



Department of Computer Science and Engineering (Data Science)

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Experiment 1 – Assignment

Aim: Implementation of Quick Sort and Merge Sort using Divide and Conquer Technique.

Example:

1. 44 33 11 55 77 90 40 60 99 22 88
2. 17 9 22 31 7 12 10 21 13 29 18 20 11
3. 100, 76, 80, 9, 111, 50

Code:

QUICK SORT ALGORITHM

```
# Quick Sort Algorithm
def Partition(array, start, end):
    pivot = array[start]
    low = start + 1
    high = end

    while True:
        while low <= high and array[high] >= pivot:
            high -= 1
        while low <= high and array[low] <= pivot:
            low += 1
        if low <= high:
            array[low], array[high] = array[high], array[low]
        else:
            break

    array[start], array[high] = array[high], array[start]
    return high

def Quick_Sort(array, start, end):
    if start >= end:
        return

    low = Partition(array, start, end)
    Quick_Sort(array, start, low-1)
    Quick_Sort(array, low+1, end)
```



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```
# 1
array = [44,33,11,55,77,90,40,60,99,22,88]
Quick_Sort(array, 0, len(array) - 1)
print(array)

# 2
array = [17, 9, 22, 31, 7, 12, 10, 21, 13, 29, 18, 20, 11]
Quick_Sort(array, 0, len(array) - 1)
print(array)

# 3
array = [100, 76, 80, 9, 111, 50]
Quick_Sort(array, 0, len(array) - 1)
print(array)
```

Output:

```
Array before sorting: [44, 33, 11, 55, 77, 90, 40, 60, 99, 22, 88]
Array after sorting: [11, 22, 33, 40, 44, 55, 60, 77, 88, 90, 99]
Array before sorting: [17, 9, 22, 31, 7, 12, 10, 21, 13, 29, 18, 20, 11]
Array after sorting: [7, 9, 10, 11, 12, 13, 17, 18, 20, 21, 22, 29, 31]
Array before sorting: [100, 76, 80, 9, 111, 50]
Array after sorting: [9, 50, 76, 80, 100, 111]
```



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MERGE SORT ALGORITHM

Code:

```
# Merge Sort Algorithm
def merge(result, left, right):
    i = j = k = 0
    while i < len(left) and j < len(right):
        if left[i] <= right[j]:
            result[k] = left[i]
            i += 1
        else:
            result[k] = right[j]
            j += 1
        k += 1
    # For all the remaining values
    while i < len(left):
        result[k] = left[i]
        i += 1
        k += 1
    while j < len(right):
        result[k] = right[j]
        j += 1
        k += 1

def mergeSort(result):
    if len(result) > 1:
        mid = int(len(result) / 2)
        left = result[:mid]
        right = result[mid:]

        # Recursive call on each half
        mergeSort(left)
        mergeSort(right)
        merge(result, left, right)
```

Output:

```
Array before sorting: [44, 33, 11, 55, 77, 90, 40, 60, 99, 22, 88]
Array after sorting: [11, 22, 33, 40, 44, 55, 60, 77, 88, 90, 99]
Array before sorting: [17, 9, 22, 31, 7, 12, 10, 21, 13, 29, 18, 20, 11]
Array after sorting: [7, 9, 10, 11, 12, 13, 17, 18, 20, 21, 22, 29, 31]
Array before sorting: [100, 76, 80, 9, 111, 50]
Array after sorting: [9, 50, 76, 80, 100, 111]
```

(1)

Aim Implementation of Quick Sort & Merge Sort using Divide and Conquer technique

Example-1

44 33 11 55 77 90 40 60 99 22 88

pivot → 44 33 11 55 77 90 40 60 99 22 88

pivot → 44 33 11 22 77 90 40 60 99 55 88

pivot → 44 33 11 22 40 90 77 60 99 55 88

pivot → [40 33 11 22] 44 [90 77 60 99 55 88]

pivot → [33 11 22] 40 44 [90 77 60 99 55 88]

pivot → 11 22 33 40 44 [90 77 60 88 55 99]

pivot → 11 22 33 40 44 [55 77 60 88] 90 99

pivot → 11 22 33 40 44 55 60 77 88 90 99

Example-2

17 9 22 31 7 12 10 21 13 29 18 20 11

pivot → 17 9 22 31 7 12 10 21 13 29 18 20 11

pivot → 17 9 11 31 7 12 10 21 13 29 18 20 22

pivot → 17 9 11 13 7 12 10 21 31 29 18 20 22

pivot → [10 9 11 13 7 12] 17 [21 31 29 18 20 22]

pivot → 10 9 11 13 7 12 17 21 31 29 18 20 22

pivot → 10 9 11 13 7 12 17 21 31 29 18 20 22

②

$[10 \ 9 \ 7 \ 13 \ 11 \ 12] \ 17 \ [21 \ 20 \ 29 \ 18 \ 31 \ 22]$
 pivot \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow pivot \uparrow \uparrow
 $7 \ 9 \ 10 \ [13 \ 11 \ 12] \ 17 \ [21 \ 20 \ 18 \ 29 \ 31 \ 22]$
 \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow
 $7 \ 9 \ 10 \ 11 \ 12 \ 13 \ 17 \ 18 \ 20 \ 21 \ 29 \ 31 \ 22$
 $7 \ 9 \ 10 \ 11 \ 12 \ 13 \ 17 \ 18 \ 20 \ 21 \ 22 \ 29 \ 31$

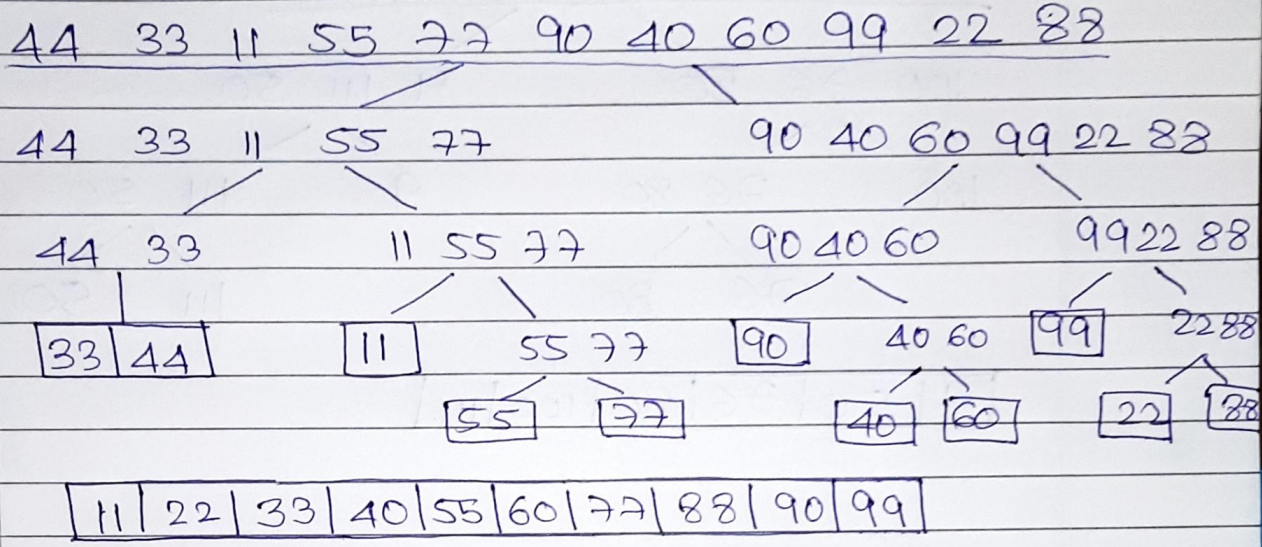
Ex-3

100, 76, 80, 9, 111, 50

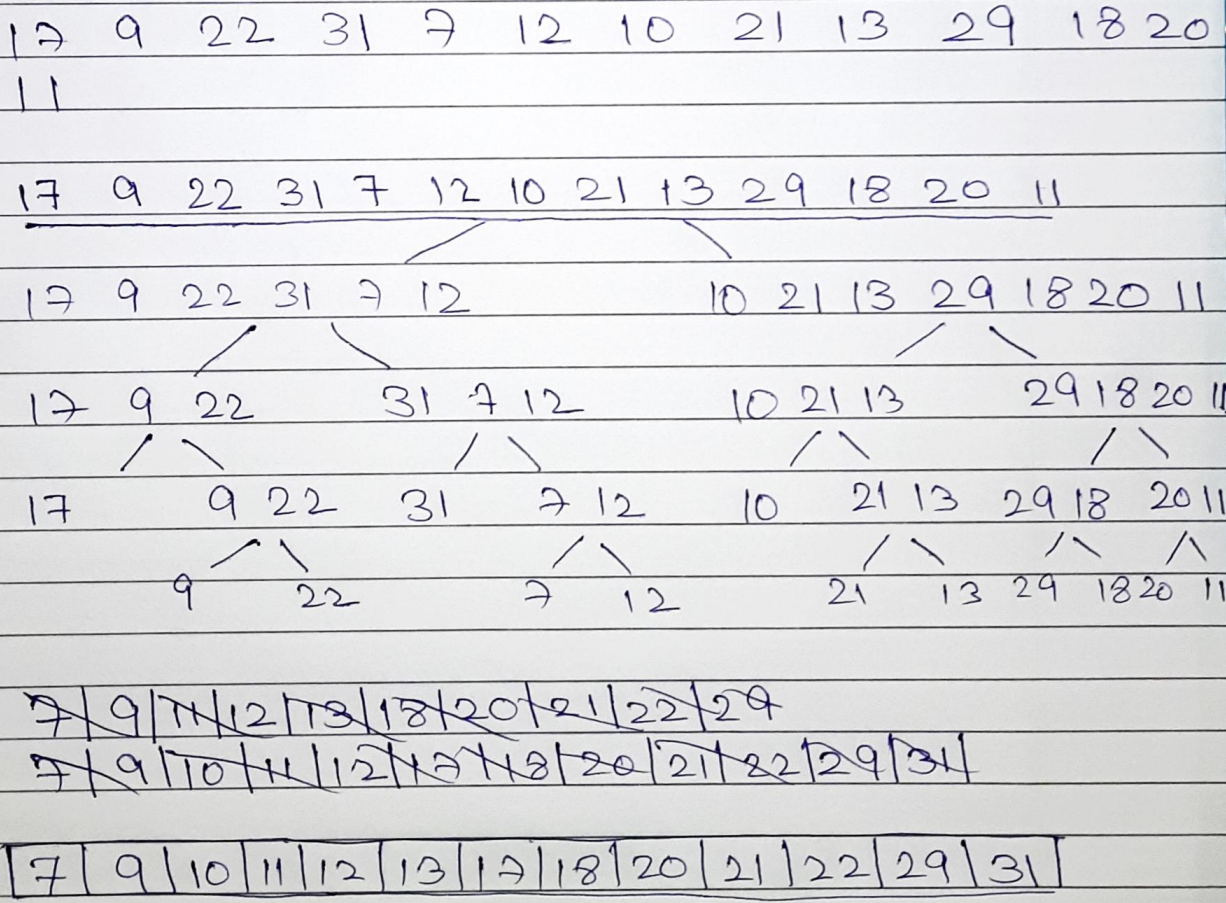
$100 \ 76 \ 80 \ 9 \ 111 \ 50$
 pivot \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow
 $100 \ 76 \ 80 \ 9 \ 111 \ 50$
 pivot \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow
 $100 \ 76 \ 80 \ 9 \ 50 \ 111$
 pivot \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow
 $[50 \ 76 \ 80 \ 9] \ 100 \ 111$
 pivot \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow
 $50 \ 9 \ 80 \ 76 \ 100 \ 111$
 pivot \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow
 $9 \ 50 \ 80 \ 76 \ 100 \ 111$
 $9 \ 50 \ 76 \ 80 \ 100 \ 111$

Merge Sort

Ex-1



Ex-2



④

Ex-3100, 76, 80, 9, III, 50

100 76 80

9 III 50

100

76 80

9

III 50

76 80

III 50

9	50	76	80	100	III
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