

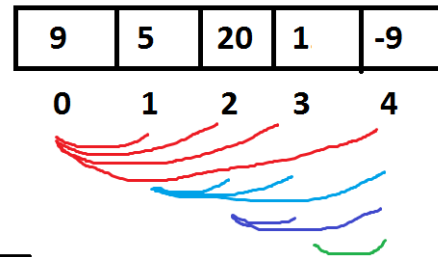
## SELECTION SORT:

selection sort:

9 5 20 1 -9  
 5 9 20 1 -9  
 1 9 20 5 -9  
 -9 9 20 5 1  
 -9 5 20 9 1  
 -9 1 20 9 5  
 -9 1 9 20 5  
 -9 1 5 20 9  
 -9 1 5 9 20

L R  
 i j

0 1,2,3,4  
 1 2,3,4  
 2 3,4  
 3 4



The image shows a screenshot of the Turbo C++ (TC) IDE. The top window displays the source code for a program that sorts an array of integers using bubble sort. The code is as follows:

```
Line 12 Col 1 Insert Indent Tab Fill Unindent * C:NONAME.C
#include<stdio.h>
#include<conio.h>
void main()
{
int a[100],n, i,j,temp;
clrscr();
printf("Enter array size ");scanf("%d",&n);
printf("Enter %d integers",n);for(i=0;i<n;i++)scanf("%d",&a[i]);
for(i=0;i<=n-2;i++) { for(j=i+1; j<=n-1;j++)
{
if(a[i]>a[j]){temp=a[i];a[i]=a[j];a[j]=temp;
}}}
printf("Sorted elements ");for(i=0;i<n;i++)printf("%4d",a[i]);
getch();
}
```

The bottom window shows the program's execution. It prompts the user to enter the array size (5) and then the 5 integers (9, 5, 20, 1, -9). The output shows the sorted elements: -9, 1, 5, 9, 20.

```
Enter array size 5
Enter 5 integers 9 5 20 1 -9
Sorted elements  -9  1  5  9 20
```

```
TC
Enter array size 9
Enter 9 integers 7 -9 0 3 7 -7 4 7 4 1
Sorted elements -9 -7 0 3 4 4 7 7 7_
```

**Descending order:**

The image shows a screenshot of the Turbo C++ (TC) IDE. The top window is the 'Edit' window, displaying the source code for a bubble sort program. The code is as follows:

```
Line 11   Col 9   Insert Indent Tab Fill Unindent * C:NONAME.C
#include<stdio.h>
#include<conio.h>
void main()
{
int a[100],n, i,j,temp;
clrscr();
printf("Enter array size ");scanf("%d",&n);
printf("Enter %d integers",n);for(i=0;i<n;i++)scanf("%d",&a[i]);
for(i=0;i<=n-2;i++) { for(j=i+1; j<=n-1;j++)
{
if(a[i]<a[j]){temp=a[i];a[i]=a[j];a[j]=temp;
}}}
printf("Sorted elements ");for(i=0;i<n;i++)printf("%4d",a[i]);
getch();
}
```

The bottom window is the 'TC' window, showing the program's execution. The output is as follows:

```
Enter array size 5
Enter 5 integers3 5 -4 9 2
Sorted elements  9  5  3  2 -4
```

The Windows taskbar at the bottom shows the date as 07/04/2022 and the time as 4:45 PM.

**Bubble sort:**

9	5	20	1	-9
5	9	20	1	-9
5	9	1	20	-9
5	9	1	-9	20
5	1	9	-9	20
5	1	-9	9	20
1	5	-9	9	20
1	-9	5	9	20
-9	1	5	9	20

9	5	20	1	-9
---	---	----	---	----



i	j	j+1
0	0-1,1-2,2-3,3-4	
1	0-1,1-2,2-3	
2	0-1,1-2,	
3	0-1	

```

TC
File Edit Run Compile Project Options Debug Break/watch
Edit
Line 13 Col 48 Insert Indent Tab Fill Unindent * C:\NONAME.C
#include<stdio.h>
#include<conio.h>
void main()
{
int a[100],n, i,j,temp;
clrscr();
printf("Enter array size ");scanf("%d",&n);
printf("Enter %d integers",n);for(i=0;i<n;i++)scanf("%d",&a[i]);
for(i=0;i<=n-2;i++) { for(j=0; j<=n-i-2;j++)
{
if(a[j]>a[j+1]){temp=a[j];a[j]=a[j+1];a[j+1]=temp;
}}}
printf("Sorted elements ");for(i=0;i<n;i++)printf("%4d",a[i]);
getch();
}

```

```

Enter array size 5
Enter 5 integers 9 5 20 1 -9
Sorted elements -9 1 5 9 20

```

```

for(i=0;i<=n-2;i++)
{
for( j=0; j<= n-i-2; j++)
{
if(a[ j]>a[ j+1] )
{
temp=a[ j];a[ j]=a[ j+1];a[ j+1]=temp;
}
}
}

```



			$n-i-2$
i	j	j+1	
0	0-1, 1-2, 2-3, 3-4		$5-0-2=3$
1	0-1, 1-2, 2-3		$5-1-2=2$
2	0-1, 1-2		$5-2-2=1$
3	0-1		$5-3-2=0$

## Two dimensional arrays:

Array with several rows and columns.

Array with two subscripting operators **[ ] [ ]**.

It is array of arrays. i.e. collection of one-dimensional arrays.

It is implicit double pointer.

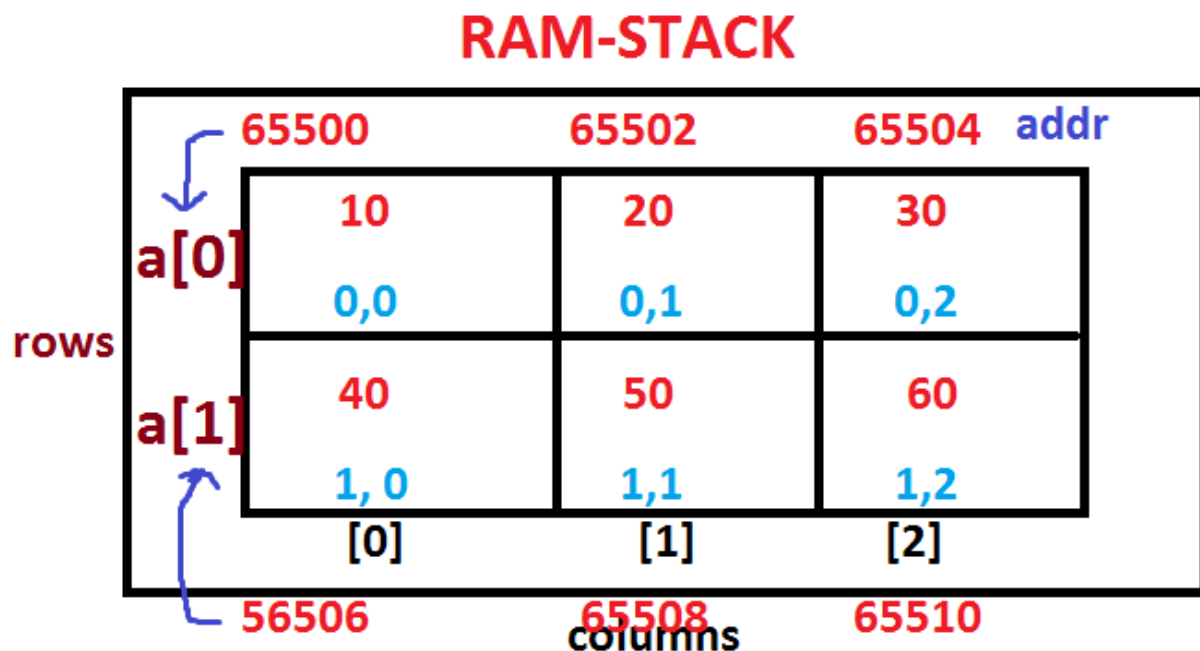
It is a  $n \times n$  matrix.

Syntax:

**datatype variable [ rows ] [ columns ] = {elements} ;**

Eg:

`int a[ 2 ][ 3 ] = { { 10, 20 , 30 } , { 40 ,50, 60 } };`



In two dimensional array the rows/first subscript is working as array of pointers and they stores first column address of each row. Hence it is an implicit/internal double pointer.

In the above example, To print the first row, first column value, we have to use

`printf("%d", a[0][0]);` → 10

**Internally how this statement is working ?**

`a[0]` means value at `a[0]` i.e. 65500.

$65500 + [0] \text{ col} \rightarrow 65500 + 0 * 2 \rightarrow 65500 \rightarrow$   
value at 65500 is 10.

Index no

Int size

p( <sup>row col</sup> `a[0][0]` );

$65500 + 0 * 2 = 65500 \Rightarrow \text{print value at } 65500 = 10$

p[1][2]=60;

$65506 + \underline{2} * 2 = 65510 \Rightarrow 60$

offset



stack

a[1][2]	<u>60</u>	65500
a[1][1]	<u>50</u>	
		65498
a[1][0]	<u>40</u>	65496
a[0][2]	<u>30</u>	
		65494
a[0][1]	<u>20</u>	65492
a[0][0]	<u>10</u>	65490

int a[2][2]={10,20,30,40};

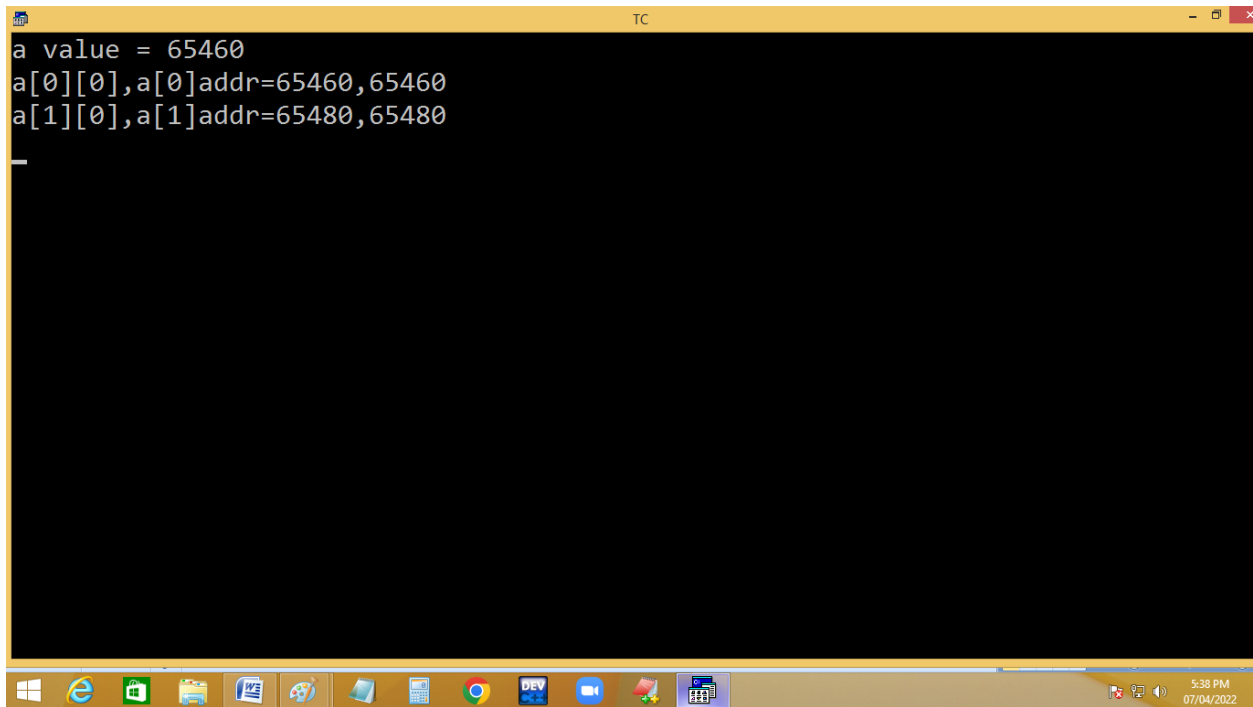
a[1][1]	<u>40</u>	65496
a[1][0]	<u>30</u>	65494
a[0][1]	<u>20</u>	65492
a[0][0]	<u>10</u>	65490

**Eg. Finding address of two dimensional array.**

```

TC
File Edit Run Compile Project Options Debug Break/watch
Edit
Line 7 Col 15 Insert Indent Tab Fill Unindent * C:\NONAME.C
#include<stdio.h>
#include<conio.h>
void main()
{
int a[2][3]={10,20,30,40,50,60};
clrscr();
printf("a = %u\n",&a);
printf("a[0][0],a[0]addr=%u,%u\n",&a[0][0],a[0]);
printf("a[1][0],a[1]addr=%u,%u\n",&a[1][0],a[1]);
getch();
}

```

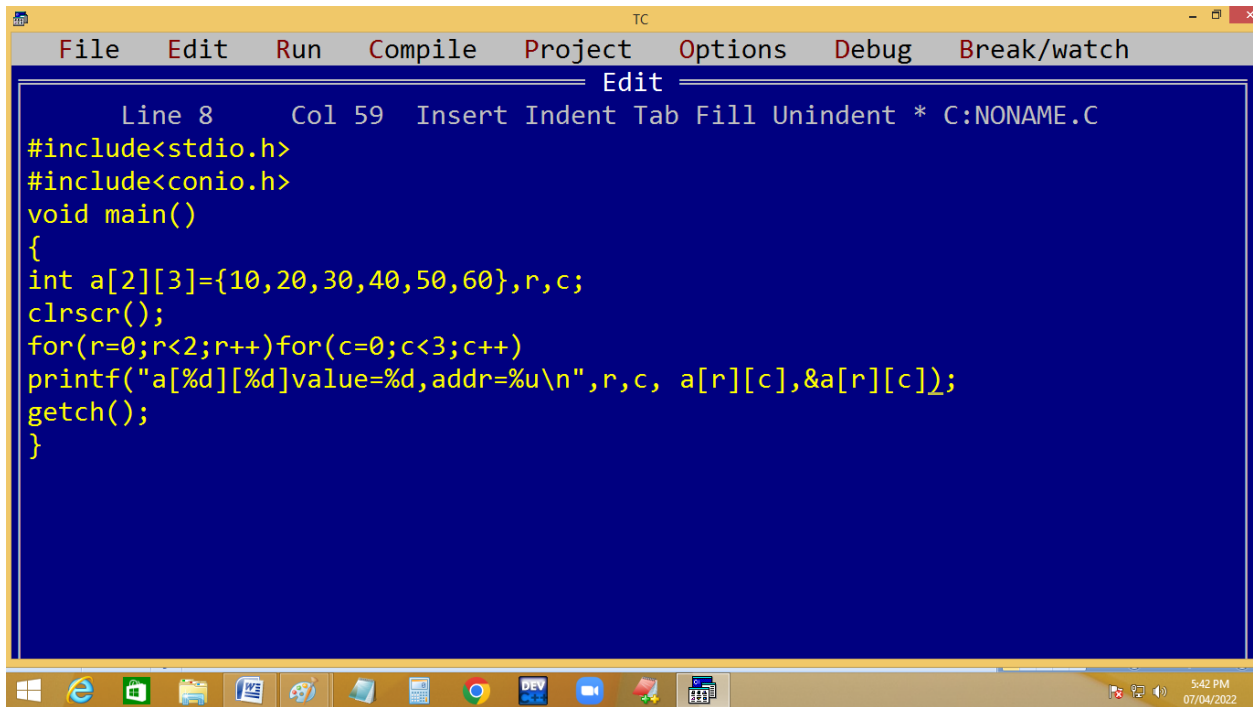


The image shows a screenshot of a Turbo C++ (TC) window. The window has a yellow title bar with the text "TC" in the center. The main area is black with white text. The text displayed is:

```
a value = 65460  
a[0][0],a[0]addr=65460,65460  
a[1][0],a[1]addr=65480,65480
```

Below the main area is a Windows taskbar with various icons including the Start button, Internet Explorer, Word, Excel, PowerPoint, Paint, File Explorer, Calculator, Chrome, Dev C++, and a folder icon. The system tray on the right shows the time as 5:38 PM and the date as 07/04/2022.

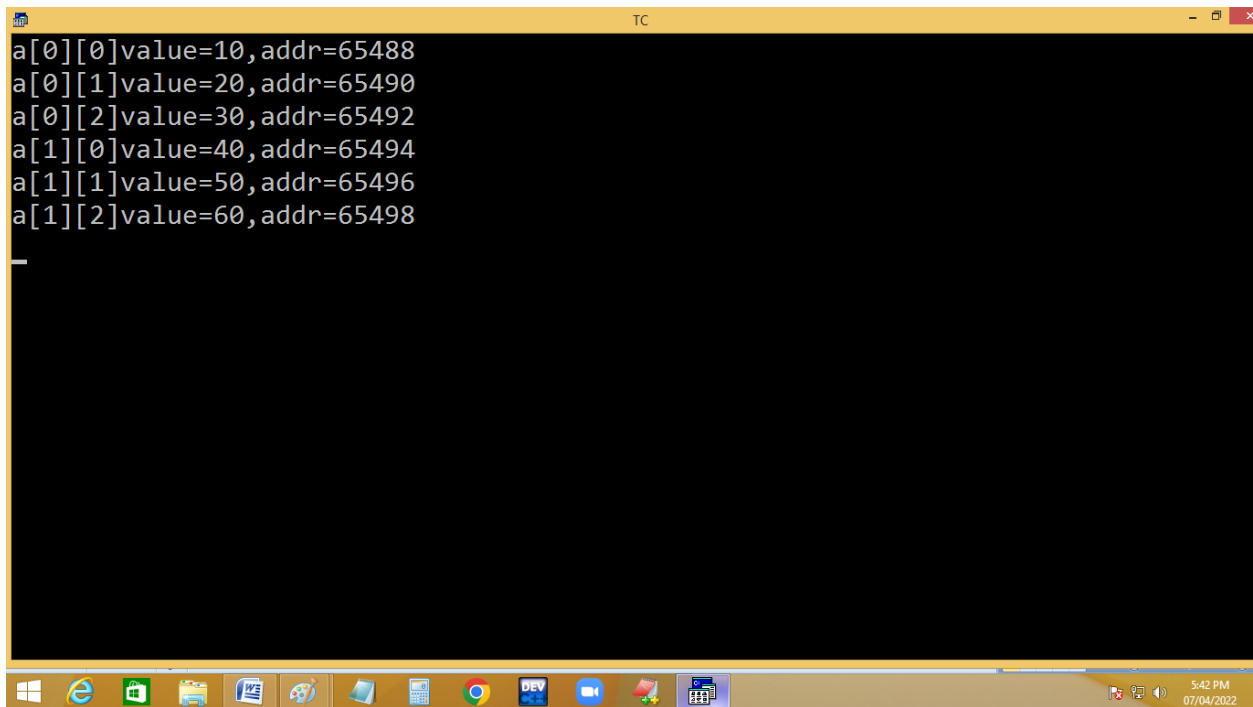
**Finding array elements address:**



The screenshot shows the Turbo C++ (TC) editor window. The menu bar includes File, Edit, Run, Compile, Project, Options, Debug, and Break/watch. The status bar at the top indicates 'Line 8 Col 59 Insert Indent Tab Fill Unindent \* C:NONAME.C'. The code in the editor is as follows:

```
Line 8 Col 59 Insert Indent Tab Fill Unindent * C:NONAME.C
#include<stdio.h>
#include<conio.h>
void main()
{
int a[2][3]={10,20,30,40,50,60},r,c;
clrscr();
for(r=0;r<2;r++)for(c=0;c<3;c++)
printf("a[%d][%d]value=%d,addr=%u\n",r,c, a[r][c],&a[r][c]);
getch();
}
```

The Windows taskbar at the bottom shows various application icons and the system clock indicating 5:42 PM on 07/04/2022.

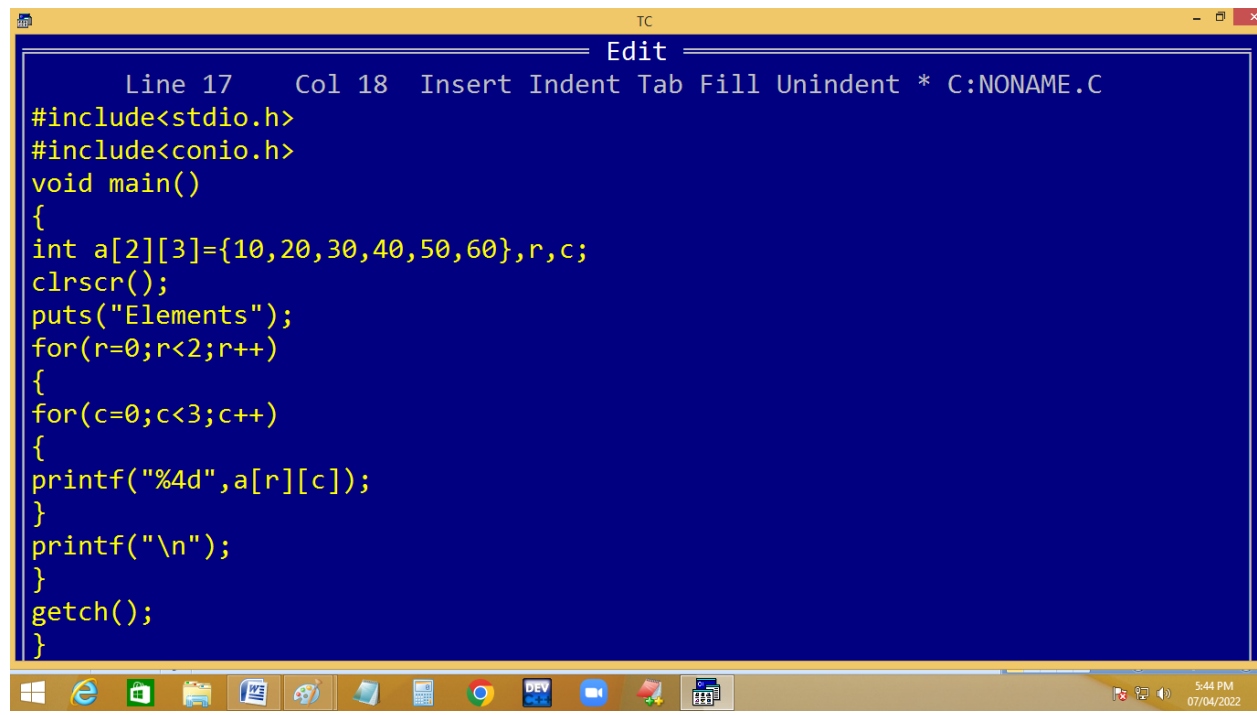


The screenshot shows the Turbo C++ (TC) console window. The output displays the memory addresses and values for each element of the 2x3 matrix:

```
a[0][0]value=10,addr=65488
a[0][1]value=20,addr=65490
a[0][2]value=30,addr=65492
a[1][0]value=40,addr=65494
a[1][1]value=50,addr=65496
a[1][2]value=60,addr=65498
```

The Windows taskbar at the bottom shows various application icons and the system clock indicating 5:42 PM on 07/04/2022.

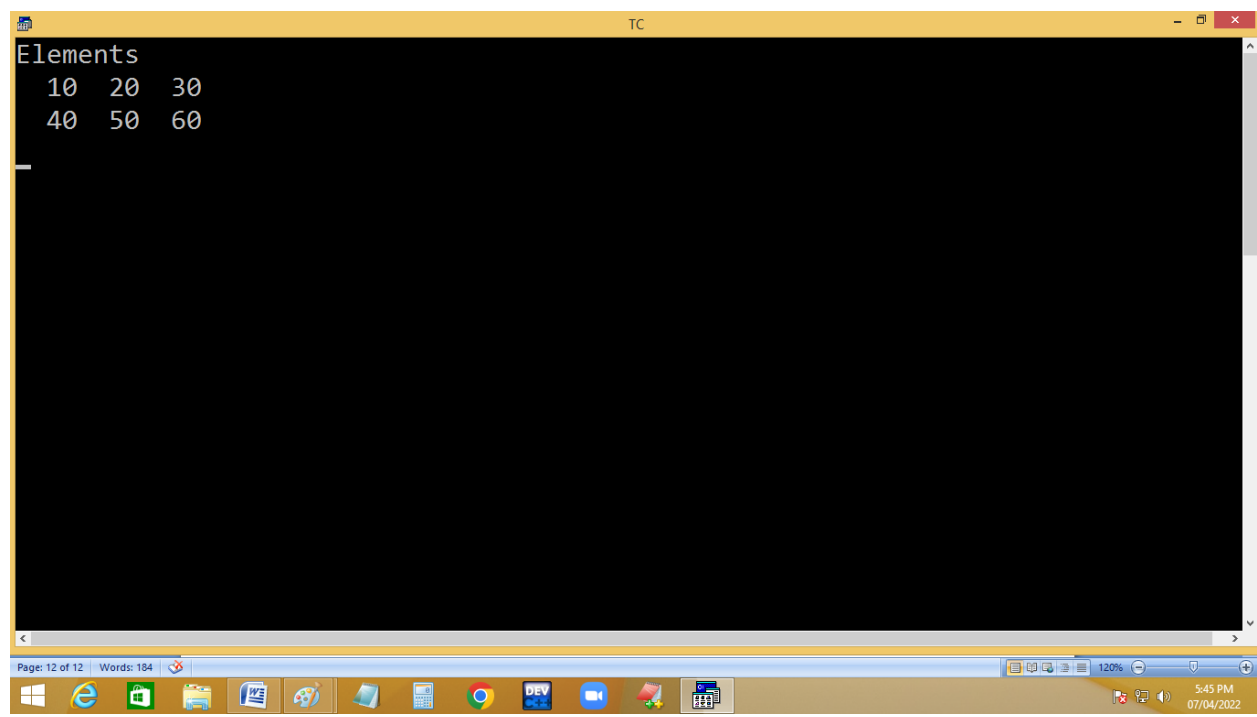
**Eg: Direct initialization of a 2 \* 3 matrix:**



The screenshot shows the Turbo C++ (TC) IDE with a blue background. The menu bar includes 'Edit'. The status bar at the top indicates 'Line 17 Col 18 Insert Indent Tab Fill Unindent \* C:NONAME.C'. The code is as follows:

```
#include<stdio.h>
#include<conio.h>
void main()
{
    int a[2][3]={10,20,30,40,50,60},r,c;
    clrscr();
    puts("Elements");
    for(r=0;r<2;r++)
    {
        for(c=0;c<3;c++)
        {
            printf("%4d",a[r][c]);
        }
        printf("\n");
    }
    getch();
}
```

The Windows taskbar at the bottom shows various application icons and the system clock displaying 5:44 PM on 07/04/2022.



The screenshot shows the Turbo C++ (TC) IDE with a black background, displaying the output of the program. The text 'Elements' is printed on the first line. Below it, the numbers 10, 20, and 30 are printed on the second line, and 40, 50, and 60 are printed on the third line, each with a width of 4 characters as specified in the code.

```
Elements
 10  20  30
 40  50  60
```

The status bar at the bottom indicates 'Page: 12 of 12 Words: 184'. The system clock displays 5:45 PM on 07/04/2022.