**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

**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.

**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

**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.