1. 159. Given an unsorted array 10,16,8,12,15,6,3,9,5 Write a program to perform Quick Sort. Choose the first element as the pivot and partition the array accordingly. Show the array after this partition. Recursively apply Quick Sort on the sub-arrays formed. Display the array after each recursive call until the entire array is sorted.
   Input : N= 9, a[]= {10,16,8,12,15,6,3,9,5}
   Output : 3,5,6,8,9,10,12,15,16

Code:

```
def quick_sort(arr, low, high):
    if low < high:
        pi = partition(arr, low, high)
        print(f"Array after partition with pivot index {pi}: {arr}")
        quick_sort(arr, low, pi - 1)
        print(f"Array after sorting left of pivot index {pi}: {arr}")
        quick_sort(arr, pi + 1, high)
        print(f"Array after sorting right of pivot index {pi}: {arr}")
def partition(arr, low, high):
    pivot = arr[low]
    left = low + 1
    right = high
    while True:
        while left <= right and arr[left] <= pivot:
            left = left + 1
        while left <= right and arr[right] >= pivot:
            right = right - 1
        if left > right:
            break
        arr[left], arr[right] = arr[right], arr[left]
    arr[low], arr[right] = arr[right], arr[low]
    return right
arr = [10, 16, 8, 12, 15, 6, 3, 9, 5]
print(f"Original array: {arr}")
quick_sort(arr, 0, len(arr) - 1)
print(f"Sorted array: {arr}")
```

output:

```
PS C:\Users\karth> & C:/Users/karth/AppData/Local/Programs/Python/Python312/python.exe c:/Users/karth/OneDrive/Desktop/csa0863_karthik/PROBLEM.py
Original array: [10, 16, 8, 12, 15, 6, 3, 9, 5]
Array after partition with pivot index 5: [6, 5, 8, 9, 3, 10, 15, 12, 16]
Array after partition with pivot index 2: [3, 5, 6, 9, 8, 10, 15, 12, 16]
Array after partition with pivot index 0: [3, 5, 6, 9, 8, 10, 15, 12, 16]
Array after sorting left of pivot index 0: [3, 5, 6, 9, 8, 10, 15, 12, 16]
Array after sorting right of pivot index 0: [3, 5, 6, 9, 8, 10, 15, 12, 16]
Array after sorting left of pivot index 2: [3, 5, 6, 9, 8, 10, 15, 12, 16]
Array after partition with pivot index 4: [3, 5, 6, 8, 9, 10, 15, 12, 16]
Array after sorting left of pivot index 4: [3, 5, 6, 8, 9, 10, 15, 12, 16]
Array after sorting right of pivot index 4: [3, 5, 6, 8, 9, 10, 15, 12, 16]
Array after sorting right of pivot index 2: [3, 5, 6, 8, 9, 10, 15, 12, 16]
Array after sorting left of pivot index 5: [3, 5, 6, 8, 9, 10, 15, 12, 16]
Array after partition with pivot index 7: [3, 5, 6, 8, 9, 10, 12, 15, 16]
Array after sorting left of pivot index 7: [3, 5, 6, 8, 9, 10, 12, 15, 16]
Array after sorting right of pivot index 7: [3, 5, 6, 8, 9, 10, 12, 15, 16]
Array after sorting right of pivot index 5: [3, 5, 6, 8, 9, 10, 12, 15, 16]
Sorted array: [3, 5, 6, 8, 9, 10, 12, 15, 16]
PS C:\Users\karth>
```

Time complexity:f(n)=o(nlogn)