

Fb | Google | so on..

1. 2sum

Given an array & no. K. Return true if there exists a pair (i, j) in array s.t $A[i] + A[j] = K$

$$i \neq j$$

A: $\{2, 7, 11, 15, 7\}$

$K=18$ True $\Rightarrow (1, 2)$

$K=14$ True $\Rightarrow (1, 4)$

$K=20$ False

Brute Force

Find all the pairs & check if their sum = K

```
for(i=0 ; i<N ; i++) {  
    for(j=i+1 ; j<N ; j++) {
```

```
        if (i != j && A[i] + A[j] == K) {
```

return true

TC $\rightarrow O(N^2)$

SC $\rightarrow O(1)$

```
}
```

```
return false
```

0 1 2 3



~~(0, 0)~~ (0, 1) (0, 2) (0, 3)

(1, 0)	(1, 1)	(1, 2)	(1, 3)
(2, 0)	(2, 1)	(2, 2)	(2, 3)
(3, 0)	(3, 1)	(3, 2)	(3, 3)

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

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

$K=25$

2	7	-2	3	15	7	11	10	6	-14
↑	↑	↑	↑	↑					

$$25-2 \quad 25-7 \quad 25-(-2) \quad 25-3 \quad 25-15$$

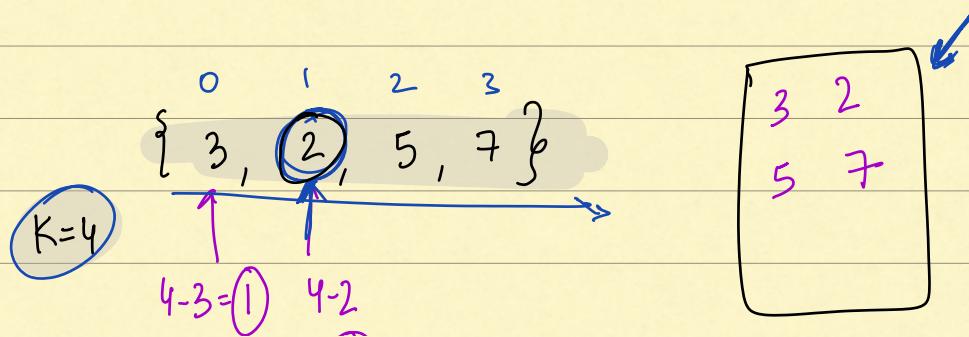
$$= 23 \quad = 18 \quad = 27 \quad = 22 \quad = 10$$

True.

set

2	7	-2
3	15	11
10	6	
-14		

TC $\rightarrow O(1)$



$\Rightarrow(2)$

True

HashMap

=

$$\{ 1, -2, 1, 7, 10, 9, -16 \}$$

$K = 7$

$7 - 1 = 6$

$7 - (-2) = 9$

$=$

True.

$K - A[i]$

$$\{ 2, -2, 1, 7, 1, 9, -16 \}$$

$K = 2$

$2 - 2 = 0$

$2 - (-2) = 4$

$2 - 1 = 1$

True

$A[i] = 4$

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

4

$2 \rightarrow 1$
 $-2 \rightarrow 1$
 $1 \rightarrow 2$
 $7 \rightarrow 1$
 $9 \rightarrow -16$

TC $\rightarrow O(N) + O(N) = O(N)$

SC $\rightarrow O(N)$

HashMap<int, int> mp;

```

for(i = 0 ; i < N ; i++) {
    if ( A[i] is present in mp ) {
        mp[A[i]] ++
    } else {
        insert (A[i], 1)
    }
}
  
```

$O(N)$

for ($i=0$; $i < N$; $i++$) {

```

    x = K - A[i]
    if (A[i] == x) {
        if (mp[x] >= 2) return true
    }
    else if (x is present in mp)
        return true
    }
    return false
    
```

$\{ \}$ $\}$ $\{ \}$ $\}$ $\{ \}$

$K=2$ $O(N)$ $1 \rightarrow 2$
 $2 \rightarrow 1$
 $4 \rightarrow 1$

$K=25$

$\{$	0	1	2	3	4	5	6	7	8	9	$\}$
	$2,$	$7,$	$-2,$	$3,$	$15,$	$7,$	$11,$	$1,$	$6,$	-14	

$K=14$

$14-2 = 12$

2	7	-2
3	15	

\uparrow \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow

$14-7 = 7$
 $14-(-2) = 16$
 $14-3 = 11$
 $14-15 = -1$

$\{$	0	1	2	3	4	5	6	7	8	9	$\}$
	$2,$	$7,$	$-2,$	$3,$	$15,$	$7,$	$11,$	$1,$	$6,$	-14	

\uparrow \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow

$L-7$
 $L-(-2)$
 $L-1$
 $L-15$
 $L-6$
 $L-(-14)$

$K = 6$	=1	=8	=3	=9	=7	=-1	=11	=5	=0	=-	=20
	2	7	6								
	-2		3								
		15		11							
		1		-19							

```
set<int> s;
for( int i=0 ; i<n ; i++ ) {
```

$x = K - A[i]$

if (x is present in s) {

| return true

| }

else {

| insert($A[i]$ in set s)

| }

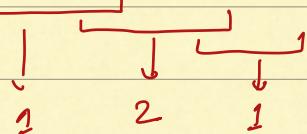
s
return false.

TC $\rightarrow O(N)$

SC $\rightarrow O(N)$

Ques 2. Given N array elements, calc no. of distinct ele in every window of size K

$A : \{ \underset{0}{1}, \underset{1}{1}, \underset{2}{2}, \underset{3}{2} \}$ $K = 2$



Return $\{1, 2, 1\}$

A: $\{6, 3, 7, 3, 8, 6, 9\}$ $K=3$

↓ ↓ ↓ ↓ ↓ ↓
3 2 3 3 3 3

Return $\{3, 2, 3, 3, 3\}$

len=N

last starting index

1 $[0 \quad N-1]$

2 $[0 \quad N-2]$

3 $[0 \quad N-3]$

:

:

:

:

K

$[0 \quad N-K]$

(i) $\rightarrow i+K-1$

$K=3$

0 1 2 3 4 5 6
↓ | ↓ | ↓
 $0+3-1$
 $=2$

2 3 4 5 6
↓ | ↓ |
 $2+3-1$
 $=4$

Brute Force

$i+3-1$

$=3$

List <int> ans;

for (i=0; i<=N-K; i++) {
 j = i+K-1

$\leq O(K)$

```

set <int> s;
for (K=i ; K<=j ; K++) {
    s.insert (A[K])
}
ans.push (s.size())

```

TC:

$$\underbrace{(N-K+1)}_{K=1} * (K)$$

$$\frac{(N-1+1)(1)}{= N}$$

$$K=N$$

$$\frac{(N-N+1)(N)}{= N}$$

return ans

$\{ \overset{\circ}{x} \overset{\circ}{x} \overset{\circ}{x} \overset{\circ}{x} \overset{\circ}{x} \}$

$\{ 4 \ 1 \ 2 \ 6 \ 2 \ ? \ 6 \ 6 \}$



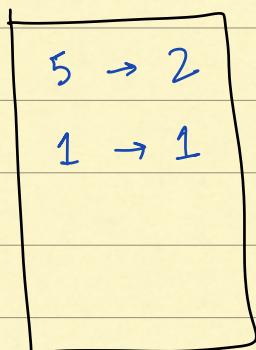
$\{ 4, 3, 2, 2, 2 \}$

$$\frac{(N-\frac{N}{2}+1)\left(\frac{N}{2}\right)}{\left(\frac{N}{2}+1\right)\left(\frac{N}{2}\right)}$$

$$= \frac{N^2}{N^2}$$

SLIDING WINDOW

0	1	2	3	4	5	6	+	K=3
4	1	4	6	6	1	5	5	



$\{ 2, 3, 2, 2, 3, 2 \}$

Steps

① Process the first window of size K

⇒ Create a frequency map for first window.

② Iterate over the remaining windows
 (Remove occurrence)
 \Rightarrow Remove first ele of prev window
 & add the new element of
 the next window

$$\textcircled{K=4}$$

Remove Add

$$0 \xleftarrow{-4} 4$$

$$1 \xleftarrow{-4} 5$$

$$2 \xleftarrow{-4} 6$$

$$3 \xleftarrow{-4} 7$$

:

:

:

$$6 \xleftarrow{-4} 10$$

$$\textcircled{i-K}$$

$$\textcircled{i}$$

`list<int> ans`

```
HashMap<int, int> mp;
for(i=0 ; i<K ; i++) {
    if (A[i] is present) {
        mp[A[i]] ++
    }
}
```

$O(K)$

```
else {
    insert (A[i], 1)
}
```

5

.....

ans.push_back(mp.size())

```
for ( i=K ; i<N ; i++ ) {  
    if ( A[i] is present ) {  
        mp[A[i]] ++  
    } else {  
        insert ( A[i], 1 )  
    }  
    x = A[i-K]  
    mp[x] --  
    if ( mp[x] == 0 ) {  
        delete ( x )  
    }  
}
```

ans.push_back (mp.size())

N-K
frequency

TC \Rightarrow
 $K + N - K$
 $O(N)$

SC \Rightarrow
 $O(K)$

return ans.

11:05 PM BREAK.

Ques. continuous
subarray sum = K

Sum
K=12 True $\rightarrow A: \{ 4, 2, -1, 3, 10, 5, 6, 3 \}$
K=24 True $\rightarrow PS[7]: \{ 4, 6, 5, 8, 18, 23, 29, 32 \}$

$K=16$ False

$$\text{sum}(i, j) = \underline{\text{PS}[j]} - \underline{\text{PS}[i-1]}$$

\Downarrow

K

$$\text{PS}[j] - \text{PS}[i-1] = K$$

Find 2 ele from PS array s.t diff = K

Edge Case