

Q → Given an integer array, check if there exist a pair (i, j) s.t. $A[i] + A[j] = K$ & $i \neq j$

$A = [8, 9, 1, -2, 4, 5, 11, -6, 4]$

$K = 6$ $A[2] + A[5] = 6$ Ans = true

$K = 22$ Ans = false

$A = [3, 5, 1, 2, 1, 2]$

$K = 7$ Ans = true

$K = 10$ Ans = false

Bruteforce → $\forall i, j$ check if $sum = K$ & $i \neq j$.

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

for $i \rightarrow 1$ to $(N-1)$ {

for $j \rightarrow 0$ to $(i-1)$ {
if $(A[i] + A[j] == K)$
return true
}

$A[i] + A[j] = A[j] + A[i]$

$i < j$ or $i > j$

} return false

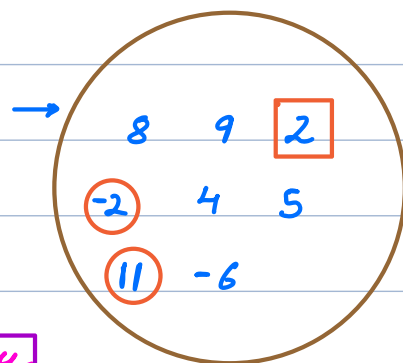
TC = $O(N^2)$ SC = $O(1)$

check if there exist

$A[j]$ st. $A[j] = K - A[i]$

Hash Set

$A = [8, 9, 2, -2, 4, 5, 11, -6, 4]$



Search $K - A[i]$ → complete array x

$K = 6$

$6 - 8 = -2$

Ans = true

$$K = 9$$

$$9 - 8 = 1 \quad \times$$

$$9 - 9 = 0 \quad \times$$

$$9 - 2 = 7 \quad \times$$

$$9 - (-2) = 11 \quad \checkmark \quad \text{Ans} = \text{true}$$

$$K = 4$$

$$4 - 8 = -4$$

$$4 - 9 = -5$$

$$4 - 2 = 2$$

Ans = ~~true~~ \rightarrow false
($i == j$)

Hashset should contain values from 0 to $(i-1)$.

$\forall i$, 1) Search for $K - A[i]$ \checkmark

2) Insert $A[i]$ in Hashset \checkmark ($j < i$)

$$A = \begin{bmatrix} 8 & 9 & 2 & -2 & 4 & 5 & 11 & -6 & 4 \end{bmatrix}$$

$\begin{matrix} 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ \times & \times & \times & \times & & & & & \end{matrix}$

$$\begin{bmatrix} -2 & 4 \\ 8 & 9 & 2 \\ 5 & 11 & -6 \end{bmatrix}$$

$$K = 4$$

$$K - A[i]$$

$$4 - 8 = -4$$

$$4 - 9 = -5$$

$$4 - 2 = 2$$

$$4 - (-2) = 6$$

$$4 - 4 = 0$$

$$4 - 5 = -1$$

$$4 - 11 = -7$$

$$4 - (-6) = 10$$

$$4 - 4 = 0$$

Ans = false \checkmark

$$K = 7$$

$$7 - 8 = -1$$

$$7 - 9 = -2$$

$$7 - 2 = 5$$

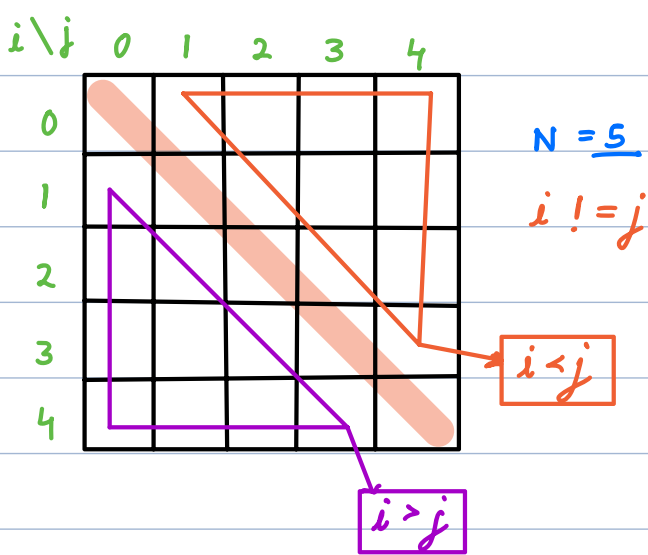
$$7 - (-2) = 9$$

Ans = true

$$\begin{bmatrix} 8 & 9 & 2 \end{bmatrix}$$

$$TC = O(N)$$

$$SC = O(N)$$



Q → Count pairs with sum = K .

$i \neq j$ & $(i, j) = (j, i)$.

$A = [3, 5, 1, 2, 1, 2]$ $K=3$

| i | j |
|-----|-----|
| 2 | 3 |
| 2 | 5 |
| 3 | 4 |
| 4 | 5 |

Ans = 4

Find # Times a value is present
⇒ Hash Map (freq.)

$A = [8, 9, 2, -2, 4, 5, -2, 5, 2]$

$\langle A[i], \text{freq.} \rangle$

$K = 7$

$K - A[i]$

count = 0

$$7 - 8 = -1$$

+1

$$7 - 9 = -2$$

+1

$$7 - 2 = 5$$

+1

$$7 - (-2) = 9$$

+1

$8 \rightarrow 1$ $4 \rightarrow 1$

$9 \rightarrow 1$ $5 \rightarrow 2$

$2 \rightarrow 1$

$-2 \rightarrow 2$

$$7 - 4 = 3$$

$$\underline{+2}$$

$$7 - 5 = 2$$

$$\underline{6} \text{ (Ans)}$$

$$7 - (-2) = 9$$

$$7 - 5 = 2$$

$$7 - 2 = 5$$

$$TC = \underline{O(N)}$$

$$SC = \underline{O(N)}$$

Q → check if there exist a subarray with sum K.
 ↓
 continuous part of array.

$$A = [\overset{0}{2} \quad \overset{1}{\underline{3}} \quad \overset{2}{9} \quad \overset{3}{-4} \quad \overset{4}{1} \quad \overset{5}{5}] \quad K = 8 \quad \text{Ans} = \text{true}$$

$$K = 12 \quad \text{Ans} = \text{true}$$

$$A = [\overset{0}{5} \quad \overset{1}{10} \quad \overset{2}{20} \quad \overset{3}{100} \quad \overset{4}{105}] \quad K = \underline{110} \quad \text{Ans} = \text{false}$$

subarray sum → prefix sum

$$\begin{matrix} i & \text{---} & j \\ \boxed{i \leq j} \end{matrix}$$

$$P[j] - P[i-1] = K$$

$$\Rightarrow P[i-1] = \boxed{P[j] - K}$$

$$(i == 0)$$

$$P[j]$$

∀ j, check $P[j] - K$ is present in prefix sum
 or $\underline{P[j] = K}$. ✓

$$A = [\overset{0}{2} \quad \overset{1}{3} \quad \overset{2}{9} \quad \overset{3}{-4} \quad \overset{4}{1}]$$

$$P \rightarrow \cancel{2} \quad 5 \quad 14$$

$$K = 12$$

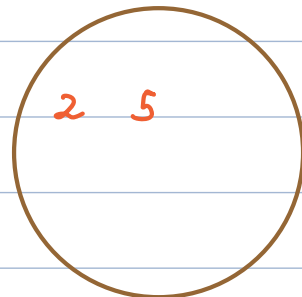
$$\text{Ans} = \underline{\text{True}}$$

$$\underline{P[j] - K}$$

$$2 - 12 = -10$$

$$5 - 12 = -7$$

$$14 - 12 = 2 \quad \checkmark \quad \text{Ans} = \underline{\text{true}}$$



Hash Set (prefix sum)

// Hash Set \rightarrow hs

p = 0

for i \rightarrow 0 to (N-1) {

p += A[i]

if (p == K) return True

if (hs.contains(p - K)) return true

hs.add(p)

}

return false

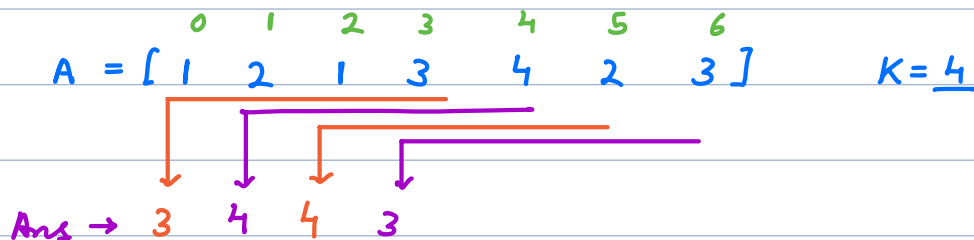
TC = $O(N)$

SC = $O(N)$

(hs)

HW \rightarrow Count subarrays with sum = K.

Q \rightarrow Given an array, find count of distinct elements in every window of size K.

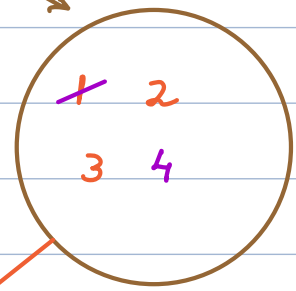
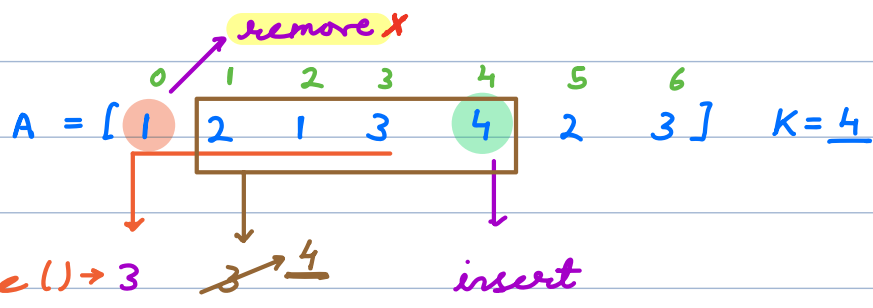


✓ { fixed size subarray \Rightarrow sliding window
distinct elements in array \Rightarrow

1) Insert all elements in hashset

\Rightarrow Ans = hs.size()

Sliding window + Hashset

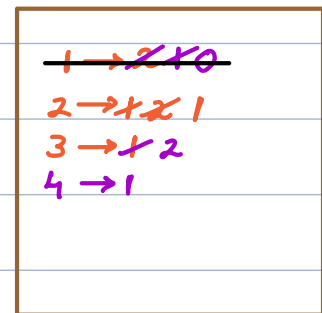
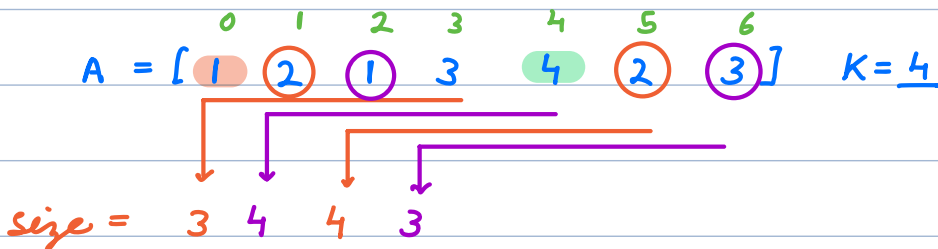


removing from hashtable removes all occurrences.

HashMap with freq. of elements.

Sliding Window + HashMap

<Ali, freq.>



```
for i → 0 to (K-1) {
    f = hm.getOrDefault(A[i], 0)
    hm.put(A[i], f+1)
}
```

print(hm.size())

```
for i → K to (N-1) { // window (i-K+1) to i
    f = hm.getOrDefault(A[i], 0)    add A[i]
    hm.put(A[i], f+1)              remove A[i-K]
    f = hm.get(A[i-K])
    if (f == 1) hm.remove(A[i-K])
    else hm.put(A[i-K], f-1)
    print(hm.size())
}
```

TC = O(N)

SC = O(K)

