

## Find duplicates in $O(n)$ time and $O(1)$ extra space

Given an array of  $n$  elements which contains elements from 0 to  $n-1$ , with any of these numbers appearing any number of times. Find these repeating numbers in  $O(n)$  and using only constant memory space.

For example, let  $n$  be 7 and array be {1, 2, 3, 1, 3, 6, 6}, the answer should be 1, 3 and 6.

This problem is an extended version of following problem.

### Find the two repeating elements in a given array

Method 1 and Method 2 of the above link are not applicable as the question says  $O(n)$  time complexity and  $O(1)$  constant space. Also, Method 3 and Method 4 cannot be applied here because there can be more than 2 repeating elements in this problem. Method 5 can be extended to work for this problem. Below is the solution that is similar to the Method 5.

### Algorithm:

```
traverse the list for i= 0 to n-1 elements
{
    check for sign of A[abs(A[i])] ;
    if positive then
        make it negative by  A[abs(A[i])]=-A[abs(A[i])];
    else // i.e., A[abs(A[i])] is negative
        this  element (ith element of list) is a repetition
}
```

### Implementation:

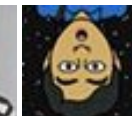
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```

#include <stdio.h>
#include <stdlib.h>

void printRepeating(int arr[], int size)
{
    int i;
    printf("The repeating elements are: \n");
    for (i = 0; i < size; i++)
    {
        if (arr[abs(arr[i])] >= 0)
            arr[abs(arr[i])] = -arr[abs(arr[i])];
        else
            printf(" %d ", abs(arr[i]));
    }
}

int main()
{
    int arr[] = {1, 2, 3, 1, 3, 6, 6};
    int arr_size = sizeof(arr)/sizeof(arr[0]);
    printRepeating(arr, arr_size);
    getchar();
    return 0;
}

```

Note: The above program doesn't handle 0 case (If 0 is present in array). The program can be easily modified to handle that also. It is not handled to keep the code simple.

Output:

*The repeating elements are:*

1 3 6

Time Complexity: O(n)

Auxiliary Space: O(1)

Please write comments if you find the above codes/algorithms incorrect, or find better ways to solve the same problem.



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