INSERTION SORT

Imagine, the list is as follows

20	35	-15	7	55	1	-22
0	1	2	3	4	5	6

- Sorted partition
- Unsorted partition

→ FirstUnsortedIndex = 1 ; this is the first index of the unsorted partition

→ i = 0 ; Variable used to traverse the sorted partition from right to left

→ newElement = 35 - the Value we want to insert into the sorted partition [firstUnsortedIndex]

20 < 35 ; Insert 35 into sorted partition.

20	35	-15	7	55	1	-22
0	1	2	3	4	5	6

→ FirstUnsortedIndex = 2 ; this is the first index of the Unsorted partition

→ i = 1 ; Variable used to traverse the sorted partition from right to left

→ newElement = -15 - the Value we want to insert into the sorted partition [firstUnsortedIndex].

-15 < 35 ; Shift 35 to the right

20 $\boxed{35}$ 35 7 55 1 -22

$\boxed{20}$ 20 35 7 55 1 -22

-15 20 35 7 55 1 -22

→ FirstUnsortedIndex = 3 - this is the first inden of the Sorted Partition

→ i = 2 - index used to traverse the sorted partition from right to left

→ newElement = 7 - the Value we want to insert into sorted partition [firstUnsortedIndex]

-15 20 $\boxed{35}$ 35 55 1 -22

-15 $\boxed{20}$ 20 35 55 1 -22

-15 7 20 35 55 1 -22

→ FirstUnsorted~~Partition~~ Index = 4; This is the first index of Unsorted Partition

→ i = 3; index used to traverse the sorted partition from right to left

→ newElement = 55 - the element we want to insert into the sorted partition

35 < 55; therefore directly insert into Sorted Partition.

-15 7 20 35 55 1 -22

→ FirstUnsorted~~Partition~~ Index = 5; This is the first index of Unsorted Partition

→ i = 4; index used to traverse the sorted partition from right to left

→ new Element = 1 - the element we want to insert into the Sorted partition

-15 7 20 35 $\boxed{55}$ 55 -22

-15 7 20 $\boxed{35}$ 35 55 -22

-15 7 $\boxed{20}$ 20 35 55 -22

-15 $\boxed{7}$ 7 20 35 55 -22

-15 1 7 20 35 55 -22

→ FirstUnsortedIndex = 6; This is the first index of Unsorted partition

→ i = 5; index used to traverse the sorted partition from right to left

→ newElement = -22, the element we want to insert into the sorted partition

-22 < 55

-15 1 7 20 35 55 -22
-15 1 7 20 35 $\boxed{55}$ 55 -22
-15 1 7 20 $\boxed{35}$ 35 55 -22
-15 1 7 $\boxed{20}$ 20 35 55 -22
-15 1 $\boxed{7}$ 7 20 35 55 -22
-15 $\boxed{1}$ 1 7 20 35 55 -22
$\boxed{-15}$ -15 1 7 20 35 55 -22
-22 -15 1 7 20 35 55

∴ All the elements have been sorted.

→ In- place Algorithm

→ $O(n^2)$ ← Quadratic time complexity

→ It takes 100 steps to sort 10 elements, 10,000 steps to sort 100 elements

→ Stable Algorithm.

Insertion Sort Implementation:

```
import java.util.Scanner;
class InsertionSort{
Public Static Void main(String [] args){
  // collection of data
  /* To collect the data from user,
remove these comments
      int array[] = new int [10];
    Scanner in = new Scanner (System.in);
    System.out.println("Enter the size of array");
    int n = in.nextInt();
    System.out.println(" Enter elements :");
    for (int i=0; i<n; i++)
    {
         array[i] = in.nextInt();
    }
  */
 //Hard - coding
  int array[] = {20, 35, -15, 7, 55, -1, -22};
 //For insertion Sort theory refer to
Insertion Sort notes
for (int FirstUnsortedIndex = 1;
FirstUnsortedIndex < array.length-1; FirstUnsortedIndex+
{
    int newElement = array[FirstUnsortedIndex];
    int i;
    for(i=FirstUnsortedIndex; i>0 &&
   array[i-1] > newElement; i--)
   {
     array[i] = array[i-1];
    }
  array[i] = new Element;
 }
 for (int element : array)
 {
   system.out.println(element);
  }
 }
}
```