



Problem with given diff.

$$\text{arr}[7] = \{5, 10, 3, 2, 50, 80\} \quad b = 78$$

pair (3, 80)

$$\begin{aligned} 3 - 80 &= -77 \\ 80 - 3 &= 77 \end{aligned}$$

pair (2, 80)

$$\begin{aligned} 2 - 80 &= -78 \\ 80 - 2 &= \underline{\underline{78}} \end{aligned}$$

Brute force

arr[] = {5, 10, 3, 2, 50, 80}

B = 78

TC: $O(N^2)$
SC: $O(1)$

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

```
{
```

```
    for (int j = i + 1; j < n; j++)
```

```
    {
```

```
        if (arr[i] - arr[j] == B || arr[j] - arr[i] == B)
```

```
        {
```

```
            return true;
```

```
        }
```

```
    }
```

```
}
```

```
return false;
```

arr[]: { 5, 10, 3, 2, 50, 80 }

B = 45

sort

arr[]: { 2, 3, 5, 50, 80 }

↑ ↑
si ei

X can't be applied

```
while (si < ei)
{
    if (arr[ei] - arr[si] == B)
        return true;
    else if (arr[ei] - arr[si] > B)
```

arr[]: { 5, 10, 3, 2, 50, 80 }

$$B = 78$$

5, 10, 3, 2,
80

HashSet

pair $\Rightarrow (x, y)$

$$\begin{aligned} x - y &= B \leadsto y = x - B \\ \text{or} \quad y - x &= B \leadsto y = x + B \end{aligned}$$

$$\begin{aligned} x &= 5 \\ y &= -73 \\ y &= 83 \end{aligned}$$

$$\begin{aligned} x &= 10 \\ y &= -68 \\ y &= 88 \end{aligned}$$

$$\begin{aligned} x &= 3 \\ y &= -75 \\ y &= 81 \end{aligned}$$

$$\begin{aligned} x &= 2 \\ y &= -76 \\ y &= 80 \end{aligned}$$

$$\begin{aligned} x &= 50 \\ y &= -28 \\ y &= 128 \end{aligned}$$

$$\begin{aligned} x &= 80 \\ y &= 2 \\ y &= 158 \end{aligned}$$

pair(80, 2)

```

public int givenDifference(int []A, int n, int B) {
    // write your code here

    // suppose pair (x, y), x - y = B || y - x = B
    // if you have x
    // then y = x - B || y = x + B

    HashSet<Integer> set = new HashSet<>();
    for (int i = 0; i < n; i++) {
        int x = A[i];

        {
            int y1 = x - B;
            int y2 = x + B;

            if (set.contains(y1) || set.contains(y2)) {
                return 1;
            }

            set.add(x);
        }
    }

    return 0;
}

```

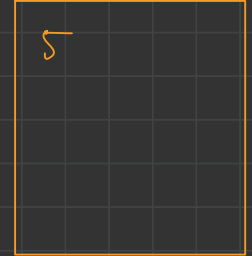
$TC: O(N)$
 $SC: O(N)$

x x
 \downarrow \downarrow
 $arr[] = \{5, 10, 3, 2, 50, 80\}$ $B = 78$
 \uparrow

pair(x, y)

$$x - y = B \Rightarrow y = x - B$$

$$y - x = B \Rightarrow y = x + B$$



set
 $\hookrightarrow TC: O(1)$

$x = 5$
 $y = -73$ ✓
 $y = 82$ ✓

Array pair divisible by K

$$\text{arr}[i] = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} \quad K = 5$$

$$n = 10$$

$\rightarrow n/2$ pairs

$(1, 9)$	$(2, 8)$	$(3, 7)$	$(4, 6)$	$(5, 10)$
\downarrow	\downarrow	\downarrow	\downarrow	\downarrow
$\underline{1}$	$\underline{2}$	$\underline{3}$	$\underline{4}$	$\underline{0}$
\downarrow	\downarrow	\downarrow	\downarrow	\downarrow
r_1	r_1	r_1	r_1	r_1
r_2	r_2	r_2	r_2	r_2
$r_1 + r_2 = K$				$= 0$

$$r_2 = K - r_1$$

NOTE : when $r_1 = 0$, then $r_2 = 0$,

\therefore , r_2 will be some multiple of K , hence \uparrow factor will inc

pair (a, b)

$$(a+b) \% K == 0$$

$$\text{if } a = x * K + r1$$

$$\text{if } b = y * K + r2$$

$$\begin{aligned}(a+b) &\Rightarrow \frac{(x * K + r1) + (y * K + r2)}{K} \\ &= \frac{K * (x+y) + (r1+r2)}{K}\end{aligned}$$

if

$$\frac{(r1+r2) \% K == 0}{}$$

then,

$$(a+b) \% K == 0$$

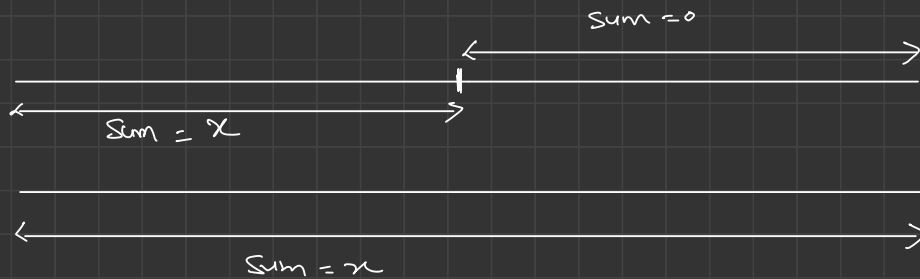
Largest Subarray with zero Sum

$$\text{arr}[] = \{15, -2, 2, -8, 1, 7, 10, 23\}$$

Brute force

compute all subarrays sum, when $\text{sum} = 0$, update maxlen.

$$\begin{cases} \text{TC: } O(N^2) \\ \text{SC: } O(1) \end{cases}$$



Sum

D

15

13

7

8

25

48

index

- 1

0

1

3

4

6

7

$$\text{len of Subarray} = \text{myIndex} - \text{firstSeen}$$

$$= 2 - 0 = 2$$

$$S - 0 = S$$

↳ ans

$O(N)$

$$\text{arr}[] = \left\{ \begin{array}{c|c|c|c|c} 0 & 1 & 2 & 3 & 4 \\ \hline 5 & 10 & -15 & -10 & 10 \\ \hline 5 & 15 & 0 & -10 & 0 \end{array} \right\}$$

Sum index

5 0

15 1

0 -1

-10 3

$$4 - (-1) = 5$$

Equilibrium Index

$a[] = [9, 3, 7, 6, 8, 1, 10]$

$(sum[]) = [0, 9, 12, 19, 25, 33, 34]$

$rrsum[] = [35, 32, 25, 19, 11, 10, 0]$

Brute force

TC: $O(N^2)$

SC: $O(N)$

$\rightarrow O(1)$

$$a[] = [9, 3, 7, 6, 8, 1, 10]$$

~~9~~ ~~3~~ ~~7~~ 6 8 1 10
 ↑

$$\text{totalSum} = 44$$

$$\text{lsum} = \cancel{0} \cancel{9} \cancel{12} \underline{\underline{19}}$$

$$\text{rsum} = \text{totalSum} - \text{lsum} - \text{val}$$

$$44 - 19 - 6$$

$$= \underline{\underline{19}}$$

