Practical No. 01

Sorting Algorithms

Aim :

To write a program to sort elements using following sorting techniques :

(i) Bubble Sort
(ii) Selection Sort
(iii) Insertion Sort

Problem Statement :

(i) Sort the following array using Bubble Sort Technique.
A= [7, 6, 4, 3, 0]

(ii) Sort the following array using Selection Sort Technique.
A= [50, 75, 65, 45, 35]

(iii) Sort the following array using Insertion Sort Technique.
A= [5, -1, 2, 7, 3]

Theory :

Algorithm : To sort an array A containing n elements using Bubble Sort Algorithm

Step – 1 : Repeat For $\boldsymbol{p = 1\ to\ n - 1}$
Step – 2 : For $\boldsymbol{i = 1\ to\ n - p}$
Step – 3 : If $\boldsymbol{A[i] > A[i + 1]}$ Then
Exchange $\boldsymbol{A[i]}$ with $\boldsymbol{A[i + 1]}$
[End If]
[End Loop]
[End Loop]
Step – 4 : Exit

Algorithm : To sort an array A containing n elements using Selection Sort Algorithm

- Step – 1 : Repeat steps 2 to 5 **For** $\boldsymbol{i = 1\ to\ n - 1}$
- Step – 2 : Set $\boldsymbol{Min = A[i]}$ and $\boldsymbol{Flag = False}$
- Step – 3 : Repeat Step – 4 **For** $\boldsymbol{j = i + 1}$ to $\boldsymbol{n}$
- Step – 4 : If $\boldsymbol{A[j] < Min}$ Then
  Set $\boldsymbol{Min = A[j]}$
  Set $\boldsymbol{Pos = j}$ and $\boldsymbol{Flag = True}$
  [End If]
  [End Loop]
- Step – 5 : If $\boldsymbol{Flag = True}$
  Set $\boldsymbol{Temp = A[i]}$
  Set $\boldsymbol{A[i] = A[Pos]}$
  Set $\boldsymbol{A[Pos] = Temp}$
  [End If]
  [End Loop]
- Step – 6 : Exit

Algorithm : To sort an array A containing n elements using Insertion Sort Algorithm

- Step – 1 : Repeat steps 2 to 4 **For** $i = 2$ *to* n
- Step – 2 : Set $Temp = A[i]$ and $k = i - 1$
- Step – 3 : Repeat While $Temp < A[k]$ AND $k > 0$
- Set $A[k+1] = A[k]$
- Set $k = k - 1$

  [End Loop]
- Step – 4 : Set $A[k+1] = Temp$

  [End Loop]
- Step – 5 : Exit

Source Code :

```
print("Bubble Sort")
A=[7,6,4,3,0]
n=len(A)
print("A=",A)

for p in range(n-1):
    print("Pass-",p+1)
    for i in range(n-p-1):
        if A[i]>A[i+1]:
            temp=A[i]
            A[i]=A[i+1]
            A[i+1]=temp
        print("\tA=",A)
```

Output :

```
Bubble Sort
A= [7, 6, 4, 3, 0]
Pass- 1
        A= [6, 7, 4, 3, 0]
        A= [6, 4, 7, 3, 0]
        A= [6, 4, 3, 7, 0]
        A= [6, 4, 3, 0, 7]
Pass- 2
        A= [4, 6, 3, 0, 7]
        A= [4, 3, 6, 0, 7]
        A= [4, 3, 0, 6, 7]
Pass- 3
        A= [3, 4, 0, 6, 7]
        A= [3, 0, 4, 6, 7]
Pass- 4
        A= [0, 3, 4, 6, 7]
```

Source Code :

```
print("\nSelection Sort")
A=[50,75,65,45,35]
n=len(A)
print("A=",A)

for i in range(n-1):
    min_elt=A[i]
    flag=0

    for j in range(i+1,n):
        if A[j]<min_elt:
            min_elt=A[j]
            pos=j
            flag=1

    if flag==1:
        temp=A[i]
        A[i]=A[pos]
        A[pos]=temp

    print("Pass-",i+1)
    print("\tA=",A)
```

Output :

```
Selection Sort
A= [50, 75, 65, 45, 35]
Pass- 1
        A= [35, 75, 65, 45, 50]
Pass- 2
        A= [35, 45, 65, 75, 50]
Pass- 3
        A= [35, 45, 50, 75, 65]
Pass- 4
        A= [35, 45, 50, 65, 75]
```

Source Code :

```
print("\nInsertion Sort")
A=[5,-1,2,7,3]
n=len(A)
print("A=",A)

for i in range(1,n):
    temp=A[i]
    k=i-1

    while temp<A[k] and k>-1:
        A[k+1]=A[k]
        k=k-1

    A[k+1]=temp

    print("Pass-",i)
    print("\tA=",A)
```

Output :

```
Insertion Sort
A= [5, -1, 2, 7, 3]
Pass- 1
        A= [-1, 5, 2, 7, 3]
Pass- 2
        A= [-1, 2, 5, 7, 3]
Pass- 3
        A= [-1, 2, 5, 7, 3]
Pass- 4
        A= [-1, 2, 3, 5, 7]
```