AIM: Sort a given set of N integer elements using **Merge Sort** technique and compute its time taken. Run the program for different values of N and record the time taken to sort. Plot a graph of the time taken versus N using MS Excel. The program should allow both manual entry of the array elements and also reading of array elements using random number generator.
Note: In the record book students should
- Handwrite the Algorithm,
- Handwrite the Program
- Pasting of the printout of the Output and Graph or handwriting of the Output and Graph.

ALGORITHM : combine(a[0….n-1],low,mid,high)
//merge two sorted arrays where first array starts from *low* to *mid* and second starts from *mid*+1 to *high*
//Input : ***a*** is a sorted array from index position low to mid
// ***a*** is a sorted array from index position mid+1 to high
//Output: Array a[0….n-1] sorted in nondecreasing order
i□low
j□mid+1
k□low
while i<=mid and j<=high **do**
if a[i]<a[j]
c[k]□a[i]
k□k+1
i□i+1
else
c[k]□a[j]
k□k+1
j□j+1
end if
end while
if i>mid
while j<=high **do**
c[k]□a[j]
k□k+1
j□j+1
end while
end if
if j>high
while i<=mid **do**
c[k]□a[i]
k□k+1
i□i+1
end while
end if
for i□low to high **do**
a[i]□c[i]
end for

ALGORITHM: split(a[0….n-1],low,high)
//Sorts array a[0….n-1] by recursive mergesort
//Input :An array a[0….n-1] of orderable elements
//Output : Array a[0….n-1] sorted in nondecreasing order
if low<high
mid□(low+high)/2
split(a,low,mid)
split(a,mid+1,high)
combine(a,low,mid,high)
end if

Program:

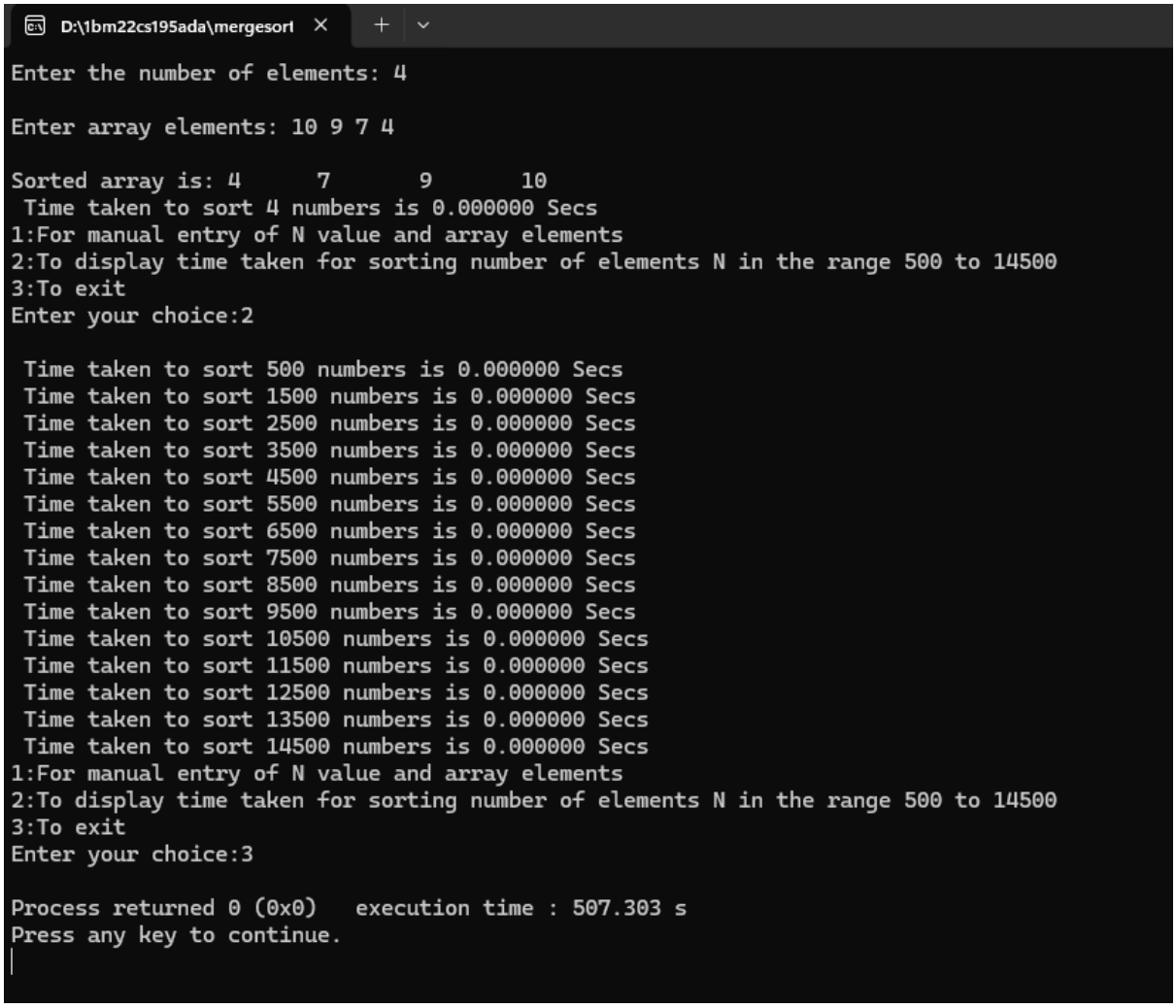
```
#include<stdio.h>
#include<time.h>
```

```
#include<stdlib.h> /* To recognise exit function when compiling with gcc*/
void split(int[],int,int);
void combine(int[],int,int,int);
void main()
{
  int a[15000],n, i,j,ch, temp;
  clock_t start,end;

  while(1)
  {
printf("\n1:For manual entry of N value and array elements");
printf("\n2:To display time taken for sorting number of elements N in the range 500 to 14500");
printf("\n3:To exit");
    printf("\nEnter your choice:");
    scanf("%d", &ch);
    switch(ch)
    {
     case 1:  printf("\nEnter the number of elements: ");
                  scanf("%d",&n);
                  printf("\nEnter array elements: ");
                  for(i=0;i<n;i++)
                   {
                    scanf("%d",&a[i]);
                   }
                  start=clock();
                  split(a,0,n-1);
                  end=clock();
                  printf("\nSorted array is: ");
                  for(i=0;i<n;i++)
                  printf("%d\t",a[i]);
printf("\n Time taken to sort %d numbers is %f Secs",n, (((double)(end-
start))/CLOCKS_PER_SEC));
                  break;
    case 2:
              n=500;
              while(n<=14500) {
              for(i=0;i<n;i++)
                    {
                     //a[i]=random(1000);
                     a[i]=n-i;
                    }
              start=clock();
              split(a,0,n-1);
        //Dummy loop to create delay
            for(j=0;j<500000;j++){ temp=38/600;}
              end=clock();
printf("\n Time taken to sort %d numbers is %f Secs",n, (((double)(end-
start))/CLOCKS_PER_SEC));
                   n=n+1000;
                    }
             break;
  case 3: exit(0);
```

```
   }
   getchar();
    }
}



void split(int a[],int low,int high)
{
 int mid;
 if(low<high)
 {
  mid=(low+high)/2;
  split(a,low,mid);
  split(a,mid+1,high);
  combine(a,low,mid,high);
 }
}

void combine(int a[],int low,int mid,int high)
{
 int c[15000],i,j,k;
 i=k=low;
 j=mid+1;
 while(i<=mid&&j<=high)
 {
  if(a[i]<a[j])
  {
   c[k]=a[i];
   ++k;
   ++i;
  }
  else
  {
   c[k]=a[j];
   ++k;
   ++j;
  }
 }
 if(i>mid)
 {
  while(j<=high)
  {
   c[k]=a[j];
   ++k;
   ++j;
  }
 }
 if(j>high)
 {
  while(i<=mid)
```

```
 {
  c[k]=a[i];
  ++k;
  ++i;
 }
}
for(i=low;i<=high;i++)
{
 a[i]=c[i];
}
}
```

Output:-



Graph output:-

N value	Time Taken in secs
500	0
1500	0
2500	0
3500	0
4500	0
5500	0
6500	0
7500	0
8500	0
9500	0
10500	0
11500	0
12500	0
13500	0
14500	0