**MICP -Week 3 Homework: 3Sum**

TEBOW-IT

T :

Given an array of integer elements, we need to find unique sets or 3 elements that sum up to 0.

E: Examples

|  |  |  |
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| Sample Input | Equivalence Class | Output |
| Null input | Null input | Null is returned |
| {} | Empty array | Null is returned |
| {1},{1,0} | Insufficient Elements in input | Null is returned |
| {3,4,5,6,7} | No solution(when first element after sorting array is larger than the sum ) | Null is returned |
| { -1, 0, 2, 1, -1, 1, 5, -2,2 } | When duplicates exist | Return unique sets:  return{-1,-1,2} once even though -1 and 2 occur twice |
| { -1, 0, 2, 1, -1, 1, 5, -2 } | When one or more solutions exist | [[-1, -1, 2], [-2, 0, 2], [-1, 0, 1]] |

B: Brute force

-Use three for loops : 1st loop from 0 to array length -1 🡪for(int i=0;i<array.length;i++)

2nd loop from 1 to array length -1🡪for(int j=1;i<array.length;i++)

3rd loop from 2 to array length-1🡪for(int k=2;i<array.length;i++)

-Check sum of 3 elements in every iteration if it adds up to 0

i.e array[i]+array[j]+array[k]=0 ? . {array[i],array[j],array[k]} becomes the subarray. Sort the subarray and pass it to unique check method to make sure it is the only set in the resultant array.

if yes, then add the set of elements {array[i],array[j],array[k]} to the resultant array.

O: Optimized Solution and Walk through

Given the array : { -1, 0, 2, 1, -1, 1, 5, -2 } and sum to be added to is 0.

Sort array in ascending order. Run one for loop throughout the array and initialize 2 pointers: pointer1 called pleft =i+1 and pointer2 called pright=array.length-1

-2 -1 -1 0 1 1 2 5

↓ ↓ ↓

i pleft pright

Keep iterating through the loop as long as array[i]+array[pleft]+array[pright]!=0

Since in the above shown case, array[i]+array[pleft]+array[pright]>0, we decrement pright;

If, array[i]+array[pleft]+array[pright]<0, we would increment pleft. These actions are performed while as long as pleft < pright.

-2 -1 -1 0 1 1 2 5

↓ ↓ ↓

i pleft pright

Since, array[i]+array[pleft]+array[pright]==0, therefore add the 3 elements to a list= [].

Store the list in a HashSet. When the next set of the list is found the HashSet checks to see if it is a unique set and then adds that list to the hashset else it dis regards it.

I: Implementation phase

Array.sory(array);

For(i=0;i<array.length;i++)

While(pleft<pright)

If((array[i]+array[pleft]+array[pright]==sum)

add(array[i],array[pleft],array[pright])-🡪 to list

If((array[i]+array[pleft]+array[pright]>sum)

Pright--;

If((array[i]+array[pleft]+array[pright]==sum)

Pleft++;

Add each unique list to hash set list;

Return hashset;