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Amazon SDE 2

Hashset	(k)	$O(1)$
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Hashmap	(k, v)	$O(1)$
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Q1) Given N array elements, check if there exists a pair (i, j) such that $A[i] + A[j] = K$ && $(i \neq j)$. i, j are indices

$A = \{ \overset{0}{8} \overset{1}{9} \overset{2}{1} \overset{3}{-2} \overset{4}{4} \overset{5}{5} \overset{6}{11} \overset{7}{-6} \overset{8}{7} \overset{9}{5} \}$

i j $A[i]$ $A[j]$

Ex $K = 11$ 4 8 4 7 **True**

$K = 10$ 5 9 5 5 **True**

$K = 22$ 6 6 **False**

1) Check all pair sum

$i < j$

00	01	02	03	04
10	11	12	13	14
20	21	22	23	24
30	31	32	33	34
40	41	42	43	44

$i > j$

```

for (i=0; i<N; i++) {
    for (j=0; j<i; j++) {
        if (A[i] + A[j] == k) {
            return true
        }
    }
}
return false

```

TC: $O(N^2)$

$\boxed{5}$, 8, 2, -3, 0

$k = 10$

$\boxed{5, 8}$, 2, -3, 0

$i = 3$

looking for $A[j] = k - A[i]$
[0, 2]

$\boxed{5, 8, 2}$, -3, 0

0-N-1

optimise:

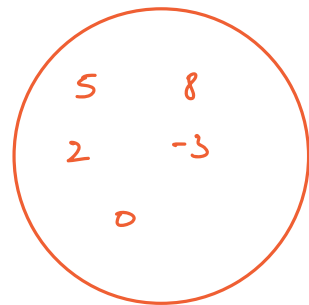
$$A[i] + A[j] = k$$

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

$\forall i$ any value which is equal $k - A[i]$

$$k = -1$$

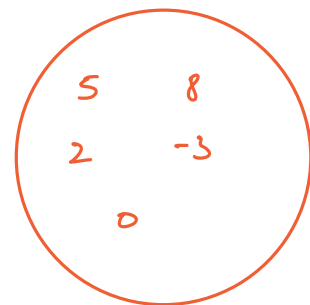
$$\begin{array}{ccc} \times & \times & \checkmark \\ \{ 5, & 8, & 2, & -3, & 0 \} \\ \downarrow & \downarrow & \downarrow \\ -1-5 & -9 & -3 \\ = -6 & & \end{array}$$



$$i \neq j$$

$$k = 4$$

$$\begin{array}{ccc} \times & \times & \\ \{ 5, & 8, & 2, & -3, & 0 \} \\ \downarrow & \downarrow & \downarrow \\ 4-5 & -4 & 2 \\ = -1 & & \end{array}$$



- \times 1) Put everything in HS
 2) For each element check if $(k - A[i])$ is present or not

$$HM(A[i], \text{freq}(A[i]))$$

$i \rightarrow [0, i-1]$ check if $k - A[i]$ is present or not

$\{5, 8, 2, -3, 0, -3\}$
 $\downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow$
 $k=4 \quad -1 \quad -4 \quad 2 \quad 7 \quad 4 \quad 7$ False

HM:

5:1

8:1

2:1

0:1

-3:2

$\{5, 8, 2, -3, 0, -3\}$
 $\downarrow \quad \downarrow \quad \downarrow \quad \downarrow$
 $k=-6 \quad -11 \quad -14 \quad -8 \quad -3$ True

$\{5, 8, 2, -3, 0, 3\}$
 $\uparrow \quad \uparrow \quad \uparrow \quad \uparrow$
 $k=4$ -4 \quad 2 \quad 7 \quad 4

5 8 2
 -3 0

$\{5, 8, 2, -3, 0, 8\}$
 $\downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow$
 $k=16 \quad 11 \quad 8 \quad 14 \quad 19 \quad 16 \quad 8$ True

5 8 2
 -3 0

```

s = set()
for (i=0; i < N; i++) {
    if (s.contains(k - A[i])) {
        return true
    }
    s.insert(A[i])
}
return false
  
```

TC: $O(N)$

SC: $O(N)$

Q2) Given N array elements, count number of pair (i, j) such that $A[i] + A[j] = K$ & $(i \neq j)$

	0	1	2	3	4	5	6	7	8	9	
{	5	9	1	-2	4	5	5	6	5	5	}
	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	
k=10	5	1	9	12	6	5	5	4	5	5	

5:9	-2:1
9:1	4:1
1:1	6:1

$$\text{ans} = 1 + 1 + 2 + 1 + 3 + 4 = 12$$

```
hm = new HashMap()
```

```
ans = 0
```

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

```
    if (hm.containsKey(k-A[i])) {
        ans = ans + hm[k-A[i]]
    }
```

```
    hm[A[i]]++
```

```
}
```

```
return ans
```

Q3) Given N elements, calculate no. of distinct elements in every subarray of size k .

$A = \{ \overset{0}{2}, \overset{1}{4}, \overset{2}{3}, \overset{3}{8}, \overset{4}{3}, \overset{5}{9}, \overset{6}{4}, \overset{7}{9}, \overset{8}{4}, \overset{9}{10} \}$

$N = 10$ $k = 4$

s	e	Print
0	3	4
1	4	3
2	5	3
3	6	4
4	7	3
5	8	2
6	9	3

$s = 0$, $e = k - 1$

while ($s \leq N - k$) {

 set = new HashSet()

 for ($i = s$; $i \leq e$; $i++$) {

 set.insert($A[i]$)

 } print (set.size())

$s++$, $e++$

}

TC: $(N - k) * k$

$= Nk - k^2$

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

$\frac{N^2}{2} - \frac{N^2}{4}$

$= \frac{N^2}{4}$

TC: $O(N^2)$

Break (10:17 - 10:30)

A = $\begin{matrix} 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ \{ & 2 & 4 & 3 & 8 & 3 & 9 & 4 & 9 & 4 & 10 \} \end{matrix}$

size = 9 s = 0 e = k-1

$\{ 2 \ 4 \ 3 \ 8 \}$

Remove A[0] and add A[4]

size = 3

$\{ 4 \ 3 \ 8 \}$

Remove A[1] and add A[5]

size = 3

$\{ 3 \ 8 \ 9 \}$

Remove A[2] and add A[6]

size = 3

$\{ 8 \ 9 \ 4 \}$

$A = \{ \overset{0}{2}, \overset{1}{4}, \overset{2}{\boxed{3}}, \overset{3}{8}, \overset{4}{3}, \overset{5}{9}, \overset{6}{\boxed{4}}, \overset{7}{9}, \overset{8}{4}, \overset{9}{10} \}$

size = 4

Remove $A[0]$ and add $A[4]$

size = 3

Remove $A[1]$ and add $A[5]$

size = 3

Remove $A[2]$ and add $A[6]$

size = 4

4:1
9:1
3:1
8:1

```
hm = new hashmap()
```

TC: $O(N)$

SC: $O(K)$

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

```
  |  
  3
```

```
    hm[A[i]]++
```

↑
0

↑
k-1

```
print(hm.size())
```

```
s = 1      e = k
```

```
while (s <= n - k) {
```

```
    # index getting added: e
```

```
    # index getting removed: s-1
```

```
    hm[A[s-1]]--
```

```
    if (hm[A[s-1]] == 0) {
```

```
        |  
        3    hm.remove(A[s-1])
```

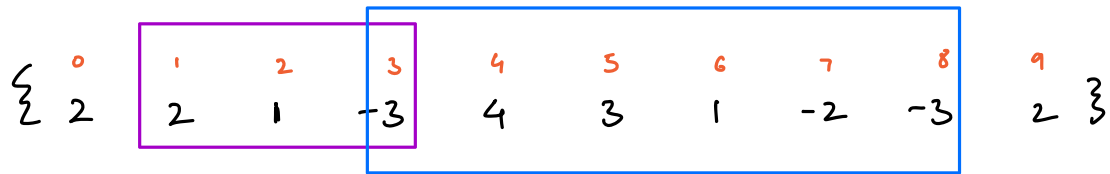
```
    hm[A[e]]++
```

```
    print(hm.size())
```

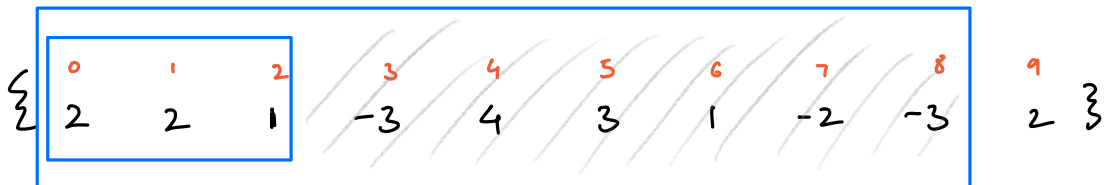
```
    s++, e++
```

```
    }
```

Q4) Given an array, check if there exists subarray with sum = 0



pf: $\{ 2 \ 4 \ 5 \ 2 \ 6 \ 9 \ 10 \ 8 \ 5 \ 1 \}$



$$pf(2) = 5$$

$$pf(8) = 5$$

$$pf(8) = \text{sum}(A[0:2]) + \text{sum}(A[3:8])$$

$$5 = 5 + \text{sum}(A[3:8])$$

$$\text{sum}(A[3:8]) = 0$$

If 2 values are equal in a pf array, then subarray sum = 0 in between

$$pf[j] = pf[i]$$

subarray ^{sum} b/w $i \rightarrow j$ is 0

$$pf[j] - pf[i] = 0$$

$$pf[j] = 0$$

subarray sum b/w $i \rightarrow j$ is 0

Q5) Check if there exists a subarray with sum = k

$\{ 2 \quad 3 \quad 9 \quad -4 \quad 1 \quad 5 \}$

k = 10

k = 11 ✓

k = 20

$\{ 2 \quad 3 \quad 9 \quad -4 \quad 1 \quad 5 \}$

k = 10 ✓

A: $\{ 2 \quad 5 \quad 14 \quad 10 \quad 11 \quad 16 \}$

k = 6



$\begin{aligned} \text{pf}[j] - \text{pf}[i] &= k \\ \text{pf}[j] &= k \end{aligned}$	$\text{b/w it } j \text{ sum} = k$
---------------------------------------------------------------------------------------	------------------------------------



$$\begin{aligned} A[j] - A[i] &= k \\ A[j] &= k \end{aligned}$$

→

$$\begin{aligned} A[i] &= A[j] - k \\ A[j] &= k \end{aligned}$$

1) A →

for (i = 1; i < N; i++) {
 1 A[i] += A[i-1]
 3

s = set()

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

if (A[i] == k) {

return true

if (s.contains(A[i]-k)) {

return true

s.insert(A[i])

}