Vidyalankar Polytechnic	DEPARTMENT OF COMPUTER ENGINEERING

Subject: - DSU	**Subject Code:** 313301
Semester: - III	**Course:** DATA STRUCTURES
Laboratory No: L003	**Name of Subject Teacher:** Prof. Imran S.
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Experiment No:	10
Title of Experiment	* Write a 'C' Program to Sort an Array of numbers using Insertion Sort Method

Aim: * Write a 'C' Program to Sort an Array of numbers using Insertion Sort Method.

Algorithm:

Step 1: Start
Step 2: Declare an integer array a[100] and variables i, n
Step 3: Clear screen using clrscr()
Step 4: Print "Enter the size of the array:"
Step 5: Scan the value of n from keyboard
Step 6: Print "Enter the elements in the array:"
Step 7: Run a loop from i = 0 to i < n
Step 7.1: Scan each element and store it in a[i]
Step 8: Call the function sort(a, n)
Step 9: Inside the sort() function
Step 9.1: Declare integer variables i, j, temp
Step 9.2: Run a loop from i = 1 to i < n
Step 9.2.1: Set temp = a[i]
Step 9.2.2: Set j = i - 1
Step 9.2.3: While j >= 0 and a[j] > temp, repeat
Step 9.2.3.1: Set a[j + 1] = a[j]
Step 9.2.3.2: Decrement j by 1
Step 9.2.4: Set a[j + 1] = temp
Step 10: After returning from function, print "Sorted Array:"
Step 11: Run a loop from i = 0 to i < n
Step 11.1: Print a[i]
Step 12: Stop

Code:

```
≡ File Edit Search Run Compile Debug Project Options Window Help
[■] SAAD57.C 1=[↕]
#include<stdio.h>
#include<conio.h>
void sort(int [],int);

void main()
{
int a[100],i,n;
clrscr();
printf("Enter the size of the array: ");
scanf("%i",&n);
printf("Enter the elements in the array: \n");
for(i=0;i<n;i++)
{
scanf("%i",&a[i]);
}
sort(a,n);
printf("\nSorted Array: \n");
for(i=0;i<n;i++)
{
printf("%i \n",a[i]);
}
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F1 Help Alt-F8 Next Msg Alt-F7 Prev Msg Alt-F9 Compile F9 Make F10 Menu
≡ File Edit Search Run Compile Debug Project Options Window Help
[■] SAAD57.C 1=[↕]
getch();
}

void sort(int a[],int n)
{
int i,j,temp;
for(i=1;i<n;i++)
{
temp=a[i];
j=i-1;
while(j>=0&&a[j]>temp)
{
a[j+1]=a[j];
j=j-1;
}
a[j+1]=temp;
}
}
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F1 Help Alt-F8 Next Msg Alt-F7 Prev Msg Alt-F9 Compile F9 Make F10 Menu
```

Output: -

```
Enter the size of the array: 5
Enter the elements in the array:
50
40
30
20
10

Sorted Array:
10
20
30
40
50
```

Practical Related Questions:

1. **Modify the Insertion Sort algorithm to use binary search for finding the correct position to insert the current element. Implement this modified algorithm and compare its performance with the standard Insertion Sort.**

   Ans:

```
≡ File Edit Search Run Compile Debug Project Options Window Help
[■] SAAD60.C 2-[↕]
#include <stdio.h>
#include <conio.h>
int bsearch(int a[],int x,int low,int high)
{
int mid;
while(low<=high)
{
mid=(low+high)/2;
if(x==a[mid])
return mid+1;
else if(x>a[mid])
low=mid+1;
else
high=mid-1;
}
return low;
}

void binsort(int a[],int n)
{
int i,j,k,temp;
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```

```
≡ File Edit Search Run Compile Debug Project Options Window Help
[■] SAAD60.C 2-[↕]
for(i=1;i<n;i++)
{
temp=a[i];
k=bsearch(a,temp,0,i-1);
j=i-1;
while(j>=k)
{
a[j+1]=a[j];
j--;
}
a[k]=temp;
}
}

void print(int a[],int n)
{
int i;
for(i=0;i<n;i++)
printf("%d ",a[i]);
printf("\n");
}
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```

```
≡ File Edit Search Run Compile Debug Project Options Window Help
[■]═══ SAAD60.C ═══2=[↕]
}

void main()
{
int a[100],n,i;
clrscr();
printf("Enter size of array: ");
scanf("%d",&n);
printf("Enter %d elements:\n",n);
for(i=0;i<n;i++)
scanf("%d",&a[i]);
printf("\nOriginal:\n");
print(a,n);
binsort(a,n);
printf("\nBinary Insertion Sort:\n");
print(a,n);
getch();
}

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```

OUTPUT:

```
Enter size of array: 5
Enter 5 elements:
5
4
3
2
1

Original:
5 4 3 2 1

Binary Insertion Sort:
1 2 3 4 5
_
```

2. **Use the Insertion Sort algorithm to count the number of inversions in an array. An inversion is a pair of elements where the earlier element is greater than the later element.**
   Ans:

```
≡ File Edit Search Run Compile Debug Project Options Window Help
[■]═══ SAAD57.C ═══1=[↕]
#include<stdio.h>
#include<conio.h>
int sort(int [],int);

void main()
{
int a[100],i,n,inver;
clrscr();
printf("Enter the size of the array: ");
scanf("%i",&n);
printf("Enter the elements in the array: \n");
for(i=0;i<n;i++)
{
scanf("%i",&a[i]);
}
inver=sort(a,n);
printf("\nNo. of Inversions: %i \n",inver);
getch();
}

int sort(int a[],int n)
21:78
F1 Help  Alt-F8 Next Msg  Alt-F7 Prev Msg  Alt-F9 Compile  F9 Make  F10 Menu
```

```
≡ File Edit Search Run Compile Debug Project Options Window Help
[■]═══ SAAD57.C ═══1=[↕]
{
int i,j,temp,inver=0;
for(i=1;i<n;i++)
{
temp=a[i];
j=i-1;
while(j>=0&&a[j]>temp)
{
a[j+1]=a[j];
j=j-1;
inver++;
}
a[j+1]=temp;
}
return inver;
}

21:78
F1 Help  Alt-F8 Next Msg  Alt-F7 Prev Msg  Alt-F9 Compile  F9 Make  F10 Menu
```

Output:

```
Enter the size of the array: 5
Enter the elements in the array:
5
4
3
2
1

No. of Inversions: 10
_
```

Marks Obtained			Dated signature of Teacher
Process Related (35)	Product Related (15)	Total (50)	