PROGRAM-1

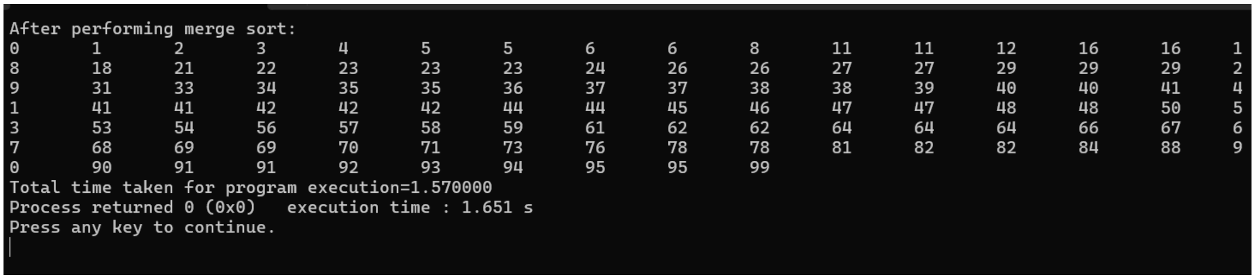
Sort a given set of N integer elements using Merge Sort technique and compute its time taken. Run the program for different values of N and record the time taken to sort.

Code:

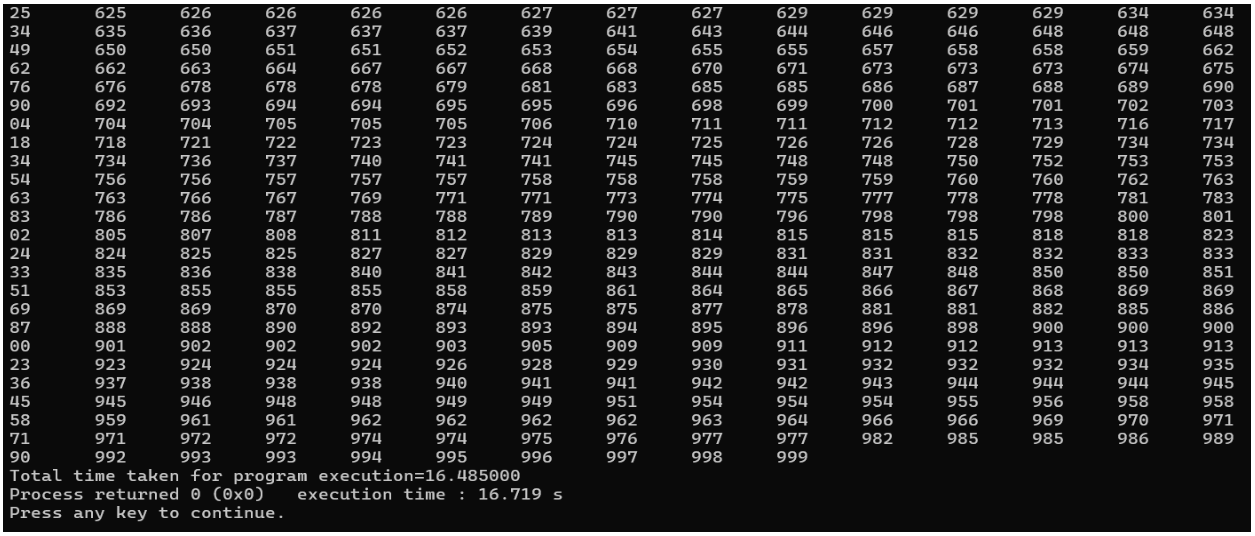
```
#include<stdio.h>
#include<stdlib.h>
#include<time.h>
#include<unistd.h>

void merge(int arr[], int st, int mid, int end){
   int temp[end-st+1];
   int i=st, j=mid+1, k=0;

   while(i<=mid && j<=end){
      if(arr[i]<arr[j])
         temp[k++]=arr[i++];
      else
         temp[k++]=arr[j++];
   }
   while(i<=mid){
      temp[k++]=arr[i++];
   }
   while(j<=end){
      temp[k++]=arr[j++];
   }

   for(int id=0;id<(end-st+1);id++)
      arr[id+st]=temp[id];
}

void mergeSort(int arr[], int st, int end){
   if(st<end){
      int mid=st+(end-st)/2;
      usleep(1000);
      mergeSort(arr, st, mid);
      mergeSort(arr, mid+1, end);
```

```
        merge(arr,st,mid,end);
    }
}

int main(){
    int n;
    clock_t start_time, end_time;

    n=100000;
    int arr[n];

    for(int i=0;i<n;i++)
        arr[i]=rand()%100000;

    start_time=clock();
    mergeSort(arr,0,n-1);
    end_time=clock();

    printf("After performing merge sort:\n");
    for(int i=0;i<n;i++)
        printf("%d\t", arr[i]);
    printf("\nTotal time taken for program execution=%lf",
(double)(end_time-start_time)/CLOCKS_PER_SEC);
    return 0;
}
```

Output:



```
After performing merge sort:
0       1       2       3       4       5       5       6       6       8       11      11      12      16      16      1
8       18      21      22      23      23      23      24      26      26      27      27      29      29      29      2
9       31      33      34      35      35      36      37      37      38      38      39      40      40      41      4
1       41      41      42      42      42      44      44      45      46      47      47      48      48      50      5
3       53      54      56      57      58      59      61      62      62      64      64      64      66      67      6
7       68      69      69      70      71      73      76      78      78      81      82      82      84      88      9
0       90      91      91      92      93      94      95      95      99
Total time taken for program execution=1.570000
Process returned 0 (0x0)   execution time : 1.651 s
Press any key to continue.
```



```
25      625     626     626     626     626     627     627     627     629     629     629     629     634     634
34      635     636     637     637     637     639     641     643     644     646     646     648     648     648
49      650     650     651     651     652     653     654     655     655     657     658     658     659     662
62      662     663     664     667     667     668     668     670     671     673     673     673     674     675
76      676     678     678     678     679     681     683     685     685     686     687     688     689     690
90      692     693     694     694     695     695     696     698     699     700     701     701     702     703
04      704     704     705     705     705     706     710     711     711     712     712     713     716     717
18      718     721     722     723     723     724     724     725     726     726     728     729     734     734
34      734     736     737     740     741     741     745     745     748     748     750     752     753     753
54      756     756     757     757     757     758     758     758     759     759     760     760     762     763
63      763     766     767     769     771     771     773     774     775     777     778     778     781     783
83      786     786     787     788     788     789     790     790     796     798     798     798     800     801
02      805     807     808     811     812     813     813     814     815     815     815     818     818     823
24      824     825     825     827     827     829     829     829     831     831     832     832     833     833
33      835     836     838     840     841     842     843     844     844     847     848     850     850     851
51      853     855     855     855     858     859     861     864     865     866     867     868     869     869
69      869     869     870     870     874     875     875     877     878     881     881     882     885     886
87      888     888     890     892     893     893     894     895     896     896     898     900     900     900
00      901     902     902     902     903     905     909     909     911     912     912     913     913     913
23      923     924     924     924     926     928     929     930     931     932     932     932     934     935
36      937     938     938     938     940     941     941     942     942     943     944     944     944     945
45      945     946     948     948     949     949     951     954     954     954     955     956     958     958
58      959     961     961     962     962     962     962     963     964     966     966     969     970     971
71      971     972     972     974     974     975     976     977     977     982     985     985     986     989
90      992     993     993     994     995     996     997     998     999
Total time taken for program execution=16.485000
Process returned 0 (0x0)   execution time : 16.719 s
Press any key to continue.
```