PW SKILLS

JAVA ARRAY

Today’s checklist

1. Introduction to Arrays
2. Syntax , accessing elements of Arrays
3. Printing Output and Taking Input
4. Length operator
5. Basic problems
6. Memory Allocation of Arrays in Java

What is an array?

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I

You have store roll no.s of 100 students

```
int rno  = 76;
int rno2 = 88;
int rno3 = 13;
```

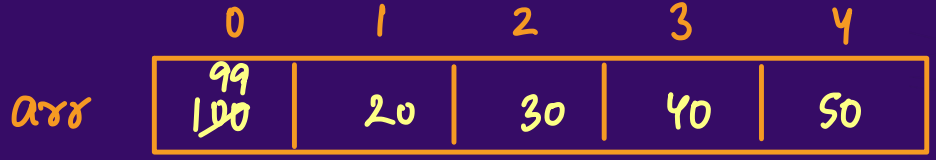
If I have to store a collection of same data type variables then I use **arrays**.

Syntax and Declaration

```
int x;

int[] y = new int[100];
```

```
int[] arr = new int[5];
arr[0] = 100;
arr[1] = 20;
arr[2] = 30;
arr[3] = 40;
arr[4] = 50;
arr[0] = 99;
```



How to access Elements in Array ?

Printing Output & Taking Input

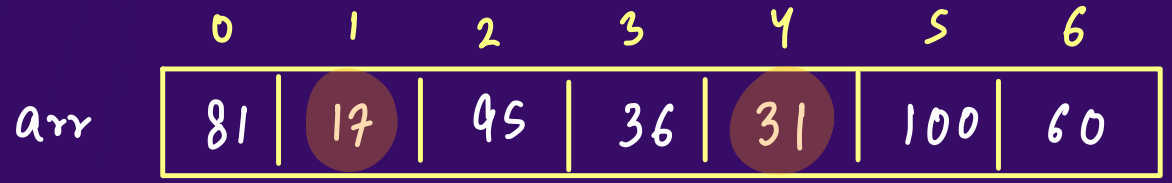
loops.

Length operator

arr.length

Ques:

Q1 : Given an array of marks of students, if the mark of any student is less than 35 print its roll number. [roll number here refers to the index of the array.




```
for(      ){
    if(arr[i] < 35)  sout(i);
}
```

Ques:

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Q2 : Are the following array declarations correct?

int a (25) ; ✗ int[] a;

int size = 10, b[size] ; → ✗ int size = 10; int b[size];

int c = {0,1,2} ; ✗ int[] c = {0, 1, 2};

Ques:

Q3 : Which element of the array does this expression reference?

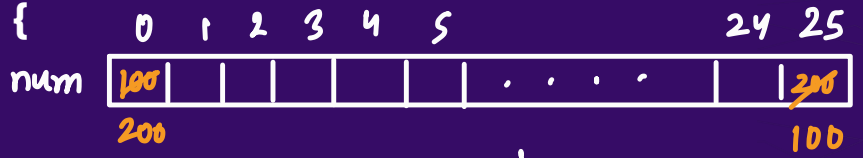
array's name

num[4] → 5th element from the start

index

Predict the output :

```
public class Main {
    public static void main(String[] args) {
        int[] num = new int[26];
        num[0] = 100;
        num[25] = 200;
        int temp = num[25];
        num[25] = num[0];
        num[0] = temp;
        System.out.println("\n" + num[0] + " " + num[25]);
    }
}
```



swap

: 200 100

Ques:

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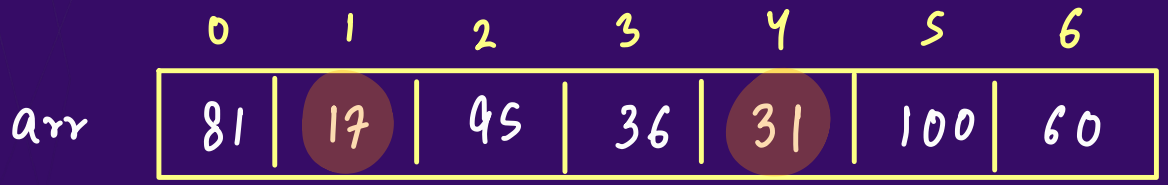
Q4 : Calculate the sum of all the elements in the given array.




```
int sum = 0;
```

Linear search

Q5 : Find the element ‘x’ in the array . Take array and x as input.

```
int x = sc.nextInt();
```

Ques:

Q6 : Find the maximum value out of all the elements in the array.

```
          0   1   2   3   4   5   6
arr = { 10, 8, 12, 4, 6, 23, 8 }
```

mx
↓
10
~~12~~
23

M-1 :

```
int mx = arr[0];
for(int i=1; i<n; i++){
    if(arr[i] > mx) mx = arr[i];
}
```

Ques:

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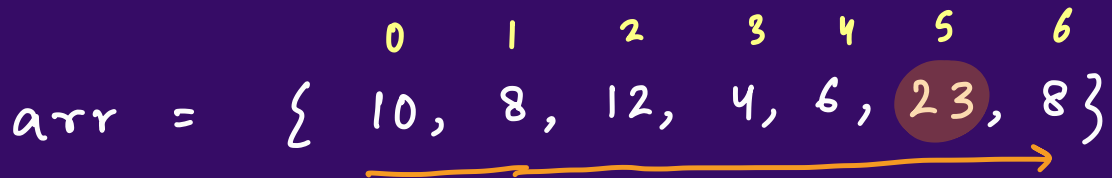
Q6 : Find the maximum value out of all the elements in the array.



M-II :

```
int mx = -1;
for(int i=0, i<n; i++){
    if(arr[i] > mx) mx = arr[i];
}
```

Ques: (Easy - med)

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Q7 : Find the second largest element in the given Array.

MCQ :

What is the difference between the 5's in these two expressions?

size of num

```
int num[]=new int[5] ;
num[5] = 11 ;
```

5th index

1. first is particular element, second is type
2. first is array size, second is particular element
3. first is particular element, second is array size
4. both specify array size

MCQ :

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What would happen if you assign a value to an element of an array whose subscript exceeds the size of the array?

index

1. the element will be set to 0
2. nothing, it's done all the time
3. other data may be overwritten
4. error message from the compiler

```
int[] arr = new int[5];   → 0 to 4

arr[6] = 7;
  ↓
index out of bound
```

State TRUE or FALSE :

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1. The array int[] num = new int[26] has twenty-six elements. True

2. The expression num[1] designates the first element in the array False
   second element

3. It is necessary to initialize the array at the time of declaration. False

4. The expression num[27] designates the 28th element in the array. True

Ques: H.W. Rakhna

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Q5: Count the number of elements in given array greater than a given number x.

Point out the errors(if any) in the following code: H.W

```
public class Main {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        int size = sc.nextInt();
        int[] arr = new int[size];
        for (int i = 0; i < size; i++) {
            arr[i] = sc.nextInt();
            System.out.print(arr[i] + " ");
        }
    }
}
```

Passing Array to Methods

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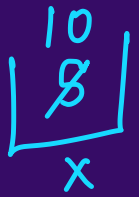
```
public static void main(String[] args) {
    int x = 5;
    System.out.println(x);
    change(x);
    System.out.println(x);
}
public static void change(int x) {
    x = 10;
}
```



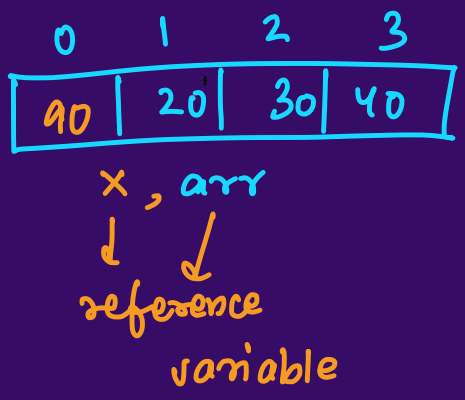
Output

5
5

Passing Array to Methods

```
public static void main(String[] args) {
    int[] arr = {10,20,30,40};
    System.out.println(arr[0]);
    change(arr);
    System.out.println(arr[0]);
}

public static void change(int[] x) {
    x[0] = 90;
}
```



Output

- 10
- 90

Pass by Reference

MCQ :

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When you pass an array as an argument to a Method, what actually gets passed?

1. address of the array (In Java Reference variable gets passed)
2. values of the elements of the array
3. address of the first element of the array
4. number of elements of the array

ArrayList in Java

Unlimited size Array

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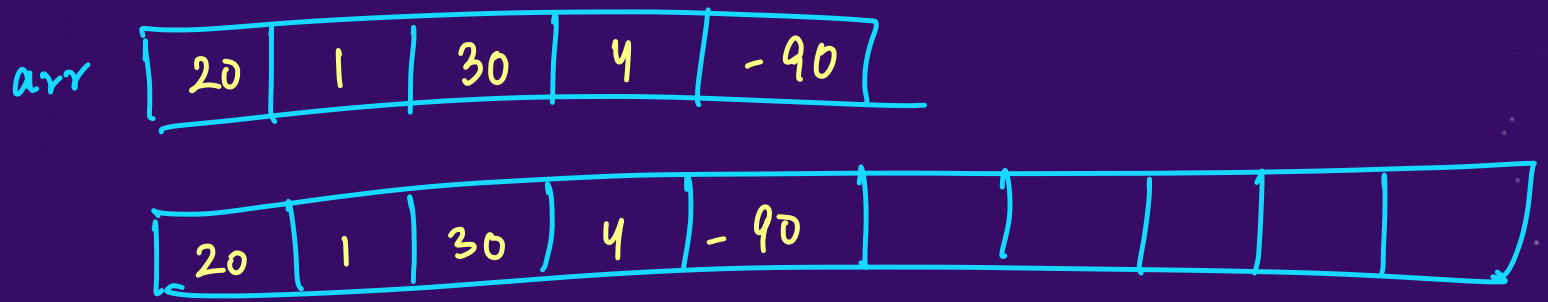
Why? → In Java, arrays they have fixed size

So, we use dynamic arrays using OOP



Basic Operations on ArrayList & Arrays

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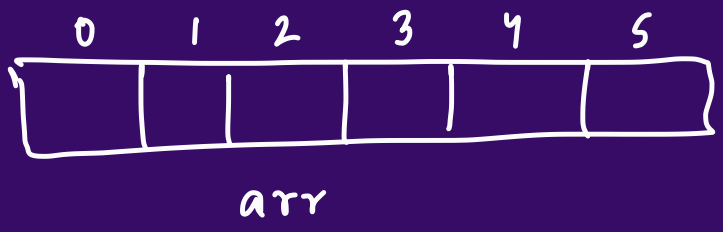
```
ArrayList<Integer> arr = new ArrayList<>(6);
```




```
arr.add(90);
```
↓
pushes 90 to the end of the list

```
arr.add(0, 30)
```
index ↑
initialised this value

```
arr.get(3);
```

```
arr.set(0, 50)
```
index ↓
update/modify

Ques :

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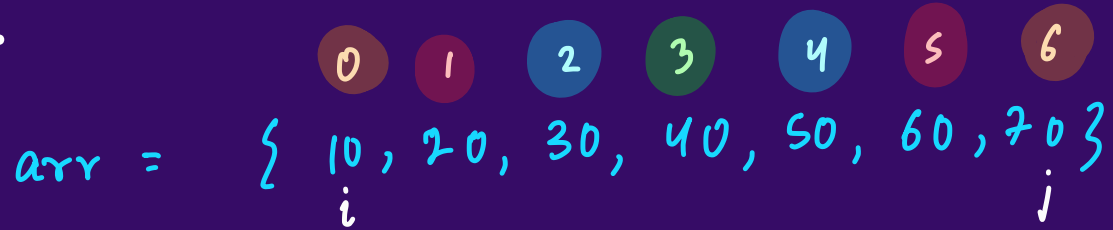
Q8 : Find the doublet in the Array whose sum is equal to the given value x. (Two Sum)

```
int[] arr = {3,-1,8,5,4,9,2};
int x = 9;
```

Two Pointers

Q9 : Write a program to reverse the array without using any extra array.



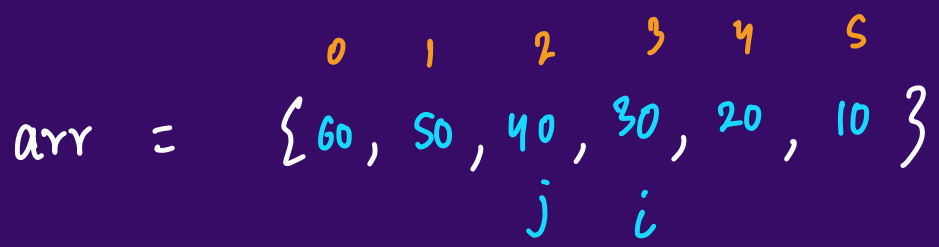
$\Rightarrow i + j = n - 1$

$j = n - 1 - i$

swap (arr[i], arr[j])

Two Pointers

Q9 : Write a program to reverse the array without using any extra array.




```
while (i<=j){
    swap(arr[i], arr[j])
    i++;
    j--;
}
```

Ques :

Q10 : Rotate the given array 'a' by k steps, where k is non-negative. Without using Extra Array

Note : k can be greater than n as well where n is the size of array 'a'.

a = {10 20 30 40 50 60 70}

K=5

n=7

n-K

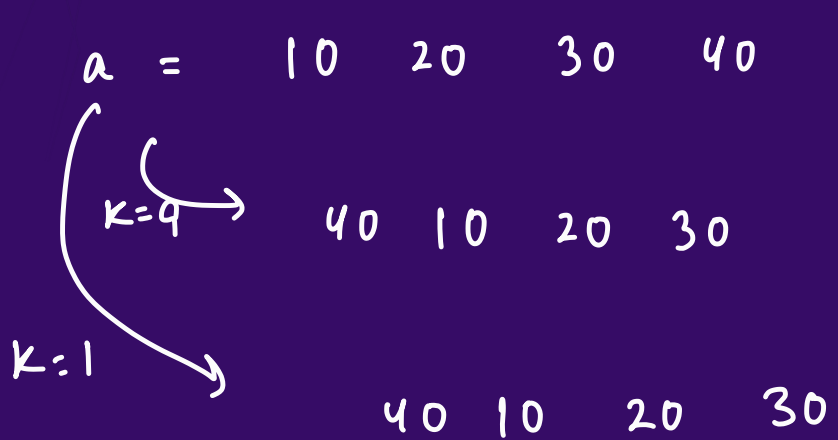
30 40 50 60 70 10 20

Ques :

Q10 : Rotate the given array ‘a’ by k steps, where k is non-negative.

$k = k \% n$

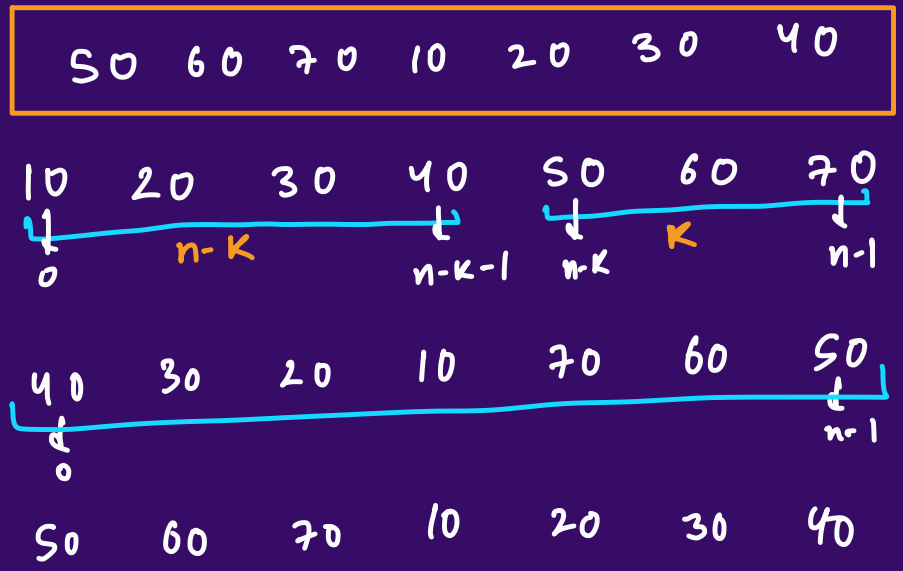
Note : k can be greater than n as well where n is the size of array ‘a’.



Ques :

Q10 : Rotate the given array ‘a’ by k steps, where k is non-negative.

Note : k can be greater than n as well where n is the size of array ‘a’.



K=3
n=7

Ques :

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Q11. Sort the array of 0's and 1's .

arr = { 1 0 0 1 1 0 0 0 1 0 }

M-I : Arrays.sort(arr);

M-II : int noOfOnes = 0, noOfZeroes = 0;

↳ Calculate no. of 0's & 1's .

Update the array with 0's & 1's

Two Pass Soln

Ques : M-2 : One Pass Soln

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Q11. Sort the array of 0's and 1's .

	0	1	2	3	4	5	6	7	8	9
arr = {	0	0	0	0	0	0	1	1	1	1 }
						i				
						j				

```
while(i<j)
    if (arr[i]==0)  i++;
    if (arr[j]==1)  j--;
    if(arr[i]==1 && arr[j]==0){
        swap(arr[i], arr[j]);
        i++;
        j--;
    }
```

#Hints

1) 2 pointer approach

2) Swapping

Ques :

Q11. Sort the array of 0's and 1's .

arr = { 0 , 0, 0 , 1, 1, 1 }
j i

```
while(i<j)
  if (arr[i]==0)  i++;
  if (arr[j]==1)  j--;
  if(arr[i]==1 && arr[j]==0){
      swap(arr[i], arr[j]);
      i++;
      j--;
  }
```

Ques :

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Q12. Sort the array of 0's , 1's and 2's . (Dutch Flag Algorithm)

Ex - arr = { 0, 1, 2, 0, 1, 2, 1, 2, 0, 0 }

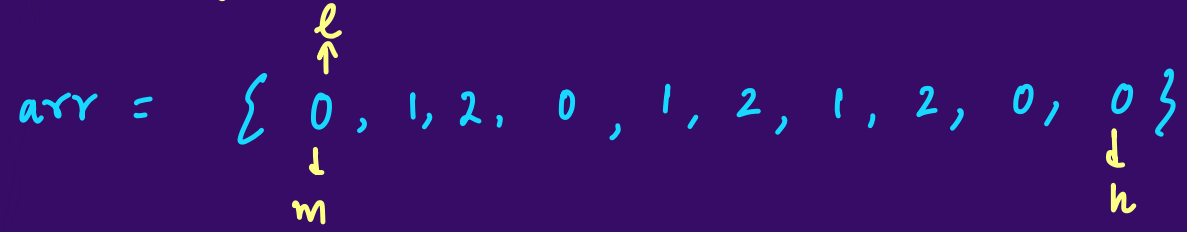
noo, noo, not
4 3 3

M-I → two- pass solution

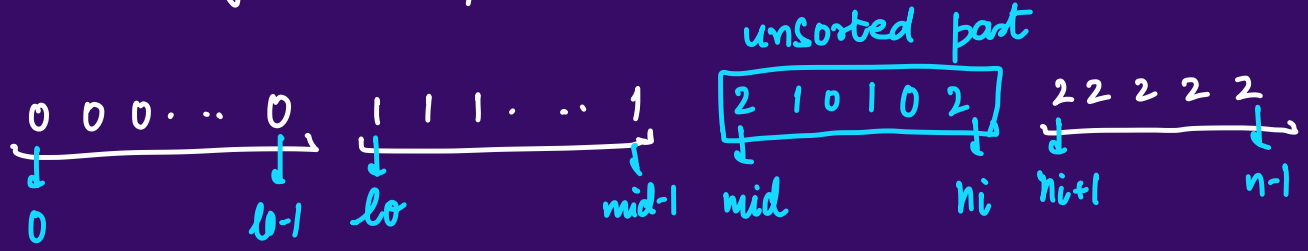
Ques : 3-pointer approach → lo, mid, hi

Q12. Sort the array of 0's , 1's and 2's . (Dutch Flag Algorithm)

Method-2 : Dutch Flag Algorithm



Steps : Break array in 4 parts



Ques :

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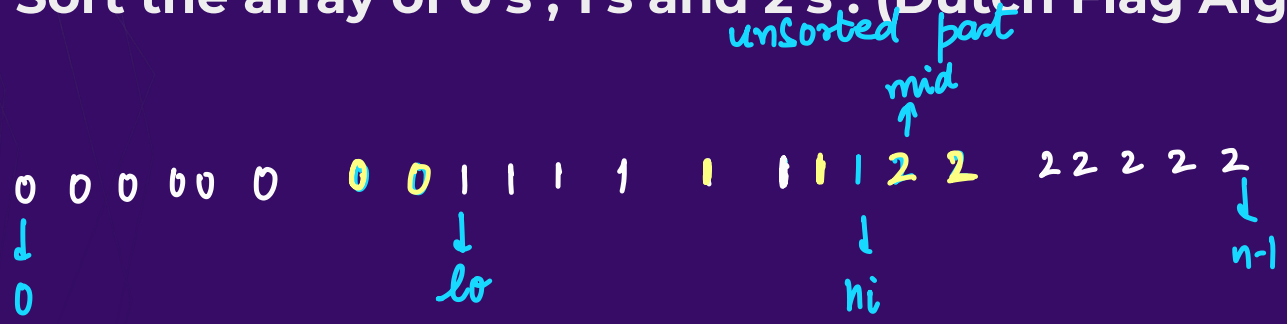
Q12. Sort the array of 0's , 1's and 2's . (Dutch Flag Algorithm)




```
if(arr[mid] == 0){
    swap(arr[lo], arr[mid])
    lo++, mid++
}
if(arr[mid] == 1)  mid++
```

```
if(arr[mid] == 2){
    swap(arr[mid], arr[hi])
    hi--;
}
```

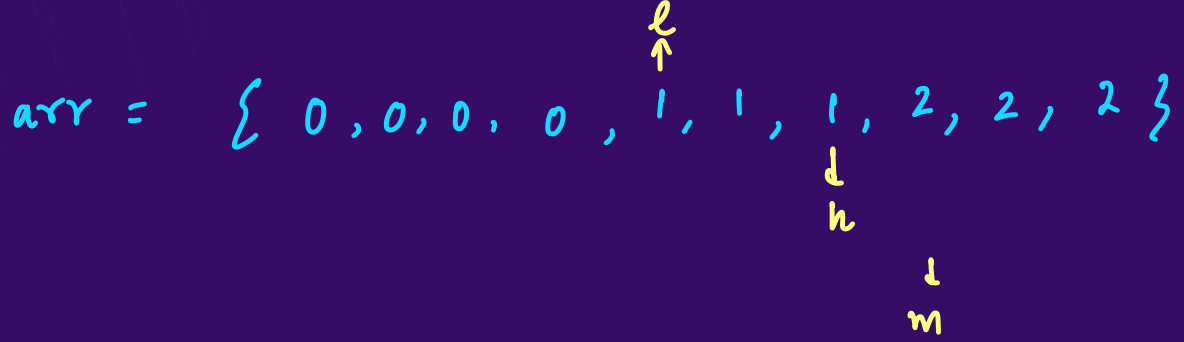
lo se pehle saare 0 hone chahiye

hi ke baad saare 2 hone chahiye

mid se pehle

Ques :

Q12. Sort the array of 0's , 1's and 2's . (Dutch Flag Algorithm)



Ques : # Hint → 3 pointer → i, j, K → 0
(i → a, j → b, K → c)

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Q13. Merge two sorted arrays in one single array.

a

0	1	2	3
11	33	42	71

b

0	1	2	3
26	54	69	81

j

i

c

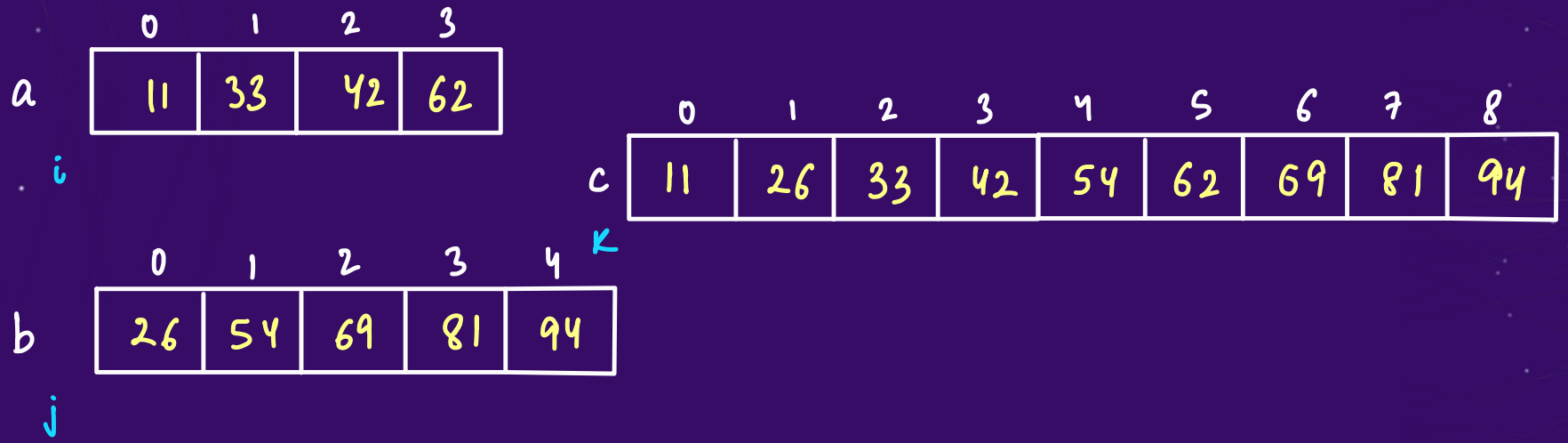
0	1	2	3	4	5	6	7
11	26	33	42	54	69	71	

K

```
if(a[i] <= b[j]){
    c[k] = a[i];
    i++;k++;
}
```

Ques :

Q13. Merge two sorted arrays .



Ques :

Next greater element ⇒ Stacks

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Q14. Next greatest element.

arr =

12	8	60	37	2	49	16	28	21

ans =

							21	-1

nge = 21 28

```
int nge = arr[n-1];
```

```
for(int i= n-2; i>=0; i--){
    ans[i] = nge;
    nge = max(nge, arr[i]);
}
```

THANK YOU