

Sorting

→ arranging something in particular order.

4 3 1 5 2

sort asc. → 1 2 3 4 5.

desc. → 5 4 3 2 1

even... odd → 2 4 1 3 5

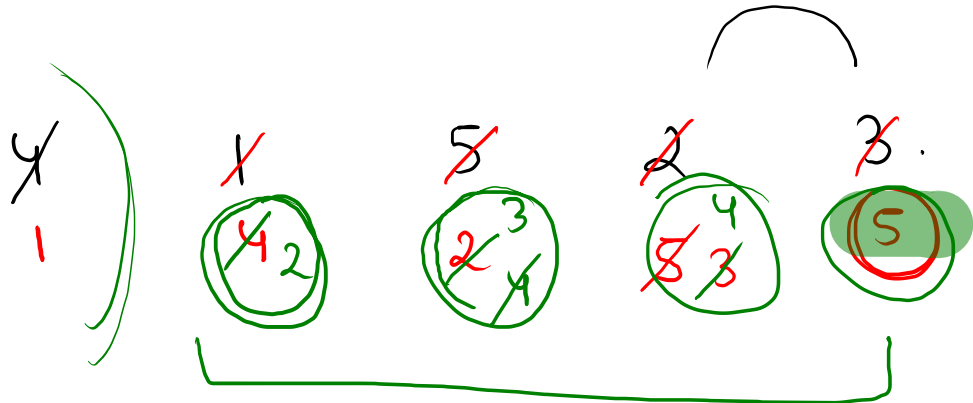
basic. / fundamental

Bubble Sort

A → 4 1 5 3 2.

some itr.

each itr. → (largest)

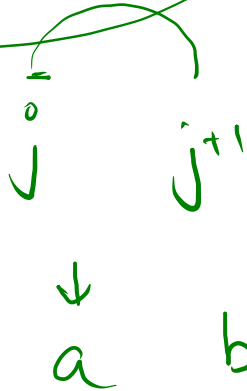
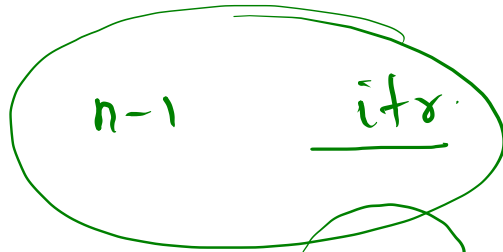


each → 1 → position

(n-1)

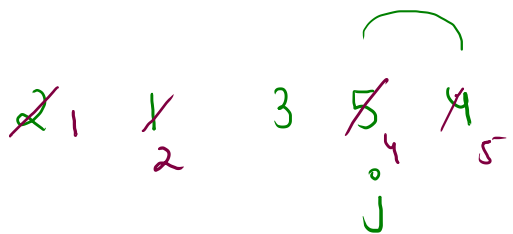
(n-1)

Bubble Sort.



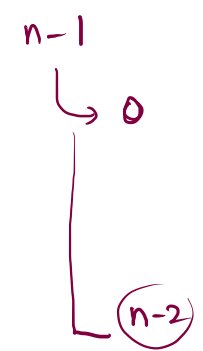
~~5~~

~~4~~



$$A[j] > A[j+1]$$

swap



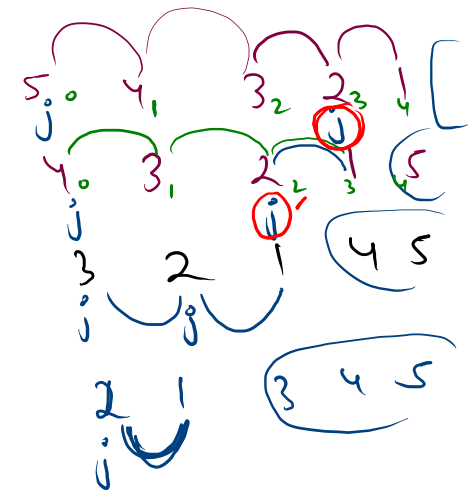
0th.
1
2
i

$$i=0$$

$$j = n-i-1$$

$$i=0 \quad 5-0-1$$

$$0 < 4$$



$$i=1$$

$$j < n-i-1$$

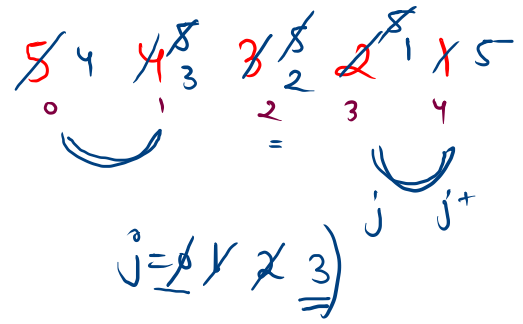
$$< 5-1-1$$

$$< 3$$

```

5 public static void bubbleSort(int [] A){
6     int n = A.length;
7     for(int i = 0; i < n-1; i++){
8         for(int j = 0; j < n-i-1; j++){
9             if(A[j] > A[j+1]){
10                 int tmp = A[j];
11                 A[j] = A[j+1];
12                 A[j+1] = tmp;
13             }
14         }
15     }
16 }

```



$i=0$

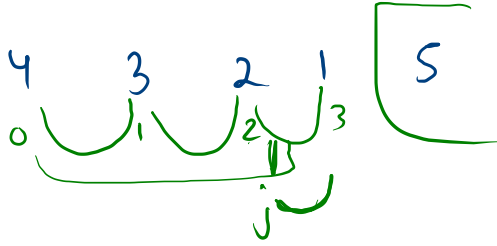
$< 5-0-1$

< 4

(< 4)

$i=1$

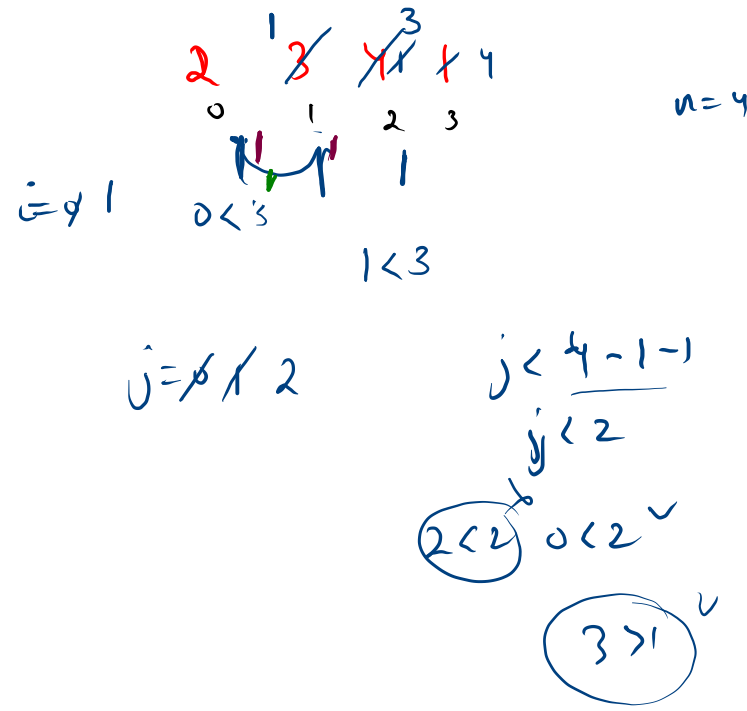
$j < 5-1-1$
 $j < 3$



```

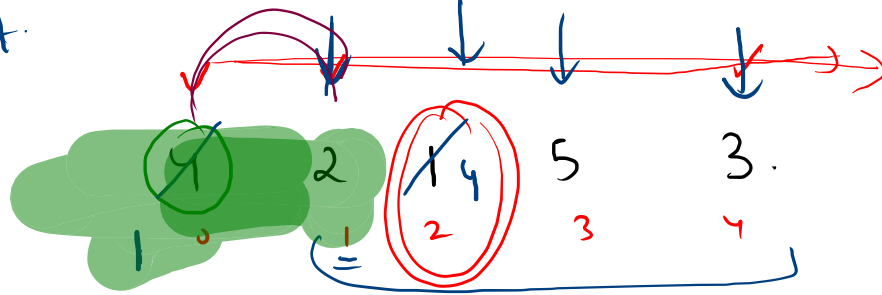
1  import java.util.*;
2  public class Main {
3      public static void bubbleSort(int [] A){
4          int n = A.length;
5          for(int i = 0; i < n-1; i++){
6              for(int j = 0; j < n-i-1; j++){
7                  if(A[j] > A[j+1]){
8                      int tmp = A[j];
9                      A[j] = A[j+1];
10                     A[j+1] = tmp;
11                 }
12             }
13         }
14         for(int i = 0; i < n; i++){
15             System.out.print(A[i] + " ");
16         }
17     }
18     public static void main(String[] args) {
19         Scanner scn = new Scanner(System.in);
20         int n = scn.nextInt();
21         int [] A = new int[n];
22         for(int i = 0; i < n; i++){
23             A[i] = scn.nextInt();
24         }
25         bubbleSort(A);
26     }
27 }

```



Selection Sort.

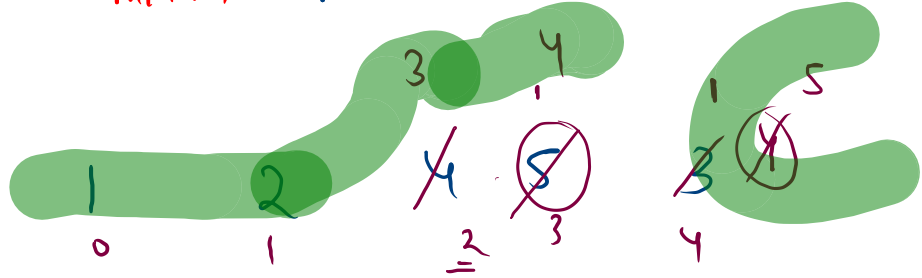
eg.



each itr

↓
smallest

min idx = 1



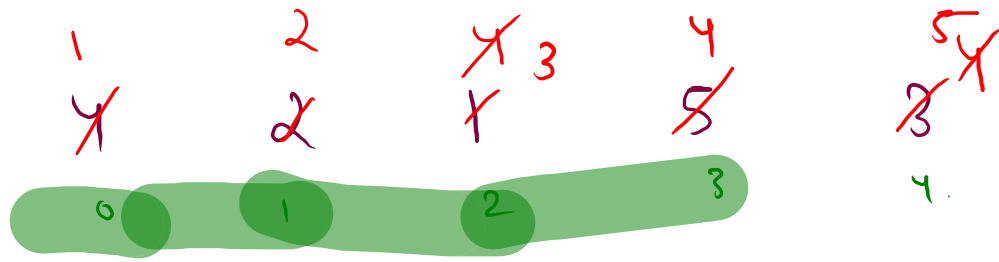
min idx = ~~1~~ 4

min idx = ~~1~~ 4

(5, 4)

(4, 5)

(4, 3)



$i = 0$
 $\min \text{idx} = 2$

$i = 1$
 $\min \text{idx} = 1$

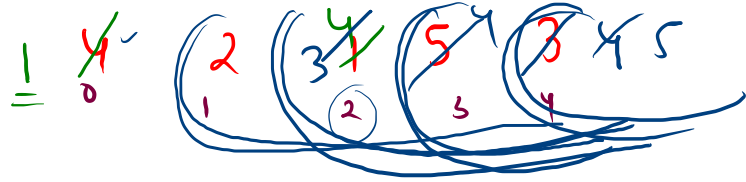
$i = 2$
 $\min \text{idx} = 4$

$i = 3$
 $\min \text{idx} = 4$

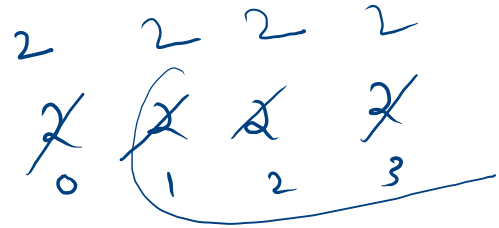

```

5 // swap(minIdx, i);
6 public class Main {
7     public static void selectionSort(int [] A){
8         int n = A.length;
9         for(int i = 0; i < n-1; i++){
10             int minIdx = i;
11             for(int j = i+1; j < n; j++){
12                 if(A[j] < A[minIdx]){
13                     minIdx = j;
14                 }
15             }
16             int tmp = A[i];
17             A[i] = A[minIdx];
18             A[minIdx] = tmp;
19         }
20         for(int i = 0; i < n; i++){
21             System.out.print(A[i] + " ");
22         }
23     }
24
25
26     public static void main(String[] args) {
27         Scanner scn = new Scanner(System.in);
28         int n = scn.nextInt();
29         int [] A = new int[n];
30         for(int i = 0; i < n; i++){
31             A[i] = scn.nextInt();
32         }
33         selectionSort(A);
34     }
35 }
36

```



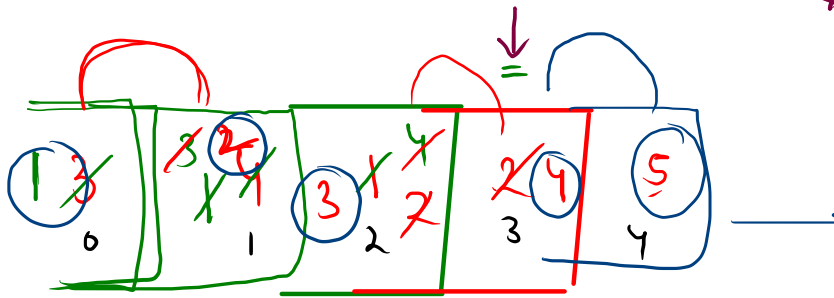
$i = 0$ ~~1~~ ~~2~~ 3
 $\text{minIdx} = 1$ ~~3~~ 4



$i = 0$

$\text{min} = 0$

Insertion sort



★ current ele
at its right pos.

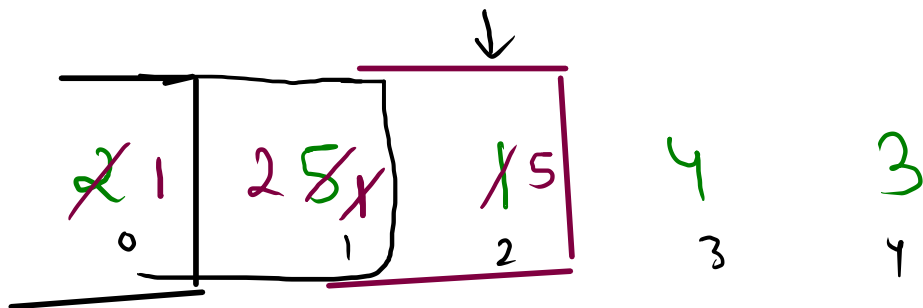
4, 1

4,

4, 2

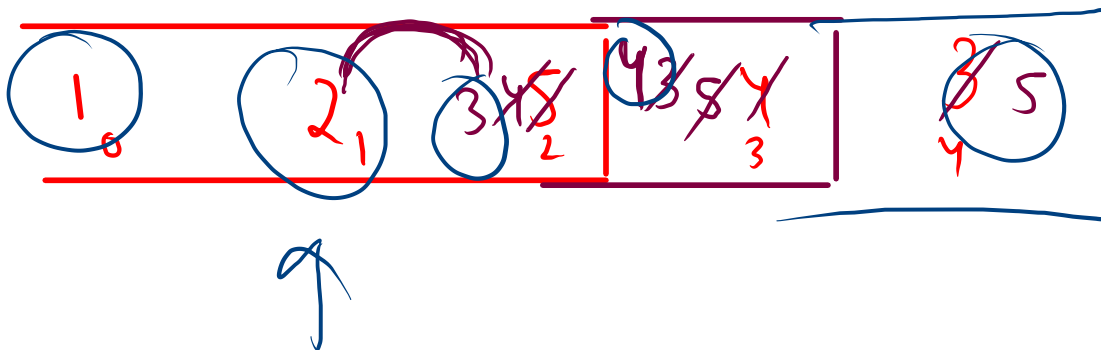
3, 2

(1, 2)



$5,1$

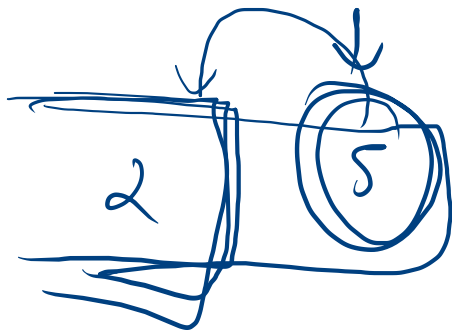
$2,1$



$5,4$

$2,4$

$5,3$



1

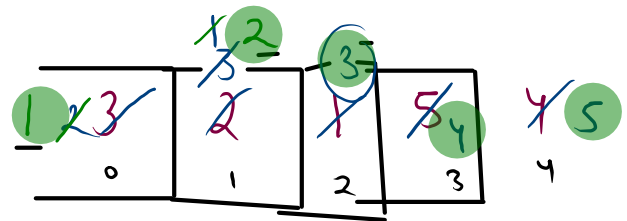
4

3

```

4 public static void insertionSort(int [] A){
5     int n = A.length;
6     for(int i = 1; i < n; i++){
7         for(int j = i; j >= 1; j--){
8             if(A[j] < A[j-1]){
9                 int tmp = A[j];
10                A[j] = A[j-1];
11                A[j-1] = tmp;
12            }
13            else{
14                break;
15            }
16        }
17    }

```



$i = 1, 2, 3, 4$

$j = 3$

$j \geq 1$
 $4 \geq 1$

$4 < 5$

$4 < 5$

```
1 import java.util.*;
2
3 public class Main {
4     public static void insertionSort(int [] A){
5         int n = A.length;
6         for(int i = 1; i < n; i++){
7             for(int j = i; j >= 1; j--){
8                 if(A[j] < A[j-1]){
9                     int tmp = A[j];
10                    A[j] = A[j-1];
11                    A[j-1] = tmp;
12                }
13                else{
14                    break;
15                }
16            }
17        }
18        for(int i = 0; i < n; i++){
19            System.out.print(A[i] + " ");
20        }
21    }
22    public static void main(String[] args) {
23        Scanner scn = new Scanner(System.in);
24        int n = scn.nextInt();
25        int [] A = new int[n];
26        for(int i = 0; i < n; i++){
27            A[i] = scn.nextInt();
28        }
29        insertionSort(A);
30    }
31 }
32
```