

Ques Given an array of size n ,
and Q queries of the format
 s and e .

Return sum of elements from index
 s to e .

0 1 2 3 4 5 6 7 8 9
A: -3 6 2 4 5 2 8 -9 3 1

Q: 4

s	e	
1	3	12
2	7	12
4	8	9
0	2	5

$s = 4, e = 8.$

Basic idea

```
for (j = 1; j <= q; j++) {
```

Sum = 0

```
for (i = s; i <= e; i++) {
```

Sum = Sum + arr[i]

}

print(Sum)

}

}

T.C \rightarrow

$q * (e - s + 1)$

\downarrow

$O(qn)$

S.C $\rightarrow O(1)$

Given with total score after every
Over of last 10 over:

41	42	43	44	45	46	47	48	49	50
288	312	330	349	360	383	394	406	436	439

↓
Cumulative
data.

Runs scored in last 5 over:-

[46-50]

$$\text{Runs}[50] - \text{Runs}[45] = 439 - 360$$

$$\Rightarrow 79$$

Last Over 50th over = 3 runs

$$\begin{aligned}\text{Runs in } 49^{\text{th}} \text{ over} &= R(49) - R(48) \\ &= 30\end{aligned}$$

Runs in 42nd to 45th over,

$$360 - 288 \Rightarrow 72$$

Prefix Sum \rightarrow Sum of all elements
from 0 to ith index.

	0	1	2	3	4	5	6	7	8	9
A:	-3	6	2	4	5	2	8	-9	3	1
pf:	-3	3	5	9	14	16	24	15	18	19

pf contains sum of elements from 0 to i.

$$pf[4] = A[0] + A[1] + A[2] + A[3] + A[4]$$

$$pf[5] = A[0] + A[1] + A[2] + A[3] + A[4] + A[5]$$

$$pf[5] = pf[4] + A[5]$$

$$pf[i] = pf[i-1] + A[i] \rightarrow i^{th} \text{ element}$$

sum of (0-i) element

sum of (0 - (i-1)) element

if $i = 0$.

$$\rightarrow pf[0] = pf[-1] + A[0]$$

```
if i = 0,
```

```
    pf[i] = A[i]
```

```
else;
```

```
    pf[i] = pf[i-1] + A[i]
```

→ Imp.

PseudoCode for Prefix Array.

```
int pf[N];
```

```
for (i = 0, i < n, i++) {
```

```
    if (i == 0) {
```

```
        pf[i] = A[i]
```

```
    } else {
```

```
        pf[i] = pf[i-1] + A[i]
```

```
    }
```

```
}
```

T.C → $O(N)$

S.C → $O(1)$

	0	1	2	3	4	5	6	7	8	9
A:	-3	6	2	4	5	2	8	-9	3	1
pf:	-3	3	5	9	14	16	24	15	18	19

s	e	
1	3	$pf[3] - pf[0] = 12$
2	7	$pf[7] - pf[1] = 15 - 3 = 12$
4	8	$pf[8] - pf[3] = 18 - 9 = 9$
0	2	$pf[2] = 5$

s e → if (s == 0)
 sum = pf[e],

else :-
 sum = pf[e] - pf[s-1]

```

for (j=1; j<=9; j++) {
    if (j != 0)
        sum = pf[e] - pf[s-1]
    else
        sum = pf[e],
}
print (sum)

```

T.C $\rightarrow O(N+1)$

S.C $\rightarrow O(1)$

Ques) Given an array of size N ,
Find Equilibrium index.
 \downarrow

index is called eq. i.s

Sum of all elements to its left = Sum of all elements to its right.



e.g.)

0	1	2	3	4	5
1	2	3	4	8	10

Ans \Rightarrow 4

e.g.2)

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

for any random index i .

$$\text{Sum } 0 \text{ to } (i-1) == \text{Sum } (i+1 \text{ to } N-1)$$

↓

$$PF[i-1] == PF[N-1] - PF[i]$$

// create a PF first

for (i=0, i<n, i++) {

int sumleft = PF[i-1]

int sumright = PF[N-1] - PF[i]

if (sumleft == sumright) {

| print(i)

}

}

T.C → O(N)

S.C → O(N)

10:28 - 10:40 → Sum
Time

(ques) Given an array of size n ,
 asked q queries:-
 each query can be of 2 type.
 if type 1, \rightarrow Sum of all even
 indices b/w.
 if type 2 \rightarrow Sum of all odd
 indices b/w.

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

$$P_{\text{even}}[6] - P_{\text{even}}[2]$$

$$8 - 3$$

8 e type
 3 6 1 5
 1 5 2 10

arr \Rightarrow 0 1 2 3 4 5 6 7
 2 3 1 -1 0 8 5 4

P_{even} : 2 2 3 3 3 3 8 8

P_{odd} : 0 3 3 2 2 10 10 14

	0	1	2	3	4	5	6
arr \rightarrow	4	1	0	-2	3	2	5
pf even \rightarrow	4	4	4	4	7	7	12

\rightarrow 2 to 6 \leftarrow Sum of even idx.

pf even [6] - pf even [1]

\Rightarrow 12 - 4 = 8.

Ques) Given an array of size n ,
count no. of special index.

\swarrow
if we delete that idx.

Sum of odd index = Sum of
even idx

\rightarrow Ans = 2

idx:-	0	1	2	3	4	5	S odd	S even
	4	3	2	7	6	-2		
<u>i=0</u>	3	2	7	6	-2		8	8

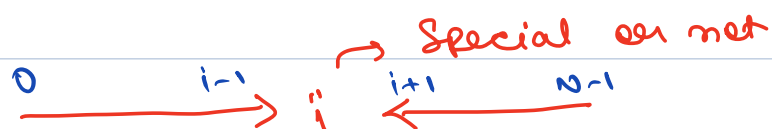
i=1 4 2 7 6 -2 8 9

i=2 4 3 7 6 -2 9 9

i=3 4 3 2 6 -2 9 4

i=4 4 3 2 7 -2 10 4

i=5 4 3 2 7 6 10 12



Before deletion :-

x :- $\text{pf_odd}[i-1] \rightarrow$ Sum of all odd elements to the left of i .

y :- $\text{pf_even}[i-1] \rightarrow$ Sum of all even elements to the left of i .

z :- $\text{pf_odd}[n-1] - \text{pf_odd}[i]$, Sum of all odd elements to the right of i .

w :- $\text{pf_even}[n-1] - \text{pf_even}[i]$, Sum of all even elements to the right of i .

to the right
of it

After deletion :-

Sum of all odd elements :-

$$x + w$$

Sum of all even elements :-

$$y + z$$

it's index ,

$$(x + w == y + z)$$

C++

// Quick pseudocode :-

// create p_{even} and p_{odd} ,

```
int c = 0;
```

```
for (i = 0; i < n; i++) {
```

```
    // i is special index or not.
```

```
    // sum of even After delete i
```

```
    int sumeven = pfeven[i-1] - pfeven[i]
```

```
    if (i != 0) {
```

```
        sumeven += pfeven[i-1]
```

```
    int sumodd = pfeven[i-1] +
```

```
        pfeven[i-1] -
```

```
        pfeven[i].
```

Do the same

```
    if (sumeven == sumodd) {
```

```
        c++;
```

```
    }
```

```
}
```

```
print(c);
```

T.C $\rightarrow O(n)$

S.C $\rightarrow O(1)$