AIM: To sort elements in an array using **Bubble Sort.**

PROGRAM:

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

void main()
{
 int i,j,temp,k,n=6;
 int a[6]={5,6,7,8,9,10};
 clrscr();

/*Instead of initialization, we
can scan elements from
user.*/
 /*printf("Enter the number of
elements: ");
 scanf("%d", &n);
 printf("\nEnter Elements: ");
 for(i=0;i<n;i++)
 {
  scanf("%d", &a[i]);
 } */

 for(i=0;i<n-1;i++)
 {
   printf("Pass %d: \n", i+1);
   for(j=0;j<n-i-1;j++)
   {
     if(a[j]>a[j+1])
      {
       temp=a[j];
       a[j]=a[j+1];
       a[j+1]=temp;
      }
      for(k=0;k<n;k++)
      {
        printf("%d ", a[k]);
      }
      printf("\n");
   }
 }

 printf("\nEnd Result: ");
 for(i=0;i<n;i++)
 {
   printf("%d ", a[i]);
 }
getch();
}
```

OUTPUT

1) Worst Case:
When none of the elements are sorted:

array initialized as:

a[6]={10,9,8,7,6,5};

```
Pass 1:
9 10 8 7 6 5
9 8 10 7 6 5
9 8 7 10 6 5
9 8 7 6 10 5
9 8 7 6 5 10
Pass 2:
8 9 7 6 5 10
8 7 9 6 5 10
8 7 6 9 5 10
8 7 6 5 9 10
Pass 3:
7 8 6 5 9 10
7 6 8 5 9 10
7 6 5 8 9 10
Pass 4:
6 7 5 8 9 10
6 5 7 8 9 10
Pass 5:
5 6 7 8 9 10

End Result: 5 6 7 8 9 10
```

2) Average Case:
When few of the elements are sorted.

array initialized as:

a[6]={5,8,9,7,6,10};

```
Pass 1:
5 8 9 7 6 10
5 8 9 7 6 10
5 8 7 9 6 10
5 8 7 6 9 10
5 8 7 6 9 10
 Pass 2:
5 8 7 6 9 10
5 7 8 6 9 10
5 7 6 8 9 10
5 7 6 8 9 10
 Pass 3:
5 7 6 8 9 10
5 6 7 8 9 10
5 6 7 8 9 10
After Pass 4:
5 6 7 8 9 10
5 6 7 8 9 10
Pass 5:
5 6 7 8 9 10

End Result: 5 6 7 8 9 10
```

3) Best Case:
When all the elements are already sorted:

array initialized as:

a[6]={5,6,7,8,9,10};

```
Pass 1:
5 6 7 8 9 10
5 6 7 8 9 10
5 6 7 8 9 10
5 6 7 8 9 10
5 6 7 8 9 10
Pass 2:
5 6 7 8 9 10
5 6 7 8 9 10
5 6 7 8 9 10
5 6 7 8 9 10
Pass 3:
5 6 7 8 9 10
5 6 7 8 9 10
5 6 7 8 9 10
Pass 4:
5 6 7 8 9 10
5 6 7 8 9 10
Pass 5:
5 6 7 8 9 10

End Result: 5 6 7 8 9 10
```

CONCLUSION: In all the above three cases, we find that the Time complexity is **O(n).** Hence, we use a more modified algorithm for Bubble sort, as discussed later.

AIM: To sort elements in an array using **Modified Bubble Sort. (Flag)**

PROGRAM:

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

void main()
{
 int i,j,temp,k,n=6,flag=0;
 int a[6]={5,6,7,8,9,10};
 clrscr();

 /*printf("Enter the number of
elements: ");
 scanf("%d", &n);
 printf("\nEnter Elements: ");
 for(i=0;i<n;i++)
 {
  scanf("%d", &a[i]);
 } */

 for(i=0;i<n-1;i++)
 {
   flag=0;
   printf("After pass %d: \n", i+1);
   for(j=0;j<n-i-1;j++)
   {
     if(a[j]>a[j+1])
      {
        flag=1;
        temp=a[j];
        a[j]=a[j+1];
        a[j+1]=temp;
      }
      for(k=0;k<n;k++)
      {
        printf("%d ", a[k]);
      }
      printf("\n");
   }
   if(flag==0)
      {
        printf("\nThe sorted array
is:\n ");
        for(k=0;k<n;k++)
        {
         printf("%d ", a[k]);
        }
        return;
      }
 }

 printf("\nEnd Result: ");
 for(i=0;i<n;i++)
 {
   printf("%d ", a[i]);
 }
getch();
}
```

EXPLAINATION: If the array is **already sorted**, then the **flag remains zero** and hence, the ‘if’ condition is executed and it saves the un-necessary ‘for’ loop iterations.