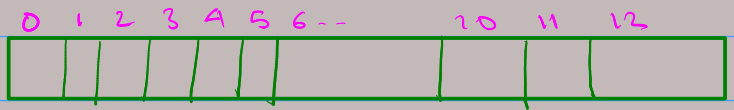
Time & Space Complexity

highest No.

arr => [1, 5, 10, 12, 5] Find dublicate

① Using double loop. TC n^2 SC = n(1)

② Using loop Arr2 :



@ Its like, create an array of size (X) whatever mention in question.

ⓑ Using for loop

```
for(int i = 0; i< len of Arr; i++) {
  // check if Arr2 of index arr of i 0 or 1
  // if 1 it mean that element is
  // already in Array
  // else go to that index make it 1,
if (arr2[arr[i]] = 1){ here is your forget}
else{ arr2[arr[i]] = 1}
```

TC is O(n) But SC may be Worst

I don't think this is correct

③ Iterate the array and sum all the elements.
Then, use this formula $\frac{n(n+1)}{2}$

It like arr = [1, 2, 5, 10] → sum = 18
using formula = $\frac{4 \times 5}{2}$ = 10

But there is no element which occur twice

So, I can say this is only valid for whole no.
like Arr = [1, 2, 3, 4] = 10
using formula = $\frac{4 \times 5}{2}$ = 10

Notations for different types of TC

1. Big oh ---> upper bound
2. Big omega ----> lower bound
3. Theta ----> may be Avg

Q. Calculate TC for this loop

```
for(int i = 0; i < n; i++){
    cout << "Devil";
}
```

Here T.C is $O(n)$

```
for(int i = 0; i < n; i+=2){
    cout << "Devil";
}
```

Still T.C is $O(n)$

All Are Same

$O(\frac{n}{2}) \simeq O(n)$

$O(2n) \simeq O(n)$

$O(n+k) \simeq O(n)$

$O(5n+k) \simeq O(n)$

But

$T.N.O \Rightarrow 5n^3 + 3n + 2$

$\Rightarrow O(n^3)$

Q.2

```
for ( int i = 1; i < n; i *= k){
    cout << "hello ";
}
```

output => if n 100, and k = 2
==> hello only 7 times

i = 1 hello
i = 2 "
i = 4 "
i = 8 "
i = 16 "
32 "
64 "

$128 > n$

$TC \Rightarrow O(\log_k n)$

$= O(\frac{\log n}{\log k})$

$\Rightarrow O(\log n)$

Q3.

```
c = 1;
for( int i = 0; i < n; i++){
        for(int j = i+1; j < m; j++){
                c++;
        }
}
```

for 1st loop

$TC = 1 + 2 + \cdots + n + (m-1) + (m-2) + (m-3) \cdots + (m-n)$

$\Rightarrow \frac{n(n+1)}{2} + (m + m + m + \cdots) \text{ n times} - \frac{n(n+1)}{2}$

$\Rightarrow O(mn)$

i = 0
j = 1, 2, 3 ---- m-1

i = 1
j = 2, ---- m-1

⋮

i = n
j = n+1, n+1, --- m-2