Lab 1: Analysis of Sorting algorithms

1. Insertion sort:

```
// Online C++ compiler to run C++ program online
#include <iostream>
using namespace std;
class sort{
    public:
  void insertion_sort(int a[],int n)
  {
     int comp_counter=0,swap_counter=0;
     for(int i=1;i<n;i++)
    {
        int j=i;
        while(j>0)
        {
            comp_counter++;
            if(a[j]<a[j-1])
            {
           swap_counter++;
           swap(a[j],a[j-1]);
            }
            j--;
        }
    }
    for(int i=0;i<n;i++)
    {
        cout<<a[i]<<" ";
    }
    cout<<endl;
    cout<<"No. Of comparisions:" << comp_counter<<endl;
    cout<<"No. Of swaps:" << swap_counter<<endl;
  }
};
int main() {
```

```
    // Write C++ code here
    int n;
    int choice;
    scanf("%d",&choice);
    scanf("%d",&n);
    int arr[n];
    switch(choice)
    {
      case 1: // for increasing-order
    for(int i=0;i<n;i++)
    {
        arr[i]=i+1;
    }
    break;

    case 2: // for decreasing order
    for(int i=0;i<n;i++)
    {
        arr[i]=n-i;
    }
    break;

    case 3: //for random numbers
    for(int i=0;i<n;i++)
    {
        arr[i]=rand() % 100;
    }
    break;

    default:
    return 0;
    }
    sort s1;
    s1.insertion_sort(arr,n);
    return 0;
}
```

O/P:

Increasing Order:

```
1
100
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
    27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48
    49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70
    71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92
    93 94 95 96 97 98 99 100
No. Of comparisions:4950
No. Of swaps:0
```

Decreasing order:

```
2
100
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
    27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48
    49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70
    71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92
    93 94 95 96 97 98 99 100
No. Of comparisions:4950
No. Of swaps:4950
```

Random Values:

```
3
100
2 3 5 5 8 11 11 12 13 13 14 15 15 19 21 21 22 23 24 24 25 26 26 26 26
    27 27 29 29 29 29 30 32 34 35 35 36 36 37 39 39 40 42 43 45 46 49
    50 51 54 56 56 57 58 59 60 62 62 62 63 64 67 67 67 67 68 68 69 70
    70 72 73 73 76 76 77 78 80 81 82 82 83 84 84 84 86 86 86 87 88 90
    91 92 93 93 94 95 96 98 99
No. Of comparisions:4950
No. Of swaps:2438
```

Selection sort:

// Online C++ compiler to run C++ program online

```
#include <iostream>
using namespace std;
class sort{
    public:
  void selection_sort(int a[],int n)
  {
     int comp_counter=0,swap_counter=0;
     for(int i=0;i<n-1;i++)
     {
         int min_ind=i;
         for(int j=i+1;j<n;j++)
         {
             comp_counter++;
             if(a[j]<a[min_ind])
             {
                 min_ind=j;
             }
         }
         if(i!=min_ind)
        {
             swap_counter++;
        swap(a[min_ind],a[i]);
        }
     }
      for(int i=0;i<n;i++)
    {
        cout<<a[i]<<" ";
    }

    cout<<endl;
    cout<<"No. Of comparisions:" << comp_counter<<endl;
    cout<<"No. Of swaps:" << swap_counter<<endl;
  }
};
int main() {
    // Write C++ code here
    int n;
```

```
    int choice;
    scanf("%d",&choice);// choice for type of data
    scanf("%d",&n); // Number of elements
    int arr[n];
    switch(choice)
    {
      case 1: // for increasing-order
    for(int i=0;i<n;i++)
    {
        arr[i]=i+1;
    }
    break;

    case 2: // for decreasing order
    for(int i=0;i<n;i++)
    {
        arr[i]=n-i;
    }
    break;

    case 3: //for random numbers
    for(int i=0;i<n;i++)
    {
        arr[i]=rand() % 100;
    }
    break;

    default:
    return 0;
    }
    sort s1;
    s1.selection_sort(arr,n);
    return 0;
}
```

O/P:

Increasing Order:

```
1
100
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
    29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52
    53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76
    77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

No. Of comparisions:4950
No. Of swaps:0
```

Decreasing order:

```
2
100
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
    29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52
    53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76
    77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

No. Of comparisions:4950
No. Of swaps:50
```

Random Values:

```
3
100
2 3 5 5 8 11 11 12 13 13 14 15 15 19 21 21 22 23 24 24 25 26 26 26 26 27 27
    29 29 29 29 30 32 34 35 35 36 36 37 39 39 40 42 43 45 46 49 50 51 54 56
    56 57 58 59 60 62 62 62 63 64 67 67 67 67 68 68 69 70 70 72 73 73 76 76
    77 78 80 81 82 82 83 84 84 84 86 86 86 87 88 90 91 92 93 93 94 95 96 98
    99
No. Of comparisions:4950
No. Of swaps:96
```