LAB 5- Selection Sort

AIM: Sort a given set of N integer elements using **Selection 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.

Note: N value should be in the range

ALGORITHM : sel_sort(a[0….n-1]

```
//Sorts a given array by selection sort
//Input : An array a[0….n-1] of orderable elements
//Output : Array a[0….n-1] sorted in ascending order
for i□0 to n-2 do
    small_pos□i
        for j□i+1 to n-1 do
            if a[j]<a[small_pos]
                small_pos□j
            end if
        end for
    swap a[i] and a[small_pos]
end for
```

Program:

```
#include<stdio.h>
#include<time.h>
#include<stdlib.h> /* To recognise exit function when compiling with gcc*/
void selsort(int n,int a[]);

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();
                   selsort(n,a);
                   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();
                selsort(n,a);
         //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 selsort(int n,int a[])
{
    int i,j,t,small,pos;
    for(i=0;i<n-1;i++)
     {
      pos=i;
      small=a[i];
      for(j=i+1;j<n;j++)
      {
            if(a[j]<small)
            {
              small=a[j];
              pos=j;
```

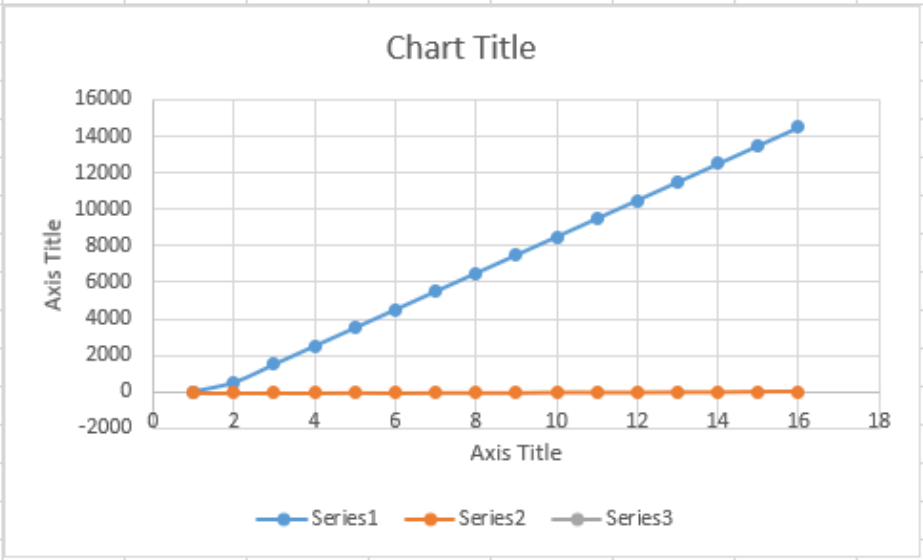
```
        }
      }
      t=a[i];
      a[i]=a[pos];
      a[pos]=t;
    }
}
```

Output:

```
1:For manual entry of N value and array elements
2:To display time taken for sorting number of elements N in the range 500 to 14500
3:To exit
Enter your choice:1

Enter the number of elements: 4

Enter array elements: 44 33 22 11

Sorted array is: 11     22      33      44
 Time taken to sort 4 numbers is 0.000000 Secs
1:For manual entry of N value and array elements
2:To display time taken for sorting number of elements N in the range 500 to 14500
3:To exit
Enter your choice:2

 Time taken to sort 500 numbers is 0.000000 Secs
 Time taken to sort 1500 numbers is 0.000000 Secs
 Time taken to sort 2500 numbers is 0.000000 Secs
 Time taken to sort 3500 numbers is 0.016000 Secs
 Time taken to sort 4500 numbers is 0.000000 Secs
 Time taken to sort 5500 numbers is 0.015000 Secs
 Time taken to sort 6500 numbers is 0.016000 Secs
 Time taken to sort 7500 numbers is 0.016000 Secs
 Time taken to sort 8500 numbers is 0.031000 Secs
 Time taken to sort 9500 numbers is 0.031000 Secs
 Time taken to sort 10500 numbers is 0.031000 Secs
 Time taken to sort 11500 numbers is 0.047000 Secs
 Time taken to sort 12500 numbers is 0.047000 Secs
 Time taken to sort 13500 numbers is 0.063000 Secs
 Time taken to sort 14500 numbers is 0.078000 Secs
1:For manual entry of N value and array elements
2:To display time taken for sorting number of elements N in the range 500 to 14500
3:To exit
Enter your choice:3

Process returned 0 (0x0)   execution time : 40.023 s
Press any key to continue.
```

Graph Screenshot:

	A	B	C	D	E	F	G	H	I	J
1	**N value**	Time Taken(Secs)								
2	500	0								
3	1500	0								
4	2500	0								
5	3500	0.016								
6	4500	0								
7	5500	0.015								
8	6500	0.016								
9	7500	0.016								
10	8500	0.031								
11	9500	0.031								
12	10500	0.031								
13	11500	0.047								
14	12500	0.047								
15	13500	0.063								
16	14500	0.078								
17										



Merge Sort

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:

```
1:For manual entry of N value and array elements
2:To display time taken for sorting number of elements N in the range 500 to 14500
3:To exit
Enter your choice:1

Enter the number of elements: 4

Enter array elements: 44 33 22 11

Sorted array is: 11     22      33      44
 Time taken to sort 4 numbers is 0.000000 Secs
1:For manual entry of N value and array elements
2:To display time taken for sorting number of elements N in the range 500 to 14500
3:To exit
Enter your choice:2

 Time taken to sort 500 numbers is 0.000000 Secs
 Time taken to sort 1500 numbers is 0.000000 Secs
 Time taken to sort 2500 numbers is 0.000000 Secs
 Time taken to sort 3500 numbers is 0.016000 Secs
 Time taken to sort 4500 numbers is 0.000000 Secs
 Time taken to sort 5500 numbers is 0.000000 Secs
 Time taken to sort 6500 numbers is 0.000000 Secs
 Time taken to sort 7500 numbers is 0.000000 Secs
 Time taken to sort 8500 numbers is 0.000000 Secs
 Time taken to sort 9500 numbers is 0.000000 Secs
 Time taken to sort 10500 numbers is 0.000000 Secs
 Time taken to sort 11500 numbers is 0.000000 Secs
 Time taken to sort 12500 numbers is 0.000000 Secs
 Time taken to sort 13500 numbers is 0.000000 Secs
 Time taken to sort 14500 numbers is 0.000000 Secs
1:For manual entry of N value and array elements
2:To display time taken for sorting number of elements N in the range 500 to 14500
3:To exit
Enter your choice:3

Process returned 0 (0x0)   execution time : 120.745 s
Press any key to continue.
```

Graph Scree shot: It can be observed from the graph below that time taken by Selection sort is more when compared to Merge sort.

19	N value	Time Taken(Secs)
20	500	0
21	1500	0
22	2500	0
23	3500	0.016
24	4500	0
25	5500	0
26	6500	0
27	7500	0
28	8500	0
29	9500	0
30	10500	0
31	11500	0
32	12500	0
33	13500	0
34	14500	0