6. Write a Program to Sort a given set of elements using quick sort algorithm. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.

```
import timeit
import random
import matplotlib.pyplot as plt


def Input(arr,n):
    for i in range(0,n):
        ele=random.randrange(1,50)
        arr.append(ele)
def partition(arr,low,high):
    i=(low-1)
    pivot=arr[high]
    for j in range(low,high):
        if arr[j]<=pivot:
            i=i+1
            arr[i],arr[j]=arr[j],arr[i]
    arr[i+1],arr[high]=arr[high],arr[i+1]
    return (i+1)
def quicksort(arr,low,high):
    if low<high:
        pi=partition(arr,low,high)
        quicksort(arr,low,pi-1)
        quicksort(arr,pi+1,high)


N=[]
CPU=[]
r=int(input("Enter the number of runs:"))
for i in range(0,r):
    arr=[]
```

```
    print("RUN NO : ",i+1)
    n=int(input("Enter the number of elements:"))
    Input(arr,n)
    print(arr)
    start=timeit.default_timer()
    quicksort(arr,0,n-1)
    times=timeit.default_timer()-start
    print("Sorted Array")
    print(arr)
    N.append(n)
    CPU.append(round(float(times)*1000000,2))
print("N CPU")
for i in range(0,r):
    print(N[i],CPU[i])
plt.figure()
plt.plot(N,CPU,'o-')
plt.xlabel('Number of elements (n)')
plt.ylabel('Time taken (milli seconds)')
plt.title('Quick Sort Time Complexity')
plt.grid(True)
plt.show()
```

Output

```
Enter the number of runs:4
RUN NO :  1
Enter the number of elements:10
[3, 48, 2, 7, 21, 48, 8, 12, 15, 22]
Sorted Array
[2, 3, 7, 8, 12, 15, 21, 22, 48, 48]
RUN NO :  2
Enter the number of elements:20
[21, 23, 9, 18, 27, 45, 7, 7, 26, 44, 29, 37, 22, 41, 47, 19, 18, 21, 43, 35]
Sorted Array
[7, 7, 9, 18, 18, 19, 21, 21, 22, 23, 26, 27, 29, 35, 37, 41, 43, 44, 45, 47]
RUN NO :  3
Enter the number of elements:30
```

[40, 10, 24, 17, 30, 36, 8, 1, 25, 32, 5, 27, 29, 6, 15, 35, 49, 47, 26, 27, 1, 18, 44, 39, 39, 41, 4, 23, 33, 31]
Sorted Array
[1, 1, 4, 5, 6, 8, 10, 15, 17, 18, 23, 24, 25, 26, 27, 27, 29, 30, 31, 32, 33, 35, 36, 39, 39, 40, 41, 44, 47, 49]
RUN NO : 4
Enter the number of elements:40
[12, 36, 19, 2, 21, 40, 26, 6, 7, 28, 5, 1, 6, 18, 1, 7, 27, 15, 47, 41, 17, 20, 41, 13, 11, 30, 39, 2 1, 17, 49, 43, 16, 39, 21, 2, 32, 17, 22, 36, 19]
Sorted Array
[1, 1, 2, 2, 5, 6, 6, 7, 7, 11, 12, 13, 15, 16, 17, 17, 17, 18, 19, 19, 20, 21, 21, 21, 22, 26, 27, 28, 30, 32, 36, 36, 39, 39, 40, 41, 41, 43, 47, 49]

N	CPU
10	19.9
20	44.4
30	138.9
40	171.1