# For loop

This lesson disucsses the concepts of for loop and nested for loop using examples and illustrations

WE'LL COVER THE FOLLOWING



A `for` *loop* is great for doing things a certain amount of time. It's like a while loop but the *increment* is included with the *condition*.

## Syntax #

A `for` loop is set up like this:

```
for (Initialization; Condition; Increment)
{
 // Code
}
```

for loop Syntax

- **Initialization** - Makes a **new** *local variable* that can only be used in the *loop*.
- **Condition** - The *loop* only runs when the *condition* is **true**.
- **Increment** - How the *variable* changes every time the *loop* runs.

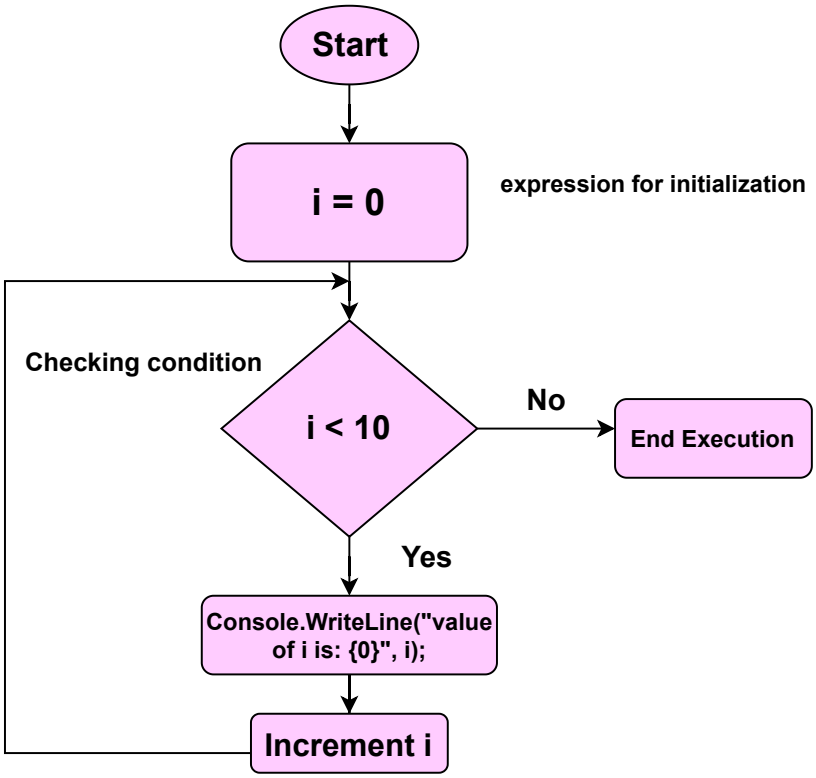
## Example #

Here's an example of how the `for` *loop* works:

```
using System;

class ForloopExample
{
    static void Main()
    {
      for (int i = 0; i < 10; i++){
        Console.WriteLine("value of i is: {0}", i);
      }
    }
}
```

For loop example

Take a loot at the illustration below to understand the code above more clearly.




Flow Chart for For Loop

## What does the for loop do?

- Prior to the *first* iteration, it sets the value of `i` to **0**.
- Next, it tests (like a normal `while` loop) if `i` is *less* than **10**.
- If the statement returns `true`, the body of the loop is run and the

program will *print* the value returned by the simple arithmetic statement `i`.

- Next, the terminal cursor moves down to the next line.
- After the loop is finished, `i` is incremented (by **1**), as specified in the update statement, and the conditional is tested again.

So, this loop will run a total of **10** times, printing the **"i"** value each time. You've just taught your program to count! **Wow!**

The *variable* used in `for` loops is generally an *integer* variable named `i`, `j`, or `k`, and is often initialized prior to the *beginning* of the `for` loop.

## Nested For Loops #

It is possible to *nest* `for` loops. *Nesting* means including one `for` loop in another `for` loop.

The syntax for a **nested** `for` loop is as follows:

```
for (expression for initialization ; expression for testing ; expression for updating ) {
   for (expression for initialization ; expression for testing ; expression for updating) {
      //body
   }
   //body
}
```

Nested for loop Syntax

### Example of Nested For Loop #

Let's take a look at an example code to understand *nesting* of `for` loops better.

```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }
```

```
        System.Console.WriteLine("All missiles have been launched.");

    }
}
```

Nested For loop example

In a nested `for` loop, for a single value of the **outer** loop, in this case, `i`, the inner (*nested*) `for` loop will iterate over all its values, that is, for example for `i=0` the inner (*nested*) loop will run from `j = 3` to `j=1`. After this is done, `i` will be incremented to **1** and the inner loop will again iterate over all its values against this value of `i`. The process continues till all values of `i` are iterated over.

Look at the illustration below which will help you visualize this and help you understand this concept more clearly.


**Main**

```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**



```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**

How many missiles will you fire?

```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**

How many missiles will you fire?
I will fire: 5 missiles



```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**
**i = ?**

How many missiles will you fire?
I will fire: 5 missiles

```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**
**i = 0**
**j = ?**

How many missiles will you fire?
I will fire: 5 missiles



```
1  class NestedLoopExample
2  {
3      static void Main()
4      {
5          int input = 5;
6          System.Console.WriteLine("How many missiles will you fire?");
7          System.Console.WriteLine("I will fire: {0}", input, "missiles");
8
9
10         for (int i = 0; i < input; i++) {  // outer for loop
11             for (int j = 3; j > 0; j--) {  // inner for loop
12                 System.Console.WriteLine(j);
13             }
14             System.Console.WriteLine("Missile {0}",i+1," has launched.");
15         }
16
17         System.Console.WriteLine("All missiles have been launched.");
18     }
19 }
```

**Main**

**input = 5**
**i = 0**
**j = 3**

How many missiles will you fire?
I will fire: 5 missiles
**3**

```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**
**i = 0**
**j = 2**

How many missiles will you fire?
I will fire: 5 missiles

**3**



```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**
**i = 0**
**j = 2**

How many missiles will you fire?
I will fire: 5 missiles

**3 2**

```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**
**i = 0**
**j = 1**

How many missiles will you fire?
I will fire: 5 missiles

**3 2**



```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**
**i = 0**
**j = 1**

How many missiles will you fire?
I will fire: 5 missiles

**3 2 1**

```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**
**i = 0**

How many missiles will you fire?
I will fire: 5 missiles

**3 2 1**



```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**
**i = 0**

How many missiles will you fire?
I will fire: 5 missiles

**3 2 1 Missile 1 has launched**

```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**
**i = 1**

How many missiles will you fire?
I will fire: 5 missiles
**3 2 1 Missile 1 has launched**



```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**
**i = 1**
**j = 3**

How many missiles will you fire?
I will fire: 5 missiles
**3 2 1 Missile 1 has launched**

```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**
**i = 1**
**j = 3**

How many missiles will you fire?
I will fire: 5 missiles
**3 2 1 Missile 1 has launched**
**3**



```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**
**i = 1**
**j = 2**

How many missiles will you fire?
I will fire: 5 missiles
**3 2 1 Missile 1 has launched**
**3**

```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**
**i = 1**
**j = 2**

How many missiles will you fire?
I will fire: 5 missiles
**3 2 1 Missile 1 has launched**
**3 2**



```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**
**i = 1**
**j = 1**

How many missiles will you fire?
I will fire: 5 missiles
**3 2 1 Missile 1 has launched**
**3 2**

```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**
**i = 1**
**j = 1**

How many missiles will you fire?
I will fire: 5 missiles
**3 2 1 Missile 1 has launched**
**3 2 1**



```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**
**i = 1**

How many missiles will you fire?
I will fire: 5 missiles
**3 2 1 Missile 1 has launched**
**3 2 1**

```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**
**i = 1**

How many missiles will you fire?
I will fire: 5 missiles
**3 2 1 Missile 1 has launched**
**3 2 1 Missile 2 has launched**



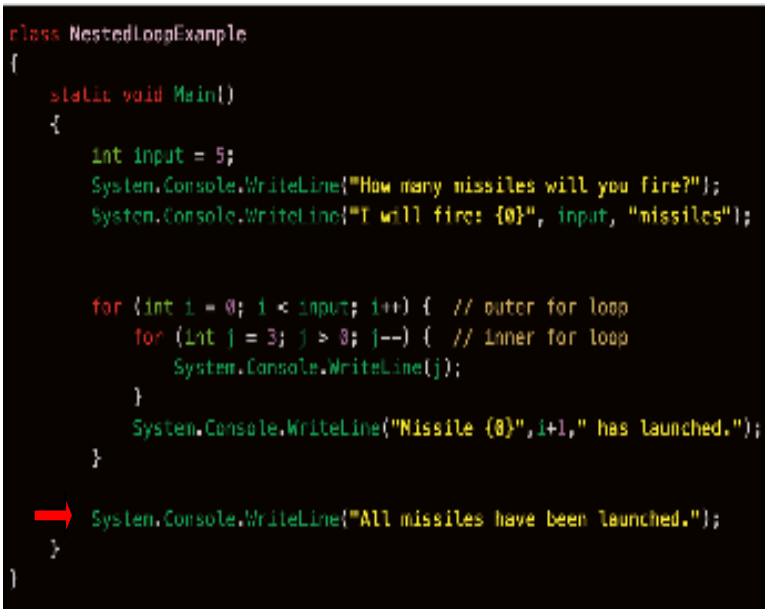
```
class NestedLoopExample
{
    static void Main()
    {
        int input = 5;
        System.Console.WriteLine("How many missiles will you fire?");
        System.Console.WriteLine("I will fire: {0}", input, "missiles");


        for (int i = 0; i < input; i++) {  // outer for loop
            for (int j = 3; j > 0; j--) {  // inner for loop
                System.Console.WriteLine(j);
            }
            System.Console.WriteLine("Missile {0}",i+1," has launched.");
        }

        System.Console.WriteLine("All missiles have been launched.");
    }
}
```

**Main**

**input = 5**
**i = 1**

How many missiles will you fire?
I will fire: 5 missiles
**3 2 1 Missile 1 has launched**
**3 2 1 Missile 2 has launched**

**These iterations will continue for all values of i up till 4**




**Main**

**input = 5**

How many missiles will you fire?
I will fire: 5 missiles

**3 2 1 Missile 1 has launched**

**3 2 1 Missile 2 has launched**

**3 2 1 Missile 3 has launched**

**3 2 1 Missile 4 has launched**

**3 2 1 Missile 5 has launched**

**All missiles have been launched**

**The final result after the program has run for all values**



Very interesting right? Now that the concept of `for` loops and *nested* `for` loops is clear let's look at some other interesting stuff related to loops in the next lesson.