

برنامه نویسی با زبان C

مجتبی اعجمی

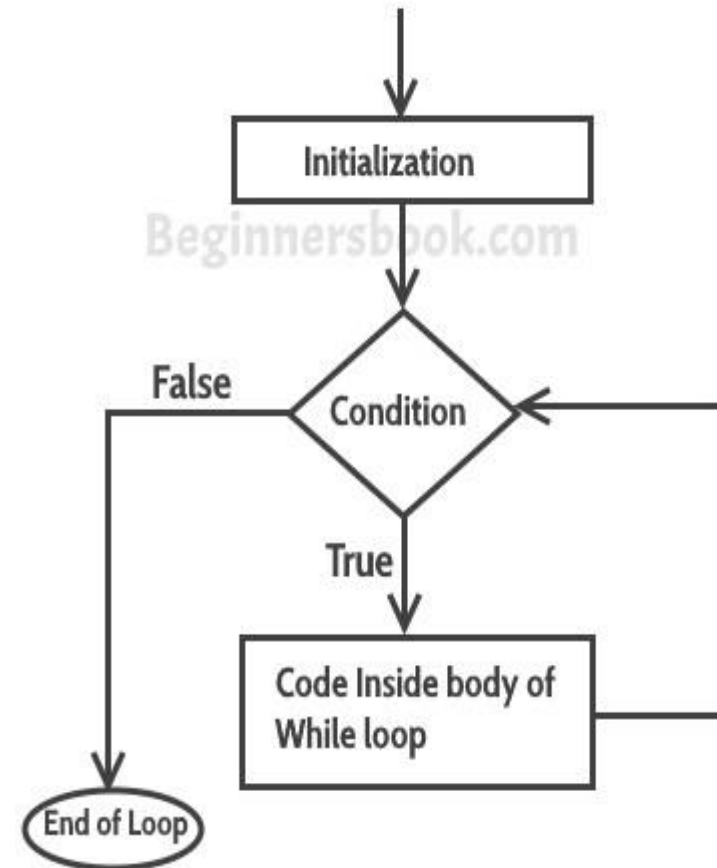
استادیار دانشگاه آزاد اسلامی واحد زنجان

حلقه تکرار

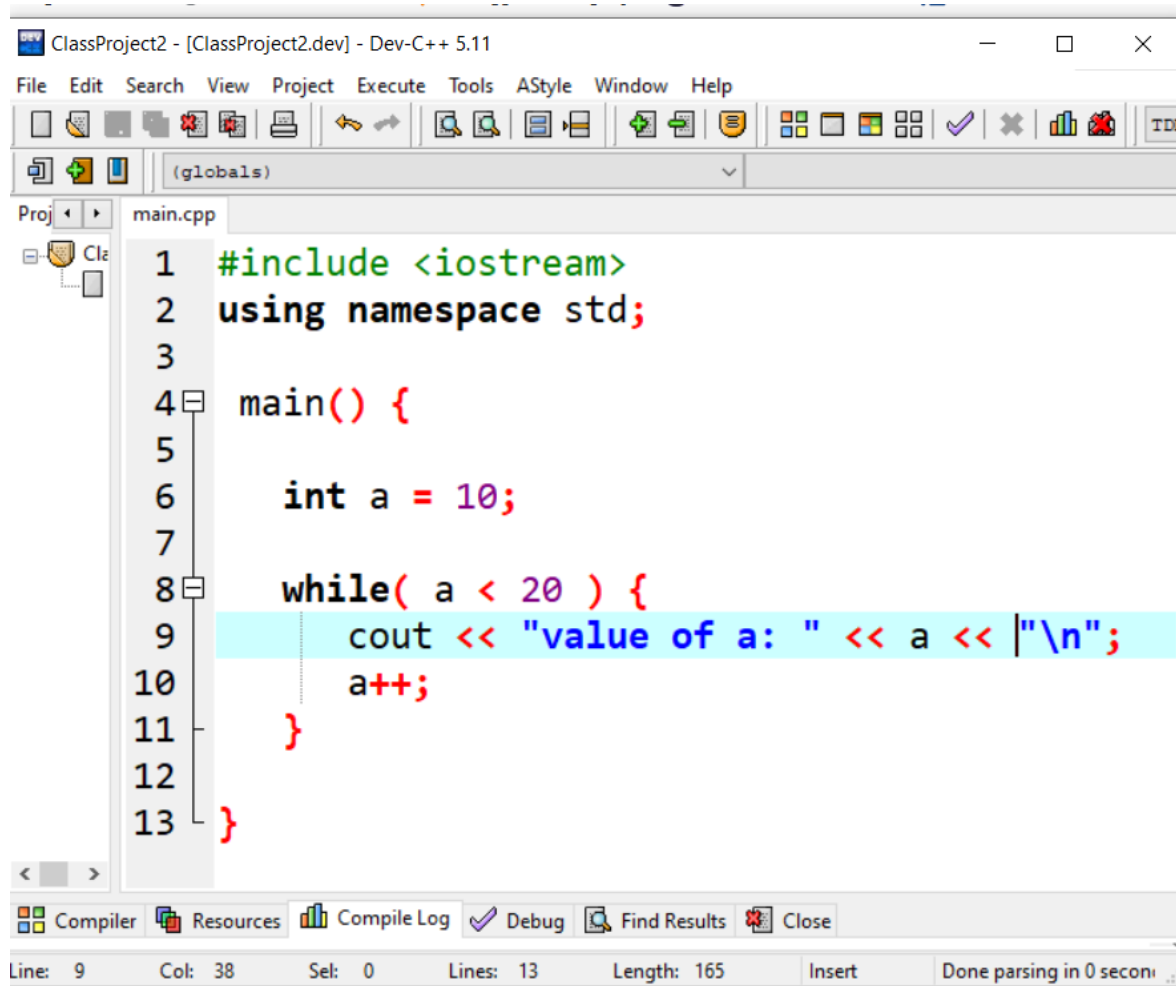
- برای حل بسیاری از مسائل لازم است که دستوراتی تکرار انجام شوند.
- محاسبه فاکتوریل
- محاسبه مجموع ارقام یک عدد صحیح
- در زبان برنامه سازی C چندین ساختار برای پیاده سازی حلقه تکرار وجود دارد.
 - `for(; ;){...}`
 - `while(){...}`
 - `do ... while (){...}`

حلقه while

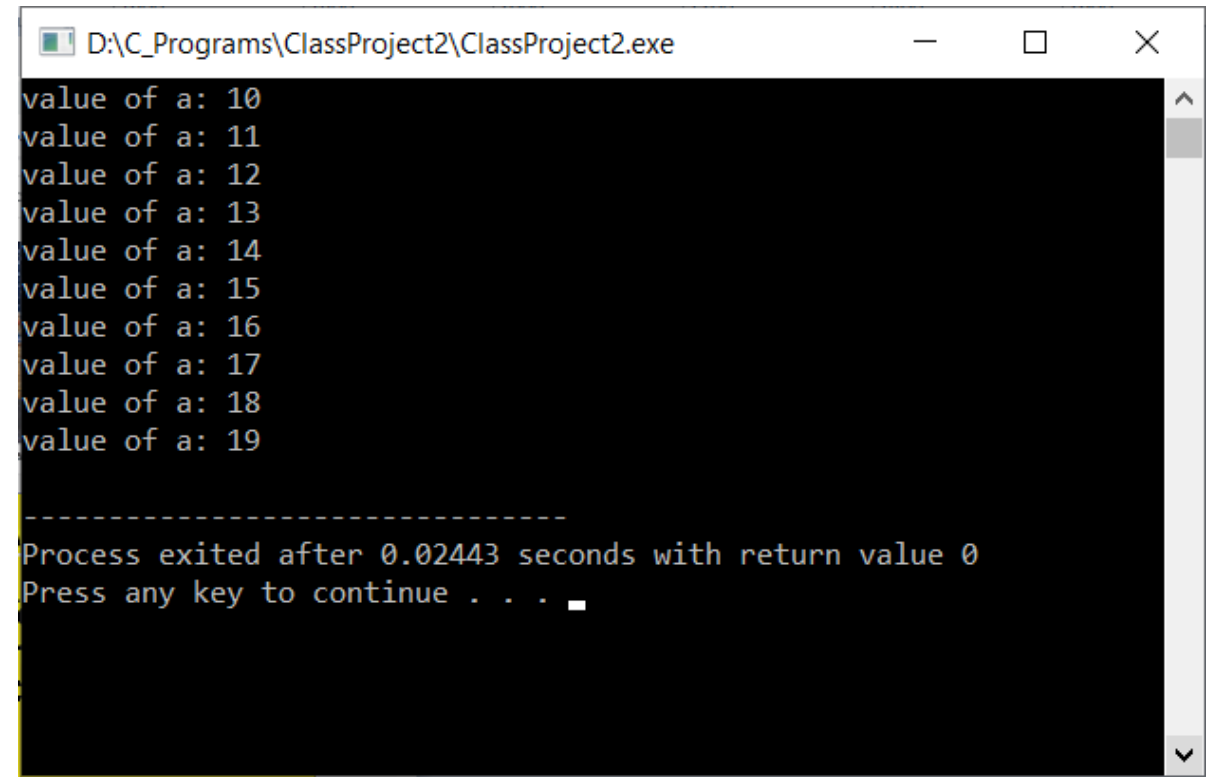
```
while (condition test) {  
    دستوراتی که باید تکرار شوند  
}
```



یک برنامه ساده با استفاده از while



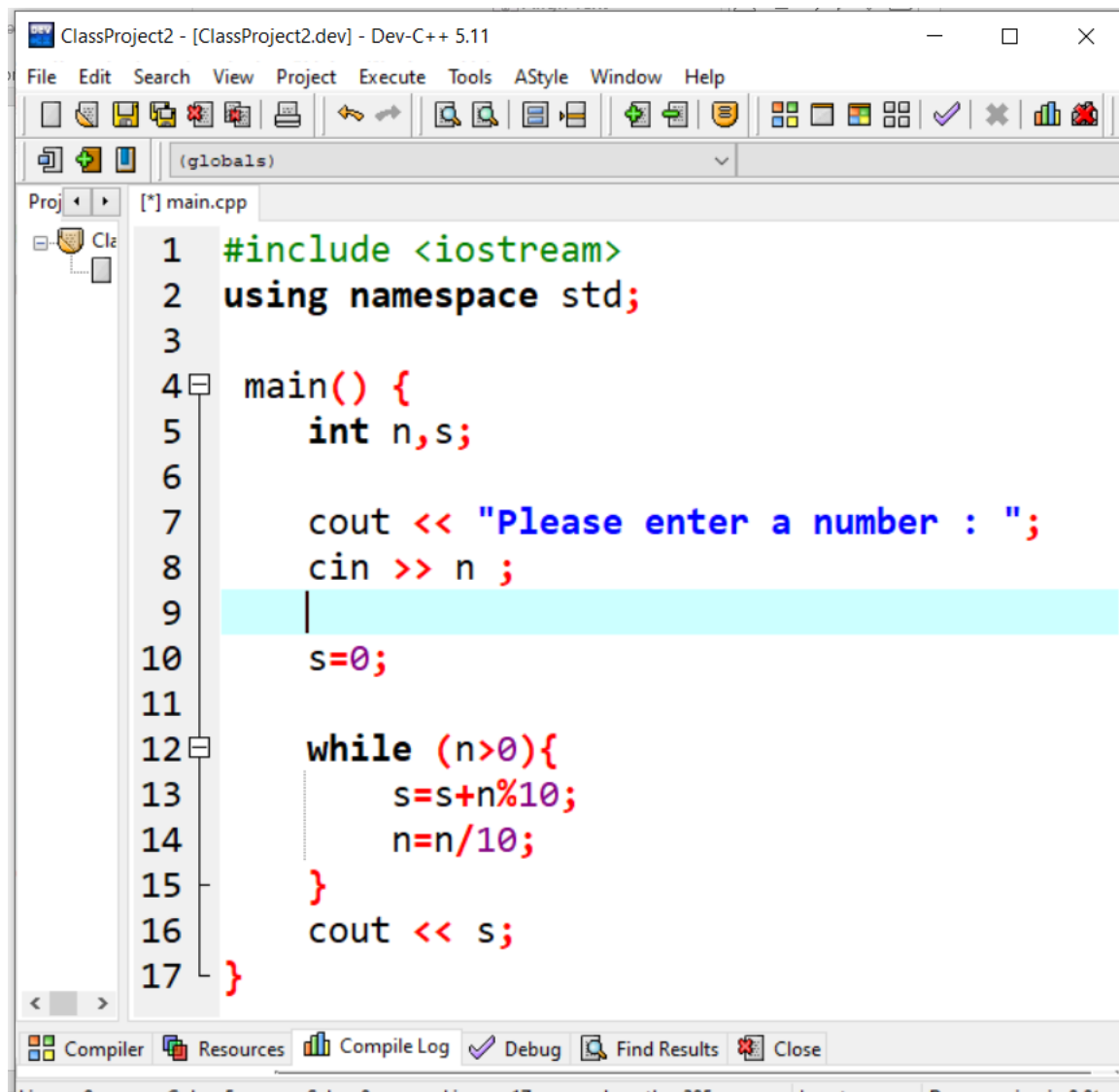
```
1 #include <iostream>
2 using namespace std;
3
4 main() {
5
6     int a = 10;
7
8     while( a < 20 ) {
9         cout << "value of a: " << a << "\\n";
10        a++;
11    }
12
13 }
```



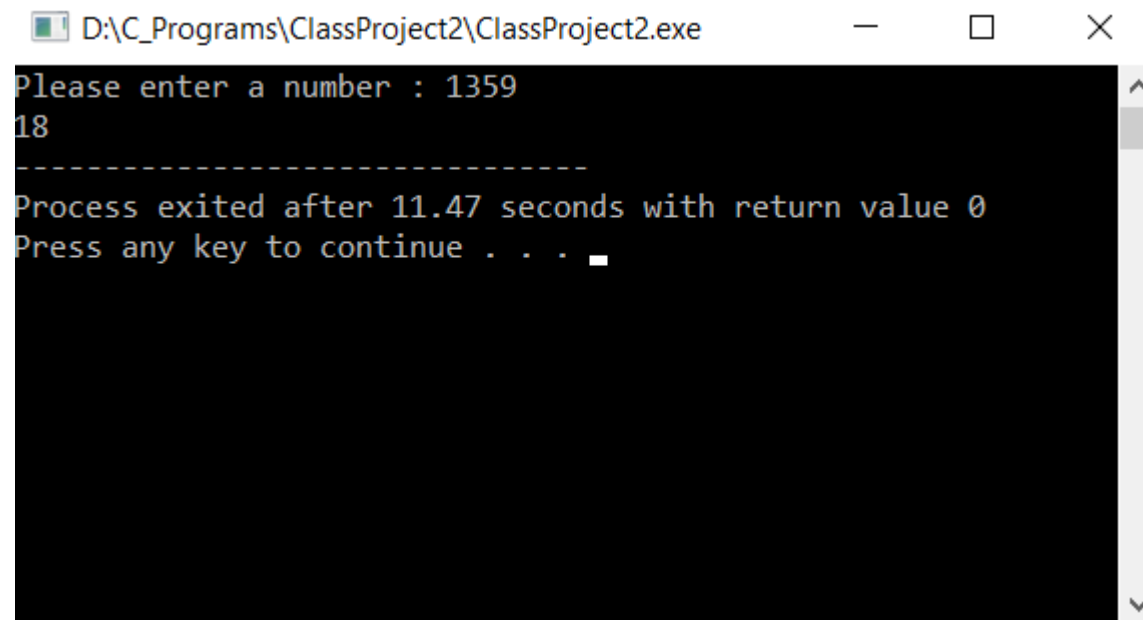
```
value of a: 10
value of a: 11
value of a: 12
value of a: 13
value of a: 14
value of a: 15
value of a: 16
value of a: 17
value of a: 18
value of a: 19

-----
Process exited after 0.02443 seconds with return value 0
Press any key to continue . . .
```

برنامه ای برای محاسبه مجموع ارقام یک عدد صحیح



```
ClassProject2 - [ClassProject2.dev] - Dev-C++ 5.11
File Edit Search View Project Execute Tools AStyle Window Help
(globals)
[*] main.cpp
1 #include <iostream>
2 using namespace std;
3
4 main() {
5     int n,s;
6
7     cout << "Please enter a number : ";
8     cin >> n ;
9
10    s=0;
11
12    while (n>0){
13        s=s+n%10;
14        n=n/10;
15    }
16    cout << s;
17 }
```



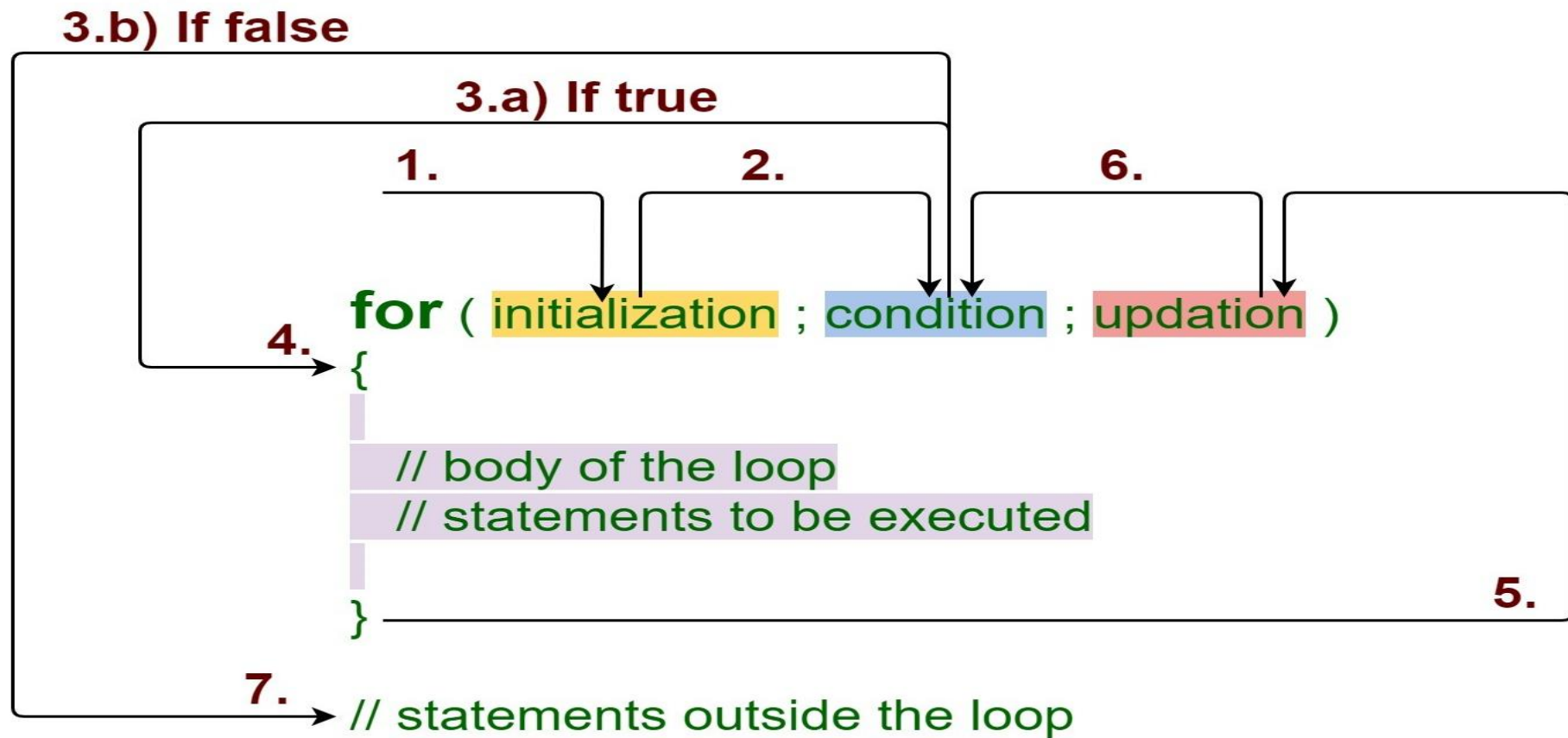
```
D:\C_Programs\ClassProject2\ClassProject2.exe
Please enter a number : 1359
18
-----
Process exited after 11.47 seconds with return value 0
Press any key to continue . . .
```

حلقه for

- زمانی از این ساختار استفاده می کنیم که می خواهیم به تعداد دفعات مشخصی دستورات داخل حلقه تکرار شوند.
- برای شمارش دفعات تکرار از یک متغیر صحیح استفاده می کنیم که به این متغیر اصطلاحاً شمارنده (iterator) گویند.

```
{ (بهنگام سازی شمارنده ; شرط تکرار ; مقداردهی اولیه شمارنده) for  
    دستوراتی که باید تکرار شوند  
}
```

for حلقة



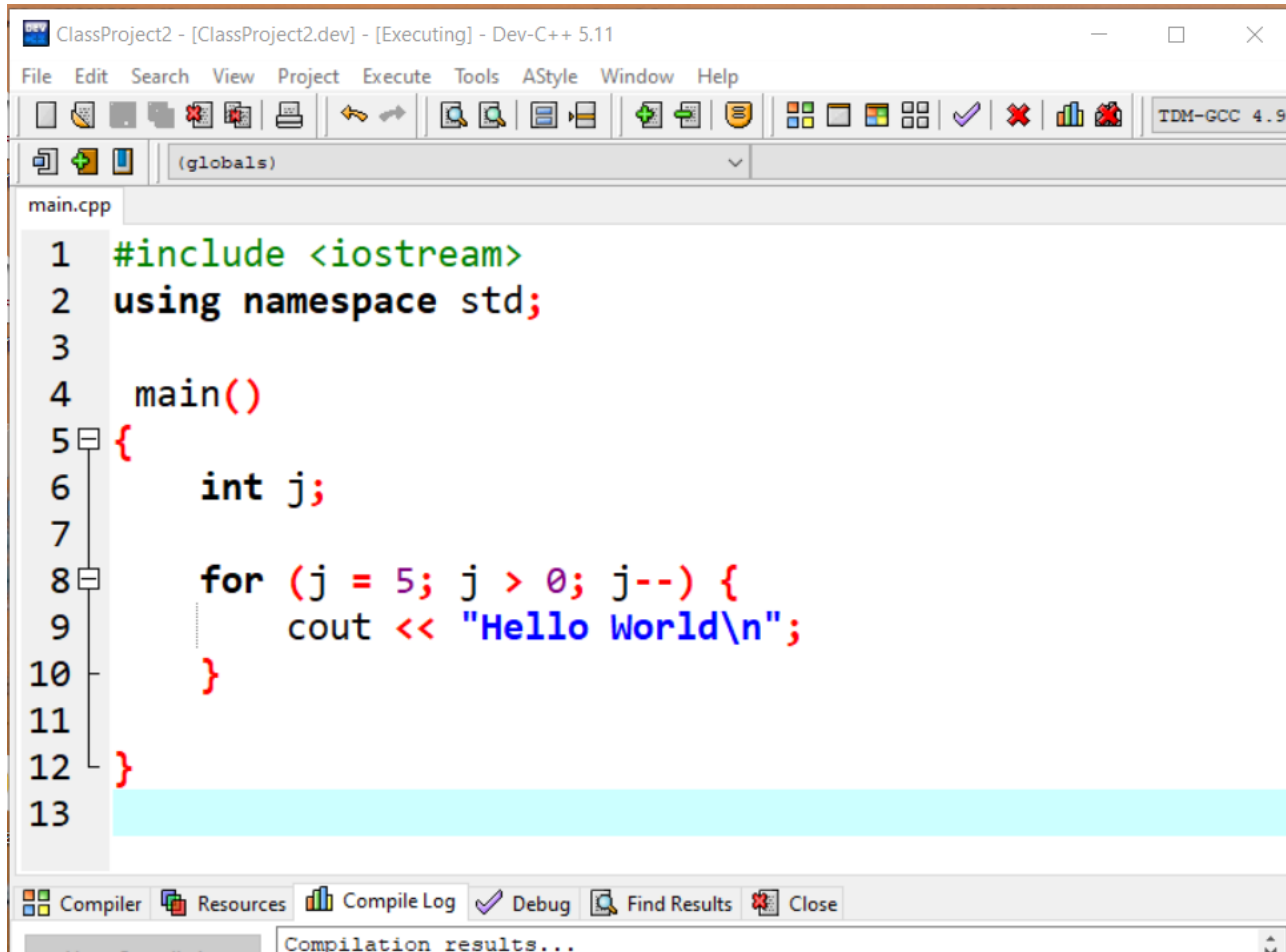
حلقه for : مثال ۱ - ۵ بار چاپ یک رشته

```
ClassProject2 - [ClassProject2.dev] - [Executing] - Dev-C++ 5.11
File Edit Search View Project Execute Tools AStyle Window Help
(globals)
[*] main.cpp
1 #include <iostream>
2 using namespace std;
3
4 main()
5 {
6     int i;
7
8     for (i = 1; i <= 5; i++) {
9         cout << "Hello World\n";
10    }
11
12 }
13
14
```

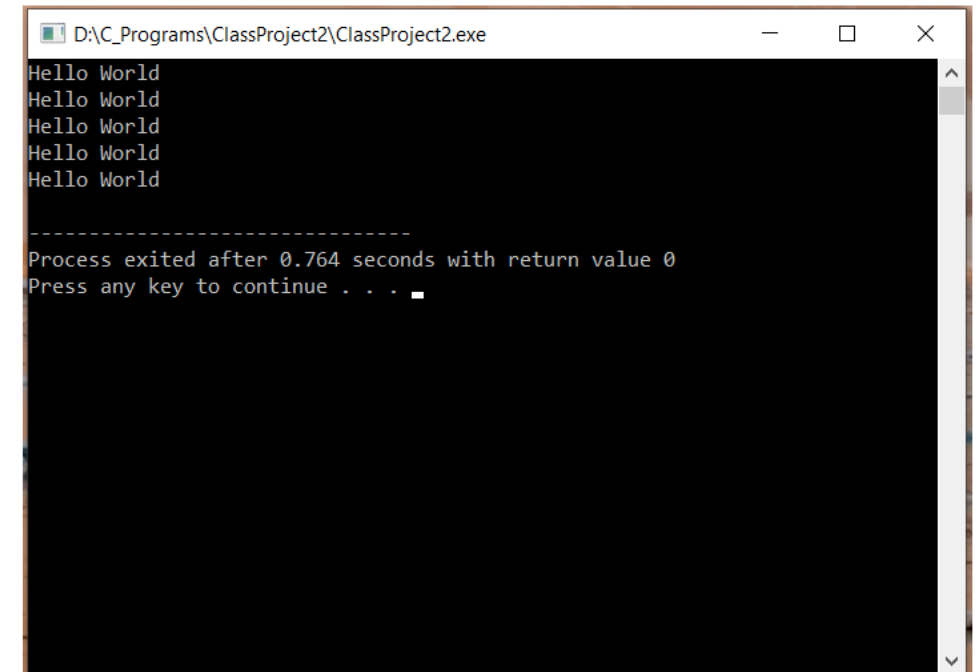
```
D:\C_Programs\ClassProject2\ClassProject2.exe
Hello World
Hello World
Hello World
Hello World
Hello World

-----
Process exited after 0.9941 seconds with return value 0
Press any key to continue . . .
```


حلقه for : مثال ۲ - ۵ بار چاپ یک رشته



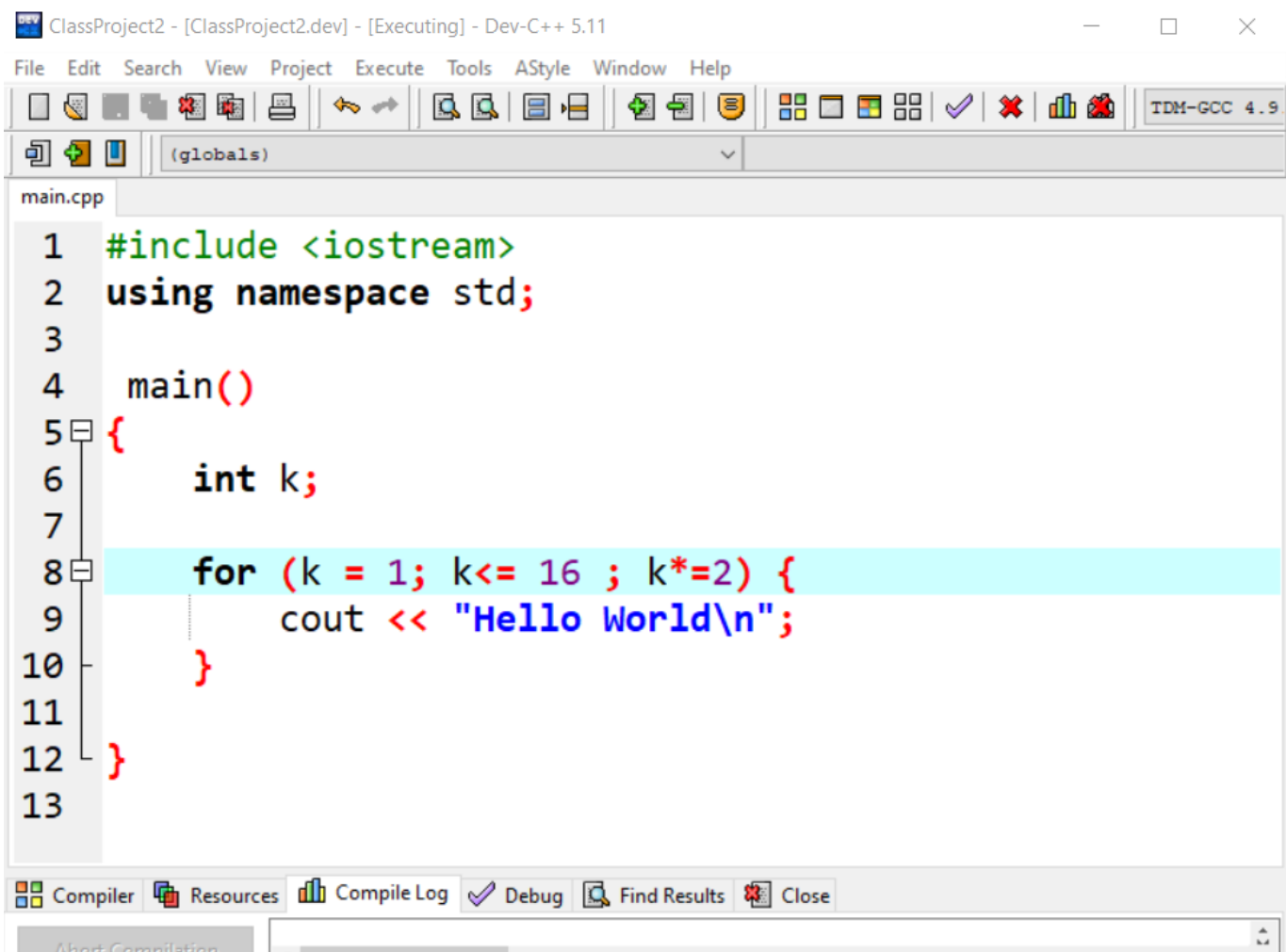
```
1 #include <iostream>
2 using namespace std;
3
4 main()
5 {
6     int j;
7
8     for (j = 5; j > 0; j--) {
9         cout << "Hello World\n";
10     }
11
12 }
13
```



```
D:\C_Programs\ClassProject2\ClassProject2.exe
Hello World
Hello World
Hello World
Hello World
Hello World

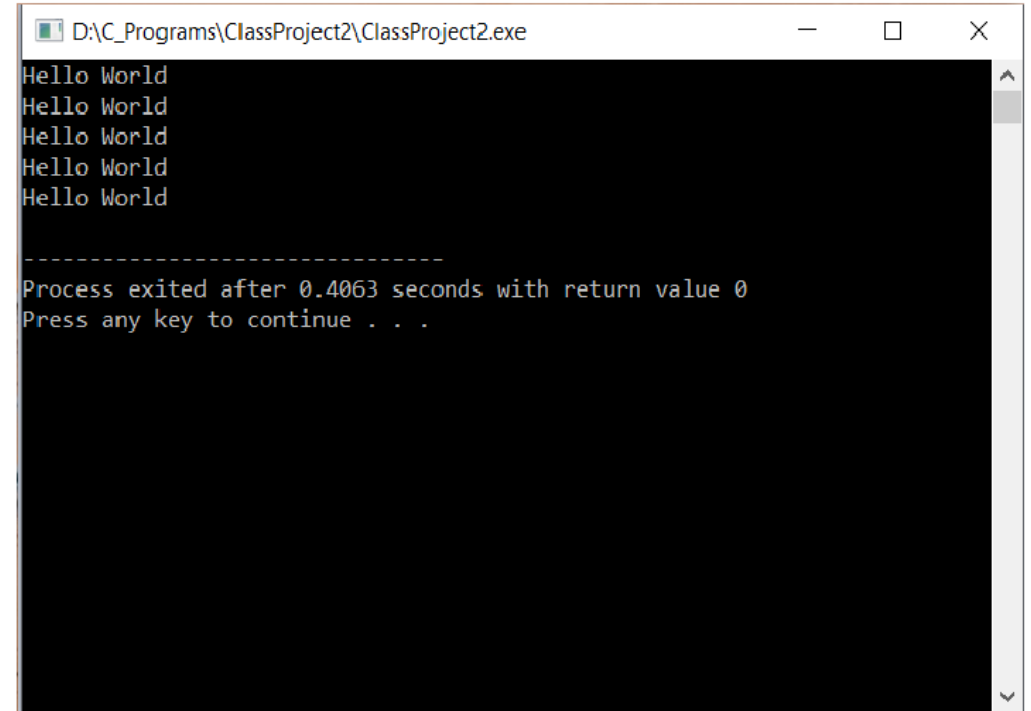
-----
Process exited after 0.764 seconds with return value 0
Press any key to continue . . .
```

حلقه for : مثال ۳ - ۵ بار چاپ یک رشته



```
1 #include <iostream>
2 using namespace std;
3
4 main()
5 {
6     int k;
7
8     for (k = 1; k <= 16 ; k*=2) {
9         cout << "Hello World\n";
10     }
11
12 }
13
```

The screenshot shows the Dev-C++ IDE with a project named 'ClassProject2'. The code in 'main.cpp' is as follows:

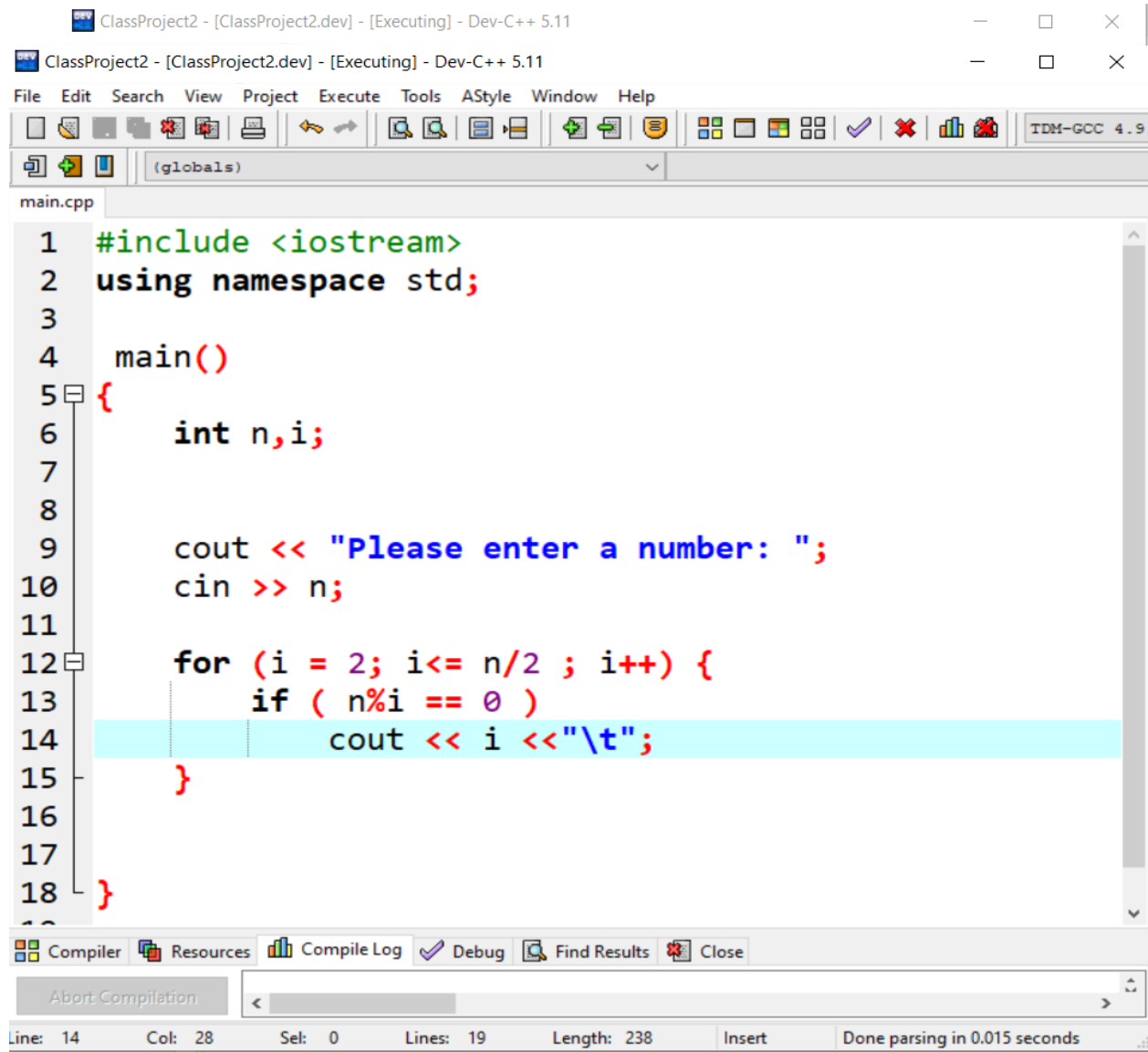


```
D:\C_Programs\ClassProject2\ClassProject2.exe
Hello World
Hello World
Hello World
Hello World
Hello World

-----
Process exited after 0.4063 seconds with return value 0
Press any key to continue . . .
```

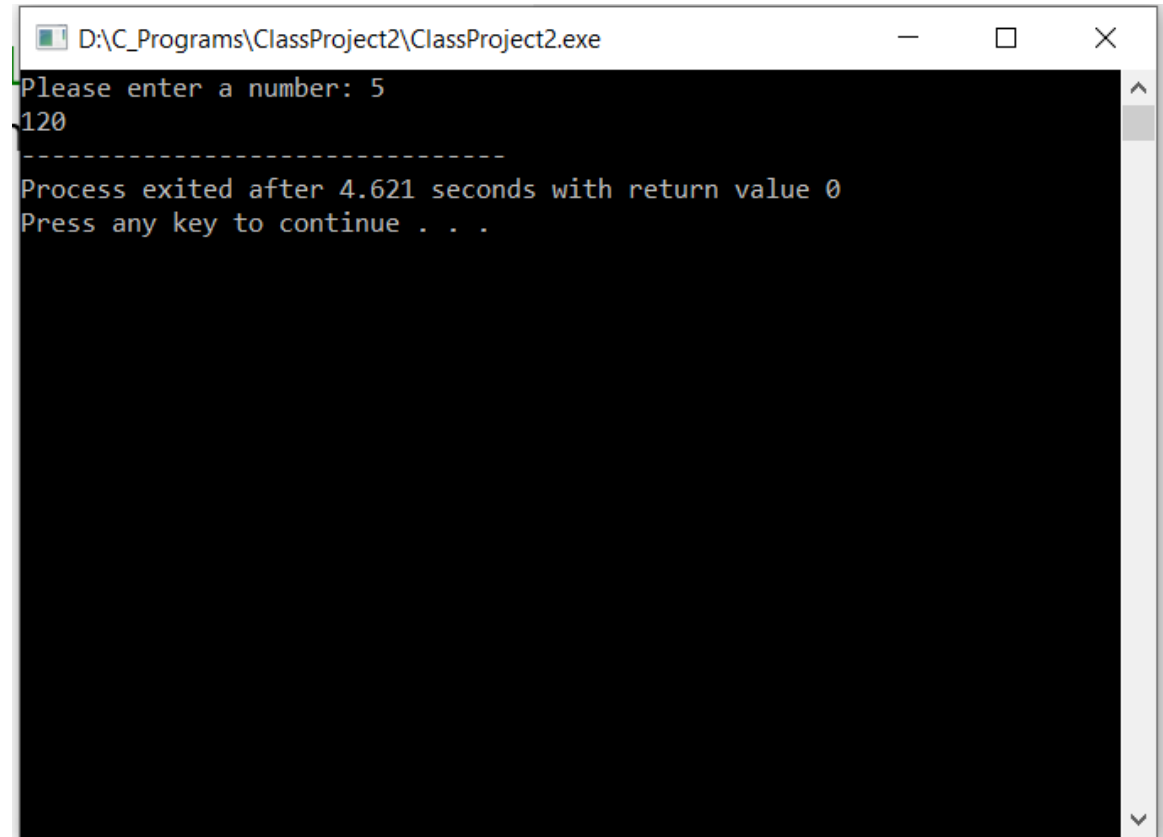
The screenshot shows the output window of the program. It displays 'Hello World' printed five times, one on each line. Below the output, it shows the process exit message: 'Process exited after 0.4063 seconds with return value 0' and 'Press any key to continue . . .'

حلقه for : مثال ۴ – چاپ مقسوم علیه های یک عدد



The screenshot shows the Dev-C++ IDE with a C++ program in a file named main.cpp. The program is designed to find and print the divisors of a user-input number. The code includes the iostream header, uses the std namespace, and defines a main function. Inside the main function, it declares variables n and i. It prompts the user to enter a number and reads it into n. Then, it uses a for loop starting from i=2 up to n/2. Within this loop, it checks if n is divisible by i (n%i == 0). If true, it prints the value of i followed by a tab character. The program is currently executing, as indicated by the status bar at the bottom which says 'Done parsing in 0.015 seconds'.

```
1 #include <iostream>
2 using namespace std;
3
4 main()
5 {
6     int n,i;
7
8
9     cout << "Please enter a number: ";
10    cin >> n;
11
12    for (i = 2; i <= n/2 ; i++) {
13        if ( n%i == 0 )
14            cout << i << "\t";
15    }
16
17
18 }
```



The screenshot shows the output window of the program. It displays the prompt 'Please enter a number: 5' and the user's input '120'. Below this, a horizontal dashed line separates the input from the output. The output shows 'Process exited after 4.621 seconds with return value 0' and 'Press any key to continue . . .', indicating the program has finished its execution.

```
Please enter a number: 5
120
-----
Process exited after 4.621 seconds with return value 0
Press any key to continue . . .
```

حلقه for : مثال ۵ – محاسبه و چاپ ب.م.م دو عدد

```
ClassProject2 - [ClassProject2.dev] - [Executing] - Dev-C++ 5.11
File Edit Search View Project Execute Tools AStyle Window Help
(globals)
main.cpp
1 #include <iostream>
2 using namespace std;
3
4 main()
5 {
6     int Num1, Num2, i, GCD;
7
8     cout << "Please Enter two integer Values :";
9     cin >> Num1 >> Num2;
10
11     for(i = 1; i <= Num1 && i <= Num2; i++)
12     {
13         if(Num1 % i == 0 && Num2 % i == 0)
14             GCD = i;
15     }
16
17     cout << "GCD of " << Num1 << " and " << Num2 << " is " << GCD;
18 }
19
20
```

```
D:\C_Programs\ClassProject2\ClassProject2.exe
Please Enter two integer Values :32
40
GCD of 32 and 40 is 8
-----
Process exited after 15.06 seconds with return value 0
Press any key to continue . . .
```

حلقه for : مثال ۵ – محاسبه و چاپ فاکتوریل یک عدد

ClassProject2 - [ClassProject2.dev] - [Executing] - Dev-C++ 5.11

File Edit Search View Project Execute Tools AStyle Window Help

TDM-GCC 4.9.2 64-bit

(globals)

main.cpp

```
2 using namespace std;
3
4 main()
5 {
6
7     int N, j, F;
8
9     cout << "Please Enter an integer number : ";
10    cin >> N;
11
12    F=1;
13    for(j = 2; j <= N; j++){
14        F*=j;
15
16    }
17
18    cout << N << "! is " << F ;
19 }
20
```


D:\C_Programs\ClassProject2\ClassProject2.exe

```
Please Enter an integer number : 5
5! is 120
-----
Process exited after 6.611 seconds with return v
alue 0
Press any key to continue . . .
```

حلقه for : مثال ۶ – تشخیص اول بودن یک عدد

- عددی را اول گوئیم که به غیر از ۱ و خودش به هیچ عدد دیگری بخش پذیر نباشد.
۱۷، ۱۳، ۲۹، ۴۳
 - برای نوشتن الگوریتم تشخیص اول بودن یا نبودن یک عدد می توان از نکته زیر استفاده کرد:
- عددی مانند n اول است اگر که به هیچ یک از اعداد ۲ تا \sqrt{n} بخش پذیر نباشد.

```
1 #include <iostream>
2 #include <math.h>
3 using namespace std;
4 int main() {
5     int n,flag,i;
6     cout<<"Please enter an integer number greater than 2 >";
7     cin>>n;
8     flag = 1;
9     for(i=2;i<sqrt(n);i++){
10         if (n%i==0){
11             flag = 0;
12             break;
13         }
14     }
15     if(flag==1){
16         cout<<"The number is prime";
17     }
18     else{
19         cout<<"The number is not prime";
20     }
21 }
```

 D:\MyCppProjects\newProject\newProject.exe

Please enter an integer number greater than 2 >23

The number is prime

Process exited after 2.934 seconds with return value 0

Press any key to continue . . .

حلقه های for تودر تو: مثال

```
ClassProject2 - [ClassProject2.dev] - [Executing] - Dev-C++ 5.11
File Edit Search View Project Execute Tools AStyle Window Help
(globals)
main.cpp
1 #include <iostream>
2 using namespace std;
3
4 int main()
5 {
6     int i,j;
7
8     for ( i = 1; i <= 10; i++) {
9         for (j=1; j<=10; j++){
10             cout << " " <<i*j;
11         }
12         cout << "\n";
13     }
14
15 }
16
Compiler Resources Compile Log Debug Find Results Close
Abort Compilation
```

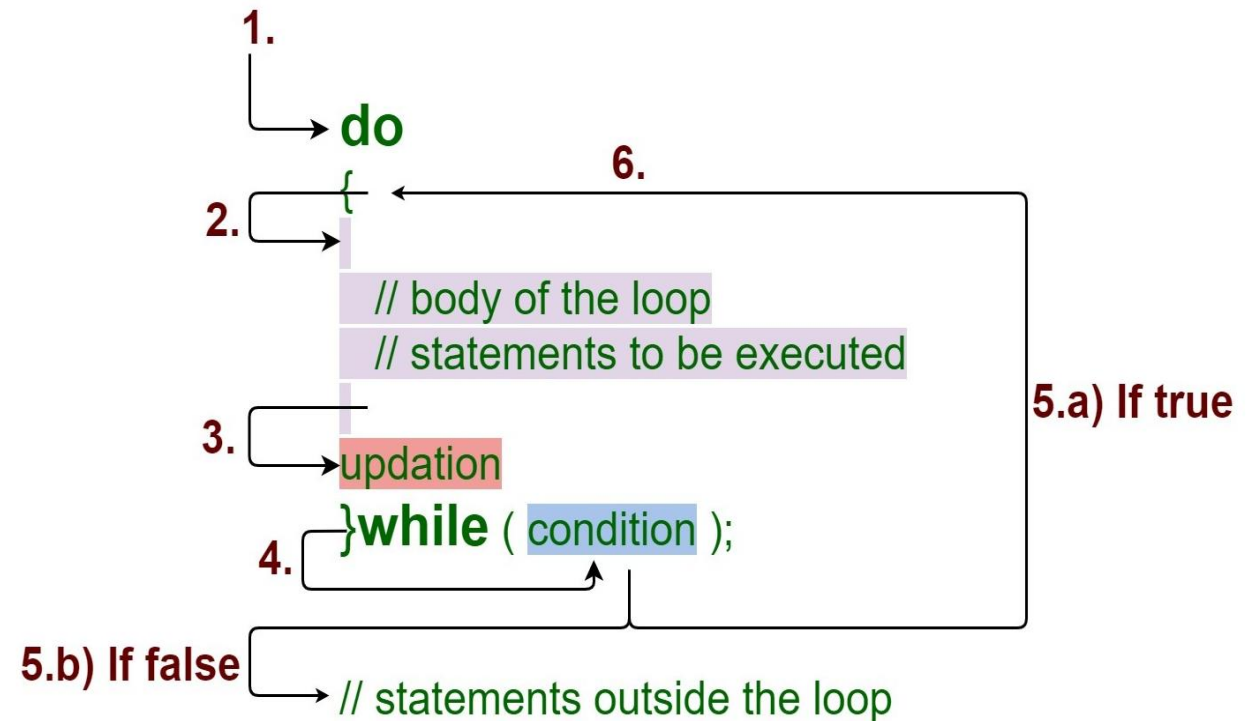
```
D:\C_Programs\ClassProject2\ClassProject2.exe
1 2 3 4 5 6 7 8 9 10
2 4 6 8 10 12 14 16 18 20
3 6 9 12 15 18 21 24 27 30
4 8 12 16 20 24 28 32 36 40
5 10 15 20 25 30 35 40 45 50
6 12 18 24 30 36 42 48 54 60
7 14 21 28 35 42 49 56 63 70
8 16 24 32 40 48 56 64 72 80
9 18 27 36 45 54 63 72 81 90
10 20 30 40 50 60 70 80 90 100

-----
Process exited after 0.766 seconds with return value 0
Press any key to continue . . .
```

حلقه do ... while

- ساختاری که دستورات داخل آن حداقل یکبار اجرا می شوند.
- شرط در انتها بررسی می شود.

```
do {  
    دستوراتی که باید تکرار شوند  
} while (condition test)
```



```
while (not edge) {  
    run();  
}
```

```
do {  
    run();  
} while (not edge);
```



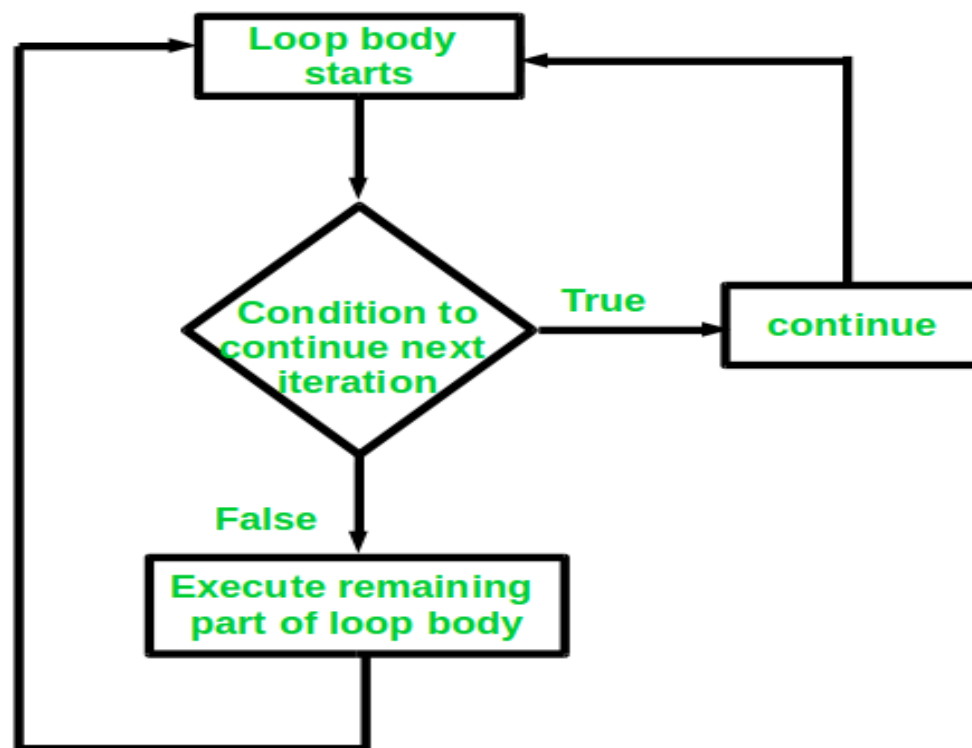
حلقه **do ... while** : مثال: برنامه ای که تا زمانی که کاربر کاراکتر @ را وارد کند از او ورودی می گیرد

```
ClassProject2 - [ClassProject2.dev] - [Executing] - Dev-C++ 5.11
File Edit Search View Project Execute Tools AStyle Window Help
(globals)
main.cpp
1 #include <iostream>
2 using namespace std;
3
4 main()
5 {
6
7     char ch;
8
9     do {
10         cin >> ch;
11     } while (ch != '@');
12
13     cout << "done";
14
15
16 }
```

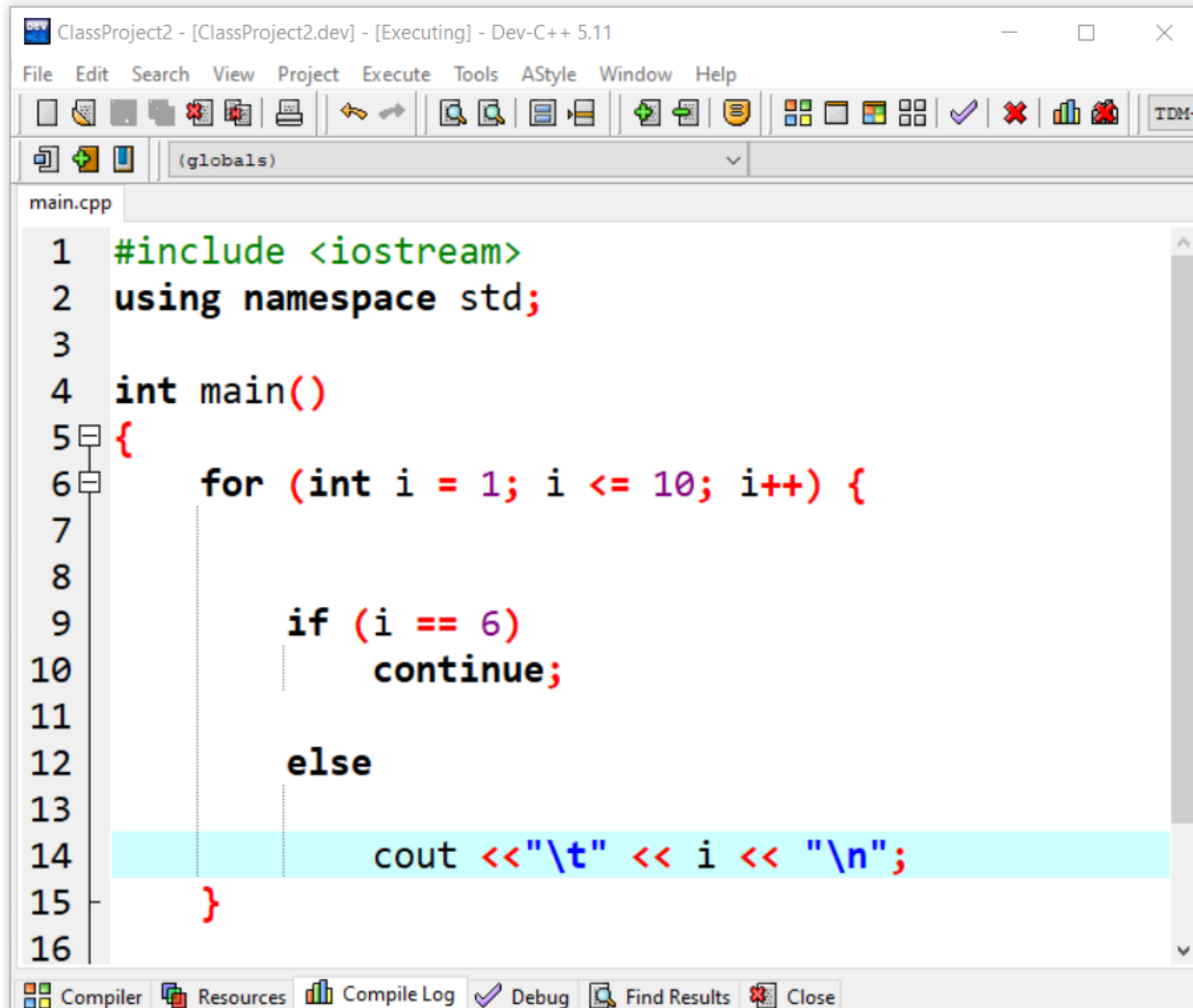
```
D:\C_Programs\ClassProject2\ClassProject2.exe
a
?
y
%
x
i
9
!
6
k
s
@
done
-----
Process exited after 44.53 seconds with return va
lue 0
Press any key to continue . . .
```

دستور continue

- هر گاه که این دستور اجرا شود **دور بعدی** حلقه شروع می شود.
- دستورات داخل حلقه بعد continue اجرا نمی شوند.



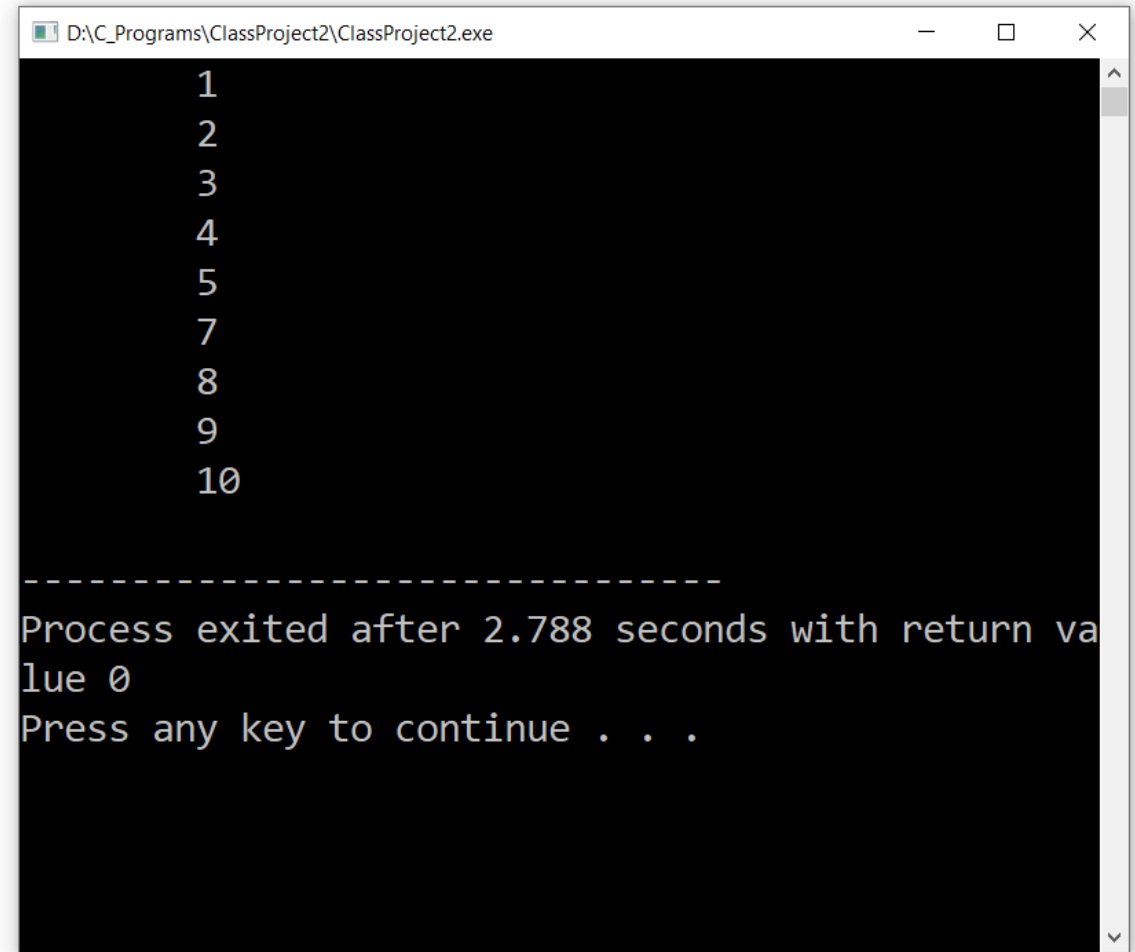
دستور continue: مثال



The screenshot shows the Dev-C++ IDE with a project named 'ClassProject2'. The main.cpp file contains the following code:

```
1 #include <iostream>
2 using namespace std;
3
4 int main()
5 {
6     for (int i = 1; i <= 10; i++) {
7
8
9         if (i == 6)
10            continue;
11
12        else
13
14            cout << "\t" << i << "\n";
15    }
16 }
```

The code is a C++ program that prints numbers 1 through 10, each on a new line, preceded by a tab character. However, it uses the `continue` statement to skip the iteration where `i` is 6. The line `cout << "\t" << i << "\n";` is highlighted in light blue.



The screenshot shows the output window of the program. It displays the numbers 1 through 10, each on a new line, preceded by a tab character. The number 6 is missing from the output, demonstrating the effect of the `continue` statement. Below the numbers, a dashed line separates the output from the program's exit message.

```
1
2
3
4
5
7
8
9
10

-----
Process exited after 2.788 seconds with return value 0
Press any key to continue . . .
```