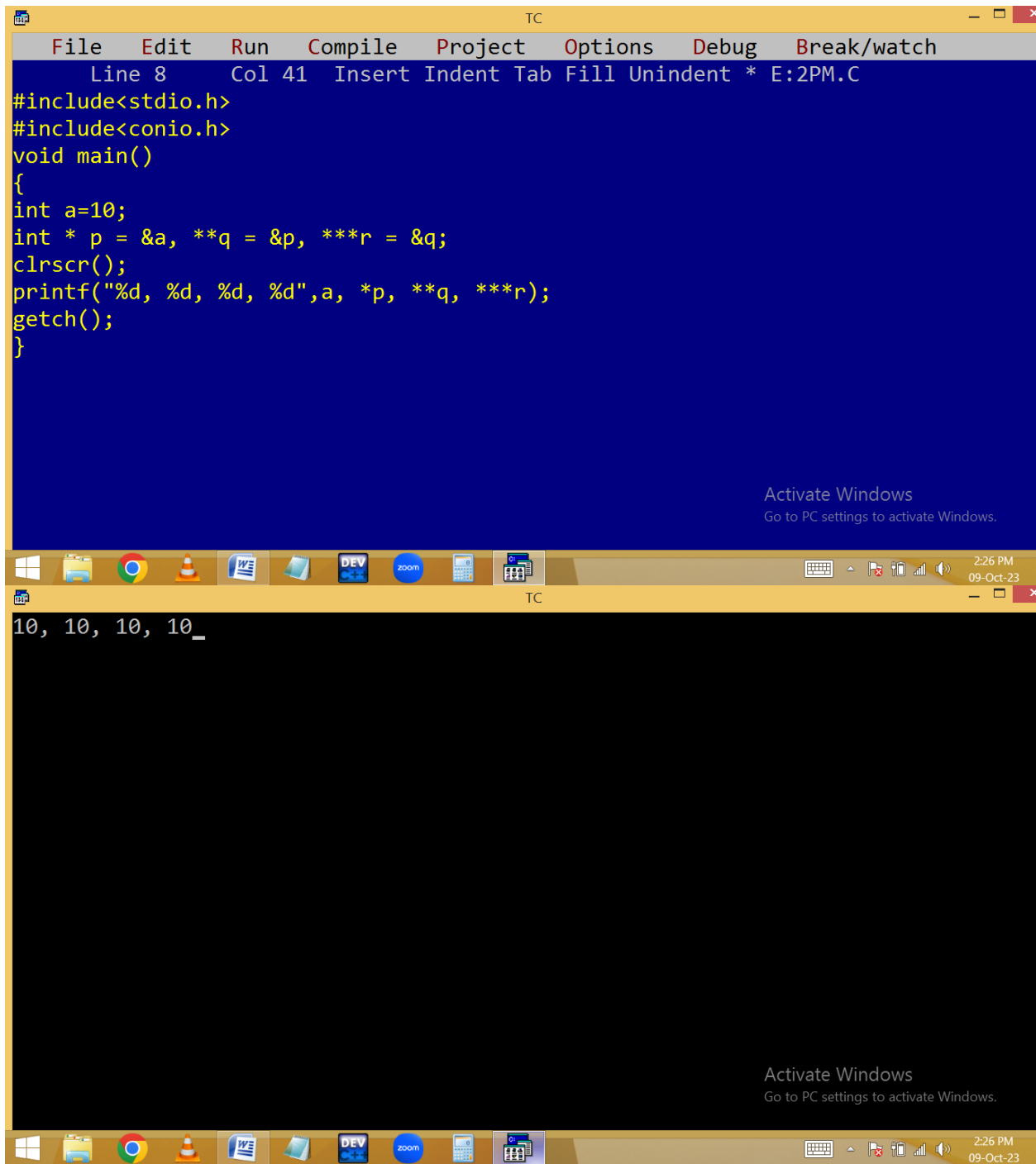


**POINTER TO POINTER / DOUBLE POINTER:** the pointer which stores the address of another pointer is called double pointer and it is used to manage dynamic arrays.



variable name	value	address
r	65504	65506
q	65502	65504
p	65500	65502
a	10	65500

```
p("%d", **r);
```

65504  
 \*65504 ==> value at 65504=65502  
 \*65502 ==> value at 65502 = 65500  
 \*65500 ==> value at 65500 = 10

**Array of pointers:** Like normal variables we can declare pointer using array. Due to this one pointer is able to store several address and reduce no of declarations and program size. It is useful to handle dynamic arrays.

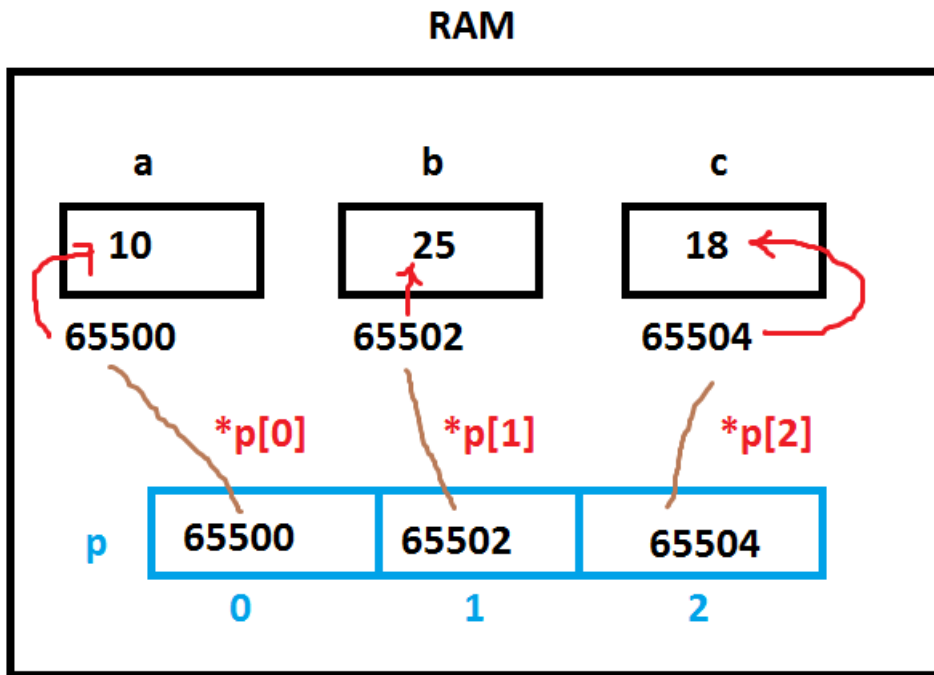
The image shows a screenshot of the Turbo C++ (TC) IDE. The top window displays a C program with the following code:

```
Line 8 Col 46 Insert Indent Tab Fill Unindent * E:2PM.C
#include<stdio.h>
#include<conio.h>
void main()
{
int a=10,b=25, c=18, *p[3], i;
p[0] = &a, p[1]=&b; p[2]=&c;
clrscr();
for(i=0;i<3;i++)printf("%c=%d\n",97+i, *p[i]);
getch();
}
```

The bottom window shows the output of the program:

```
a=10
b=25
c=18
_
```

Both windows include a status bar at the bottom with the text "Activate Windows Go to PC settings to activate Windows." and a taskbar at the very bottom showing various application icons and the system clock (2:41 PM, 09-Oct-23).



### Pointer to array:

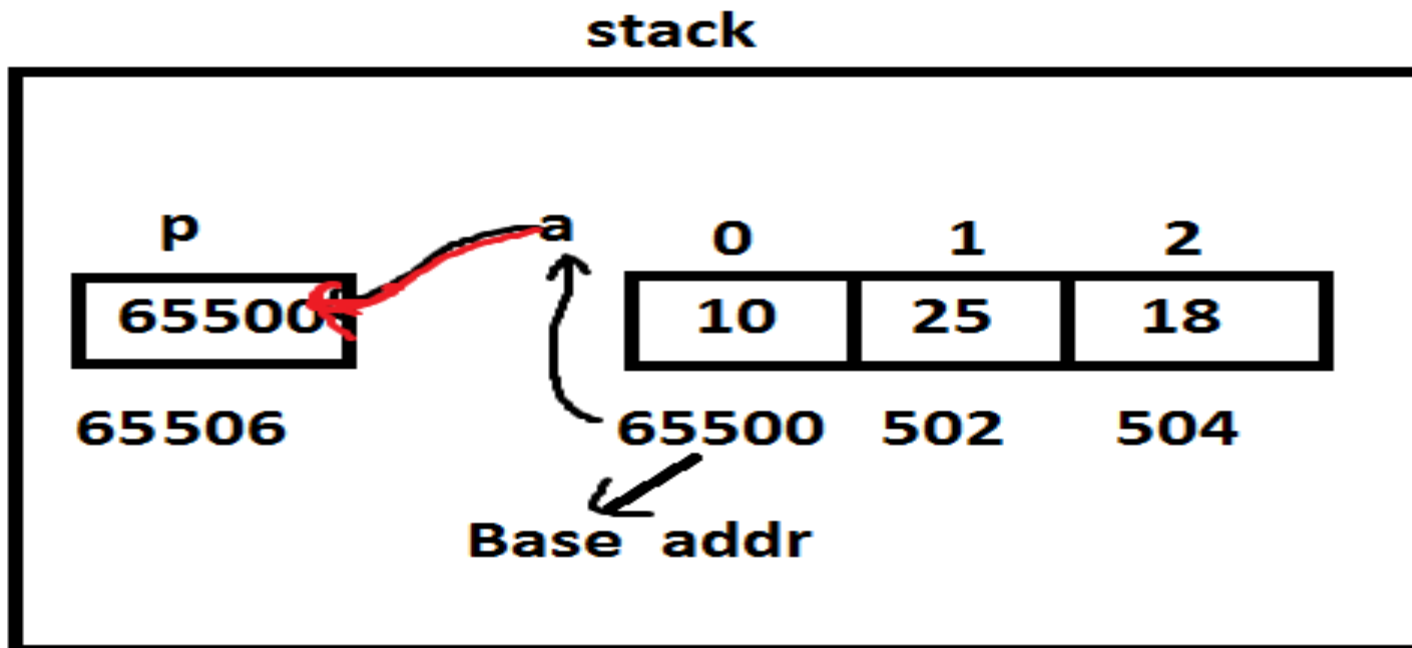
Array is implicit pointer. Due to this it holds the base cell addr [ 0 cell addr ] implicitly. By assigning the array name or 0 cell addr to the pointer, we can handle array elements using the following syntax.

**`*(ptrvariable + offset/index * sizeof(variable));`**

**Eg:**

**`int a[3]={10, 25, 18}, *p, i;`**

**`p = a ; or p = &a[0]; or p = &a;`**



```
for(i=0;i<3;i++)  
printf("%4d", *(p+i));
```

**Here  $*(p+i)$  meaning is:**

**p is 65500**

1.  $*(p+0*2) \rightarrow *65500 \rightarrow \text{value at } 65500 \rightarrow 10$
2.  $*(p+1*2) \rightarrow *65502 \rightarrow \text{value at } 65502 \rightarrow 25$
3.  $*(p+2*2) \rightarrow *65504 \rightarrow \text{value at } 65504 \rightarrow 18$

**Note:** Here **2** is int size.

**Eg:**

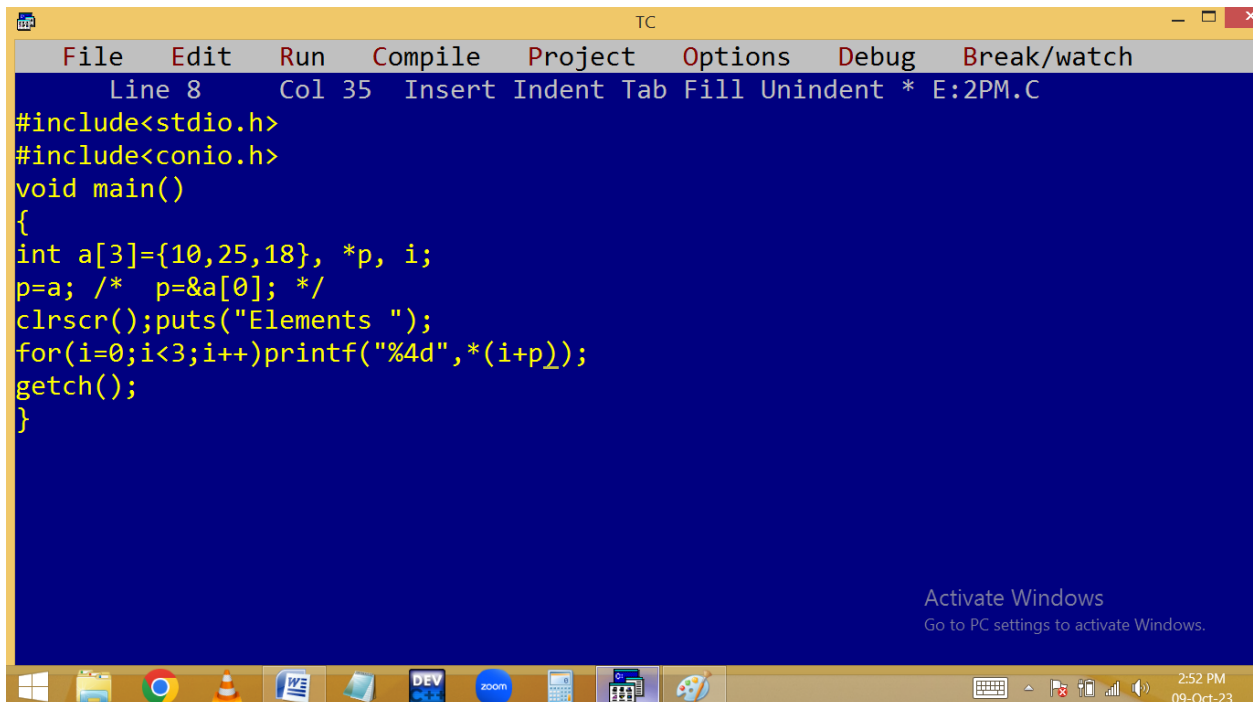
```
#include<stdio.h>  
#include<conio.h>  
void main()  
{  
int *p, a[3]={10,25,18}, i;  
clrscr();  
p = a; /* p=&a[0]; or p=&a; */
```

```
printf("Elements are: ");  
for(i=0;i<3;i++)  
printf("%4d",*(p+i));  
getch();  
}
```

**Output:** Elements are: 10 25 18

**Note:** We can access array elements using array / pointer in following ways.

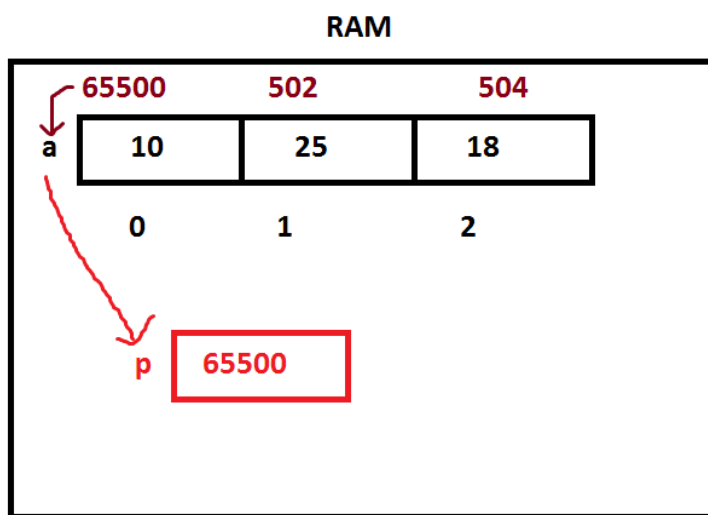
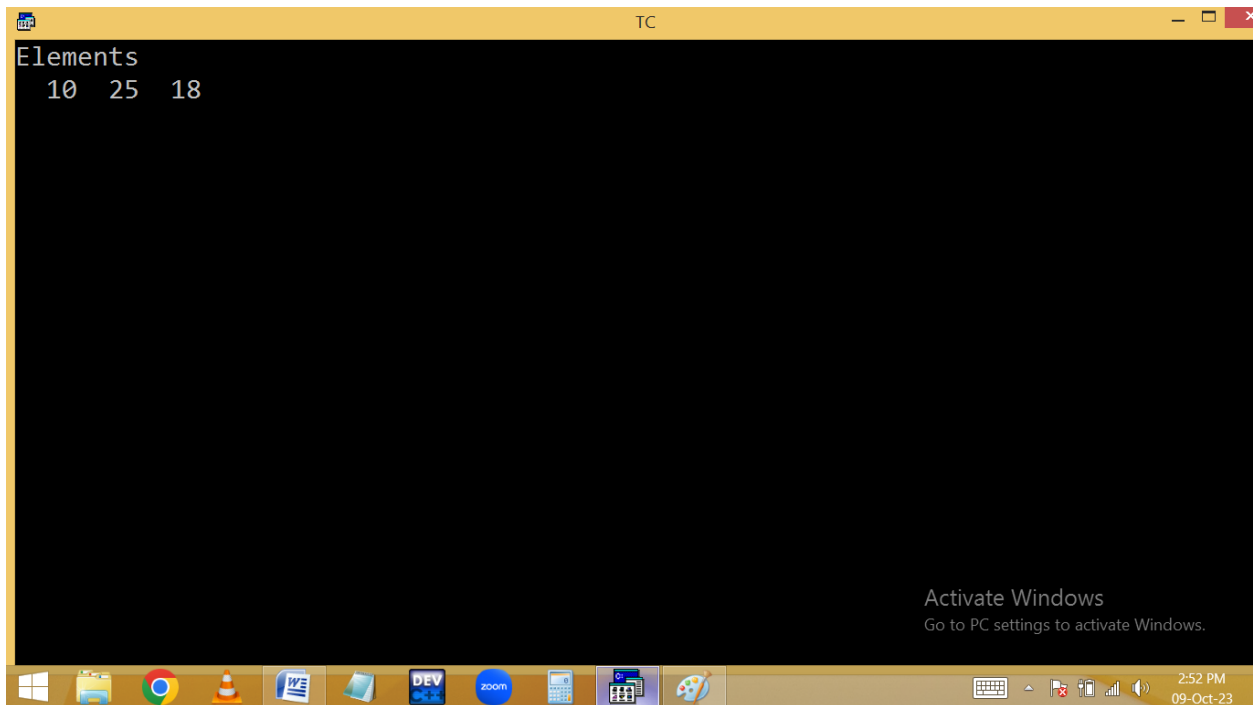
**a[i] / i[a] / p[i] / i[p] / \*(p+i) / \*(a+i) / \*(i+p) / \*(i+a)**



The screenshot shows a Turbo C++ (TC) IDE window. The title bar reads "TC". The menu bar includes "File", "Edit", "Run", "Compile", "Project", "Options", "Debug", and "Break/watch". The status bar at the top indicates "Line 8", "Col 35", and "Insert Indent Tab Fill Unindent \* E:2PM.C". The code editor contains the following C program:

```
#include<stdio.h>  
#include<conio.h>  
void main()  
{  
int a[3]={10,25,18}, *p, i;  
p=a; /* p=&a[0]; */  
clrscr();puts("Elements ");  
for(i=0;i<3;i++)printf("%4d",*(i+p));  
getch();  
}
```

At the bottom of the window, there is a taskbar with various application icons (Windows, File Explorer, Chrome, VLC, Word, etc.) and a system tray showing the time as "2:52 PM" and the date as "09-Oct-23". An "Activate Windows" watermark is visible in the bottom right corner of the IDE window.



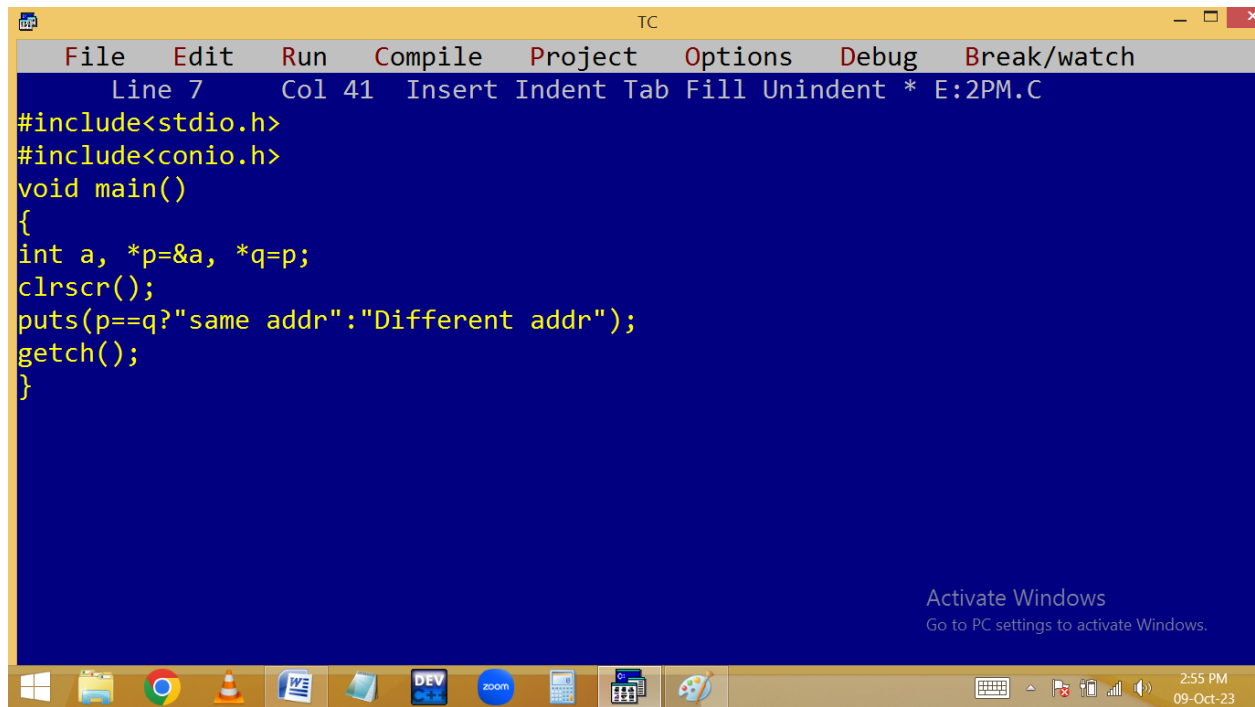
```
for(i=0;i<3;i++)  
p("%4d", *(p+i));
```

\*65500+0\*2=\*65500=value at 65500=10  
\*65500+1\*2=\*65502=value at 65502=25  
\*65500+2\*2=\*65504=value at 65504=18

## Pointer arithmetic:

Like general variables we can do the operations like `=`, `==`, `+`, `-`, `++`, `--` on pointers. But we can't perform `*`, `%`, `/` on pointers.





TC

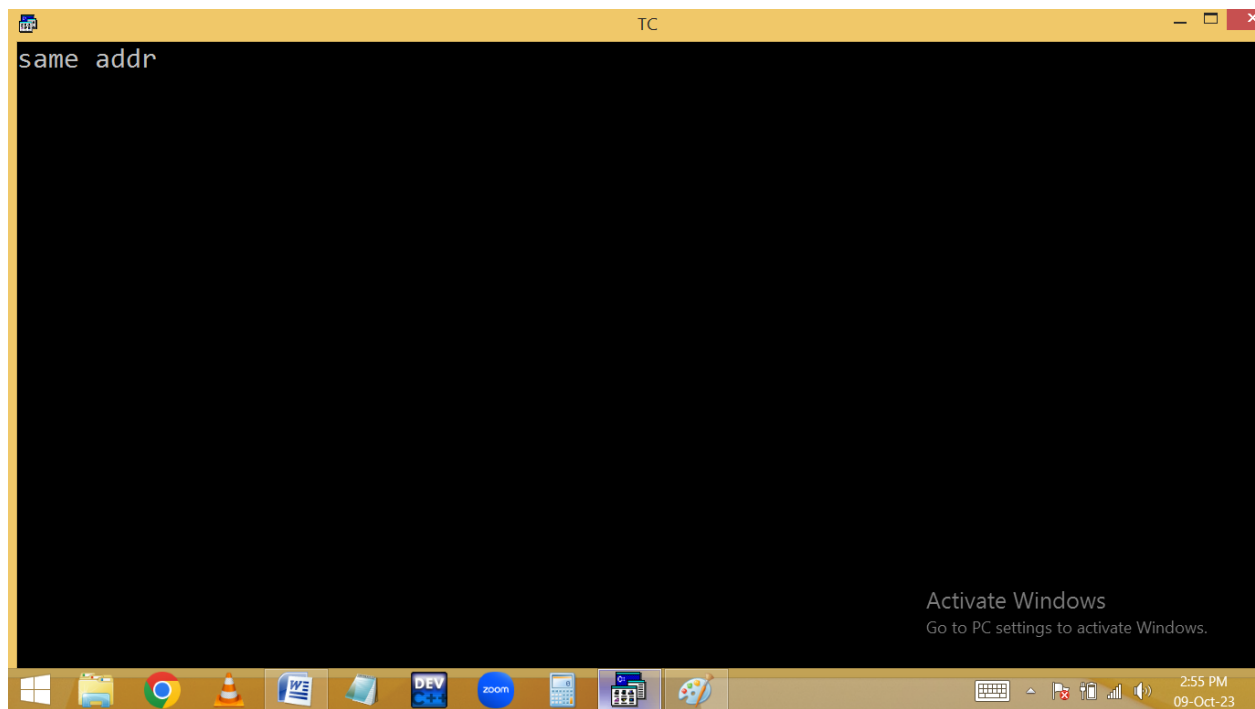
File Edit Run Compile Project Options Debug Break/watch

Line 7 Col 41 Insert Indent Tab Fill Unindent \* E:2PM.C

```
#include<stdio.h>
#include<conio.h>
void main()
{
int a, *p=&a, *q=p;
clrscr();
puts(p==q?"same addr":"Different addr");
getch();
}
```

Activate Windows  
Go to PC settings to activate Windows.

2:55 PM  
09-Oct-23

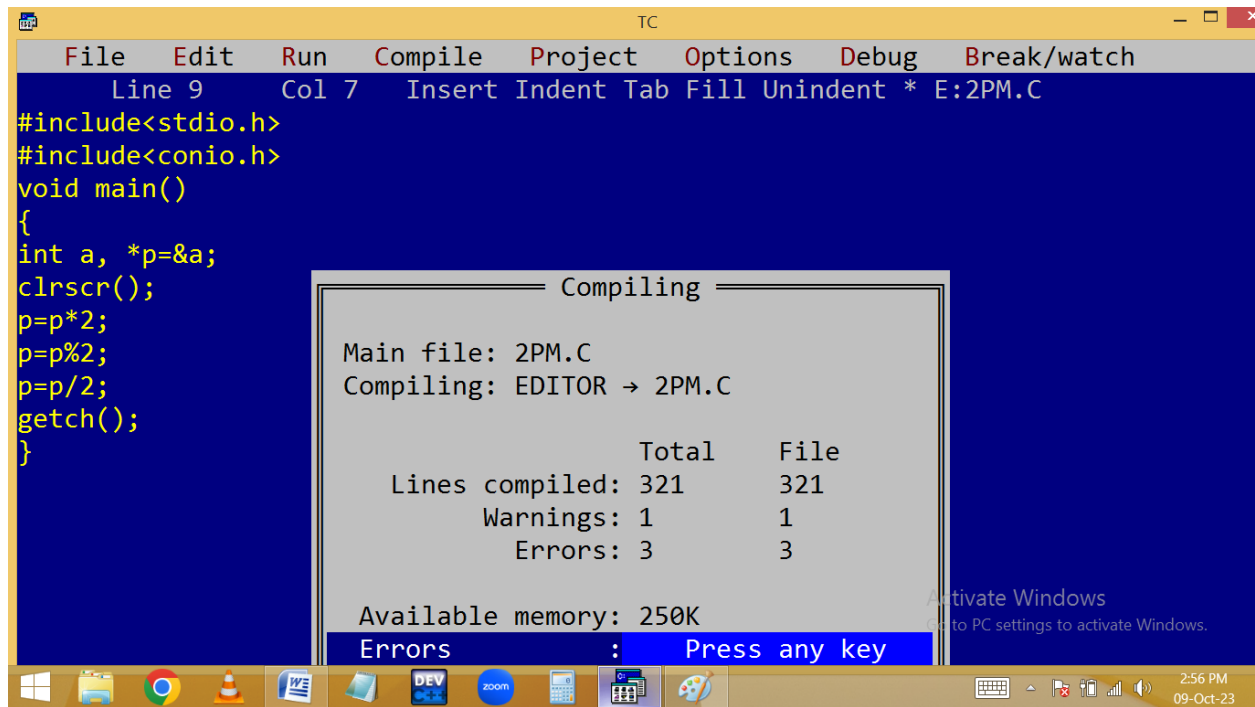


TC

same addr

Activate Windows  
Go to PC settings to activate Windows.

2:55 PM  
09-Oct-23



TC

File Edit Run Compile Project Options Debug Break/watch

Edit

Line 1 Col 38 Insert Indent Tab Fill Unindent \* E:2PM.C

```
#include<stdio.h>
#include<conio.h>
void main()
{
int a[5]={10,20,30,40,50}, *p=&a[0],i;
clrscr();
p++; printf("%d\n",*p);
--p; printf("%d\n",*p);
*p++; printf("%d\n",*p);
++*p; printf("%d\n",*p);
p=p+2; (*p)--; printf("%d\n",*p);
for(i=0;i<5;i++)printf("%4d",a[i]);
getch();
}
```

Activate Windows  
Go to PC settings to activate Windows.

3:04 PM  
09-Oct-23

TC

```
20
10
20
21
39
10 21 30 39 50
```

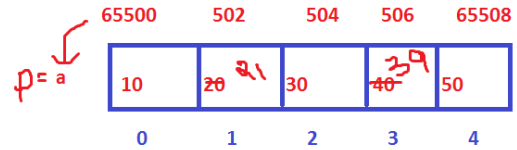
Activate Windows  
Go to PC settings to activate Windows.

3:04 PM  
09-Oct-23

```

p=65500
p++==> 65500+1*2=65502
p(*p)==>value at 65502==> 20
--p; 65502-1*2=65500
p(*p)==>value at 65500==> 10
*p++ ==>p++ ==>65500+1*2=65502
p(*p)==>value at 65502 ==> 20
++*p ==> ++ of value at *p==>value at 65502
++ ==> 20++ ==> 21
p(*p)==>value at 65502 ==> 21
p=p+2==>65502+2*2=65506
(*p)-- ==> value at 65506-- ==> 40-- ==> 39

```



p(\*p)==> value at 65506 ==> 39

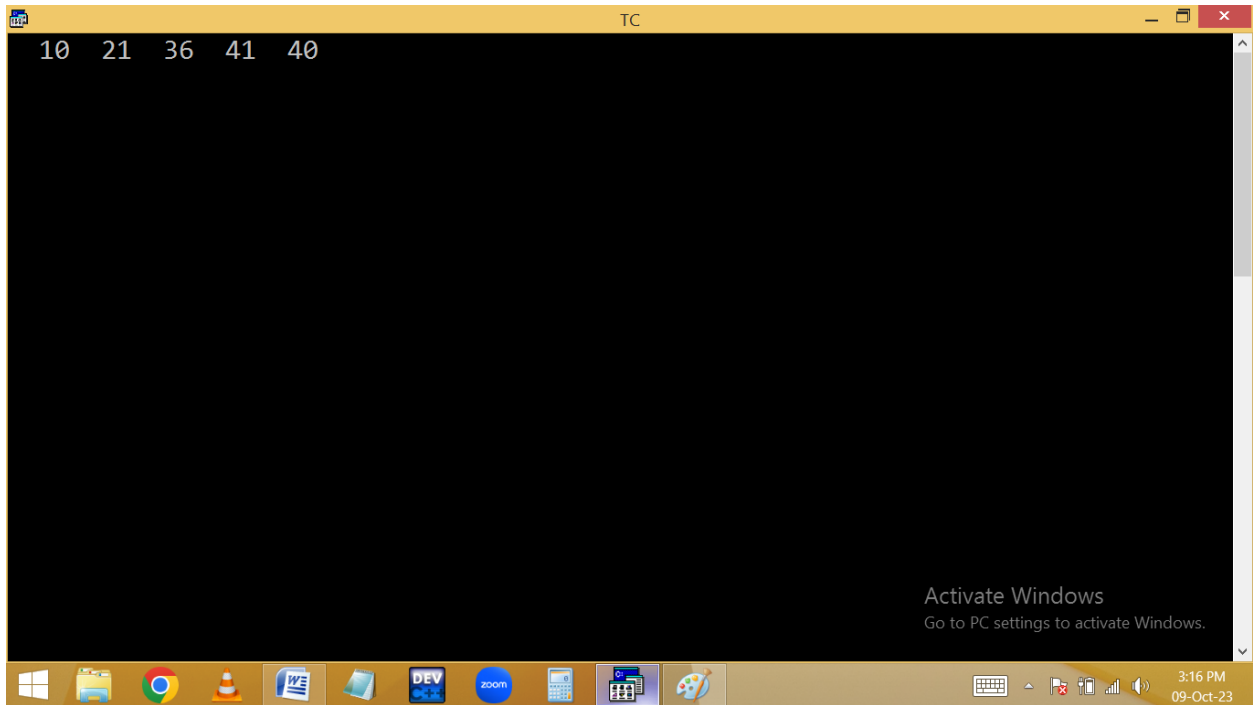
```

TC
File Edit Run Compile Project Options Debug Break/watch
Edit
Line 11 Col 9 Insert Indent Tab Fill Unindent * E:2PM.C
#include<stdio.h>
#include<conio.h>
void main()
{
int a[5]={10,20,30,40,50}, *p=&a[0],i;
clrscr();
p[1]++;
++p[2];
p+=2;
p[0]+=5;
p[2]=p[1]++;
for(i=0;i<5;i++)printf("%4d",a[i]);
getch();
}

```

Activate Windows  
Go to PC settings to activate Windows.

3:16 PM  
09-Oct-23



`p=65500`

`p[1]++ ==> value at 65502++ ==> 21`

`++p[2] ==> ++ of value at 65504 ==> ++30 ==> 31`

`p+=2 ==> p = 65500+2*2=65504`

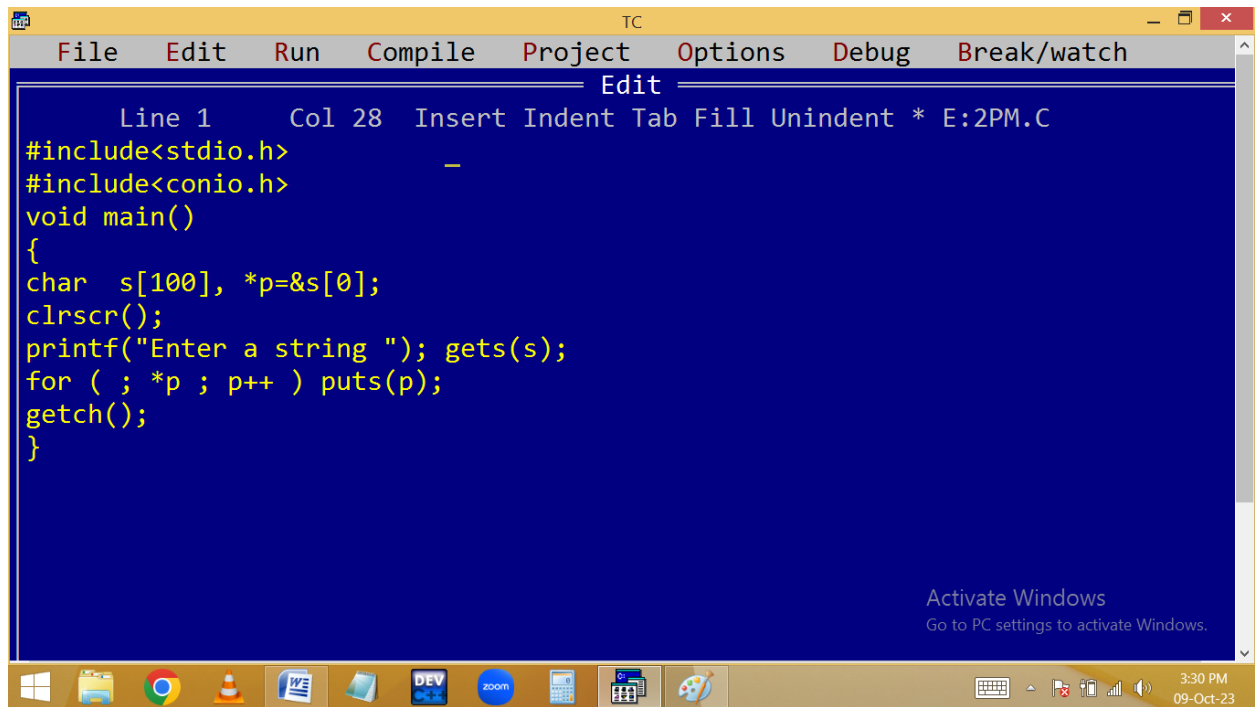
`p[0]+=5 ==> p[0]=p[0]+5 ==> value at 65504 + 5 ==> 31+5 = 36`

`p[2]=p[1]++; p[2]=p[1] i.e. 65508=65506 ==> 50=40`

`p[1]++ ==> 65506++ ==> 40++ ==> 41`



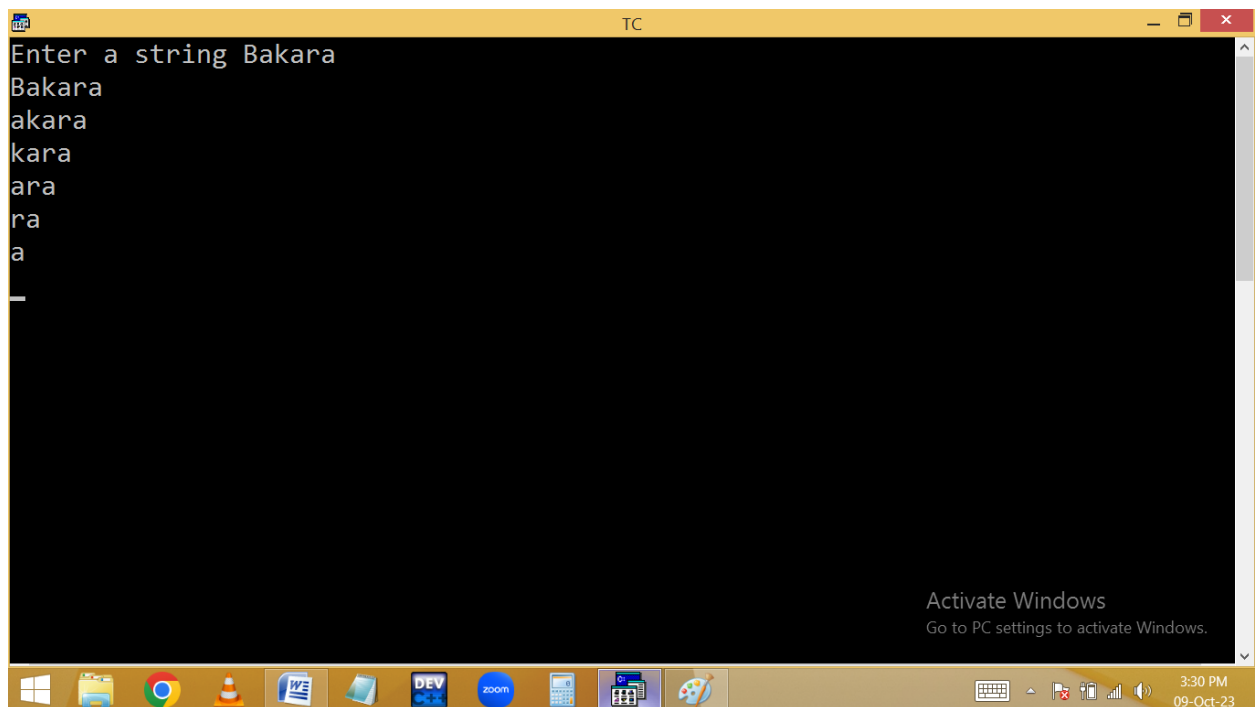
**Pointer to string:**



The screenshot shows the Turbo C++ (TC) IDE with a menu bar (File, Edit, Run, Compile, Project, Options, Debug, Break/watch) and a toolbar. The main window is titled 'Edit' and contains the following C code:

```
Line 1      Col 28  Insert Indent Tab Fill Unindent * E:2PM.C
#include<stdio.h>
#include<conio.h>
void main()
{
char  s[100], *p=&s[0];
clrscr();
printf("Enter a string "); gets(s);
for ( ; *p ; p++ ) puts(p);
getch();
}
```

The status bar at the bottom right indicates 'Activate Windows' and 'Go to PC settings to activate Windows.' The taskbar at the bottom shows various icons including Windows, File Explorer, Chrome, VLC, Word, Excel, DEV C++, Zoom, and a clock showing 3:30 PM on 09-Oct-23.

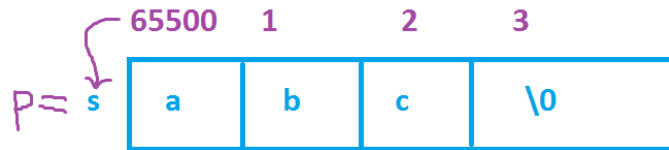


The screenshot shows the Turbo C++ (TC) IDE with the same menu bar and toolbar as the first image. The main window is titled 'TC' and displays the output of the program:

```
Enter a string Bakara
Bakara
akara
kara
ara
ra
a
_
```

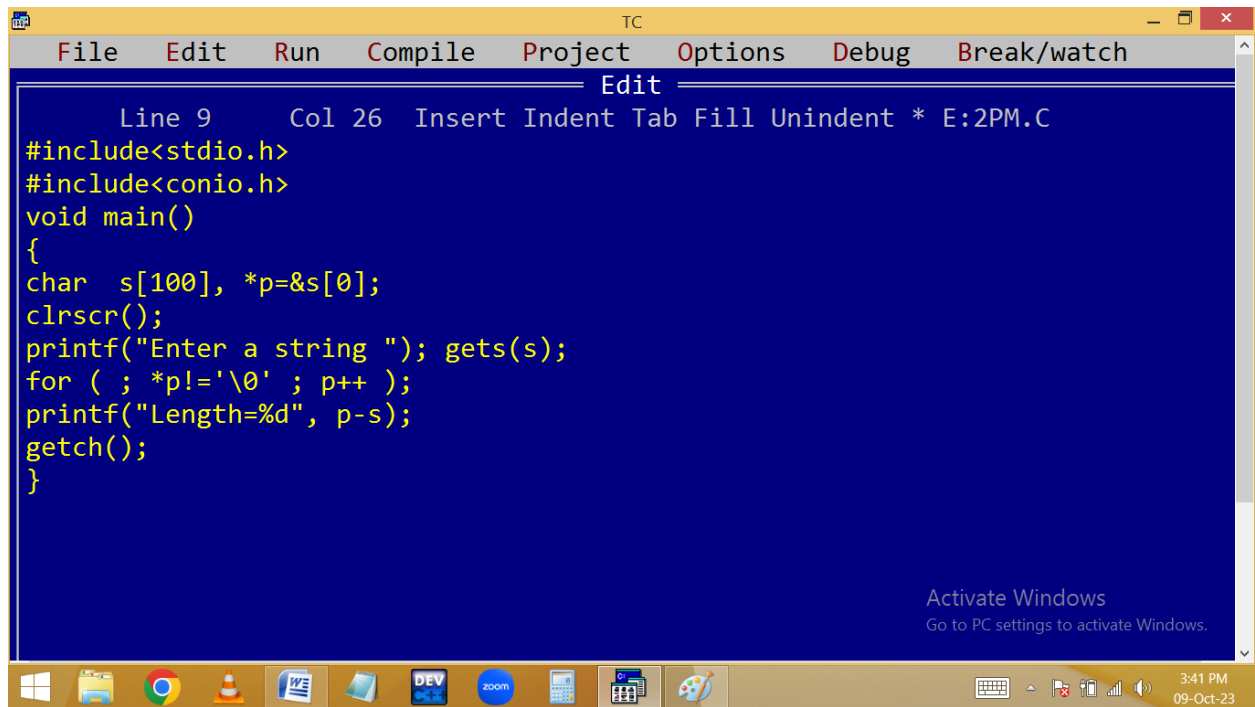
The status bar at the bottom right indicates 'Activate Windows' and 'Go to PC settings to activate Windows.' The taskbar at the bottom shows various icons including Windows, File Explorer, Chrome, VLC, Word, Excel, DEV C++, Zoom, and a clock showing 3:30 PM on 09-Oct-23.

↗ \*p!='\0';  
for( ; \*p ; p++ ) puts(p);



65500+0\*1=65500 to \0 = abc  
65500+1\*1=65501 to \0 = bc  
65500+2\*1=65502 to \0 = c  
65500+3\*1=65503='\0' != \0 =false

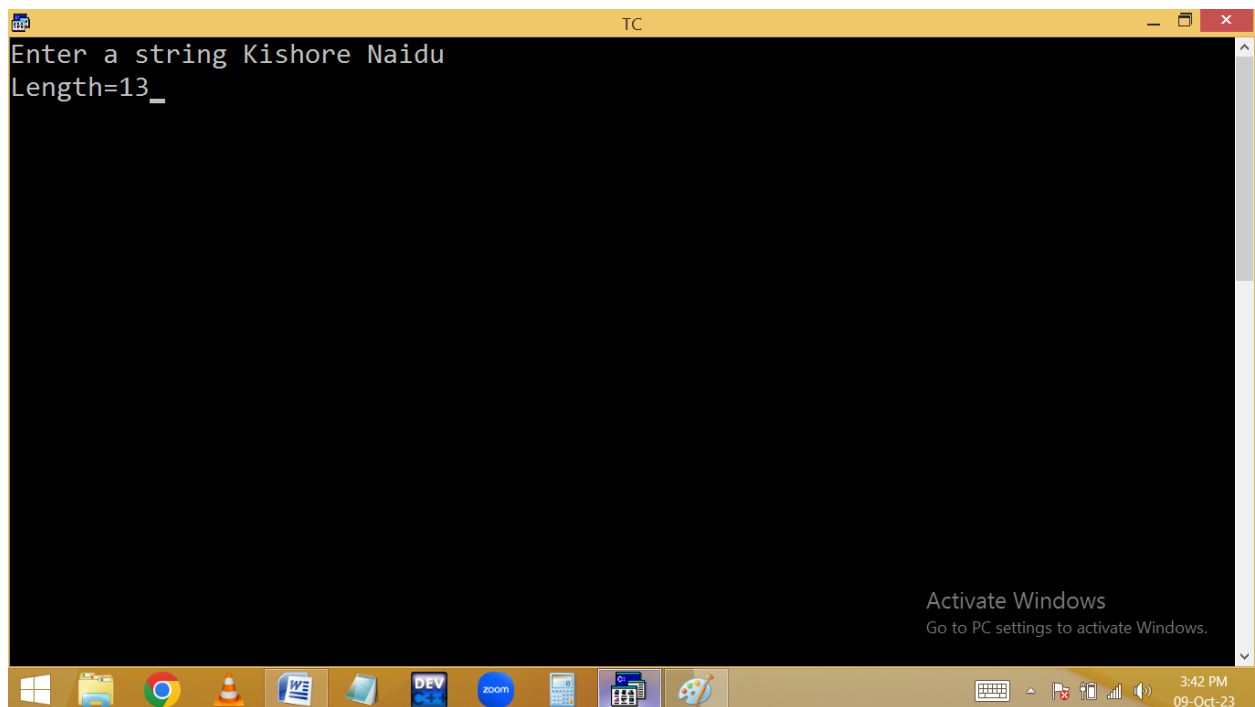
**Finding string length using pointers.**



The screenshot shows the Turbo C++ (TC) IDE interface. The menu bar includes File, Edit, Run, Compile, Project, Options, Debug, and Break/watch. The status bar at the top indicates 'Line 9 Col 26 Insert Indent Tab Fill Unindent \* E:2PM.C'. The main editing area has a blue background and contains the following C code:

```
#include<stdio.h>
#include<conio.h>
void main()
{
char s[100], *p=&s[0];
clrscr();
printf("Enter a string "); gets(s);
for ( ; *p!='\0' ; p++ );
printf("Length=%d", p-s);
getch();
}
```

An 'Activate Windows' watermark is visible in the bottom right corner of the IDE window. The Windows taskbar at the bottom shows various application icons and the system clock indicating 3:41 PM on 09-Oct-23.



This screenshot shows the same Turbo C++ IDE after the program has been executed. The output window displays the text 'Enter a string Kishore Naidu' followed by 'Length=13\_'. The 'Activate Windows' watermark is also present in the bottom right corner. The Windows taskbar at the bottom shows the system clock updated to 3:42 PM on 09-Oct-23.



TC

Line 1 Col 2 Insert Indent Tab Fill Unindent \* E:2PM.C

```
#include<stdio.h>
#include<conio.h>
void main()
{
int  a[2][3]={1,2,3,4,5,6}, r,c;
clrscr();
*(*(a+1)+1)=10;
for(r=0;r<2;r++)
{
for(c=0;c<3;c++)
{
printf("%4d",a[r][c]);
}
printf("\n");
}
getch();
}
```

Activate Windows  
Go to PC settings to activate Windows.

3:47 PM  
09-Oct-23

TC

```
1  2  3
4 10  6
```

Activate Windows  
Go to PC settings to activate Windows.

3:47 PM  
09-Oct-23