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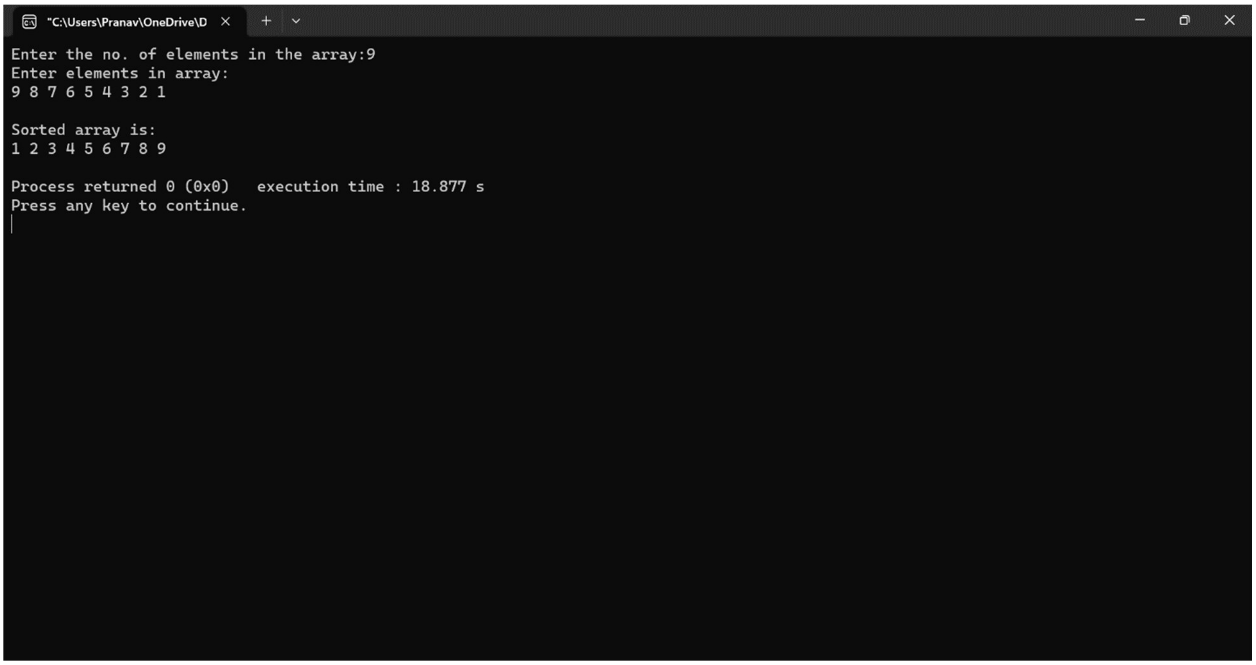
SUBJECT	Design and Analysis of Algorithm
EXP No.	2
AIM:	Sorting the Array using Merge Sort Algorithm
ALGORITHM:	

```
• MergeSort function
    if left < right
        mid= (left+right)/2
        MergeSort(array, left, mid)
        MergeSort (array, mid+1, right)
        Merge(array, left, mid, right)
• Merge function
  n1= mid-left+1
  n2= right-q
  create arrays L[n1+1] and R[n2+1]
  for i from 0 to n1-1
        do L[i]=array[p+i]
  for i from 0 to n2-1
        do R[i]=array[q+i+1]
  L[n1]= aprox. Infinity
  R[n2]= aprox. Infinity
  Declare k, i=1 and j=1
  For k from left to right
         Do if L[i]<=R[j]
                Then array[k]=L[i]
                 i++
             else
                 array[k]=R[j]
                 j++
```

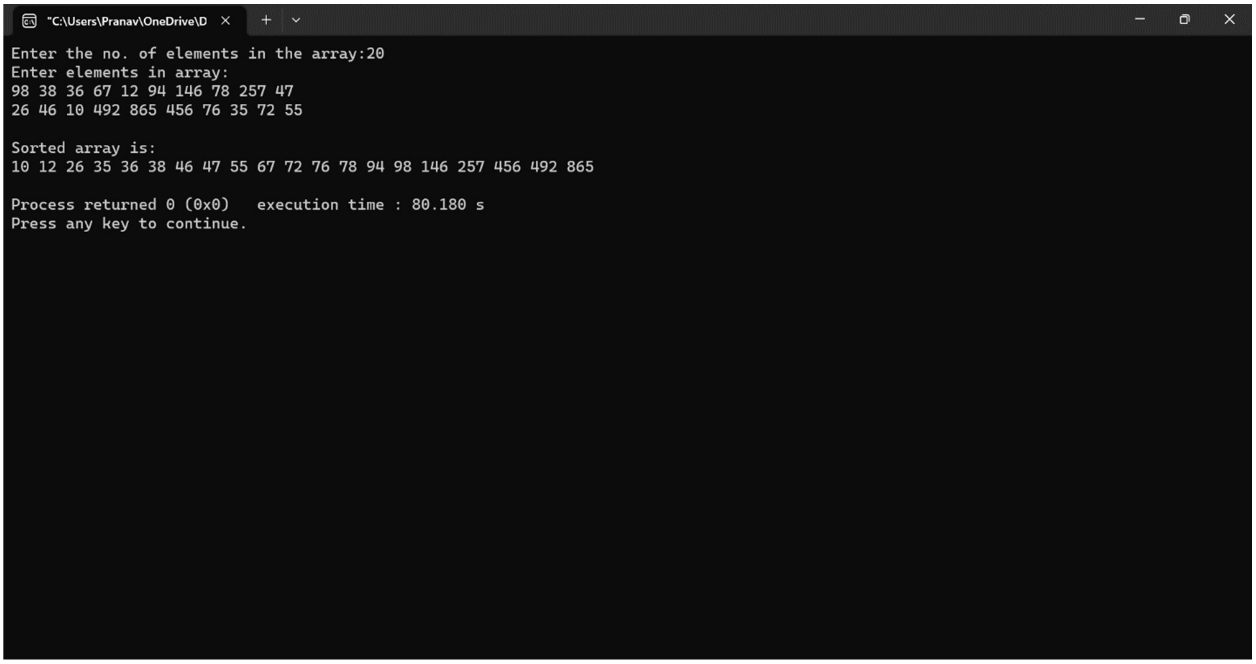
PROGRAM:

```
#include<stdio.h>
#include<stdlib.h>
#include<math.h>


void Printarr(int arr[],int n)
{
    for(int i=0; i<n; i++)
    {
        printf("%d ",arr[i]);
    }
    printf("\n");
}


void Merge(int arr[],int p,int q,int r)
{
    int n1,n2;
    n1=q-p+1;
    n2=r-q;
    int L[n1+1], R[n2+1];
    for(int i=0; i<n1; i++)
    {
        L[i]=arr[p+i];
    }
    for(int i=0; i<n2; i++)
    {
        R[i]=arr[q+i+1];
    }
    L[n1]=9999999;
    R[n2]=9999999;

    int i=0,j=0;
    for(int k = p ; k <= r ; k++)
    {
        if(L[i] <= R[j])
        {
            arr[k] = L[i];
            i++;
        }
        else
        {
            arr[k] = R[j];
            j++;
        }
    }
    return;
}


void MergeSort(int arr[],int p,int r)
{
    int q;
    if(r>p)
    {
        int q = (p+r)/2;
        MergeSort(arr,p,q);
        MergeSort(arr,q+1,r);
        Merge(arr,p,q,r);
    }
    return;
}


int main()
{
    int n;
    printf("Enter the no. of elements in the array:");
    scanf("%d",&n);
    int arr[n];

    printf("Enter elements in array:\n");
    for(int i=0; i<n; i++)
    {
        scanf("%d",&arr[i]);
    }

    MergeSort(arr,0,n-1);

    printf("\nSorted array is:\n");
    Printarr(arr,n);

    return 0;
}
```

RESULT (SNAPSHOT)



```
Enter the no. of elements in the array:9
Enter elements in array:
9 8 7 6 5 4 3 2 1

Sorted array is:
1 2 3 4 5 6 7 8 9

Process returned 0 (0x0)   execution time : 18.877 s
Press any key to continue.
```



```
Enter the no. of elements in the array:20
Enter elements in array:
98 38 36 67 12 94 146 78 257 47
26 46 10 492 865 456 76 35 72 55

Sorted array is:
10 12 26 35 36 38 46 47 55 67 72 76 78 94 98 146 257 456 492 865

Process returned 0 (0x0)   execution time : 80.180 s
Press any key to continue.
```

CONCLUSION:	The experiment demonstrated the efficiency and scalability of the merge sort algorithm. The results showed that the algorithm had a linear time complexity of O(n log n), making it an ideal choice for sorting large data sets. The results were consistent with the expected results, and the algorithm was able to sort the data sets efficiently and accurately.