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| Course: | Advance Algorithm Laboratory |
| Course Code: | DJ19CEL602 |
| Experiment No.: | 03 |

**AIM: Implement Quick Sort using Randomized Algorithm and perform complexity analysis**

**of the solution.**

**CODE:**

# Randomized quicksort

import random

import time

def randomized\_quicksort(arr):

    global c1

    if len(arr) <= 1:

        return arr

    else:

        pivot = random.choice(arr)

        left = [x for x in arr if x < pivot]

        middle = [x for x in arr if x == pivot]

        right = [x for x in arr if x > pivot]

        c1+= len(left)+len(right)

        return randomized\_quicksort(left) + middle + randomized\_quicksort(right)

def quicksort(arr):

    global c2

    if len(arr) <= 1:

        return arr

    else:

        pivot = arr[0]

        left = []

        right = []

        for i in range(1, len(arr)):

            if arr[i] < pivot:

                left.append(arr[i])

                c2+=1

            else:

                right.append(arr[i])

                c2+=1

        return quicksort(left) + [pivot] + quicksort(right)

arr = [1,2,3,4,5,6,7,8,9,10]

arr1 = arr.copy()

c1 ,c2 = 0,0

# print(arr)

st = time.time()

print("Sorted by randomized way:",randomized\_quicksort(arr))

print("Time taken by randomized quicksort:",(time.time() - st) ,"Comparisons :", c1)

st = time.time()

print("Sorted by normal way",quicksort(arr1))

print("Time taken by normal quicksort:" , (time.time()-st)  ,"Comparisons" ,c2)

print("----------------------------------------------------------------")

arr = [random.randint(0,100) for i in range(500)]

# arr = [1,2,3,4,5,6,7,8,9,10]

arr1 = arr.copy()

c1 ,c2 = 0,0

# print(arr)

st = time.time()

print("Sorted by randomized way:",randomized\_quicksort(arr))

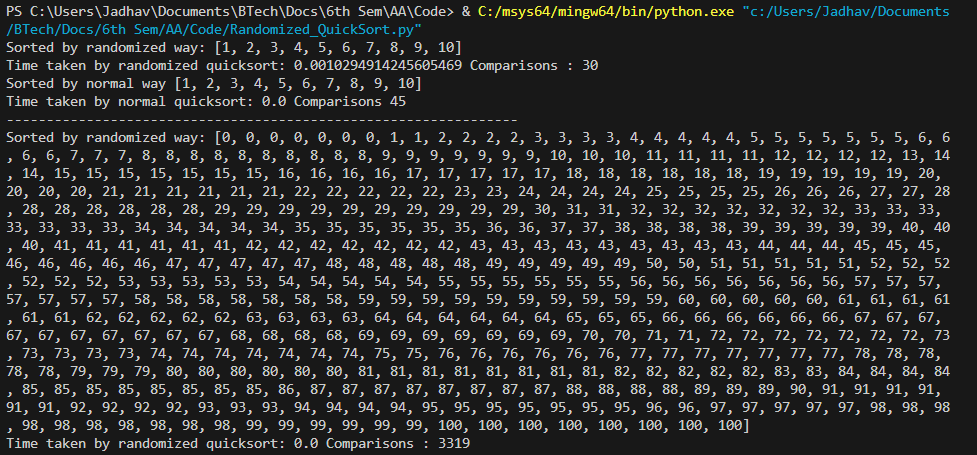
print("Time taken by randomized quicksort:",(time.time() - st) ,"Comparisons :", c1)

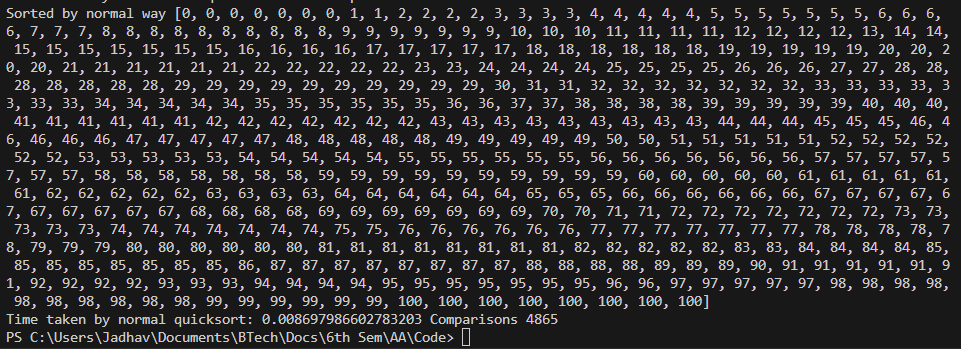
st = time.time()

print("Sorted by normal way",quicksort(arr1))

print("Time taken by normal quicksort:" , (time.time()-st)  ,"Comparisons" ,c2)

**OUTPUT:**

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