


array → group of similar data type + contiguous memory

integers

int a

int b

int c

int d

int e

[array]

int → string X

class Main {
 prv fun ()
 int a=5
}
prv main () {

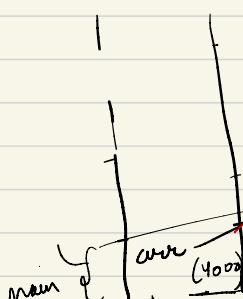
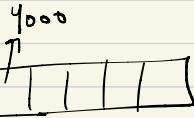
int [] arr;
arr = new int [n];

}

temporary
stack memory

RAM

permanent
heap memory



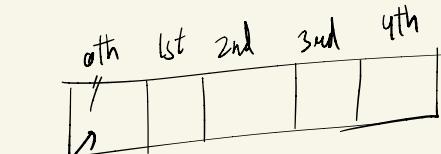
Syntax

data type + [] + array name

int [] arr; // declaration

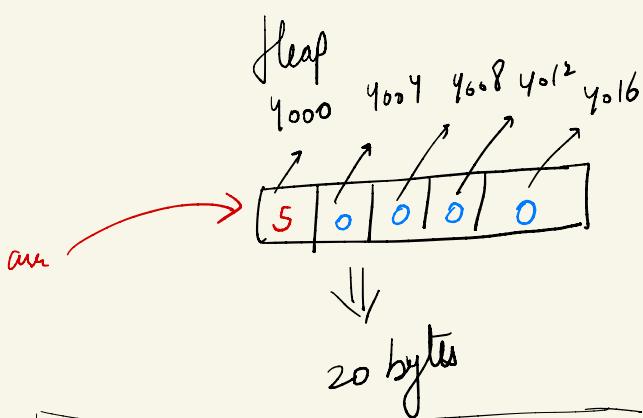
arr = new int [s];

(indexes)



arr size = n;
Indices = [0, n-1]

int () arr;
arr = new int [s]



set

arr [idx] = value;

size

int size = arr. length;

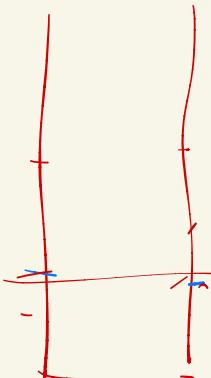
get

arr [idx]

class Main {

```
psv main() {
    1) int arr;
    2) arr = new int [s];
}
```

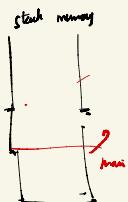
stack



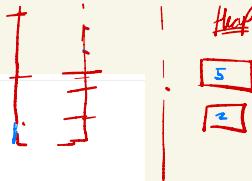
Heap

garbage
collector

`arr = new int[5]; // initialization`



```
1 public class MyClass {  
2     public static void swap(int[] arr1, int[] arr2){  
3         int temp=arr1[0];  
4         arr1[0]=arr2[0];  
5         arr2[0]=temp;  
6     }  
7     public static void main(String args[]){  
8         int[] arr1={1,2,3};  
9         int[] arr2={4,5,6};  
10        swap(arr1,arr2);  
11        System.out.println(arr1[0]);  
12        System.out.println(arr2[0]);  
13    }  
14 }
```



Heap

Ques 1) Take an input n , create an array of size n .

Then Take n inputs, store it in array and print it.

Ques 2) Print the array in reverse.



$n=5$

$i=0 ; i < n$

$i = 4 \rightarrow 0$

array()

19

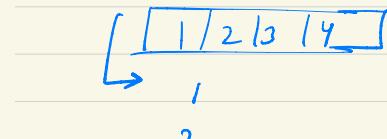
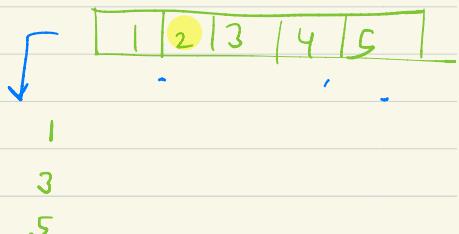
15

13

22

1

Ques 3) Print alternate elements of array



Ques 4) Print all the even numbers existing in your array. and print at which index they are.

Ques 5) Get the sum of all the even numbers and all the odd numbers in your array and find their difference.

Ques 6) Find the number of elements with index = to n .

Ans 1) 0 or 1.

↓
input this value.

$A = b$

$$\left[\begin{array}{cccc|c} 0 & 1 & 2 & 3 & 4 & 5 \\ 4 & 4 & 1 & 4 & 4 & 12 \end{array} \right] \rightarrow 1$$

$$\boxed{\tan = 4}$$

$\uparrow \tan > 0 \text{ & } \tan < 1$

0	1	2	3	4
12	13	19	16	28

$$\text{Even sum} = 12 + 16 + 28 = 56$$

$$\text{Odd sum} = 13 + 19 + 32 = 64$$

(24)

```

44
45     System.out.println("Difference of all the even and odd numbers");
46
47     int esum=0;
48     int osum=0;
49
50     for(int i=0; i<n; i++){
51         int v=arr[i];
52
53         if(v%2==0){
54             esum=esum+v;
55         } else {
56             osum=osum+v;
57         }
58     }
59
60     System.out.println("The difference is = "+(esum-osum));
61
62 }
```

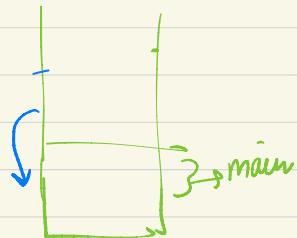
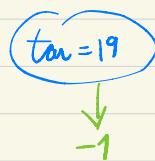
Ques 1) Take an input n , input n integers in your array
Take another input "tar". Find at which index
tar exist

eg.

0	1	2	3	4	5	
9	4	5	13	4	13	9

```
for (int i=0; i < n; i++) {  
    if (arr[i] == tar) {  
        return i;  
    }  
}
```

$i = 6 \times 2 + 3 + 5$



funtion → employee

↓
(input) → work/processes → output

↓
parameters/arguments

Ques 2 Find the maximum value in this array.

Find the minimum value in this array.

0	1	2	3	4
-10	-3	-4	-19	-5

max = -3
↓
Intelligent Value

```
// find maximum in array
public static int max_of_array(int[] arr, int n){
    int max=0; // this is wrong

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

    return max;
}
```

$$n=5$$

↓

0	0	0	0	0	1
---	---	---	---	---	---

int a=5;
int b=3;

Math.max

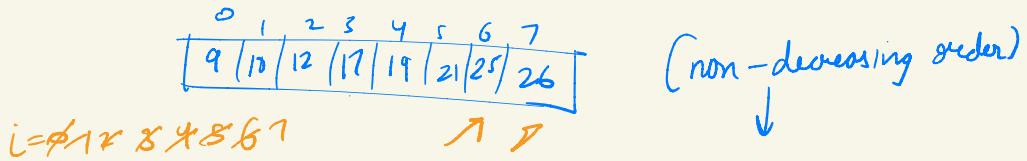
b = Math.max(a, b);

$$b = 5$$

a = Math.max(a, b);

$$a = 85$$

Ques \Rightarrow Given a sorted array, check if it contains duplicate values or not.

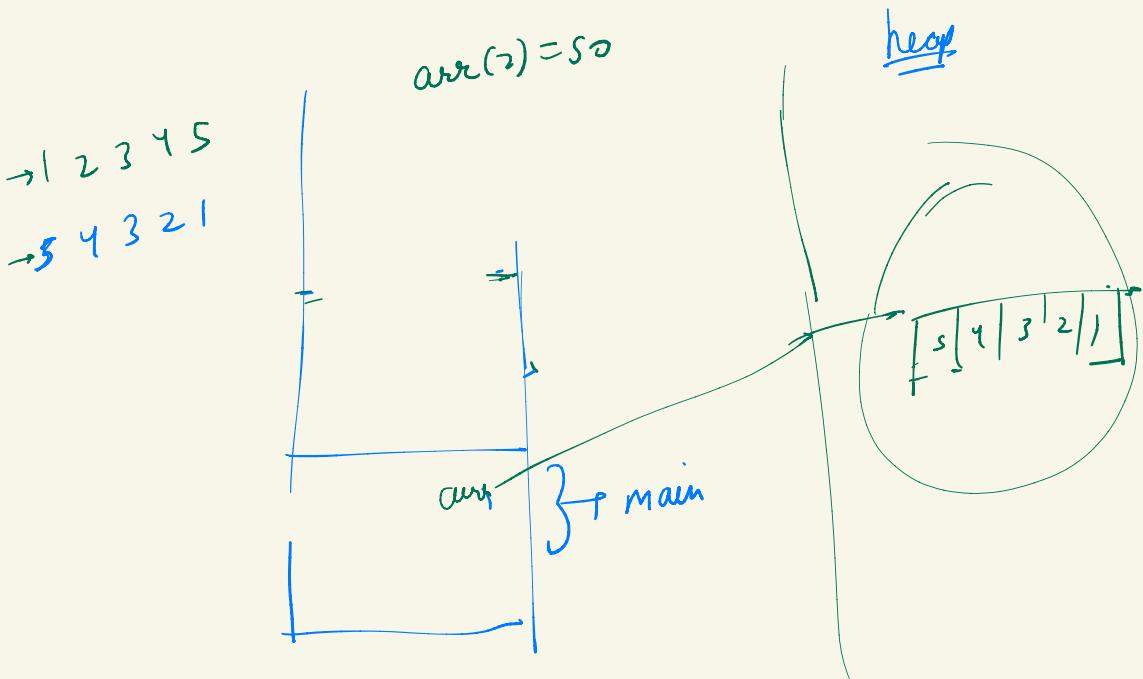


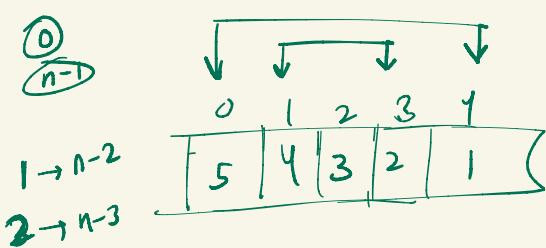
```
//find if duplicates are there in sorted array
//n-> size of array
public static boolean containsDuplicates(int[] arr, int n){
    for(int i=0; i<n; i++){
        if(arr[i]==arr[i+1]){
            return true;
        }
    }
    return false;
}
```

$i < n-1$

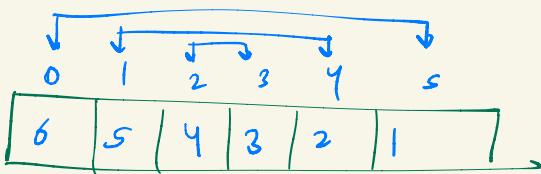
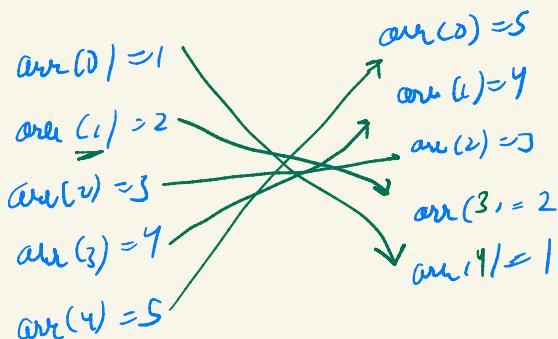
arr(i) = 26 arr(j)
arr(i+1) = arr(8)
↓
(arr[8])

Ques) Reverse an array. [Inplace some way]





first index \rightarrow last index
 second index \rightarrow last second index
 3rd \rightarrow last 3rd index
 \dots \rightarrow last n th index



$$\begin{cases} 0 \rightarrow n-1(5) \\ 1 \rightarrow n-2(4) \\ 2 \rightarrow n-3(3) \end{cases}$$

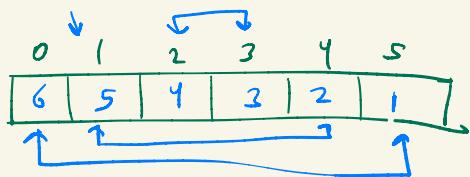
$$\begin{aligned}
 0 &\rightarrow (n-1)-0 \Rightarrow (n-1) \\
 1 &\rightarrow (n-1)-1 \Rightarrow (n-2) \\
 2 &\rightarrow (n-1)-2 \Rightarrow (n-3) \\
 3 &\rightarrow (n-1)-3 \Rightarrow (n-4)
 \end{aligned}$$

`for (int i=0; i<n/2; ++i)`

$(i, n-1-i)$

$i \rightarrow (n-1)-i$

$n=6$



$i=0$

$i < 3$

```

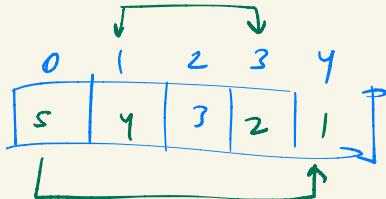
57
58     public static void reverse_array(int[] arr, int n){
59         for(int i=0; i<n/2; i++){
60             //swap (i) and (n-i-1);
61             int temp=arr[i];
62
63             arr[i]=arr[n-i-1];
64             arr[n-i-1]=temp;
65
66     }

```

$i=0, \quad n-1$

$\frac{S}{2} + 2$

$n=5$



$i=0, \quad n-1$

$i=1, \quad n-1-1 \rightarrow (n-2)$

$i < 2$

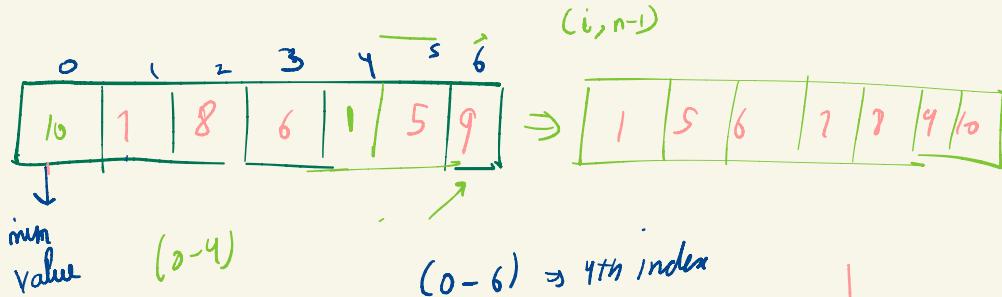
int $a=5$
int $b=6$

$swap(a, b) \rightarrow$ $b=5$
 $a=b$

{
 int temp = a; ($temp=5$)
 a = b ($a=6$)
 b = temp ($b=5$)

$a=b \quad X$
 $b=a$

1) Selection Sort



```

4 public static void swap(int[] arr, int i, int j) {
5     int temp=arr[i];
6
7     arr[i]=arr[j];
8     arr[j]=temp;
9 }
10
11 public static void sort_array(int[] arr, int n){
12     for(int i=0; i<n; i++){
13         int min_idx=i;
14
15         for(int j=i+1; j<n; j++){
16             if(arr[j]<arr[min_idx]){
17                 min_idx=j;
18             }
19         }
20
21         swap(arr,i,min_idx);
22     }
23 }
```

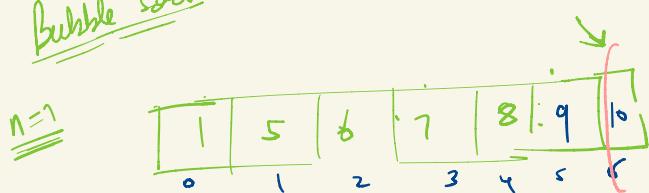
$i \geq 0$
 \downarrow
 $1, 5, 6, 7, 7, 9, 10$

\downarrow
 $\text{min_idx} = \emptyset \leftarrow 3$

\downarrow
 arr(min_idx)
 \downarrow
 min_min

$i < n-1$

Bubble Sort

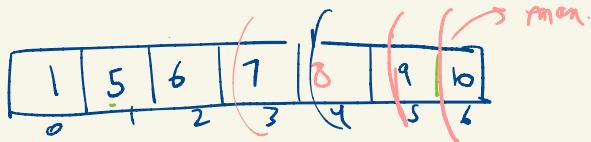


$0\text{th it} \rightarrow n-2 (< n-1)$
 $1\text{st it} \rightarrow n-3 (< n-2)$

$0\text{th iteration} \rightarrow (5, 6)$
 $1\text{st iteration} \rightarrow (4, 5) \quad (\text{itm } n-3)$
 $2\text{nd iter} \rightarrow (3, 4)$
 $3\text{rd} \rightarrow (2, 3)$
 $4\text{th} \rightarrow (1, 2)$
 $5\text{th} \rightarrow (0, 1)$

$n-1$

$i = 0 \rightarrow n-2 \quad (\text{itm } < n-1)$
 $i = 1 \rightarrow n-3 \quad (\text{itm } < n-2)$
 $i = 2 \rightarrow n-4 \quad (\text{itm } < n-3)$
 $i = 3 \rightarrow n-5 \quad (\text{itm } < n-4)$
 $i = 4 \rightarrow n-6 \quad (\text{itm } < n-5)$
 $i = 5 \rightarrow n-7 \quad (\text{itm } < n-6)$
 \downarrow
 $n-1-5$



$i=2 \text{ to } 6$

```

25 // bubble sort =====
26
27 public static void bubble_sort(int[] arr, int n){
28
29     for(int i=0; i<n-1; i++){ // more than one iterations will be required
30
31         for(int idx=0; idx<n-1-i; idx++){
32             if(arr[idx]>arr[idx+1]){
33                 swap(arr, idx, idx+1);
34             }
35         }
36     }
37 }
38 }
39 }
40 }
```

$i < n-1-i$ $i < 2$
 $i < n-5$ $i < 1$

$\text{arr}[i]$

6
4 5 3 8 6 1
↑
 $i = 1$
 $i < n-1$

$\text{arr}[i-1] < \text{arr}[i] > \text{arr}[i+1]$
 $\text{arr}[i-1] < \text{arr}[i]$
 $\text{arr}[i+1] < \text{arr}[i]$

Break Statement

```
for (int i=1; i<=10; i++) {
    if (i==5)
        break;
}
```

$i=1 \leftarrow$
 $i=2 \leftarrow$
 $i=3 \leftarrow$
 $i=4 \leftarrow$
 $i=5 \leftarrow$

Continue Statement \rightarrow skips the current iteration -

```
for(int i=1; i<=10; i++){
    if(i==7){
        continue;
    }
    System.out.println(i);
}
```

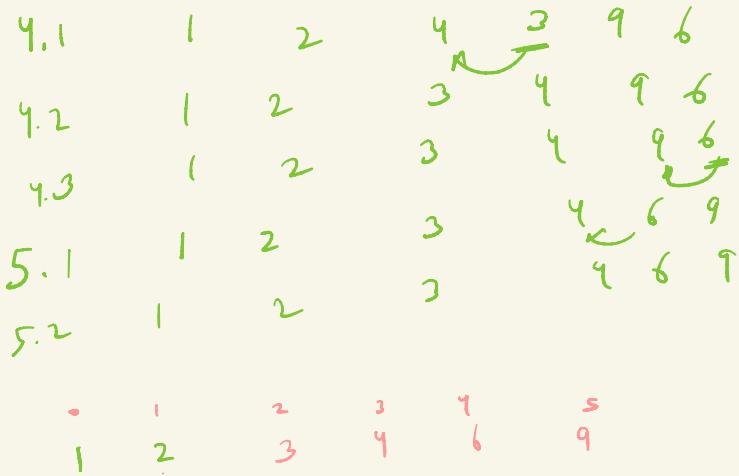
$i=x8$

1
 2
 3
 4
 5
 6
 8
 9
 10

Insertion Sort

Iterations = n - 1

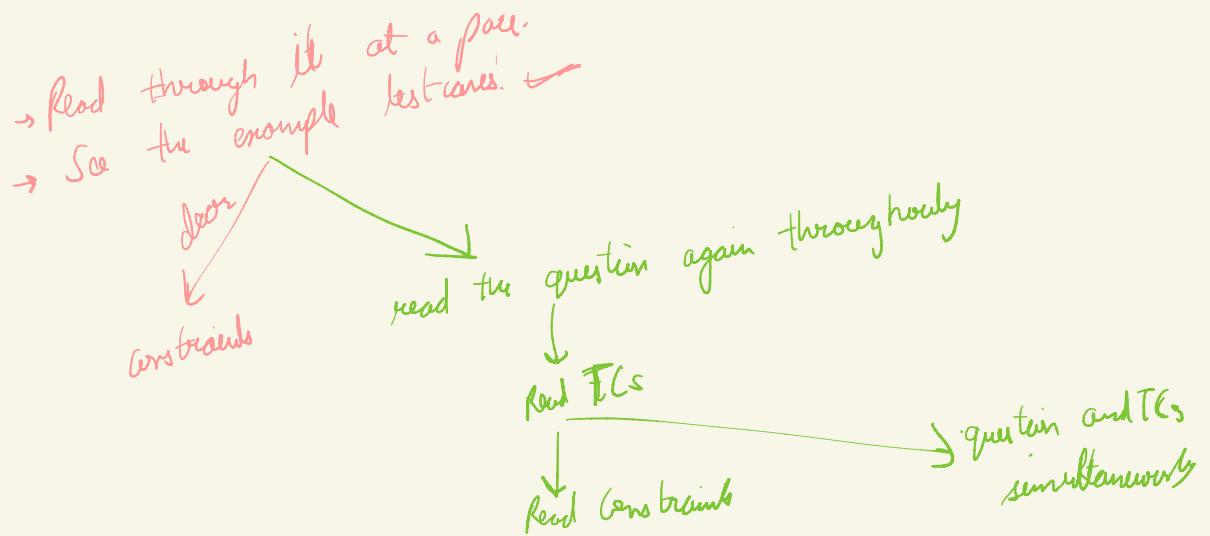
	0	1	2	3	4	5
	9	2	4	1	3	6
1.1	2	9	4	1	3	6
2.1	2	9	9	1	3	6
2.2	2	9	9	1	3	6
3.1	2	9	9	1	9	6
3.2	2	1	9	9	3	6
3.3	1	2	9	9	3	6



$i = 1, 2, 3, 4, 5,$

```
public static void insertion_sort(int[] arr, int n) {
    for(int i=1; i<n; i++){ // we need to insert arr[i] at correct position
        for(int j=1; j>0; j--){ // asking j-1 everytime
            if(arr[j-1]>arr[j]){
                swap(arr,j-1,j);
            } else {
                break;
            }
        }
    }
}
```

5 3 4 2 1



0 1 2 3 4 5
3 6 9 3 3 9

(0, 3)
(0, 4)

(2, 5)
(3, 4)

```
public static int getLuckyPairs(int[] arr, int n){  
    int count = 0; int i=0; i<n; i++
```

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

```
    return count;  
}
```

Ans Given an array, find first occurrence and last occurrence of given target value.

0	1	2	3	4	5	6	7	8	9	10	11
1	3	4	3	4	5	5	3	7	3	4	5

for $i=3$, $j=0 = 1$ \rightarrow single for loop
 $j=0 = 9$

$i=7 + 2 \times 2 = 11$ 8 9
10 7

```

int lo=-1;
int fo=-1;

for(int i=0; i<n; i++){
    if(arr[i]==tar){
        if(fo== -1){
            fo=i;
        }
        lo=i;
    }
}

```

```

System.out.println("first occurrence is: "+fo);
System.out.println("last occurrence is: "+lo);

```

Ques Find if the given array is mountain array or not

→ 2, 21, 45, 50, 33, 29, 25, 19 ✓

(i) 1, 81, 79, 50, 40 ✓

(i=1) 1, 2, 7, 9, 11, 5 ✓
1 2 3 4 5 → X

| 4 3 8 2 → X 5 4 3 2 1 → X

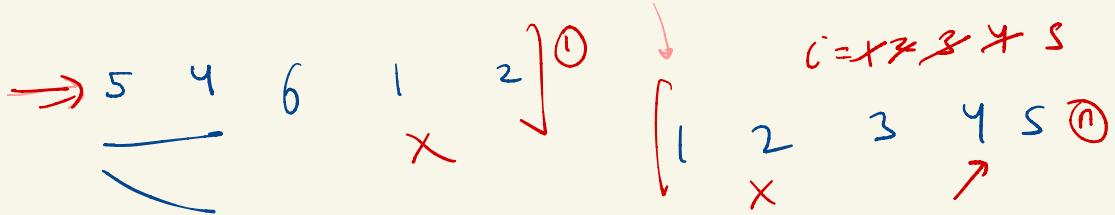
✓ arr < arr(i) < - - arr(i) > arr(i+1) > arr(i+2)
- - - arr(n-1)

5 4 6 2 1 → false

i = X ≠ 3

[2 4 8 5 3] ?

($i=1$ || $i==n$)



```
for(i=1; i<n; i++){
    if(arr[i-1]>=arr[i]){
        break;
    }
}
```