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Lesson 5 from

PROGRAMMING FUNDAMENTALS_I

First Class

Loop Statements

2. For loop

The general form of the for loop is:

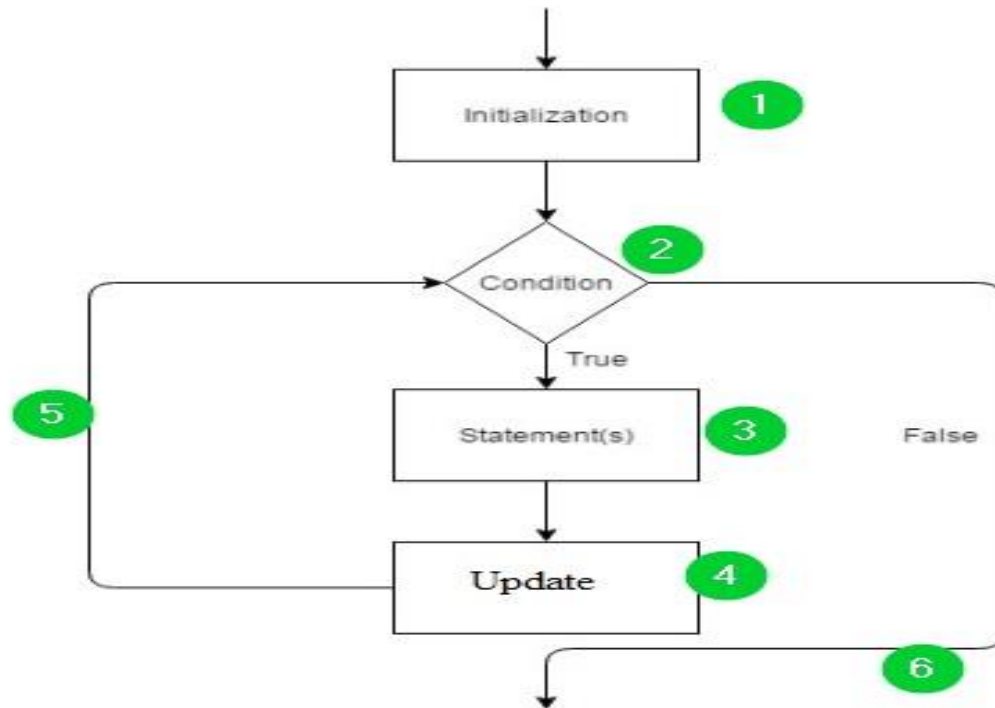
```
for (initialization; continuation condition; update)
{
    statement(s);
}
```

Here,

- The **initialization** step is executed first, and only once. This step allows you to declare and initialize any loop control variables. You are not required to put a statement here, as long as a semicolon appears.
- Next, the **condition** is evaluated. If it is true, the body of the loop is executed. If it is false, the body of the loop does not execute, and the flow of control jumps to the next statement just after the for loop.
- After the body of the for loop executes, the flow of control jumps back to the **update** statement. This statement can be left blank, as long as a semicolon appears after the condition.
- The **condition** is now evaluated again. If it is **true**, the loop executes, and the process repeats itself (body of the loop, then update step, and then again **condition**). After the **condition** becomes **false**, the for loop terminates.

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The Flowchart of **for** Loop is shown as follows:



Ex 1.

- Write a C++ program for printing numbers between 0 and 5.

```
#include <iostream.h>
#include <conio.h>
void main()
{
    for ( int i = 0; i <=5; i ++ )
    {
        cout << i << " ";
    }
    getch();
}
```

Output

0 1 2 3 4 5

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Ex 2.

- Write a C++ program for printing the odd numbers between 1 and 9.

```
#include <iostream.h>
#include <conio.h>
Void main()
{
    for ( int i = 1; i <=9; i += 2)
    {
        cout << i;
    }
    getch();
}
```

Output

1 3 5 7 9

Ex 3.

- Write a C++ program for printing the even numbers between 0 and 8.

```
#include <iostream.h>
#include <conio.h>
Void main()
{
    for ( int i = 0; i <=8; i= i+ 2)
    {
        cout << i;
    }
    getch();
}
```

Output

0 2 4 6 8

Ex 4.

- Write a C++ program for printing numbers between 10 and 14.

```
#include <iostream.h>
#include <conio.h>
void main ()
{
```

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```
for( int a = 10; a < 15; a = a + 1 )
{
    cout << "value of a: " << a << endl;
}
getch();
}
```

Output

```
value of a: 10
value of a: 11
value of a: 12
value of a: 13
value of a: 14
```

Ex 5.

- Write a C++ program to sum the numbers between 1 and 5.

```
#include<iostream.h>
#include<conio.h>
void main( )
{
    int sum = 0;
    for ( int i = 1; i <= 5; i ++ ){
        sum = sum + i;
    }
    cout << "The sum is: " << sum;
    getch();
}
```

Output

```
The sum is: 15
```

Ex 6.

- Write a C++ program to find the factorial of n, using for loop.

$$n! = n * n-1 * n-2 * n-3 * \dots * 2 * 1$$

```
#include <iostream.h>
#include<conio.h>
Void main()
{
    int n;
    int f = 1;
    cout << "Enter a positive integer: ";
    cin >> n;
    if (n < 0)
```

Output 1

```
Enter a positive integer: -10
Error! Factorial of a negative number doesn't exist.
```

Output 2

```
Enter a positive integer: 5
Factorial of 5 = 120
```

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```
cout << "Error! Factorial of a negative number doesn't exist.";
else
{
    for(int i = n; i >= 1; i--)
    {
        f= f * i;
    }
    cout << "Factorial of " << n << " = " << f;
}
}
```

Output 3

Enter a positive integer: 6
Factorial of 6 = 720

Ex 7:

- Write a C++ program to solve the following equation:

$$\text{sum} = \sum_{i=1}^4 a_i^2$$

```
#include <iostream.h>
#include <conio.h>
Void main()
{
    int sum = 0;
    for ( int i = 1; i <= 4; i ++ )
    {
        sum = sum + ( i * i );
    }
    cout << "The sum is: " << sum;
}
```

Output

The sum is: 30

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Ex 8.

- Write a C++ program to read 4 integer numbers, and find the sum of positive numbers only.

```
#include<iostream.h>
#include<conio.h>
void main( )
{
    int num, sum = 0;
    for ( int i = 1; i <= 4; i ++ )
    {
        cout << "Enter your number: ";
        cin >> num;
        if ( num >= 0 )
        {
            sum = sum + num;
        }
    }
    cout << "The sum is: " << sum;
}
```

Output 1

```
Enter your number: 10
Enter your number: -10
Enter your number: 5
Enter your number: -77
The sum is: 15
```

Output 2

```
Enter your number: 10
Enter your number: -6
Enter your number: 12
Enter your number: -8
The sum is: 22
```

Ex 9.

- Write a C++ program to print the following series: 1, 2, 4, 8, 16, 32, 64.

```
#include<iostream.h>
#include<conio.h>
void main( )
{
    int x;
    cout<<"The series is:";
    for ( x = 1; x < 65; x *= 2 ){
        cout << x <<" ";
    }
    getch();
}
```

Output

```
The series is:1 2 4 8 16 32 64
```

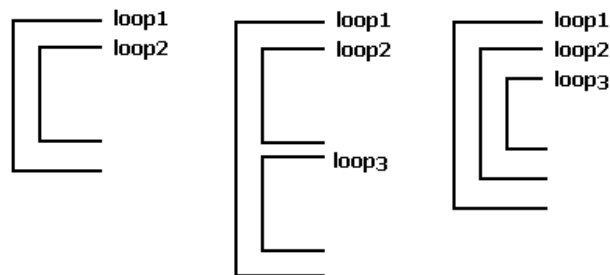
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Nested for Loops.

Nested for loop means a loop statement inside another loop statement. That is why nested loops are also called as “**loop inside loop**”.

```
for ( initialization; condition; increment )
{
    for ( initialization; condition; increment )
    {
        // statement of inside loop
    }
    // statement of outer loop
}
```

Or as the following figure:



When working with nested loops, the outer loop changes only after the inner loop is completely finished.

The following C++ code shows an example of nested for loop:

```
For (int num2 = 0; num2 <= 3; num2++)
{
    For (int num1 = 0; num1 <= 2; num1++)
    {
        cout<< num2<< "      " << num1<< endl;
    }
}
```

Let's take a look at a trace of two nested loops.

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Memory		Screen
int num2	int num1	0 0
0	0	0 1
	1	0 2
	2	1 0
	3 end loop	1 1
		1 2
1	0	2 0
	1	2 1
	2	2 2
	3 end loop	3 0
		3 1
2	0	3 2
	1	
	2	
	3 end loop	
3	0	
	1	
	2	
	3 end loop	
4 end loop		

Ex 10.

- Write a C++ program to print the following figure.

```
#include <iostream.h>
#include<conio.h>
void main()
{
    int r = 5, c = 3;
    for (int i = 1; i <= r; i++)
    {
        for (int j = 1; j <= c; j++)
        {
            cout << "*" ";
        }
        cout << endl;
    }
}
```

```
* * *
* * *
* * *
* * *
* * *
```

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Ex 11.

- Write a C++ program to print the following figure.

```
#include<iostream.h>
Void main ()
{
    int i, j;
    for(i=0; i<=5; i++)
    {
        for( j=0; j <= 5; j++)
        {
            cout << i << j <<" \t";
        }
        cout <<"\n";
    }
}
```

00	01	02	03	04	05
10	11	12	13	14	15
20	21	22	23	24	25
30	31	32	33	34	35
40	41	42	43	44	45
50	51	52	53	54	55

Ex 12.

- Write a C++ program to print the following figure.

```
#include <iostream.h>
#include<conio.h>
Void main()
{
    int i , j;
    for (i = 1; i<=5; i++)
    {
        for (j=1; j <= i; j++ )
        {
            cout <<j<<" ";
        }
        cout << endl;
    }
    getch();
}
```

1
1 2
1 2 3
1 2 3 4
1 2 3 4 5

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Ex 13.

- Write a C++ program to print the following figure.

```
#include <iostream.h>
#include <conio.h>
void main()
{
    int i, j;
    for ( i = 1; i <= 10; i ++ )
    {
        for ( j = 1; j <= i; j ++ )

            cout << " + ";

        cout << "\n";
    }
    getch();
}
```

```
+
+ +
+ + +
+ + + +
+ + + + +
+ + + + + +
+ + + + + + +
+ + + + + + + +
+ + + + + + + + +
```

Homework.

1. Write a C++ program to display the following figure.

5	4	3	2	1
---	---	---	---	---
2. Write a C++ program to read 4 integer numbers, and find the sum of odd number only.
3. Write a C++ program to read 4 integer numbers, and find the sum of even number only.
4. Write a C++ program to read n integer numbers, and find the sum of odd number only.
5. Write a C++ program to read n integer numbers, and find the sum of even number only.
6. Write a C++ program to print the following series: 1,3,9,27,81.

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7. What is the output of the following C++ Program?

```
#include <iostream.h>
#include <conio.h>
void main( )
{
    int k = 0;
    for (k = 7; k < 3; k++)
    {
        cout<<"Hello"<<" ";
    }
    cout<<"\n";
}
```

8. What is the output of the following C++ Program?

```
#include <iostream.h>
#include <conio.h>
void main( )
{
    int k = 0;
    for (k = 1, k < 3, k++)
    {
        cout<<"morning"<<" ";
    }
    cout<<"\n";
}
```

9. How many times "Babylon" word is printed in the below C++ program?

```
#include <iostream>
#include <conio.h>
void main( )
{
    int k = 0;
    for (k = 1; k < 4; k++)
    {
        cout<<"Babylon"<<" ";
    }
    cout<<"\n";
}
```

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10. What is the output of the following C++ Program?

```
#include <iostream.h>
#include <conio.h>
void main( )
{
    int i = 0;
    for ( i = 2; i == 3; i++)
    {
        cout<<"In for loop "<<"\n";
    }
    cout<<"After loop\n";
    cout<<"\n";
}
```

11. What is the output of the following C++ Program?

```
#include <iostream.h>
Void main()
{
    for (int i = 1; i <= 5; ++i)
    {
        cout << "Hello World " << endl;
    }
}
```

12. Apply (for loop) into all the programs in lesson 4.