**SESSION 5**

1. **SUBARRAY WITH SUM K**

**INPUT** : N=5

ARR = [10, -2, 2, -20, 10]

K=-10

**OUTPUT:** 3

**EXP :**  1.INDEX : [ 0, 1, 2, 3 ]

ARR: [ 10, -2, 2, -20 ]

**EXPLANATION:**

1. Select a each element of array and add that element to sum
2. Then substract sum with k store with sum1
3. Then check prefixsumindex[sum1] is present or not present
4. Then add that element and freq to map prefixsumindex
5. Note:

1. If sum1 is equal to zero then increment count by 1.

2. If sum is equal to K then increment count by 1.

3. If present then add and increment count by 1

4. If not present then juz add to map

6. Return count

**Pseudo code:**

1. Sum+=arr[i]
2. Sum1= Sum – k
3. Mp[prefixsumindex[sum-k].find()
4. Mp[sum]++
5. 1. Sum == 0 count++ and [Mp[sum]++]

2. Sum == k count++ and Mp[sum]++

3. Sum is present count++ and Mp[sum]++

4. Sum is not present mp[sum]++

6. return count;

**INTUTION:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **ARRAY :** | 2 | 4 | -3 | 2 | 5 | -1 | 2 |
| **INDEX :** | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**Initial step** :

K= 3

Unordered\_map<int,int> prefixsumindex;

Sum =0 , sum1 = 0

Count = 0

Idx = 0

1. **Step 1 :**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **ARRAY :** | 2 | 4 | -3 | 2 | 5 | -1 | 2 |
| **INDEX :** | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**Idx**

**Idx = 1, arr[idx] = 2, sum=0 , sum1 = 0**

1. **Sum = sum + arr[idx]**

**Sum = 0 + 2**

**Sum = 2**

1. **Sum1 = Sum - K**

**Sum1 = 2 - 3**

**Sum1 = -1**

|  |  |  |
| --- | --- | --- |
| **Prefixsumindex[sum1] / prefixsumindex[sum – k]** | **Present** | **Not present** |
| Prefixsumindex[-1] |  | NP |

1. **Not present so add sum to prefixsumindex map**

**Prefixsumindex {**

**{2,1}**

**}**

1. **Count = 0**
2. **Step 2:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **ARRAY :** | 2 | 4 | -3 | 2 | 5 | -1 | 2 |
| **INDEX :** | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**Idx**

**Idx = 2, arr[idx] = 4, sum = 2 , sum1 = -1**

**1. Sum = sum + arr[idx]**

**Sum = 2 + 4**

**Sum = 6**

**2. Sum1 = Sum - K**

**Sum1 = 6 - 3**

**Sum1 = 3**

|  |  |  |
| --- | --- | --- |
| **Prefixsumindex[sum1] / prefixsumindex[sum – k]** | **Present** | **Not present** |
| Prefixsumindex[-1] |  | NP |
| Prefixsumindex[3] |  | NP |

1. **Not present so add sum to prefixsumindex map {sum, freq }**

**Prefixsumindex {**

**{2,1}**

**{6,1}**

**}**

1. **Count = 0**
2. **Step 3 :**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **ARRAY :** | 2 | 4 | -3 | 2 | 5 | -1 | 2 |
| **INDEX :** | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**Idx**

**Idx = 3, arr[idx] = -3, sum = 6, sum1 = 3**

**1. Sum = sum + arr[idx]**

**Sum = 6 + [-3] = 6 – 3**

**Sum = 3**

1. **Sum1 = Sum - K**

**Sum1 = - 3 - 3**

**Sum1 = 0**

1. ***NOTE : when we get sum1 has zero which means we got our subarray so increment count to 1.***

|  |  |  |
| --- | --- | --- |
| **Prefixsumindex[sum1] / prefixsumindex[sum – k]** | **Present** | **Not present** |
| Prefixsumindex[-1] |  | NP |
| Prefixsumindex[3] |  | NP |
| **NO NEED OF CHECKING BEC IT IS ZERO** | | |

1. **Not present so add sum to prefixsumindex map {sum, freq }**

**Prefixsumindex {**

**{2,1}**

**{6,1}**

**{3,1}**

**}**

1. **Count = 1**
2. **Step 4:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **ARRAY :** | 2 | 4 | -3 | 2 | 5 | -1 | 2 |
| **INDEX :** | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**Idx**

**Idx = 4, arr[idx] = 2 , sum = 3 , sum1 = 0**

**1. Sum = sum + arr[idx]**

**Sum = 3 + 2**

**Sum = 5**

1. **Sum1 = Sum - K**

**Sum1 = 5 - 3**

**Sum1 = 2**

|  |  |  |
| --- | --- | --- |
| **Prefixsumindex[sum1] / prefixsumindex[sum – k]** | **Present** | **Not present** |
| Prefixsumindex[-1] |  | NP |
| Prefixsumindex[3] |  | NP |
| **NO NEED OF CHECKING BEC IT IS ZERO** | | |
| Prefixsumindex[2] | **P** | - |

1. **It is present so add sum to prefixsumindex map {sum, freq } and increase count by 1.**

**Prefixsumindex {**

**{2,1}**

**{6,1}**

**{3,1}**

**{5,1}**

**}**

1. **Count = 2**
2. **Step 5:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **ARRAY :** | 2 | 4 | -3 | 2 | 5 | -1 | 2 |
| **INDEX :** | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**Idx**

**Idx = 5, arr[idx] = 5 , sum = 5 , sum1 = 2**

**1. Sum = sum + arr[idx]**

**Sum = 5 + 5**

**Sum = 10**

1. **Sum1 = Sum - K**

**Sum1 = 10 - 3**

**Sum1 = 7**

|  |  |  |
| --- | --- | --- |
| **Prefixsumindex[sum1] / prefixsumindex[sum – k]** | **Present** | **Not present** |
| Prefixsumindex[-1] |  | NP |
| Prefixsumindex[3] |  | NP |
| **NO NEED OF CHECKING BEC IT IS ZERO** | | |
| Prefixsumindex[2] | **P** | - |
| Prefixsumindex[7] | **-** | NP |

1. **Not present so add sum to prefixsumindex map {sum, freq }**

**Prefixsumindex {**

**{2,1}**

**{6,1}**

**{3,1}**

**{5,1}**

**{10,1}**

**}**

1. **Count = 2**
2. **Step 6:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **ARRAY :** | 2 | 4 | -3 | 2 | 5 | -1 | 2 |
| **INDEX :** | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**Idx**

**Idx = 6, arr[idx] = -1 , sum = 10 , sum1 = 7**

**1. Sum = sum + arr[idx]**

**Sum = 10 + (-1) = 10 -1**

**Sum = 9**

1. **Sum1 = Sum - K**

**Sum1 = 9 - 3**

**Sum1 = 6**

|  |  |  |
| --- | --- | --- |
| **Prefixsumindex[sum1] / prefixsumindex[sum – k]** | **Present** | **Not present** |
| Prefixsumindex[-1] |  | NP |
| Prefixsumindex[3] |  | NP |
| **NO NEED OF CHECKING BEC IT IS ZERO** | | |
| Prefixsumindex[2] | **P** | - |
| Prefixsumindex[7] | **-** | NP |
| Prefixsumindex[6] | **P** | - |

1. **It is present so add sum to prefixsumindex map {sum, freq } and increase count by 1**

**Prefixsumindex {**

**{2,1}**

**{6,1}**

**{3,1}**

**{5,1}**

**{10,1}**

**}**

1. **Count = 3**
2. **Step 7:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **ARRAY :** | 2 | 4 | -3 | 2 | 5 | -1 | 2 |
| **INDEX :** | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**Idx**

**Idx = 7, arr[idx] = 2 , sum = 9 , sum1 = 6**

**1. Sum = sum + arr[idx]**

**Sum = 9 + 2**

**Sum = 11**

**2. Sum1 = Sum - K**

**Sum1 = 11 - 3**

**Sum1 = 8**

**3.**

|  |  |  |
| --- | --- | --- |
| **Prefixsumindex[sum1] / prefixsumindex[sum – k]** | **Present** | **Not present** |
| Prefixsumindex[-1] |  | NP |
| Prefixsumindex[3] |  | NP |
| **NO NEED OF CHECKING BEC IT IS ZERO** | | |
| Prefixsumindex[2] | **P** | - |
| Prefixsumindex[7] | **-** | NP |
| Prefixsumindex[6] | **P** | - |
| Prefixsunidex[8] | **-** | NP |

1. **Not present so add sum to prefixsumindex map {sum, freq }.**

**Prefixsumindex {**

**{2,1}**

**{6,1}**

**{3,1}**

**{5,1}**

**{10,1}**

**{11,1}**

**}**

1. **Count = 3**