VP Vidyalankar Polytechnic	DEPARTMENT OF COMPUTER ENGINEERING

Subject: - DSU	**Subject Code:** 313301
Semester: - III	**Course:** Computer Engineering
Laboratory No: L003	**Name of Subject Teacher:** Prof. Imran S.
Name of Student: Mohd Saad Khan	**Roll Id: -** 24203A0007
Experiment No:	11
Title of Experiment	* Write a 'C' Program to Sort an Array of Strings using Insertion Sort Method

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

Algorithm:

Step 1: Start
Step 2: Declare a 2D character array a[5][20], key[20], and temp[20]
Step 3: Declare integer variables i, j, b, and flag = 0
Step 4: Clear screen using clrscr()
Step 5: Print "Enter 5 Strings in the array:"
Step 6: Run a loop from i = 0 to i < 5
Step 6.1: Scan a string and store it in a[i]
Step 7: Print "Sorted Array:"
Step 8: Run a loop from i = 1 to i < 5
Step 8.1: Copy a[i] into temp
Step 8.2: Set j = i - 1
Step 8.3: Compare a[j] and temp using strcmp() and store result in b
Step 8.4: While j >= 0 and b > 0, repeat
Step 8.4.1: Copy a[j] into a[j + 1]
Step 8.4.2: Decrement j by 1
Step 8.5: Copy temp into a[j + 1]
Step 9: Run a loop from i = 0 to i < 5
Step 9.1: Print a[i]
Step 10: Stop

Code:

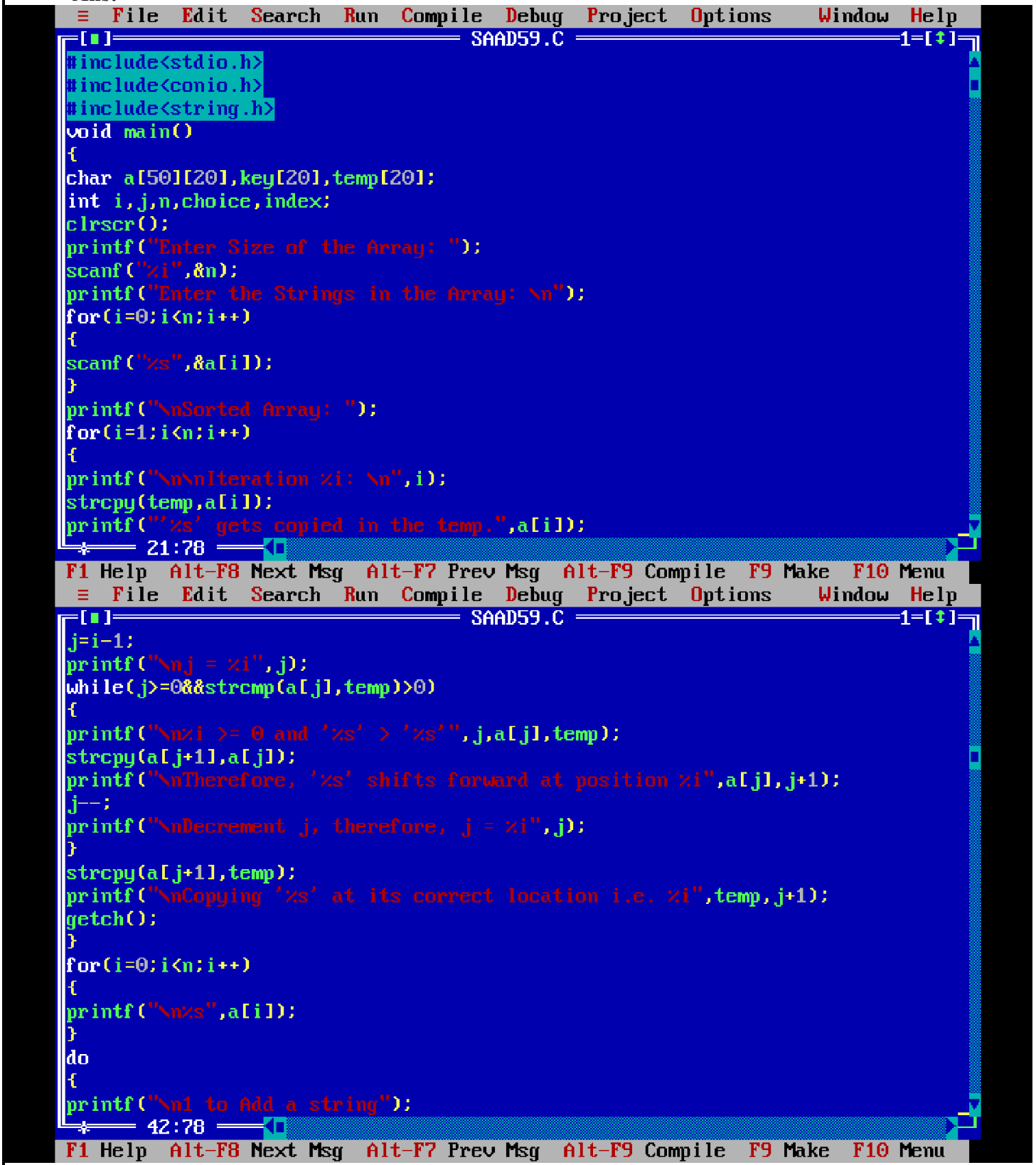
```
≡  File  Edit  Search  Run  Compile  Debug  Project  Options    Window  Help
[■]═══════════ SAAD57.C ═══════════1=[↕]
#include<stdio.h>
#include<conio.h>
#include<string.h>
void main()
{
char a[5][20],key[20],temp[20];
int i,j,b,flag=0;
clrscr();
printf("Enter 5 Strings in the array: \n");
for(i=0;i<5;i++)
{
scanf("%s",a[i]);
}
printf("\nSorted Array: ");
for(i=1;i<5;i++)
{
strcpy(temp,a[i]);
j=i-1;
b=strcmp(a[j],temp);
while(j>=0&&b>0)
{
═══ 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=[↕]
strcpy(a[j+1],a[j]);
j--;
}
strcpy(a[j+1],temp);
}
for(i=0;i<5;i++)
{
printf("\n%s",a[i]);
}
getch();
}
═══ 34:78 ═══
F1 Help  Alt-F8 Next Msg  Alt-F7 Prev Msg  Alt-F9 Compile  F9 Make  F10 Menu
```

Output: -

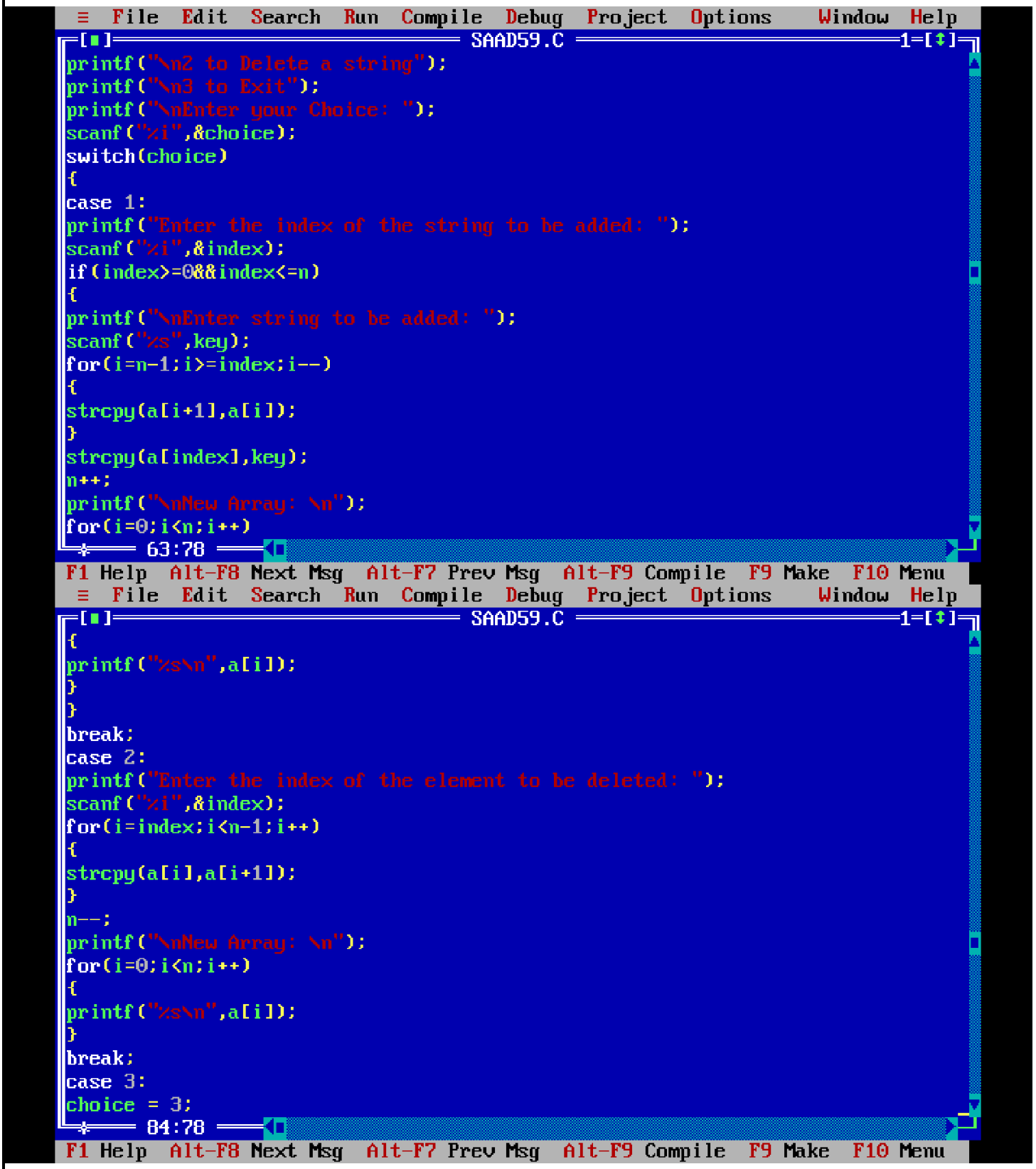
```
Enter 5 Strings in the array:
lichi
mango
banana
watermelon
apple

Sorted Array:
apple
banana
lichi
mango
watermelon_
```

Practical Related Questions

1. **Create an interactive game where the user enters a list of strings, and the program sorts them using insertion sort. Allow the user to add or remove strings dynamically and see the sorting process step by step.**
   Ans:



```
 ≡  File  Edit  Search  Run  Compile  Debug  Project  Options    Window  Help
[■]═══════════ SAAD59.C ═══════════1=[↕]
#include<stdio.h>
#include<conio.h>
#include<string.h>
void main()
{
char a[50][20],key[20],temp[20];
int i,j,n,choice,index;
clrscr();
printf("Enter Size of the Array: ");
scanf("%i",&n);
printf("Enter the Strings in the Array: \n");
for(i=0;i<n;i++)
{
scanf("%s",&a[i]);
}
printf("\nSorted Array: ");
for(i=1;i<n;i++)
{
printf("\n\nIteration %i: \n",i);
strcpy(temp,a[i]);
printf("'%s' gets copied in the temp.",a[i]);
 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
[■]═══════════ SAAD59.C ═══════════1=[↕]
j=i-1;
printf("\nj = %i",j);
while(j>=0&&strcmp(a[j],temp)>0)
{
printf("\n%i >= 0 and '%s' > '%s'",j,a[j],temp);
strcpy(a[j+1],a[j]);
printf("\nTherefore, '%s' shifts forward at position %i",a[j],j+1);
j--;
printf("\nDecrement j, therefore, j = %i",j);
}
strcpy(a[j+1],temp);
printf("\nCopying '%s' at its correct location i.e. %i",temp,j+1);
getch();
}
for(i=0;i<n;i++)
{
printf("\n%s",a[i]);
}
do
{
printf("\n1 to Add a string");
 42:78
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
SAAD59.C
printf("\n2 to Delete a string");
printf("\n3 to Exit");
printf("\nEnter your Choice: ");
scanf("%i",&choice);
switch(choice)
{
case 1:
printf("Enter the index of the string to be added: ");
scanf("%i",&index);
if(index>=0&&index<=n)
{
printf("\nEnter string to be added: ");
scanf("%s",key);
for(i=n-1;i>=index;i--)
{
strcpy(a[i+1],a[i]);
}
strcpy(a[index],key);
n++;
printf("\nNew Array: \n");
for(i=0;i<n;i++)
63:78
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
SAAD59.C
{
printf("%s\n",a[i]);
}
}
break;
case 2:
printf("Enter the index of the element to be deleted: ");
scanf("%i",&index);
for(i=index;i<n-1;i++)
{
strcpy(a[i],a[i+1]);
}
n--;
printf("\nNew Array: \n");
for(i=0;i<n;i++)
{
printf("%s\n",a[i]);
}
break;
case 3:
choice = 3;
84:78
F1 Help Alt-F8 Next Msg Alt-F7 Prev Msg Alt-F9 Compile F9 Make F10 Menu

```
choice = 3;
break;
default:
printf("Invalid Input...");
}
}while(choice!=3);
getch();
}
```

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F1 Help Alt-F8 Next Msg Alt-F7 Prev Msg Alt-F9 Compile F9 Make F10 Menu

OUTPUT:

```
Enter Size of the Array: 5
Enter the Strings in the Array:
zebra
plane
studs
apple
mango

Sorted Array:

Iteration 1:
'plane' gets copied in the temp.
j = 0
0 >= 0 and 'zebra' > 'plane'
Therefore, 'zebra' shifts forward at position 1
Decrement j, therefore, j = -1
Copying 'plane' at its correct location i.e. 0

Iteration 2:
'studs' gets copied in the temp.
j = 1
1 >= 0 and 'zebra' > 'studs'
Therefore, 'zebra' shifts forward at position 2
Decrement j, therefore, j = 0
Copying 'studs' at its correct location i.e. 1
```

```
Iteration 3:
'apple' gets copied in the temp.
j = 2
2 >= 0 and 'zebra' > 'apple'
Therefore, 'zebra' shifts forward at position 3
Decrement j, therefore, j = 1
1 >= 0 and 'studs' > 'apple'
Therefore, 'studs' shifts forward at position 2
Decrement j, therefore, j = 0
0 >= 0 and 'plane' > 'apple'
Therefore, 'plane' shifts forward at position 1
Decrement j, therefore, j = -1
Copying 'apple' at its correct location i.e. 0
```

```
Iteration 4:
'mango' gets copied in the temp.
j = 3
3 >= 0 and 'zebra' > 'mango'
Therefore, 'zebra' shifts forward at position 4
Decrement j, therefore, j = 2
2 >= 0 and 'studs' > 'mango'
Therefore, 'studs' shifts forward at position 3
Decrement j, therefore, j = 1
1 >= 0 and 'plane' > 'mango'
Therefore, 'plane' shifts forward at position 2
Decrement j, therefore, j = 0
Copying 'mango' at its correct location i.e. 1
apple
mango
plane
studs
zebra
```

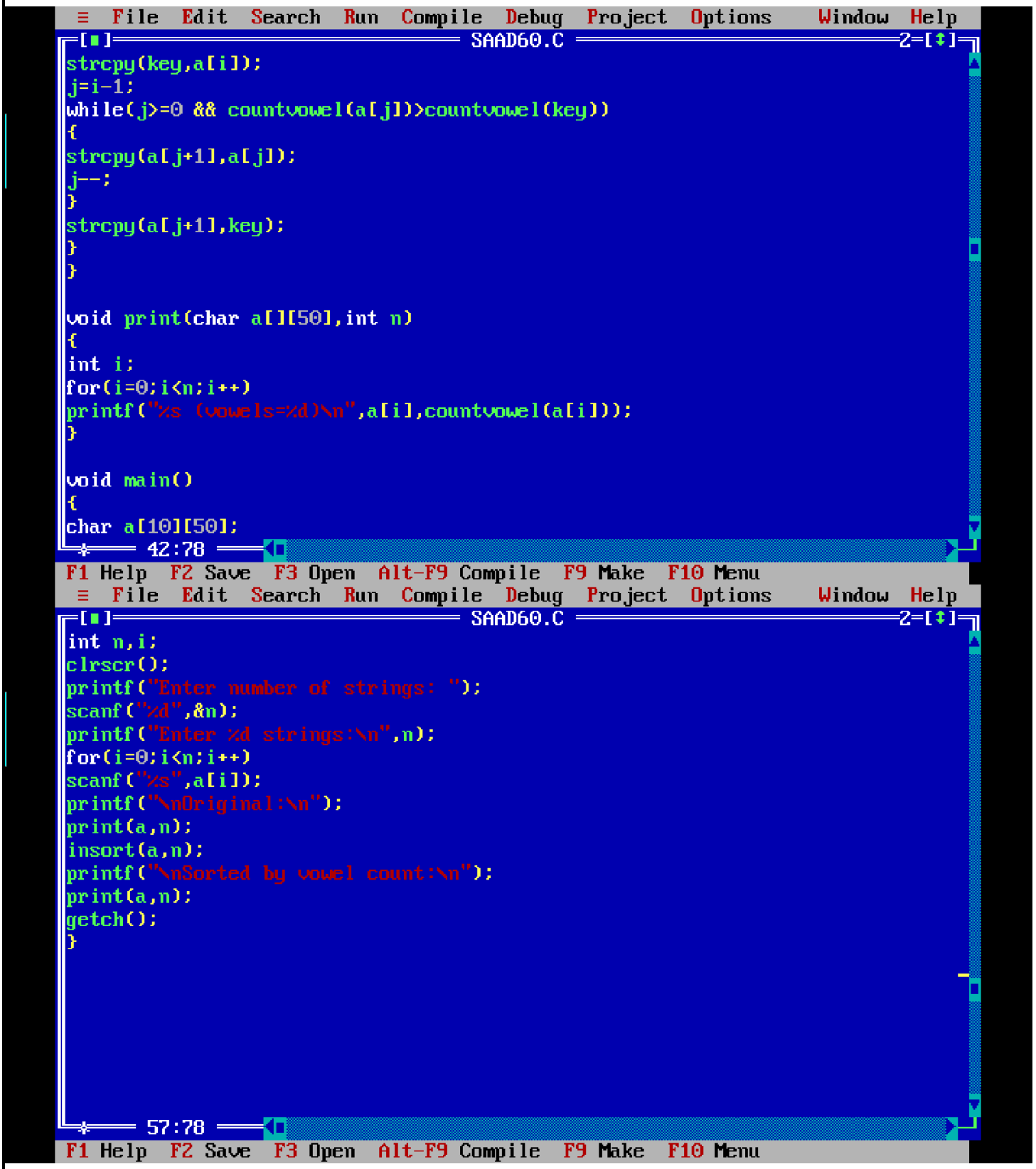
```
1 to Add a string
2 to Delete a string
3 to Exit
Enter your Choice: 1
Enter the index of the string to be added: 3

Enter string to be added: football

New Array:
apple
mango
plane
football
studs
zebra
```

```
1 to Add a string
2 to Delete a string
3 to Exit
Enter your Choice: 2
Enter the index of the element to be deleted: 3

New Array:
apple
mango
plane
studs
zebra

1 to Add a string
2 to Delete a string
3 to Exit
Enter your Choice: 3
```

2. **Implement insertion sort with a custom comparison function that sorts strings based on a specific criterion (e.g., number of vowels, number of consonants, etc.).**

Ans:

```
≡ File  Edit  Search  Run  Compile  Debug  Project  Options  Window  Help
[■]═══ SAAD60.C ═══2-[↕]
#include <stdio.h>
#include <conio.h>
#include <string.h>
int countvowel(char s[])
{
int i,c=0;
for(i=0;s[i]!='\0';i++)
{
if(s[i]=='a'||s[i]=='e'||s[i]=='i'||s[i]=='o'||s[i]=='u'||
s[i]=='A'||s[i]=='E'||s[i]=='I'||s[i]=='O'||s[i]=='U')
c++;
}
return c;
}

void insort(char a[][50],int n)
{
int i,j;
char key[50];
for(i=1;i<n;i++)
{
═══ 21:78 ═══
F1 Help  F2 Save  F3 Open  Alt-F9 Compile  F9 Make  F10 Menu
```


File Edit Search Run Compile Debug Project Options Window Help
SAAD60.C
strcpy(key,a[i]);
j=i-1;
while(j>=0 && countvowel(a[j])>countvowel(key))
{
strcpy(a[j+1],a[j]);
j--;
}
strcpy(a[j+1],key);
}
}
void print(char a[][50],int n)
{
int i;
for(i=0;i<n;i++)
printf("%s (vowels=%d)\n",a[i],countvowel(a[i]));
}
void main()
{
char a[10][50];
42:78
F1 Help F2 Save F3 Open Alt-F9 Compile F9 Make F10 Menu
File Edit Search Run Compile Debug Project Options Window Help
SAAD60.C
int n,i;
clrscr();
printf("Enter number of strings: ");
scanf("%d",&n);
printf("Enter %d strings:\n",n);
for(i=0;i<n;i++)
scanf("%s",a[i]);
printf("\nOriginal:\n");
print(a,n);
insort(a,n);
printf("\nSorted by vowel count:\n");
print(a,n);
getch();
}
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F1 Help F2 Save F3 Open Alt-F9 Compile F9 Make F10 Menu

OUTPUT:

```
Enter number of strings: 5
Enter 5 strings:
apple
mango
zebra
plane
studs

Original:
apple (vowels=2)
mango (vowels=2)
zebra (vowels=2)
plane (vowels=2)
studs (vowels=1)

Sorted by vowel count:
studs (vowels=1)
apple (vowels=2)
mango (vowels=2)
zebra (vowels=2)
plane (vowels=2)
_
```

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