2	3	4	5

remove index 0  $\rightarrow$

3	2	7	6	-2
0	1	2	3	4

$\rightarrow \sum_{\text{odd}} = 8$   
 $\rightarrow \sum_{\text{even}} = 8$



remove index 1  $\rightarrow$

4	2	7	6	-2
0	1	2	3	4

$\rightarrow \sum_{\text{odd}} = 8$   
 $\rightarrow \sum_{\text{even}} = 9$



remove index 2  $\rightarrow$

4	3	7	6	-2
0	1	2	3	4

$\rightarrow \sum_{\text{odd}} = 9$   
 $\rightarrow \sum_{\text{even}} = 9$



⋮

and so on

A =

2	3	2	4	0	-1	2	-2	10	8
0	1	2	3	4	5	6	7	8	9

pOdd<sub>A</sub> =

0	3	3	7	7	6	6	4	4	12
0	1	2	3	4	5	6	7	8	9

pEven<sub>A</sub> =

2	2	3	3	3	3	5	5	15	15
0	1	2	3	4	5	6	7	8	9

on removing index 3  $A \rightarrow A'$

$$A' = \begin{array}{|c|c|c|c|c|c|c|c|c|} \hline 2 & 3 & 2 & 0 & -1 & 2 & -2 & 10 & 8 \\ \hline 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ \hline \end{array}$$

$S_{\text{odd}}^{A'} = 15$   
 $S_{\text{even}}^{A'} = 8$

$$\begin{aligned} S_{\text{odd}}^{A'} &= S_o[0-2]_A + S_e[4-9]_A \\ &= p_{\text{odd}}^A[2] + [p_{\text{even}}^A[4] - p_{\text{even}}^A[3]] \\ &= 3 + [15 - 3] = 3 + 12 = 15 \end{aligned}$$

$$\begin{aligned} S_{\text{even}}^{A'} &= S_e[0-2]_A + S_o[4-9]_A \\ &= p_{\text{even}}^A[2] + p_{\text{odd}}^A[9] - p_{\text{odd}}^A[3] \\ &= 3 + 12 - 7 = 8 \end{aligned}$$

$\Rightarrow$  for  $k^{\text{th}}$  index, where  $|A| = N$  &  $k > 0$

$$S_{\text{even}}^{A'} = p_{\text{sum}}^{\text{even}}[k-1] + p_{\text{sum}}^{\text{odd}}[N-1] + p_{\text{sum}}^{\text{odd}}[k]$$

but what for  $k=0$

$$\begin{array}{|c|c|c|c|c|c|c|c|c|} \hline 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ \hline 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ \hline \end{array}$$

let's remove 0<sup>th</sup> index

$A' =$

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

$$S_0 = 3 + 5 + 7 + 9 \rightarrow \text{Seven in A except } A[0]$$

$$S_e = 2 + 4 + 6 + 8 \rightarrow S_{\text{odd in A}}$$

which translates to the equation

$$S'_{\text{even}} == S'_{\text{odd}} \text{ for } i=0?$$

$$\Rightarrow \text{if } (pSumO[N-1] == pSumE[N-1] - A[0])$$