Quick Sort

Consider 6 as the pivot element

0	1	2	3	4	5	6	7	8	9	10	11	12	13
3	5	78	89	456	123	23	9	7	200	308	196	345	6

Legend

- = Swap
- = Sub-sorted elements
- = Sub array

Pass 1
i=0, j=1
pivot=6

0	1	2	3	4	5	6	7	8	9	10	11	12	13
3	5	78	89	456	123	23	9	7	200	308	196	345	6
i	j												

Pass 2
i=0, j=2
pivot=6

0	1	2	3	4	5	6	7	8	9	10	11	12	13
3	5	78	89	456	123	23	9	7	200	308	196	345	6
i		j											

Since j (78) > pivot (6), swap the elements

0	1	2	3	4	5	6	7	8	9	10	11	12	13
3	5	78	89	456	123	23	9	7	200	308	196	345	6
i		j											

Pass 3
i=1, j=3
pivot=6

0	1	2	3	4	5	6	7	8	9	10	11	12	13
3	5	6	89	456	123	23	9	7	200	308	196	345	78
	i		j										

Pass 4
i=1, j=4
pivot=6

0	1	2	3	4	5	6	7	8	9	10	11	12	13
3	5	6	89	456	123	23	9	7	200	308	196	345	78
	i			j									

Pass 5
i=1, j=5
pivot=6

0	1	2	3	4	5	6	7	8	9	10	11	12	13
3	5	6	89	456	123	23	9	7	200	308	196	345	78
	i				j								

Pass 6
i=1, j=6
pivot=6

0	1	2	3	4	5	6	7	8	9	10	11	12	13
3	5	6	89	456	123	23	9	7	200	308	196	345	78
	i					j							

Pass 7
i=1, j=7
pivot=6

0	1	2	3	4	5	6	7	8	9	10	11	12	13
3	5	6	89	456	123	23	9	7	200	308	196	345	78
	i						j						

Pass 8
i=1, j=8
pivot=6

0	1	2	3	4	5	6	7	8	9	10	11	12	13
3	5	6	89	456	123	23	9	7	200	308	196	345	78
	i							j					

Pass 9
i=1, j=9
pivot=6

0	1	2	3	4	5	6	7	8	9	10	11	12	13
3	5	6	89	456	123	23	9	7	200	308	196	345	78
	i								j				

Pass 10
i=1, j=10
pivot=6

0	1	2	3	4	5	6	7	8	9	10	11	12	13
3	5	6	89	456	123	23	9	7	200	308	196	345	78
	i									j			

Pass 11
i=1, j=11
pivot=6

0	1	2	3	4	5	6	7	8	9	10	11	12	13
3	5	6	89	456	123	23	9	7	200	308	196	345	78
	i										j		

Pass 12
i=1, j=12
pivot=6

0	1	2	3	4	5	6	7	8	9	10	11	12	13
3	5	6	89	456	123	23	9	7	200	308	196	345	78
	i											j	

Pass 13
i=1, j=13
pivot=6

0	1	2	3	4	5	6	7	8	9	10	11	12	13
3	5	6	89	456	123	23	9	7	200	308	196	345	78
	i												j

Now that we have reached the end of the array, we partition the array into two sub-arrays: **[3, 5]** and **[89, 456, 123, 23, 9, 7, 200, 308, 196, 345, 78].**

Pass 14
Consider sub array [3,5]

0	1	2	3	4	5	6	7	8	9	10	11	12	13
3	5	6	89	456	123	23	9	7	200	308	196	345	78
	i												j

Since the sub-array has only two elements, it is already sorted.

Pass 15
Sorting sub-array [89, 456, 123, 23, 9, 7, 200, 308, 196, 345, 78]

Consider 78 as the pivot
i=0, j=1

0	1	2	3	4	5	6	7	8	9	10
89	456	123	23	9	7	200	308	196	345	78
i	j									

Consider 78 as the pivot
i=0, j=1
Since 78 < 89, swap

0	1	2	3	4	5	6	7	8	9	10
89	456	123	23	9	7	200	308	196	345	78
i	j									

Pass 16

Pivot=78
i=1, j=2

0	1	2	3	4	5	6	7	8	9	10
78	456	123	23	9	7	200	308	196	345	89
	i	j								

Pass 17

Pivot=89
i=1, j=3
Since j < pivot, bring j to the left of the array

0	1	2	3	4	5	6	7	8	9	10
78	456	123	23	9	7	200	308	196	345	89
	i		j							

Pass 18

Pivot=78
i=1, j=4
Since j < pivot, bring j to the left of the array

0	1	2	3	4	5	6	7	8	9	10
78	23	456	123	9	7	200	308	196	345	89
	i			j						

Pass 19

Pivot=78
i=1, j=5
Since j < pivot, bring j to the left of the array

0	1	2	3	4	5	6	7	8	9	10
78	23	9	456	123	7	200	308	196	345	89
	i				j					

Pass 20

Pivot=78
i=1, j=6

0	1	2	3	4	5	6	7	8	9	10
78	23	9	7	456	123	200	308	196	345	89
		i				j				

Pass 21

Pivot=78
i=2, j=7

0	1	2	3	4	5	6	7	8	9	10
78	23	9	456	123	7	200	308	196	345	89
		i					j			

Pass 22

Pivot=78
i=2, j=8

0	1	2	3	4	5	6	7	8	9	10
78	23	9	7	456	123	200	308	196	345	89
		i						j		

Pass 23

Pivot=78
i=3, j=9

0	1	2	3	4	5	6	7	8	9	10
78	23	9	7	456	123	200	308	196	345	89
			i						j	

Pass 24

Pivot=78
i=3, j=10

0	1	2	3	4	5	6	7	8	9	10
78	23	9	7	456	123	200	308	196	345	89
			i							j

Pass 25

The pivot is placed in the correct position

0	1	2	3	4	5	6	7	8	9	10
7	23	9	78	456	123	200	308	196	345	89
				i						j

Pass 26

We now have two sub-arrays: **[7, 23, 9]** and **[456, 123, 200, 308, 196, 345, 89]**

0	1	2	3	4	5	6	7	8	9	10
7	23	9	78	456	123	200	308	196	345	89

Pass 27
Consider 9 as the pivot
i=0, j=1

0	1	2
7	23	9
i	j	

Pass 28
Swapping these 2 elements

0	1	2
7	23	9
i	j	

Pass 29
The sub array is sorted

0	1	2
7	9	23
	i	j

Pass 30
Consider sub-array: [456, 123, 200, 308, 196, 345, 89]
i=0, j=1
Pivot=89

0	1	2	3	4	5	6
456	123	200	308	196	345	89
i	j					

Pass 31
i=0, j=1
Pivot=89
Since i > pivot, swap

0	1	2	3	4	5	6
456	123	200	308	196	345	89
i	j					

Pass 32
i=1, j=2
Pivot=89

0	1	2	3	4	5	6
89	123	200	308	196	345	456
	i	j				

Pass 33
i=1, j=3
Pivot=89

0	1	2	3	4	5	6
89	123	200	308	196	345	456
	i		j			

Pass 34
i=1, j=4
Pivot=89

0	1	2	3	4	5	6
89	123	200	308	196	345	456
	i			j		

Pass 35
i=1, j=5
Pivot=89

0	1	2	3	4	5	6
89	123	200	308	196	345	456
	i				j	

Pass 36
i=1, j=6
Pivot=89

0	1	2	3	4	5	6
89	123	200	308	196	345	456
	i					j

Now, we consider sub-array [123, 200, 308, 196, 345, 456],
as 89 is already in the correct position

Pass 36
i=0, j=1
Pivot=456

0	1	2	3	4	5
123	200	308	196	345	456
i	j				

Pass 37
i=0, j=2
Pivot=456

0	1	2	3	4	5
123	200	308	196	345	456
i		j			

Pass 38
i=0, j=3
Pivot=456

0	1	2	3	4	5
123	200	308	196	345	456
i			j		

Pass 39
i=0, j=4
Pivot=456

0	1	2	3	4	5
123	200	308	196	345	456
i				j	

Pass 40
i=0, j=5
Pivot=456

0	1	2	3	4	5
123	200	308	196	345	456
i					j

Since 456 is in the correct position, therefore consider a new sub array **[123, 200, 308, 196, 345]**
Pass 41
i=0, j=1
Consider 345 as the pivot

0	1	2	3	4
123	200	308	196	345
i	j			

Pass 42
i=0, j=2
Pivot=345

0	1	2	3	4
123	200	308	196	345
i		j		

Pass 43
i=0, j=3
Pivot=345

0	1	2	3	4
123	200	308	196	345
i			j	

Since 345 is in the correct position, partition the array and repeat the process

0	1	2	3	4
123	200	308	196	345
i			j	

Pass 44
i=0, j=1
Pivot=196

0	1	2	3
123	200	308	196
i	j		

Since j > pivot, swap the elements

0	1	2	3
123	200	308	196
i	j		

Now, 196 is in the correct position.

0	1	2	3
123	196	308	200
	i	j	

Since **123** is a single element, we consider the second half of the array **[308, 200]**

Pass 45

0	1
308	200

Considering 200 as the pivot, it is smaller than 308, hence we swap it

0	1
308	200

After Swapping

0	1
200	308

Final Result
After all the passes, the array is sorted in ascending order:

0	1	2	3	4	5	6	7	8	9	10	11	12	13
3	5	6	7	9	23	78	89	123	196	200	308	345	456