

## POINTERS

Pointer is a variable, which holds the address of another variable of same type.

Pointer is a memory location, which holds the address of another memory location.

Pointer is a derived data type.

### Advantages:

1. Dynamic memory allocation.
2. Program performance is increased due to preventing memory wastage.
3. They are very much used in System programming.
4. They are very much used in dynamic linked list & Stacks [**data structures**].
5. **It allows to access local variable outside the function i.e. data sharing between functions.**  
[ **call by address/Reference** ].
6. **To handle strings, arrays etc in functions we need pointers.**

7. To handle **data files** we are using pointers.
8. They directly works on variable address. Due to this search time is reduced and execution speed is increased.

### **Dis-advantage:**

They are not secured.

### **Syntax:**

**datatype \* variable;**

- \* indicates it is a pointer data type.
- \* is called indirection operator.
- \* is called dereferencing operator.
- **\* is a re-direction operator.**
- \* indicates value at that address.
- \* indicates pointer value.

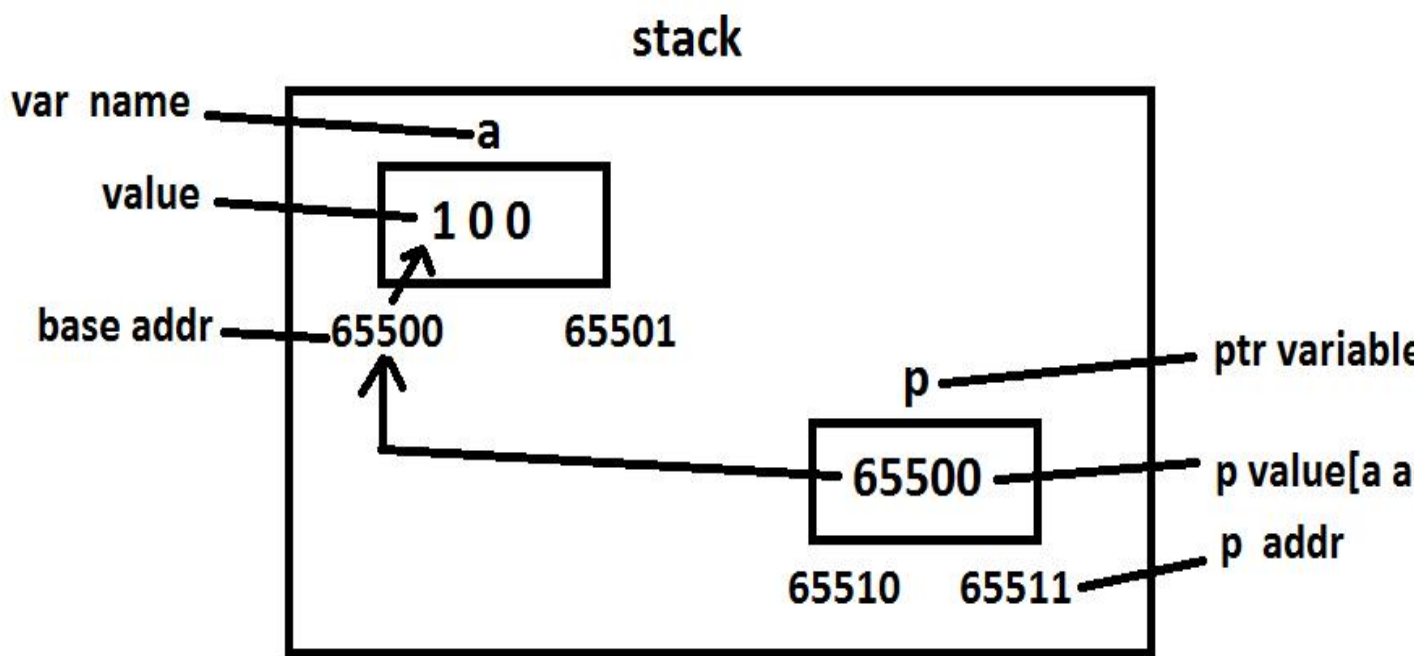
**Eg:**

```
int a=100, * p;
```

In the above example '**a**' is a general variable.

\* indicates '**p**' is a pointer type variable and it is able to store the address of general variable '**a**' as follows.

```
p = &a;
```



In the above example, to pick the value of **a** through pointer variable **p**, we have to use the **printf()** as follows.

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

→ **100**

Here **\*p** means **value of p** or **value at that addr.**  
i.e. **65500**. But **65500** is the **addr of 'a'**. The  
value in **a** address is **100**.

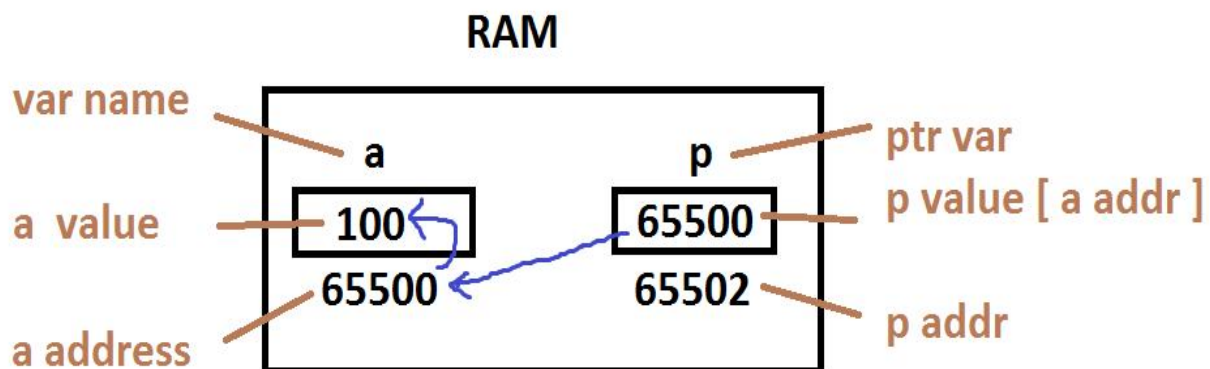
Or

Here **p** means **65500**. **\*p** means value at 65500.  
i.e. **100**.

Due to this example any changes conducted in  
**\*p** effects the value of **'a'**. Hence **p** is called  
**pointer to a**.

Eg: **\*p=200;**

Now **a** value becomes **200**.



**p("%d",\*p); ==> 100**

→ **p value i.e. 65500**

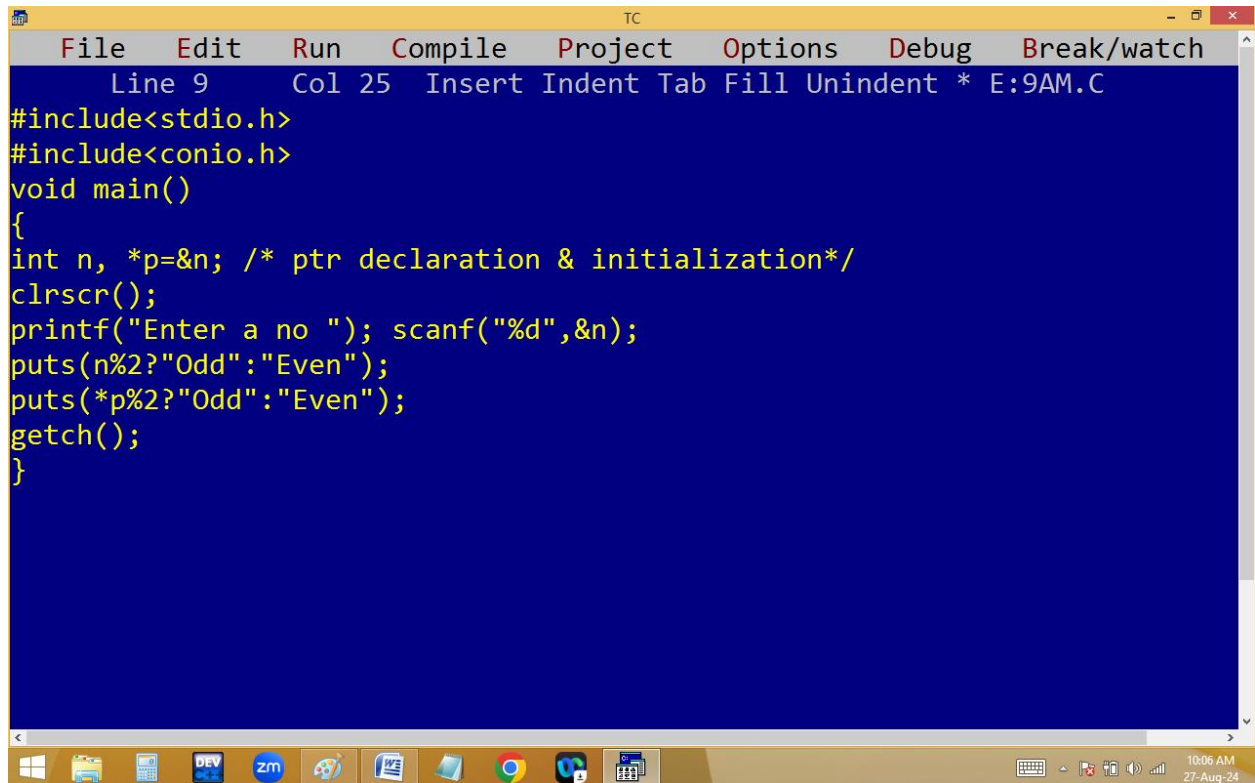
→ **\*65500 ==> value at 65500 ==> 100**

## Finding a variable value and address using pointer:

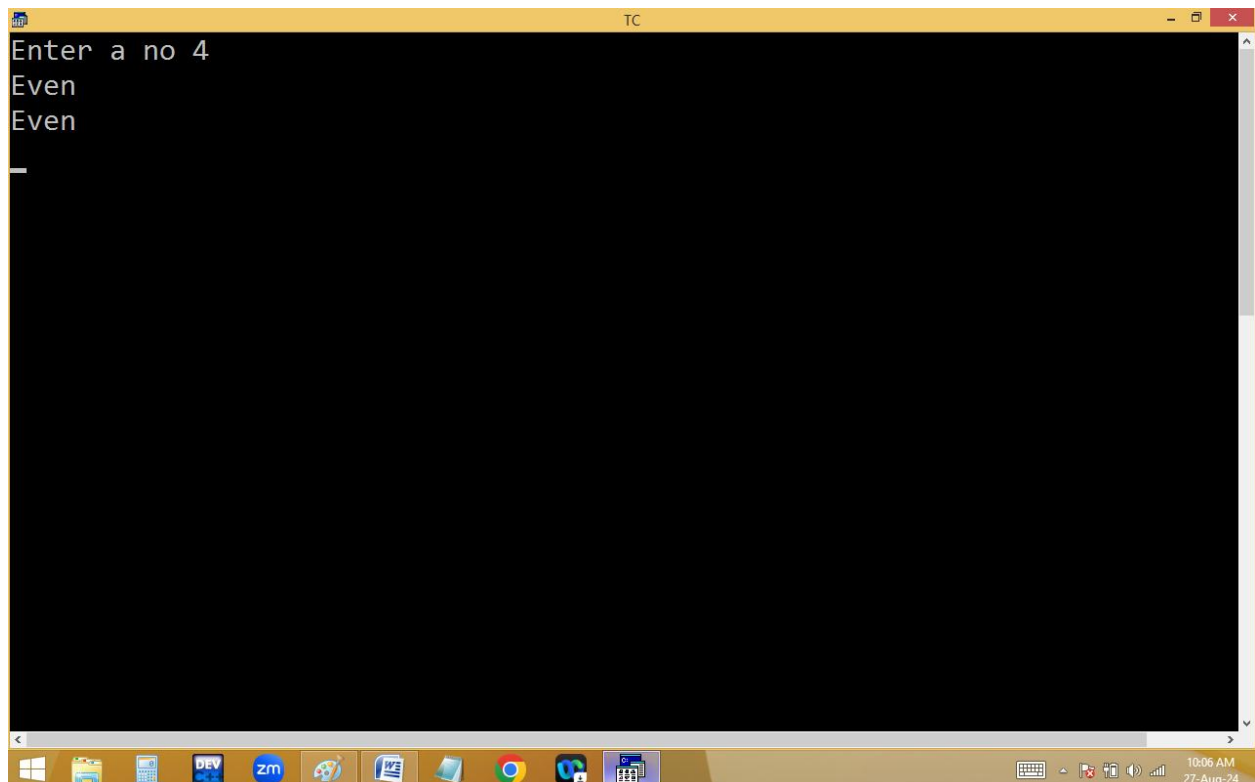
```
TC
File Edit Run Compile Project Options Debug Break/watch
Line 14 Col 1 Insert Indent Tab Fill Unindent * E:9AM.C
#include<stdio.h>
#include<conio.h>
void main()
{
int a=100, *p; /* ptr declaration */
p = &a; /* ptr initialization */
clrscr();
printf("a value %d\n",a);
printf("a addr  %u\n",&a);
printf("p value %u\n",p);
printf("a value through p %d\n",*p);
*p=200;
printf("a=%d, *p=%d\n",a,*p);
a=300;
printf("a=%d, *p=%d\n",a,*p);
getch();
}
```

```
TC
a value 100
a addr  65502
p value 65502
a value through p 100
a=200, *p=200
a=300, *p=300
```

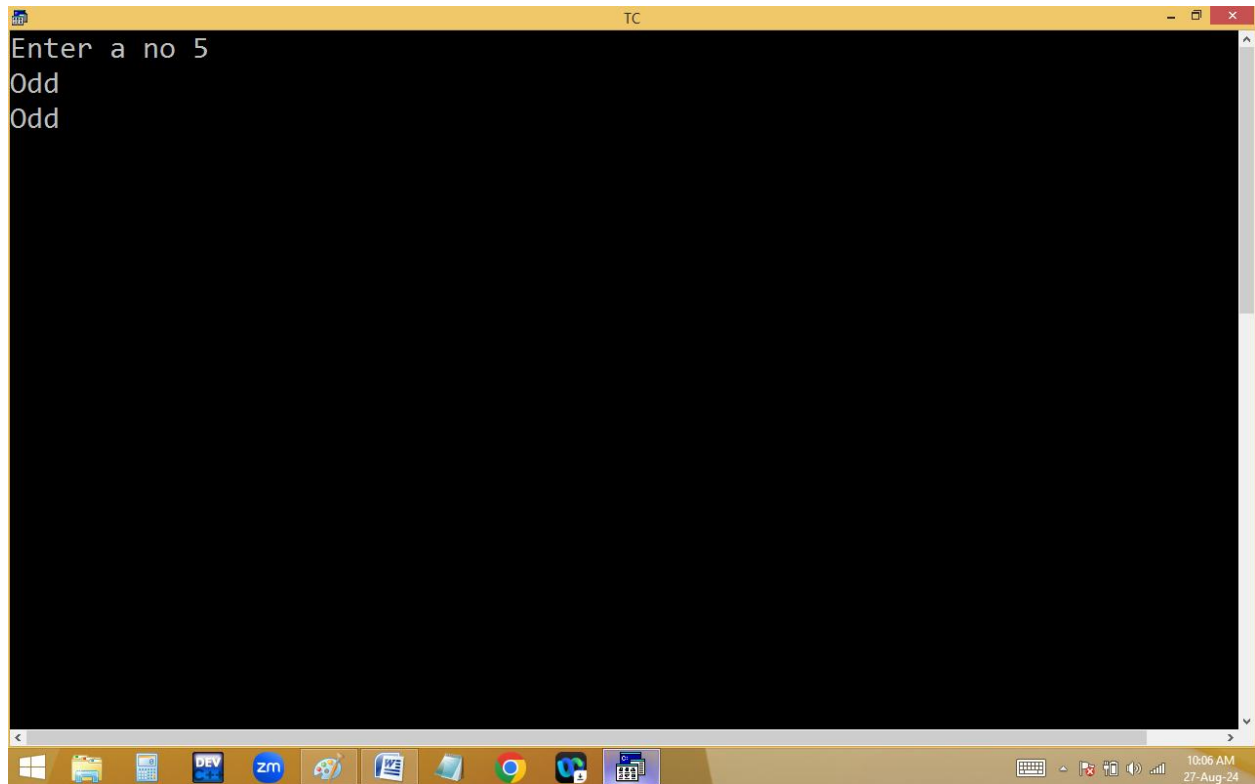
## Finding even/odd using pointer:



```
TC
File Edit Run Compile Project Options Debug Break/watch
Line 9 Col 25 Insert Indent Tab Fill Unindent * E:9AM.C
#include<stdio.h>
#include<conio.h>
void main()
{
int n, *p=&n; /* ptr declaration & initialization*/
clrscr();
printf("Enter a no "); scanf("%d",&n);
puts(n%2?"Odd":"Even");
puts(*p%2?"Odd":"Even");
getch();
}
```



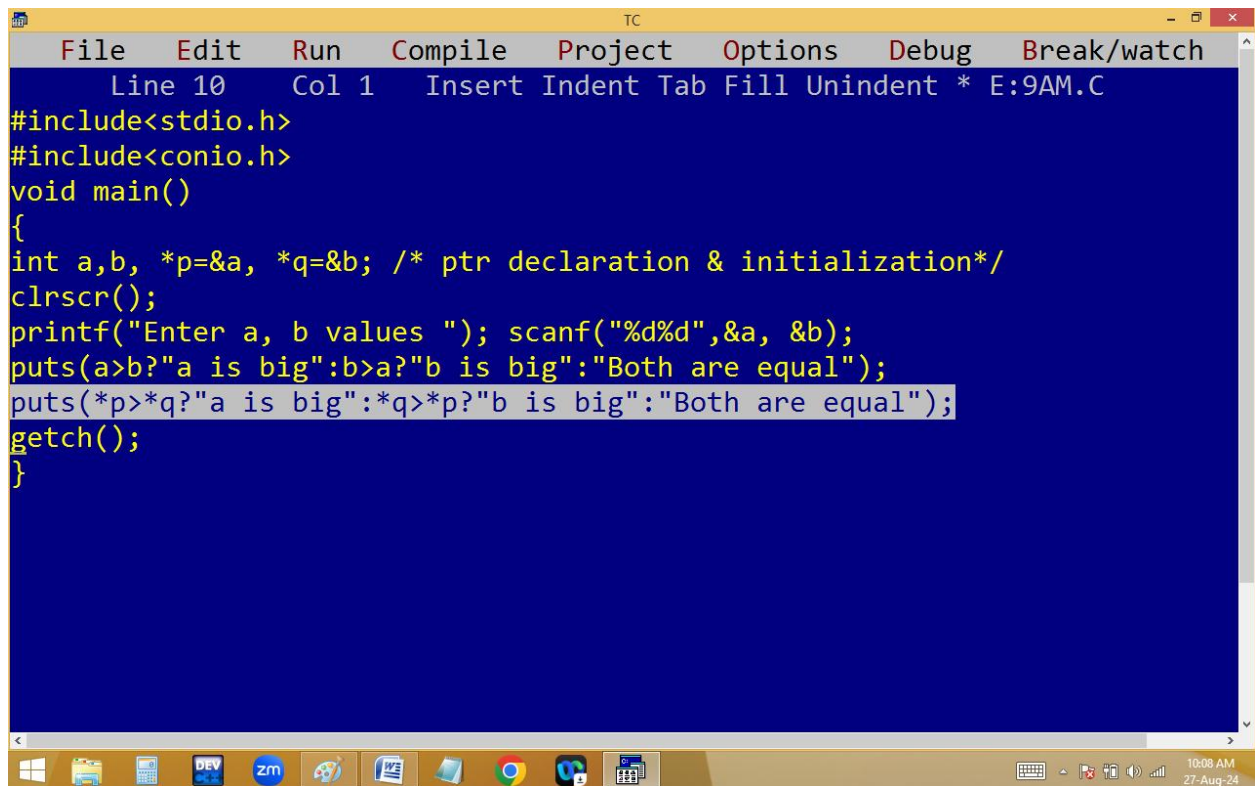
```
TC
Enter a no 4
Even
Even
```



```
TC
Enter a no 5
Odd
Odd
```

The screenshot shows a Turbo C++ (TC) window with a black background. The text "Enter a no 5" is on the first line, "Odd" on the second line, and "Odd" on the third line. The Windows taskbar is visible at the bottom with various icons and a system clock showing 10:06 AM on 27-Aug-24.

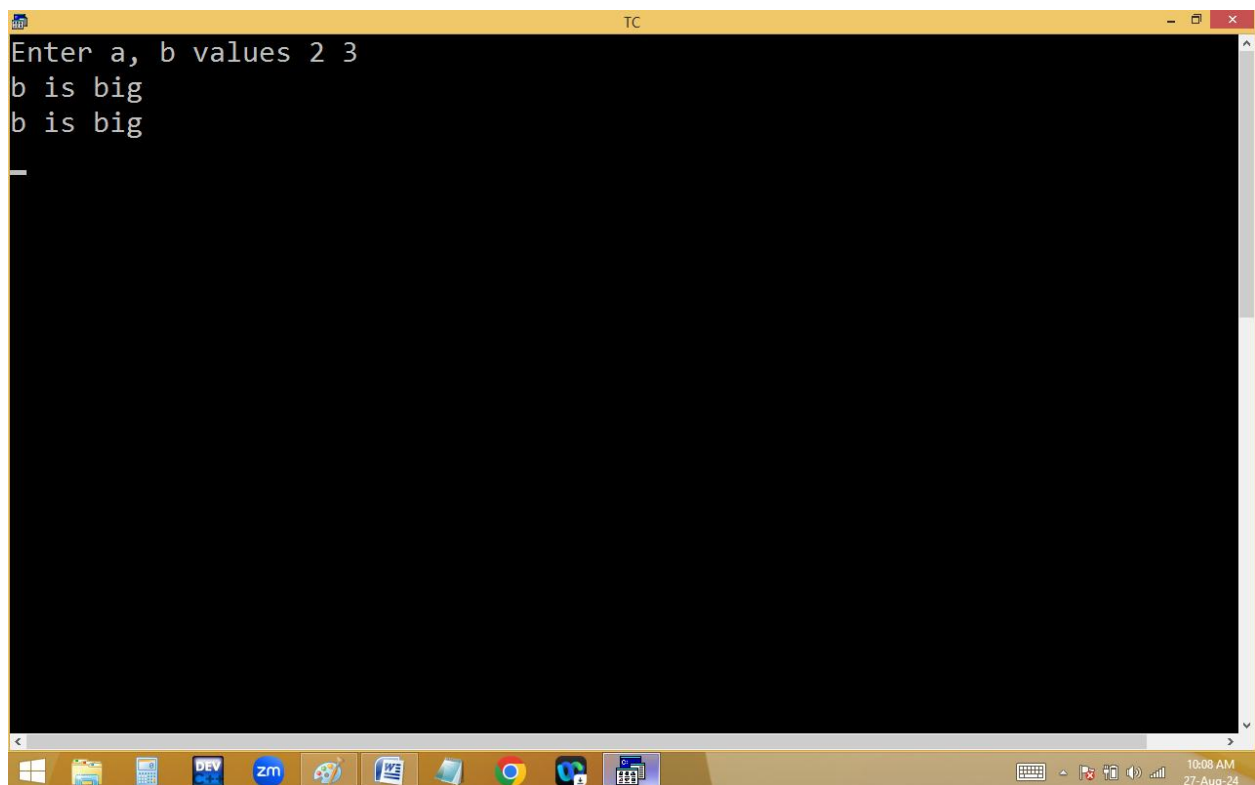
**Finding max in 2 no's using pointers:**



The screenshot shows the Turbo C++ (TC) IDE with a blue background. The menu bar includes File, Edit, Run, Compile, Project, Options, Debug, and Break/watch. The status bar at the top indicates 'Line 10 Col 1 Insert Indent Tab Fill Unindent \* E:9AM.C'. The code is as follows:

```
#include<stdio.h>
#include<conio.h>
void main()
{
int a,b, *p=&a, *q=&b; /* ptr declaration & initialization*/
clrscr();
printf("Enter a, b values "); scanf("%d%d",&a, &b);
puts(a>b?"a is big":b>a?"b is big":"Both are equal");
puts(*p>*q?"a is big":*q>*p?"b is big":"Both are equal");
getch();
}
```

The taskbar at the bottom shows various application icons including Windows Explorer, DEV C++, Zm, and others. The system clock in the bottom right corner displays '10:08 AM 27-Aug-24'.



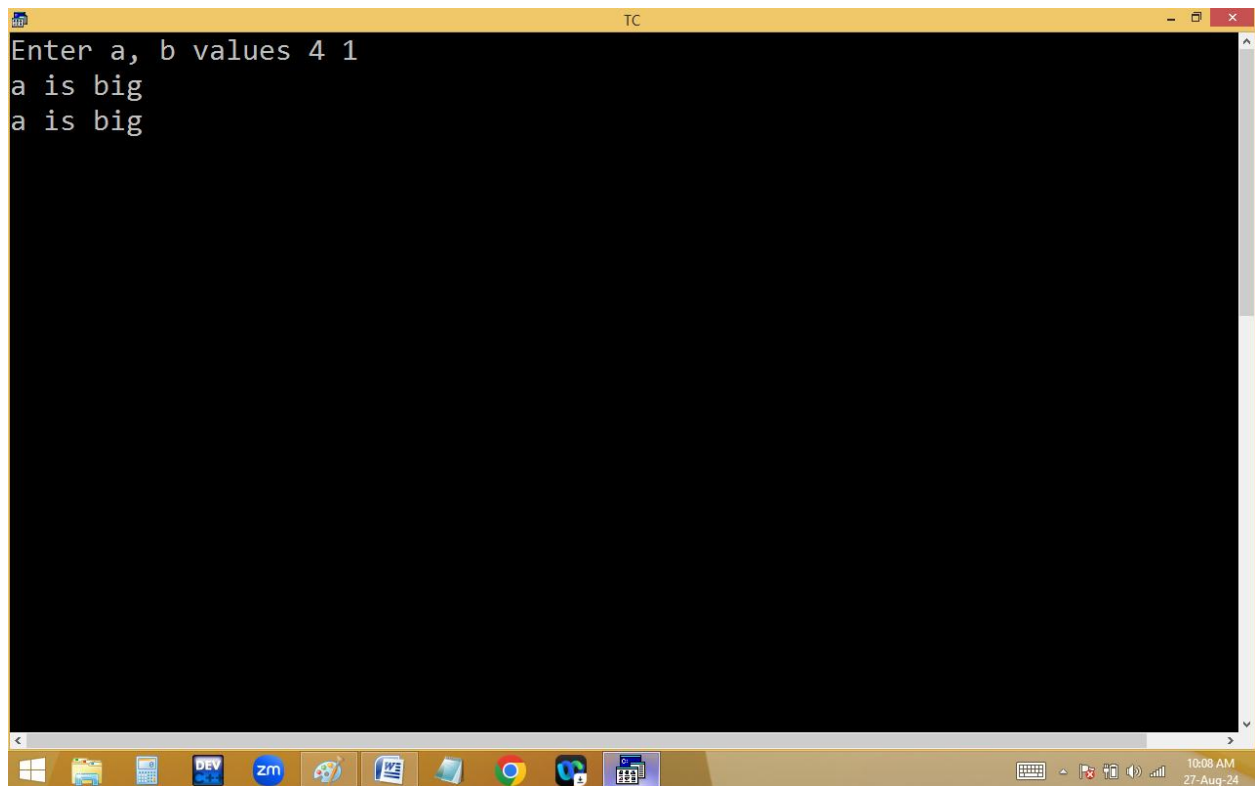
The screenshot shows the Turbo C++ (TC) IDE with a black background, displaying the output of the program. The text shown is:

```
Enter a, b values 2 3
b is big
b is big
```

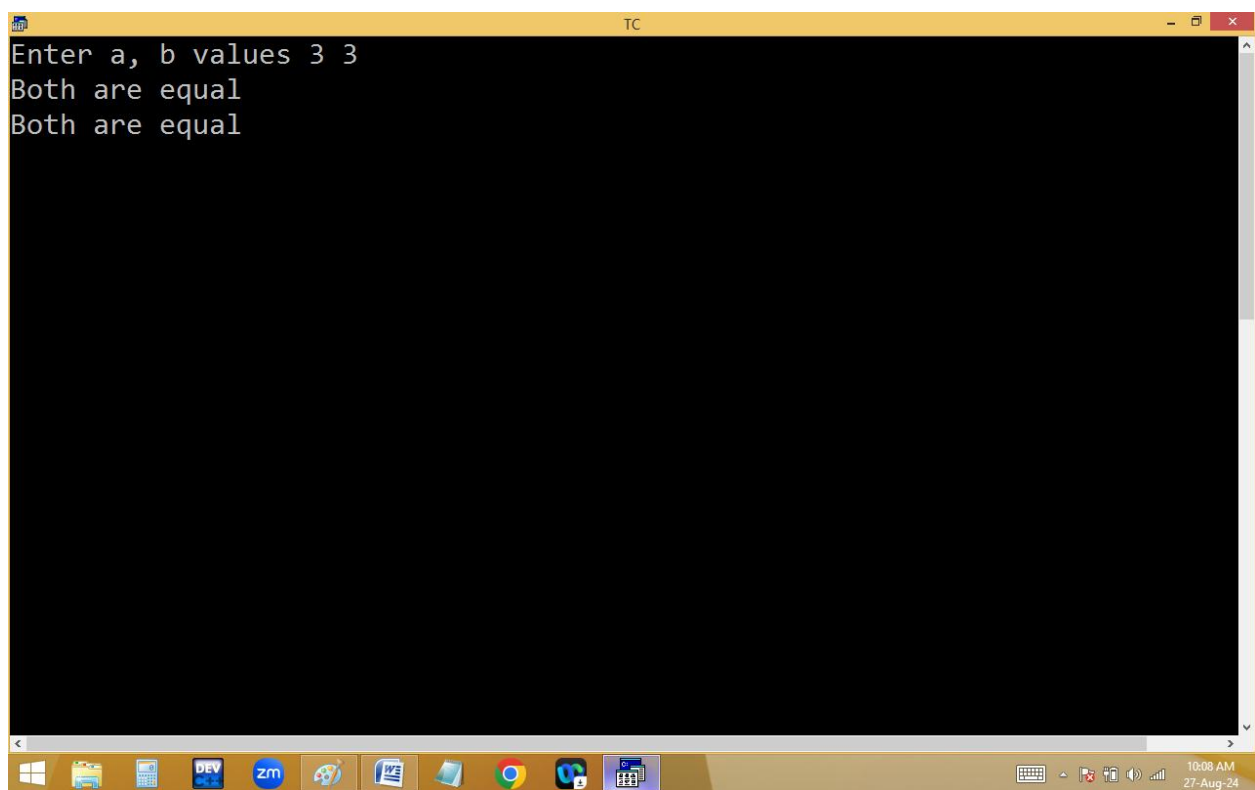
The taskbar at the bottom is identical to the first screenshot, showing the same application icons and system clock ('10:08 AM 27-Aug-24').



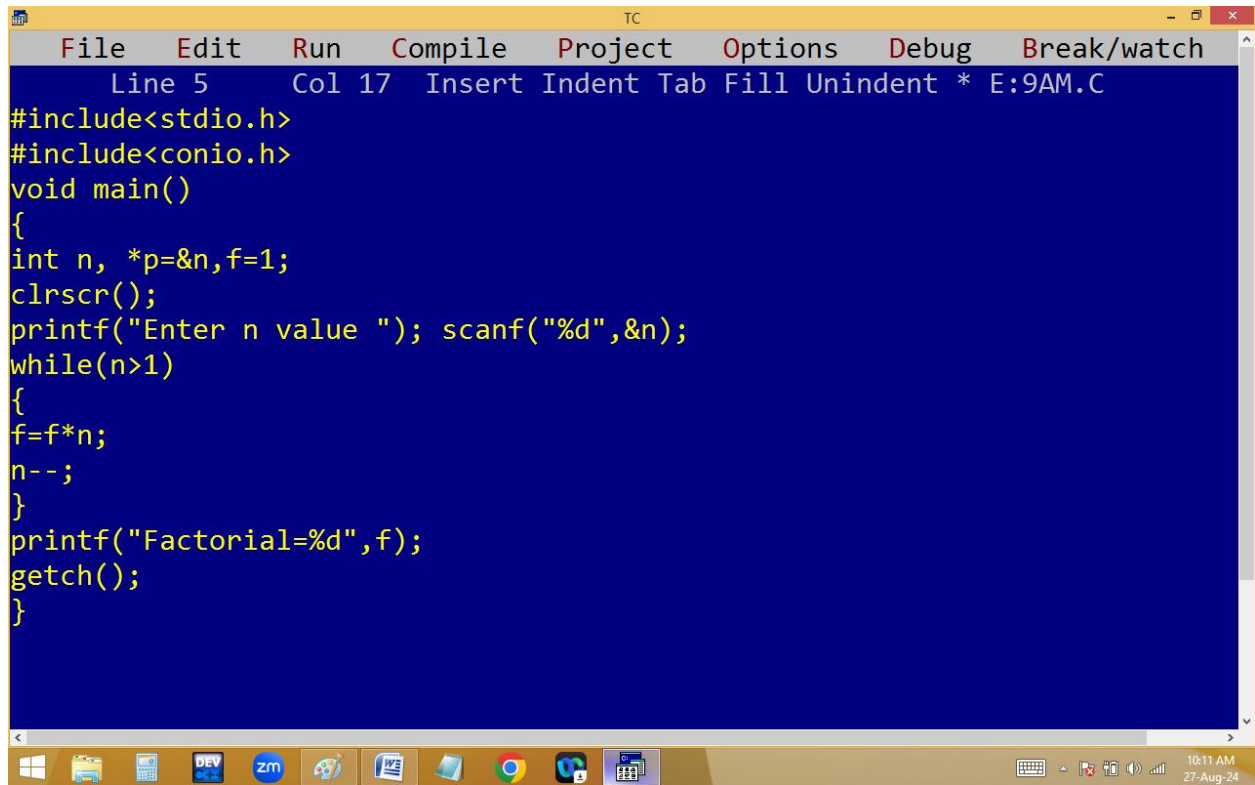
```
TC
Enter a, b values 4 1
a is big
a is big
```



```
TC
Enter a, b values 3 3
Both are equal
Both are equal
```



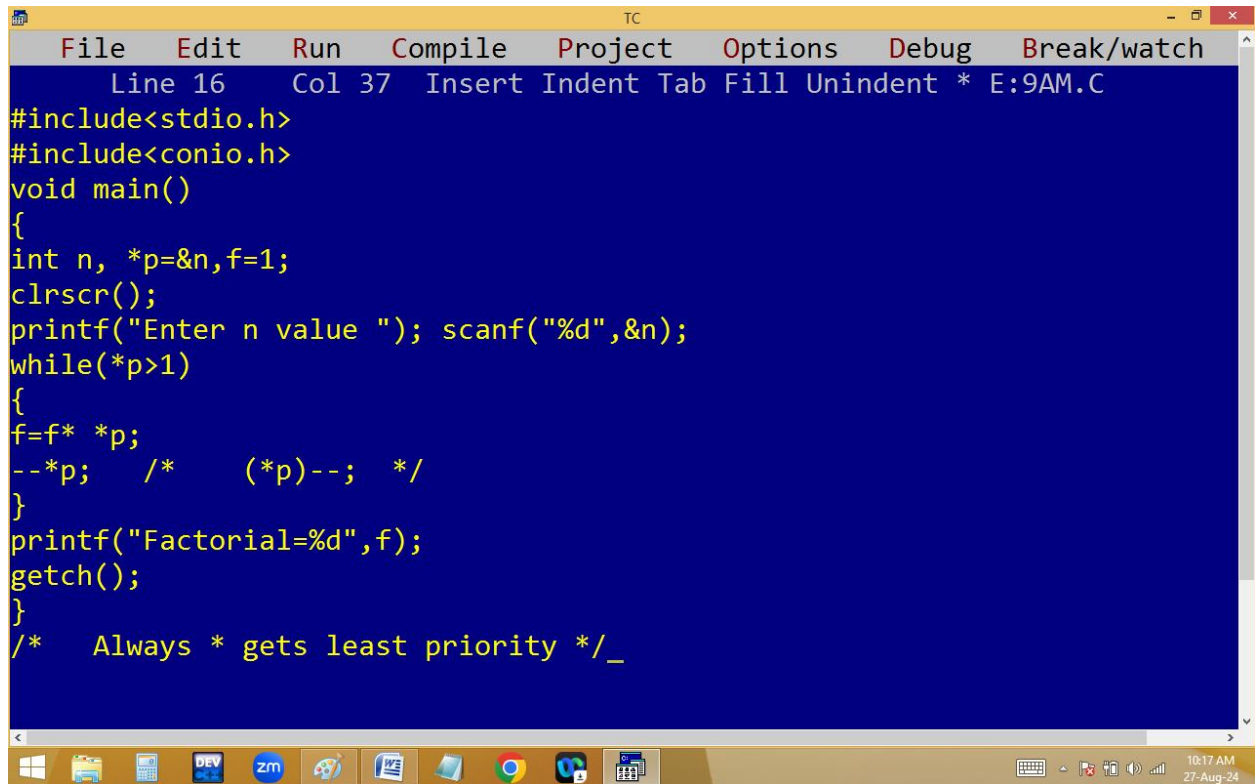
## Finding factorial using pointer:



```
TC
File Edit Run Compile Project Options Debug Break/watch
Line 5 Col 17 Insert Indent Tab Fill Unindent * E:9AM.C
#include<stdio.h>
#include<conio.h>
void main()
{
int n, *p=&n,f=1;
clrscr();
printf("Enter n value "); scanf("%d",&n);
while(n>1)
{
f=f*n;
n--;
}
printf("Factorial=%d",f);
getch();
}
```



```
TC
Enter n value 4
Factorial=24_
```



The screenshot shows the Turbo C++ (TC) IDE with a menu bar (File, Edit, Run, Compile, Project, Options, Debug, Break/watch) and a status bar (Line 16, Col 37, Insert, Indent, Tab, Fill, Unindent, \* E:9AM.C). The code in the editor is as follows:

```
#include<stdio.h>
#include<conio.h>
void main()
{
int n, *p=&n,f=1;
clrscr();
printf("Enter n value "); scanf("%d",&n);
while(*p>1)
{
f=f* *p;
--*p; /* (*p)--; */
}
printf("Factorial=%d",f);
getch();
}
/* Always * gets least priority */_
```

The Windows taskbar at the bottom shows the Start button and several application icons, including File Explorer, Calculator, DEV C++, Zoom, and others. The system clock indicates 10:17 AM on 27-Aug-24.



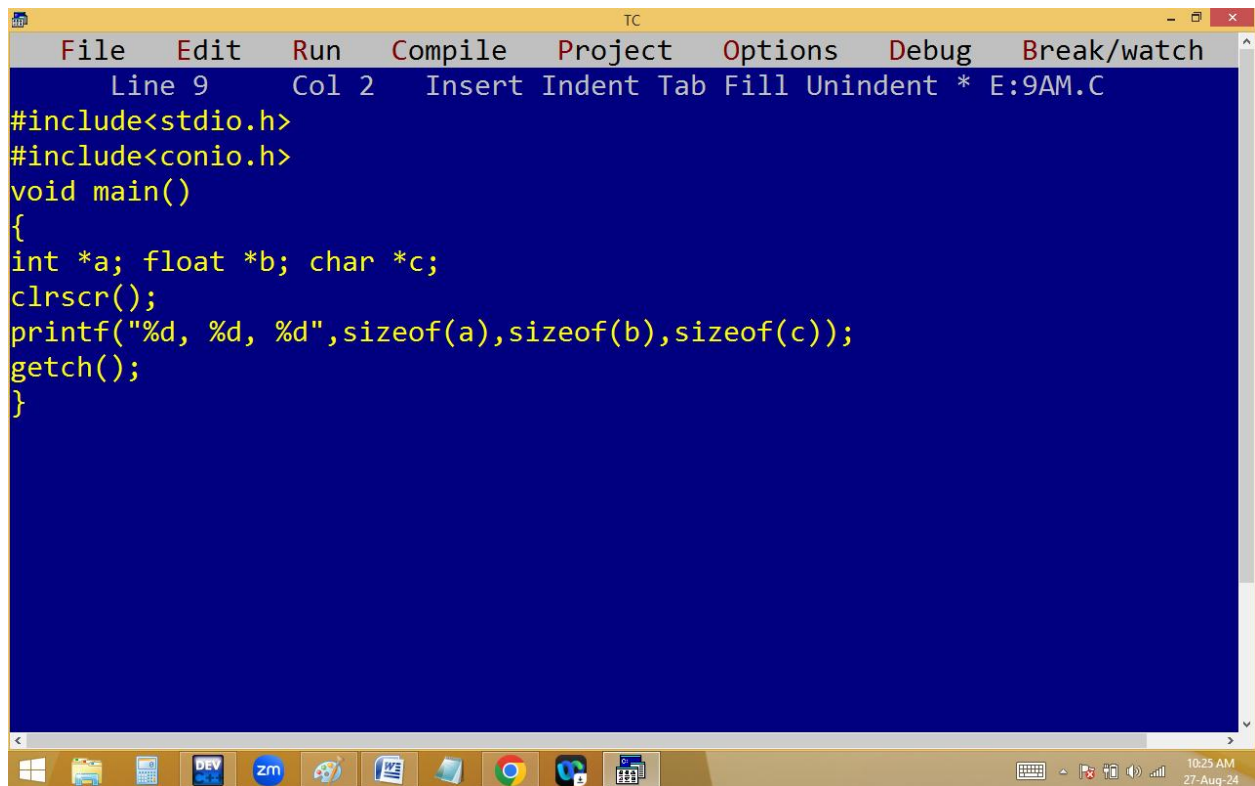
The screenshot shows the Turbo C++ (TC) IDE after execution. The output window displays the following text:

```
Enter n value 5
Factorial=120
```

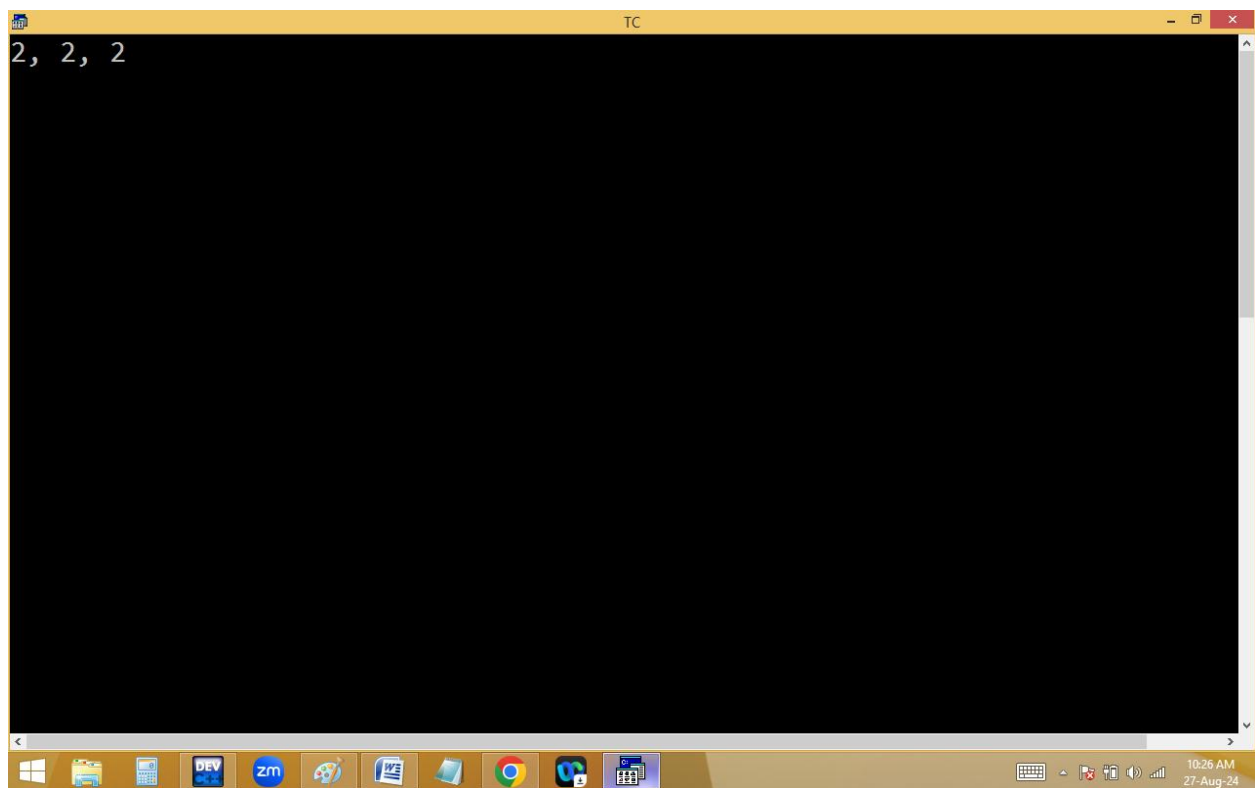
The rest of the IDE interface, including the menu bar and taskbar, is consistent with the previous screenshot.

### **Finding pointer size:**

**Pointer stores address of another variable and address is always unsigned int. due to this the pointer takes 2 / 4 / 8 bytes in 16 / 32 / 64 bit compilers.**

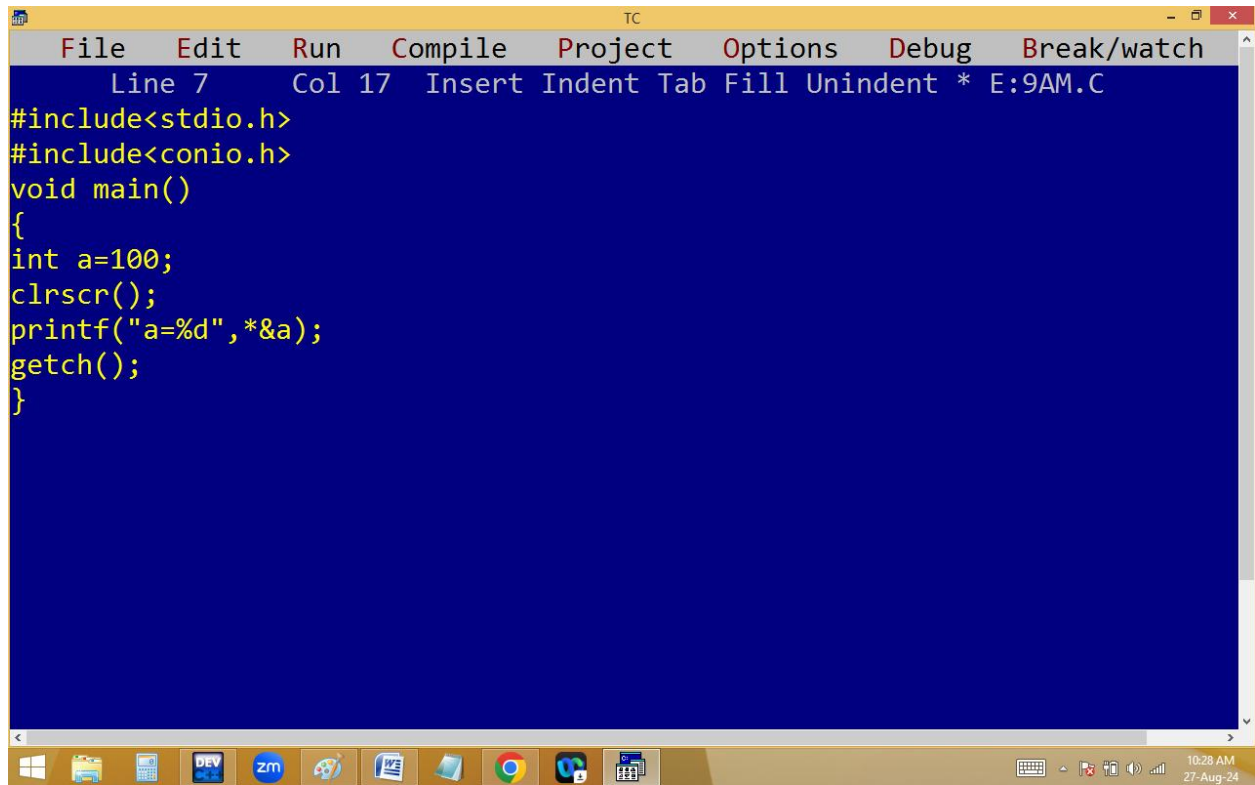


```
File Edit Run Compile Project Options Debug Break/watch
Line 9 Col 2 Insert Indent Tab Fill Unindent * E:9AM.C
#include<stdio.h>
#include<conio.h>
void main()
{
int *a; float *b; char *c;
clrscr();
printf("%d, %d, %d",sizeof(a),sizeof(b),sizeof(c));
getch();
}
```

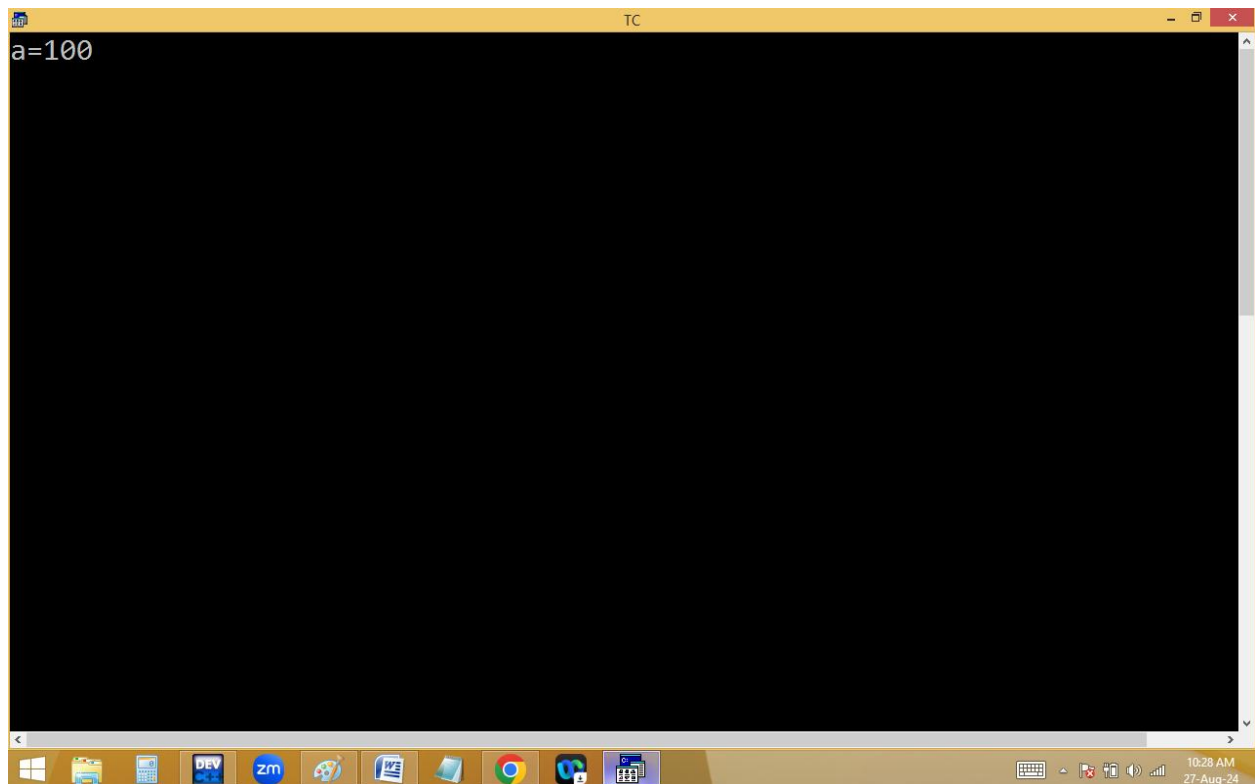


```
2, 2, 2
```

## Finding a normal variable value using pointer mechanism:

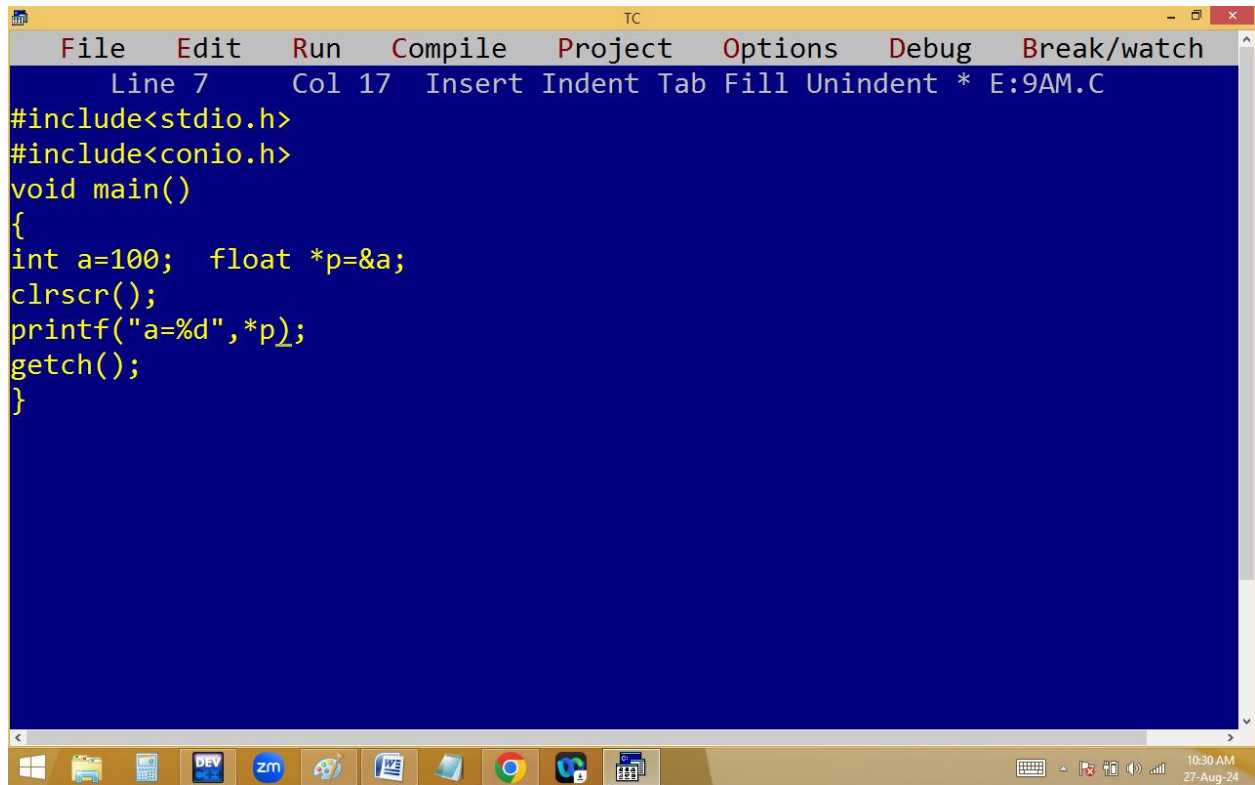


```
TC
File Edit Run Compile Project Options Debug Break/watch
Line 7 Col 17 Insert Indent Tab Fill Unindent * E:9AM.C
#include<stdio.h>
#include<conio.h>
void main()
{
int a=100;
clrscr();
printf("a=%d",*&a);
getch();
}
```



```
TC
a=100
```

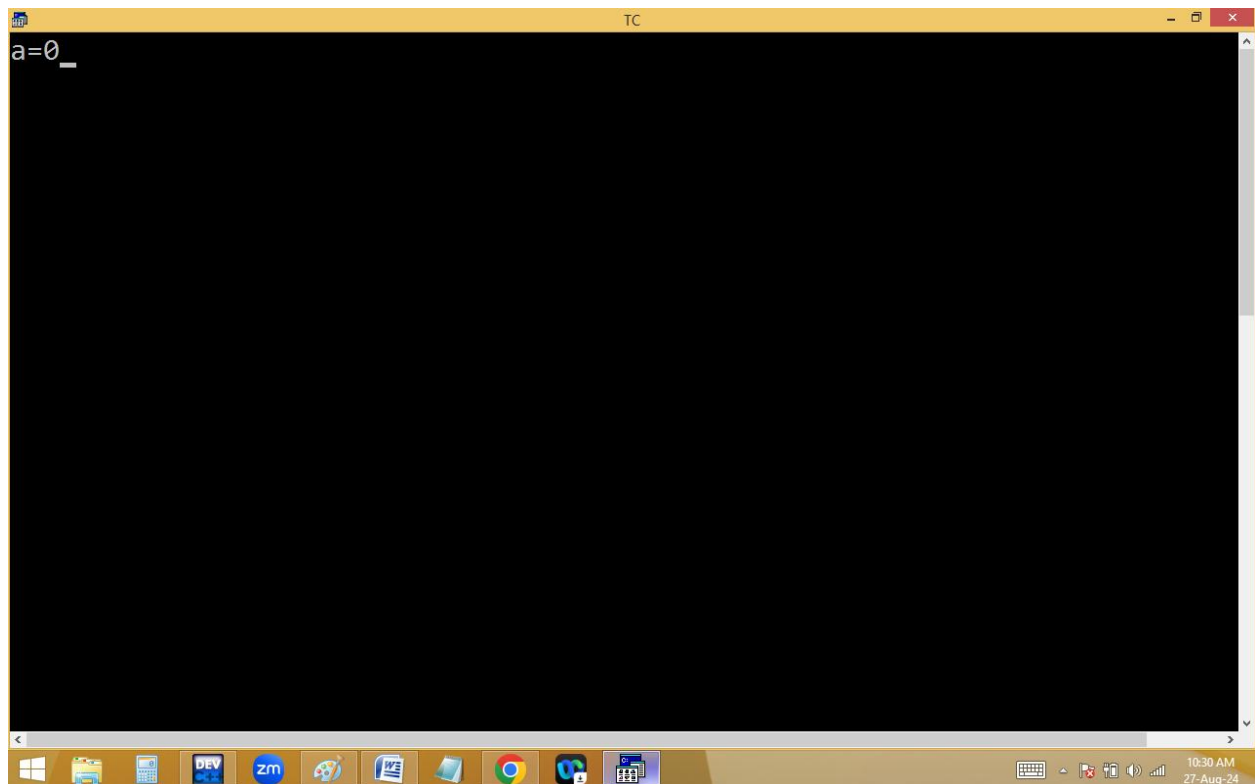
## Pointer compatibility:



The screenshot shows the Turbo C++ (TC) IDE with a menu bar (File, Edit, Run, Compile, Project, Options, Debug, Break/watch) and a status bar (Line 7, Col 17, Insert, Indent, Tab, Fill, Unindent, \* E:9AM.C). The code in the editor is as follows:

```
#include<stdio.h>
#include<conio.h>
void main()
{
int a=100; float *p=&a;
clrscr();
printf("a=%d",*p);
getch();
}
```

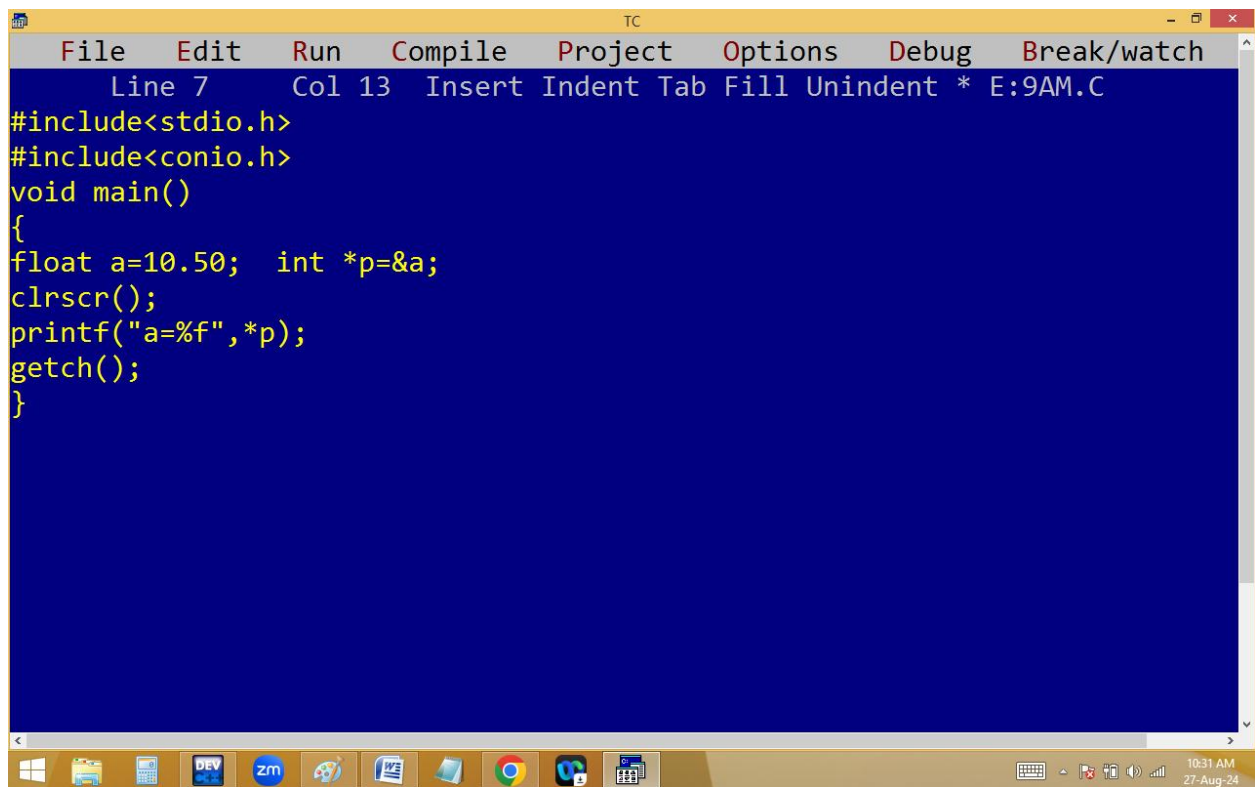
The Windows taskbar at the bottom shows various application icons and the system clock indicating 10:30 AM on 27-Aug-24.



The screenshot shows the Turbo C++ (TC) IDE with the same menu bar and status bar. The output window displays the result of the program execution:

```
a=0_
```

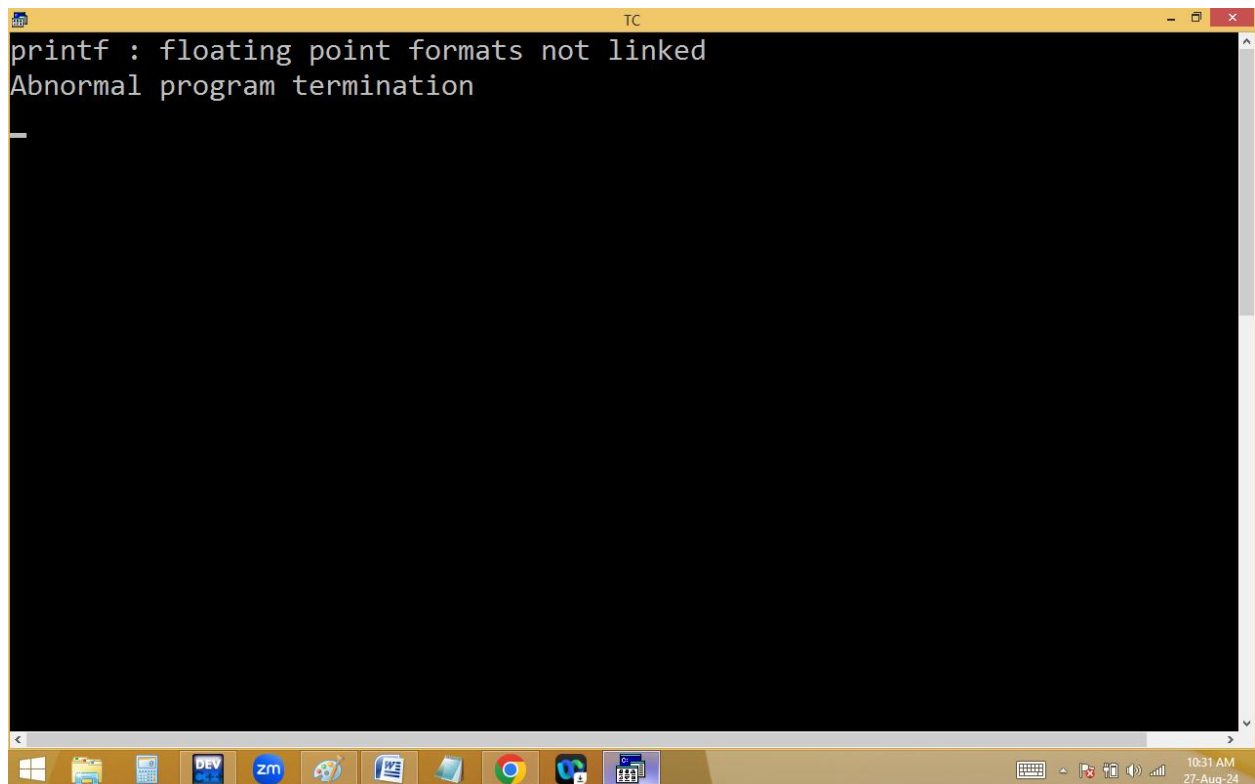
The Windows taskbar at the bottom is identical to the previous screenshot, showing the same application icons and system clock (10:30 AM on 27-Aug-24).



The screenshot shows the Turbo C++ (TC) IDE with a menu bar (File, Edit, Run, Compile, Project, Options, Debug, Break/watch) and a status bar (Line 7, Col 13, Insert, Indent, Tab, Fill, Unindent, \* E:9AM.C). The code in the editor is as follows:

```
#include<stdio.h>
#include<conio.h>
void main()
{
float a=10.50; int *p=&a;
clrscr();
printf("a=%f",*p);
getch();
}
```

The Windows taskbar at the bottom shows the Start button and several application icons, including DEV, zm, and a folder icon. The system clock indicates 10:31 AM on 27-Aug-24.



The screenshot shows the Turbo C++ (TC) IDE with the same menu bar and status bar as the first image. The output window displays the following error message:

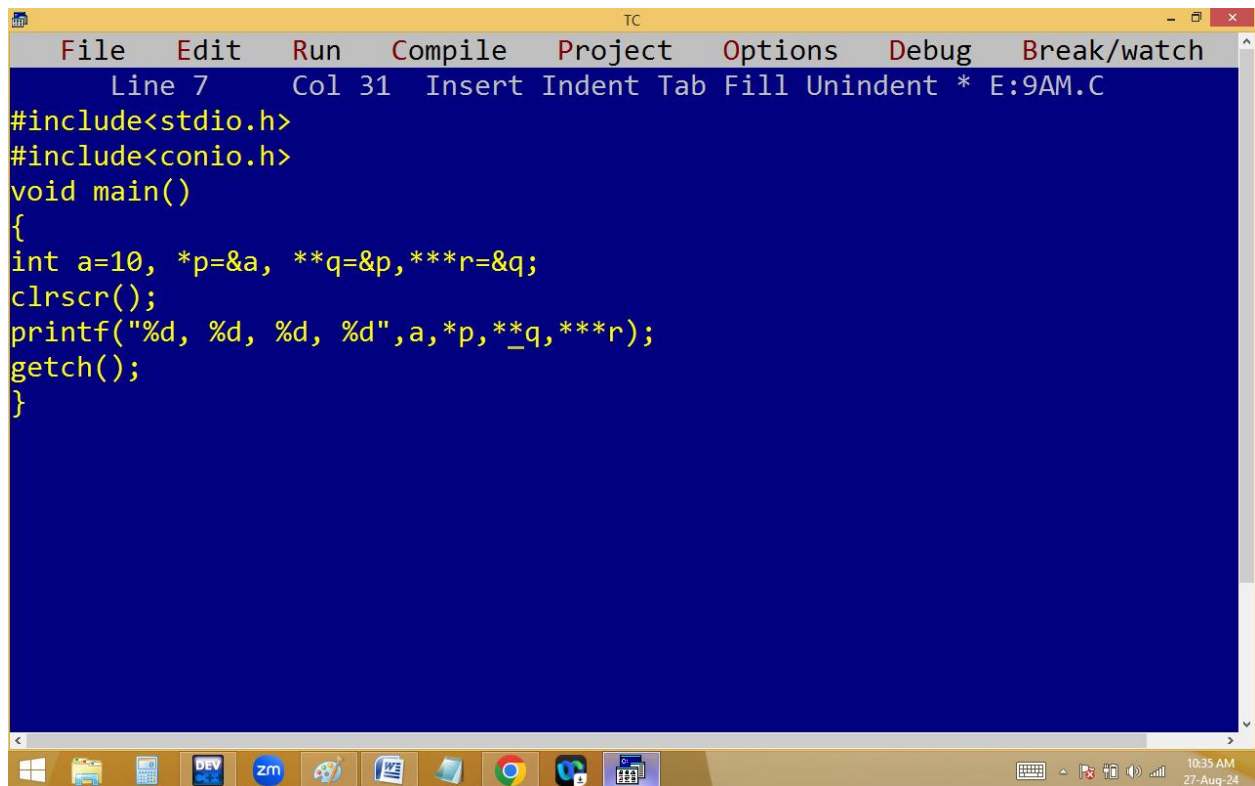
```
printf : floating point formats not linked
Abnormal program termination
```

The Windows taskbar at the bottom is identical to the first image, showing the Start button and application icons, with the system clock indicating 10:31 AM on 27-Aug-24.

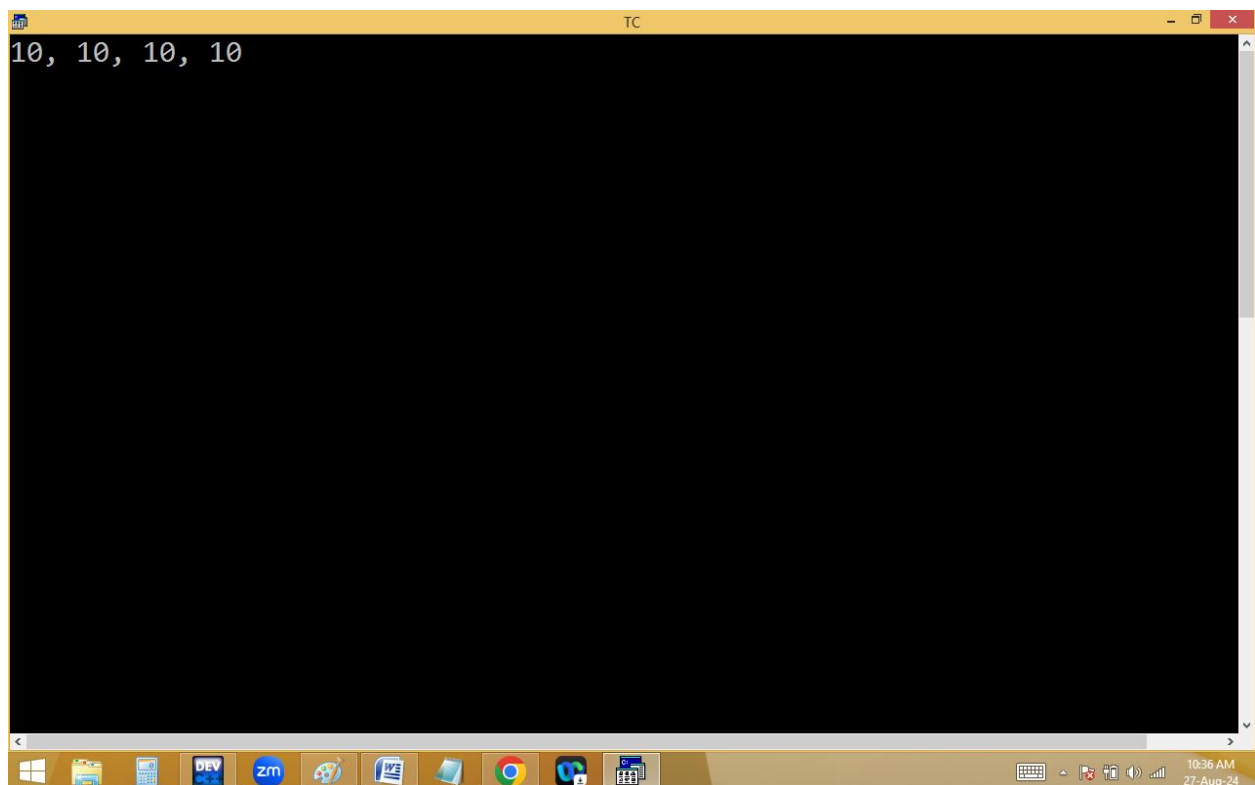


### **Double pointer / pointer to pointer:**

**The pointer which stores the address of another pointer is called double pointer and they are used to handle dynamic multi dimensional array.**



```
TC
File Edit Run Compile Project Options Debug Break/watch
Line 7 Col 31 Insert Indent Tab Fill Unindent * E:9AM.C
#include<stdio.h>
#include<conio.h>
void main()
{
int a=10, *p=&a, **q=&p,***r=&q;
clrscr();
printf("%d, %d, %d, %d",a,*p,**q,***r);
getch();
}
```



```
TC
10, 10, 10, 10
```

