Experiment No: 2

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Program:

Merge Sort :

```cpp
#include <iostream>
using namespace std;

void merge(int array[], int const left, int const mid,
   int const right)
{
   auto const subArrayOne = mid - left + 1;
   auto const subArrayTwo = right - mid;

   auto* leftArray = new int[subArrayOne],
     * rightArray = new int[subArrayTwo];

   for (auto i = 0; i < subArrayOne; i++)
     leftArray[i] = array[left + i];
   for (auto j = 0; j < subArrayTwo; j++)
     rightArray[j] = array[mid + 1 + j];

   auto indexOfSubArrayOne = 0, indexOfSubArrayTwo = 0;
   int indexOfMergedArray = left;

   while (indexOfSubArrayOne < subArrayOne
     && indexOfSubArrayTwo < subArrayTwo) {
     if (leftArray[indexOfSubArrayOne]
       <= rightArray[indexOfSubArrayTwo]) {
       array[indexOfMergedArray]
         = leftArray[indexOfSubArrayOne];
       indexOfSubArrayOne++;
     }
     else {
       array[indexOfMergedArray]
         = rightArray[indexOfSubArrayTwo];
       indexOfSubArrayTwo++;
     }
     indexOfMergedArray++;
   }
```

```cpp
        while (indexOfSubArrayOne < subArrayOne) {
            array[indexOfMergedArray]
                = leftArray[indexOfSubArrayOne];
            indexOfSubArrayOne++;
            indexOfMergedArray++;
        }
        while (indexOfSubArrayTwo < subArrayTwo) {
            array[indexOfMergedArray]
                = rightArray[indexOfSubArrayTwo];
            indexOfSubArrayTwo++;
            indexOfMergedArray++;
        }
        delete[] leftArray;
        delete[] rightArray;
}


void mergeSort(int array[], int const begin, int const end)
{
    if (begin >= end)
        return;

    auto mid = begin + (end - begin) / 2;
    mergeSort(array, begin, mid);
    mergeSort(array, mid + 1, end);
    merge(array, begin, mid, end);
}



void printArray(int A[], int size)
{
    for (auto i = 0; i < size; i++)
        cout << A[i] << " ";
}

int main()
{
    cout << "Name: Aniket Tiwari \nRoll No : 21143285\n";
    int n;
    cout << "Enter the size of array : ";
    cin >> n;
    int arr[n];
    cout << "Enter array elements : ";
    for (auto& x : arr)
        cin >> x;
```

```cpp
    cout << "Given array is \n";
    printArray(arr, n);

    mergeSort(arr, 0, n - 1);

    cout << "\nSorted array is \n";
    printArray(arr, n);
    return 0;
}
```

Output:

Quick Sort:

```cpp
#include <bits/stdc++.h>
using namespace std;

int partition(int arr[], int low, int high)
{
    int pivot = arr[high];
    int i = (low - 1);

    for (int j = low; j <= high - 1; j++)
    {
        if (arr[j] < pivot)
        {
```

```cpp
        i++;
        swap(arr[i], arr[j]);
      }
   }
   swap(arr[i + 1], arr[high]);
   return (i + 1);
}

void quickSort(int arr[], int low, int high)
{
   if (low < high)
   {
      int pi = partition(arr, low, high);
      quickSort(arr, low, pi - 1);
      quickSort(arr, pi + 1, high);
   }
}

int main()
{
   cout << "Name: Aniket Tiwari \nRoll No : 21143285\n";
   int n;
   cout << "Enter the size of array : ";
   cin >> n;
   int arr[n];
   cout << "Enter array elements : ";
   for (auto& x : arr)
      cin >> x;

   cout << "Array is : ";
   for (auto x : arr)
      cout << x << " ";

   quickSort(arr, 0, n - 1);
   cout << "\nSorted array: ";
   for (auto x : arr)
      cout << x << " ";

   return 0;
}
```

Output:

```
Microsoft Windows [Version 10.0.22621.521]
(c) Microsoft Corporation. All rights reserved.

D:\Programming\College Experiments\TY 5 Sem\DAA Lab>cd "d:\
d:\Programming\College Experiments\TY 5 Sem\DAA Lab\"QuickS
Name: Aniket Tiwari
Roll No : 21143285
Enter the size of array : 10
Enter array elements : 15 16 98 1 53 11 90 43 62 012
Array is : 15 16 98 1 53 11 90 43 62 12
Sorted array: 1 11 12 15 16 43 53 62 90 98
d:\Programming\College Experiments\TY 5 Sem\DAA Lab>
```