C# Introduction

Basic Syntax , I/O, Conditions, Loops and Debugging

SoftUni Team

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Software University

https://softuni.bg

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Introduction and Basic Syntax

C# Programming Language

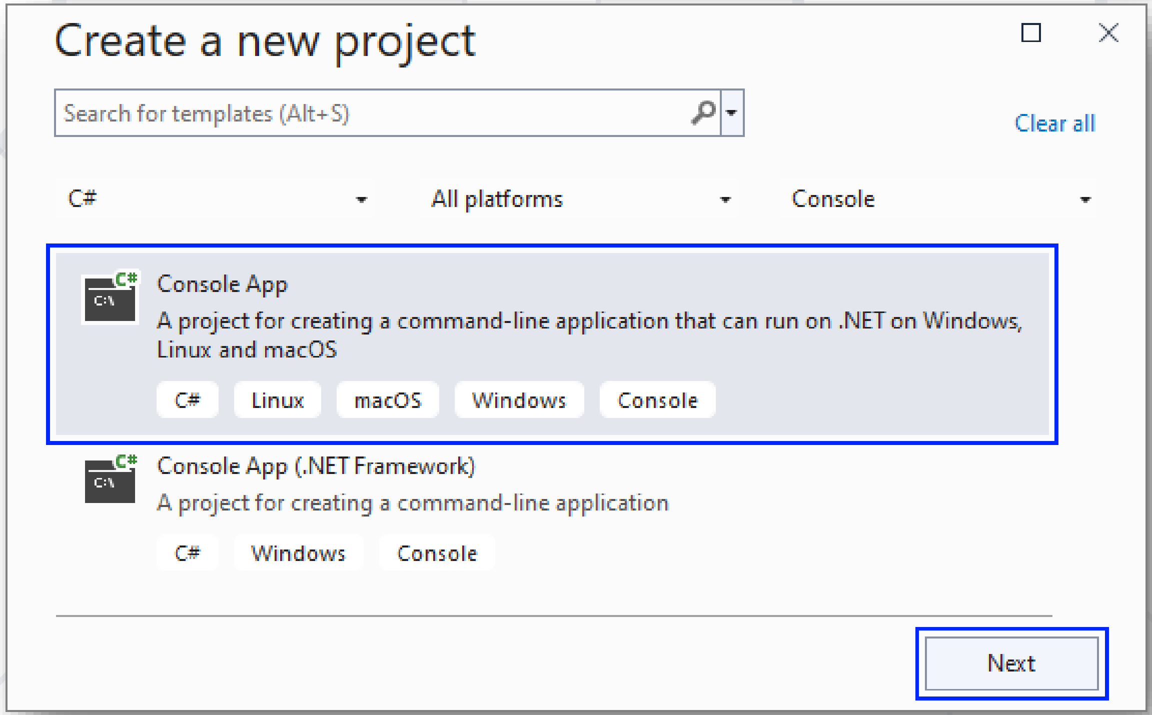
- C# is modern, flexible, general-purpose programming language
- **Object-oriented** by nature, statically-typed, compiled
- Runs on .NET Framework / .NET Core

```
static void Main()
{
    // Source code
}
```

Program starting point

Using Visual Studio

- **Visual Studio** (VS) is powerful IDE for C#
- Create a **console application**



Create a new project

Search for templates (Alt+S)

Clear all

C# | All platforms | Console

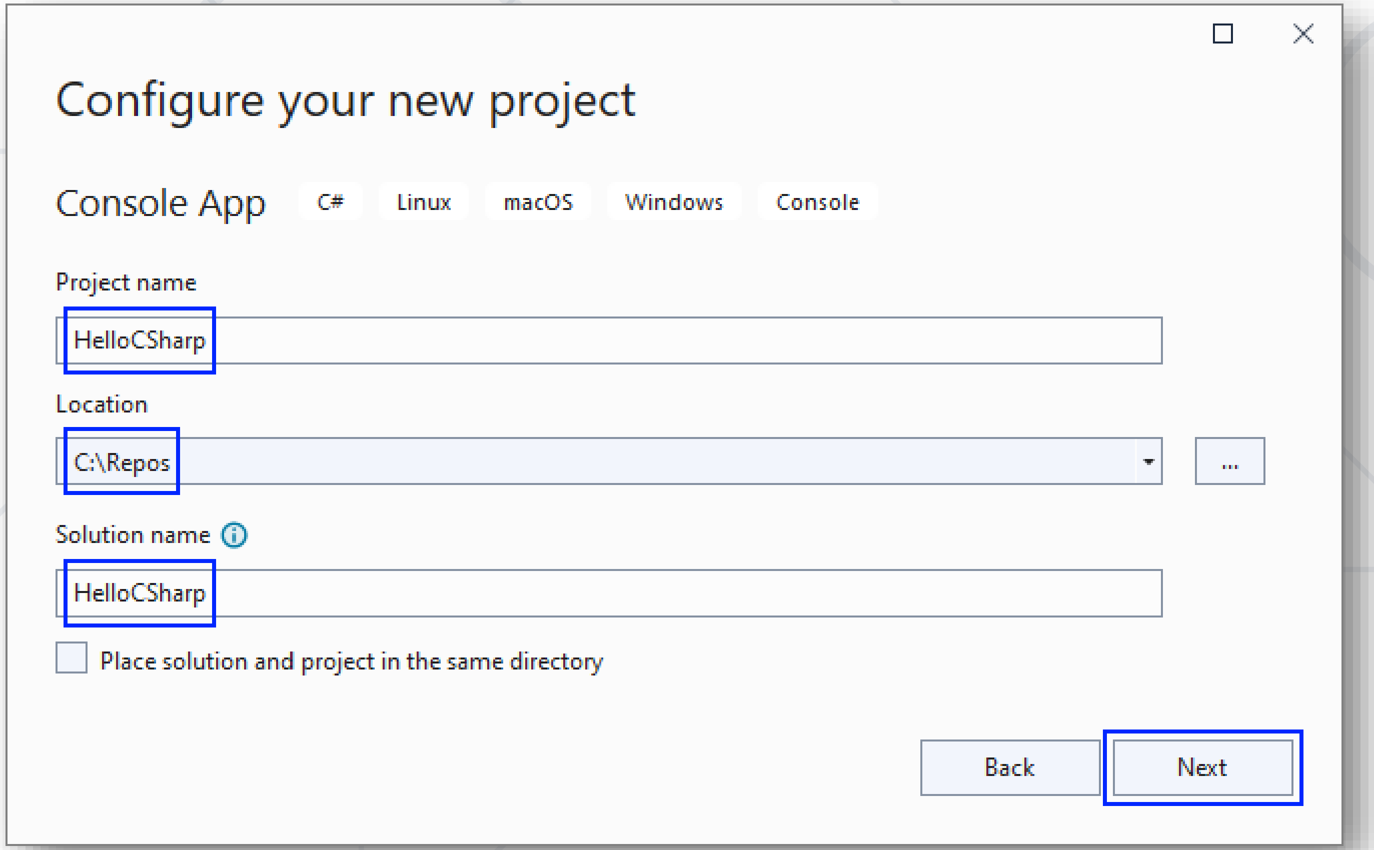
Console App
A project for creating a command-line application that can run on .NET on Windows, Linux and macOS
C# Linux macOS Windows Console

Console App (.NET Framework)
A project for creating a command-line application
C# Windows Console

Next

Using Visual Studio

- Give the console application a **proper name**



Configure your new project

Console App `C#` `Linux` `macOS` `Windows` `Console`

Project name: HelloCSharp

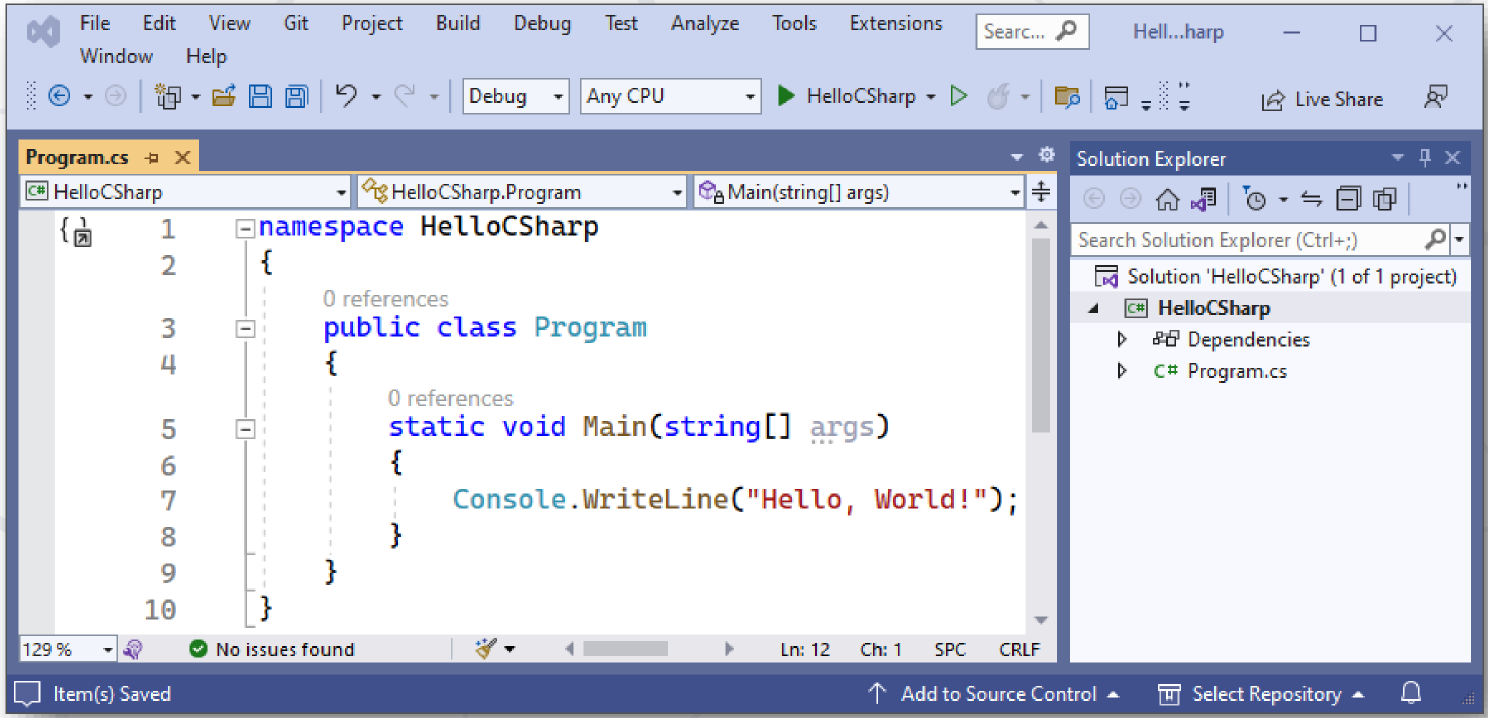
Location: C:\Repos

Solution name: HelloCSharp

☐ Place solution and project in the same directory

Running the Program

- Start the program from VS using [**Ctrl** + **F5**]



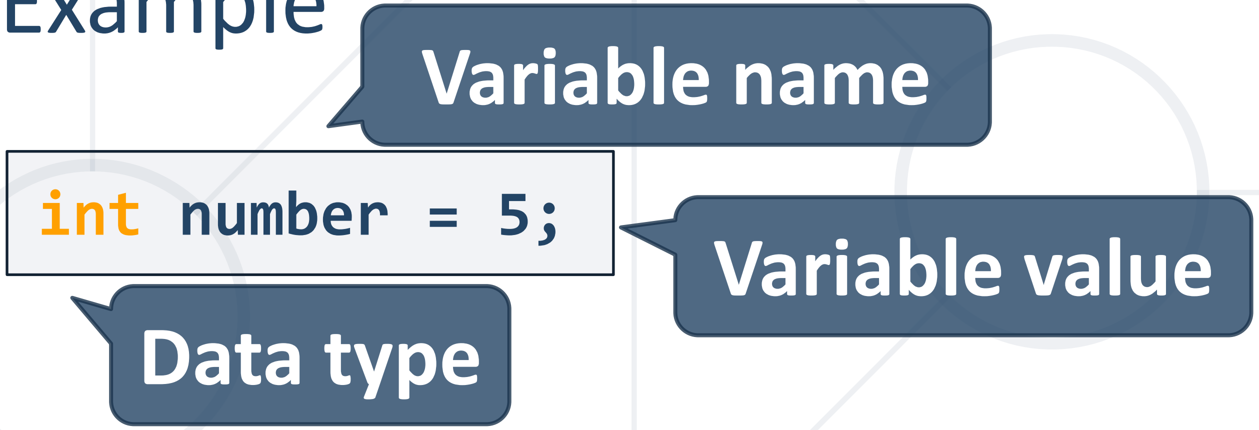
```
namespace HelloCSharp
{
    0 references
    public class Program
    {
        0 references
        static void Main(string[] args)
        {
            Console.WriteLine("Hello, World!");
        }
    }
}
```

Declaring Variables

- Defining and Initializing variables

```
{data type / var} {variable name} = {value};
```

- Example


```
int number = 5;
```

Input / Output

Reading from and Writing to the Console

Reading from the Console

- We can **read** / **write** to the console, using the `Console` class
- Use the `System` namespace to access `System.Console` class

```
using System;
```

- Reading input from the console using `Console.ReadLine()`

Returns `string`

```
string name = Console.ReadLine();
```

Converting Input from the Console

- `Console.ReadLine()` returns a **`string`**
- Convert the string to number by **parsing**

```
string name = Console.ReadLine();
int age = int.Parse(Console.ReadLine());
double salary = double.Parse(Console.ReadLine());
bool isHungry = bool.Parse(Console.ReadLine());
```

Printing to the Console

- We can **print** to the console using the `Console` class
- Use the `System` namespace to access `System.Console` class
- Writing output to the console
  - `Console.Write()`
  - `Console.WriteLine()`

```
Console.Write("Hi, ");
Console.WriteLine("John!");
// Hi, John!
```

Using Placeholders

- Using **placeholders** to print on the console
- Examples

```
string name = "George";
int age = 5;
Console.WriteLine("Name: {0}, Age: {1}", name, age);
// Name: George, Age: 5
```

Placeholder {0} corresponds to name

Placeholder {1} corresponds to age

Formatting Numbers in Placeholders

- **D** – format number to certain digits with leading zeros
- **F** – format floating point number with certain digits after the decimal point
- Examples

```
double grade = 5.5334;
int percentage = 55;
Console.WriteLine("{0:F2}", grade);       // 5.53
Console.WriteLine("{0:D3}", percentage); // 055
```

Using String Interpolation

- Using string interpolation to print on the console
- Examples

```
string name = "George";
int age = 5;

Console.WriteLine($"Name: {name}, Age: {age}");
// Name: George, Age 5
```

Put $ in front of the string to use string interpolation

Problem: Student Information

- You will be given 3 input lines:
  - Student Name, Age and Average Grade
- Print the input in the following format:
  - `"Name: {name}, Age: {age}, Grade: {grade}"`
  - Format the grade to 2 decimal places

```
John
15
5.40
```

```
Name: John, Age: 15, Grade: 5.40
```

Check your solution here: https://alpha.judge.softuni.org/contests/basic-syntax-conditional-statements-and-loops-lab/1188/practice#0

Solution: Student Information

```
string name = Console.ReadLine();
int age = int.Parse(Console.ReadLine());
double grade = double.Parse(Console.ReadLine());

Console.WriteLine($"Name: {name}, Age: {age}, Grade: {grade:f2}");
```

```
Name: John, Age: 15, Grade: 5.40
```

Check your solution here: https://alpha.judge.softuni.org/contests/basic-syntax-conditional-statements-and-loops-lab/1188/practice#0

Comparison Operators

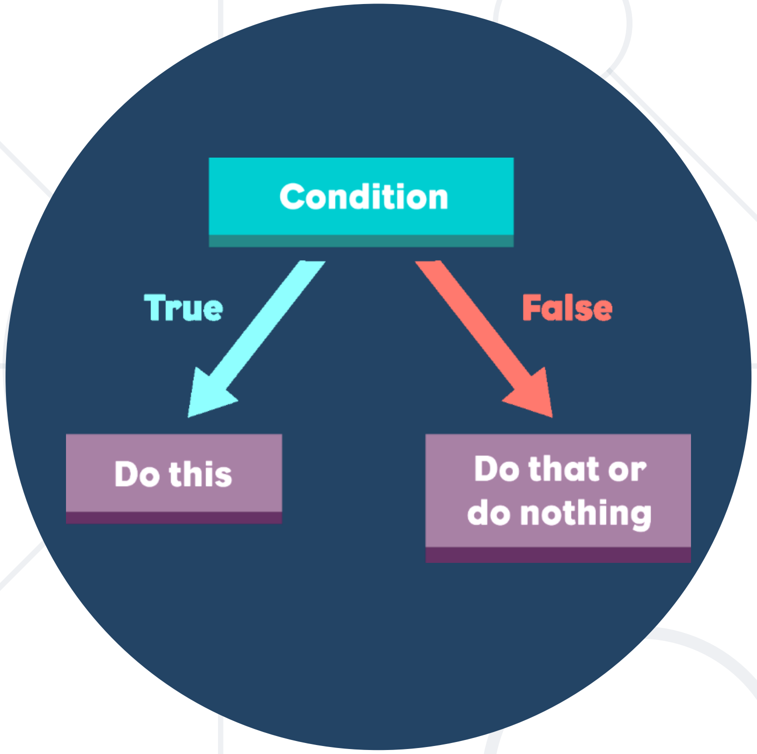
Comparison Operators

Operator	Notation in C#
Equals	==
Not Equals	!=
Greater Than	>
Greater Than or Equals	>=
Less Than	<
Less Than or Equals	<=

Comparing Numbers

- Values can be compared:

```
int a = 5;
int b = 10;
Console.WriteLine(a < b);           // true
Console.WriteLine(a > 0);           // true
Console.WriteLine(a > 100);         // false
Console.WriteLine(a < a);           // false
Console.WriteLine(a <= 5);          // true
Console.WriteLine(b == 2 * a);      // true
```



Implementing Control-Flow Logic

The If-else Statement

The If Statement

- The most simple **conditional statement**
  - Test for a condition
- Example: Take as an input a grade and check if the student has passed the exam (grade >= 3.00)

```
double grade = double.Parse(Console.ReadLine());
if (grade >= 3.00)
{
  Console.WriteLine("Passed!");
}
```

In C# the opening bracket stays on a new line

Check your solution here: https://alpha.judge.softuni.org/contests/basic-syntax-conditional-statements-and-loops-lab/1188/practice#1

The If-Else Statement

- Executes **one branch** if the condition is **true** and **another** if it is **false**
- Example: **Upgrade** the last example, so it prints "**Failed!**" if the mark is lower than 3.00:

```
if (grade >= 3.00)
{
  Console.WriteLine("Passed!");
}
else
{
  // TODO: Print the message
}
```

The `else` keyword stays on a new line

Check your solution here: https://alpha.judge.softuni.org/contests/basic-syntax-conditional-statements-and-loops-lab/1188/practice#2

Problem: Back in 30 Minutes

- Write a program that reads hours and minutes from the console and calculates the time after 30 minutes
  - The hours and the minutes come on separate lines
- Examples

1 46	→	2:16	0 01	→	0:31	23 59	→	0:29
11 08	→	11:38	12 49	→	13:19	11 32	→	12:02

Check your solution here: https://alpha.judge.softuni.org/contests/basic-syntax-conditional-statements-and-loops-lab/1188/practice#3

Solution: Back in 30 Minutes

```
int hours = int.Parse(Console.ReadLine());
int minutes = int.Parse(Console.ReadLine()) + 30;
if (minutes > 59) {
  hours += 1;
  minutes -= 60;
}
if (hours > 23) {
  hours = 0;
}
Console.WriteLine("{0}:{1:D2}", hours, minutes);
```

Check your solution here: https://alpha.judge.softuni.org/contests/basic-syntax-conditional-statements-and-loops-lab/1188/practice#3

The Switch-Case Statement

Simplified If-else-if-else

The Switch-case Statement

- Switch-case statement works as a sequence of `if-else`
- Example: Read an input number and print its corresponding month

```
int month = int.Parse(Console.ReadLine());
switch (month)
{
  case 1: Console.WriteLine("January"); break;
  case 2: Console.WriteLine("February"); break;
  // TODO: Add the other cases
  default: Console.WriteLine("Error!"); break;
}
```

Problem: Foreign Languages

- By given country print its typical language:
  - English → England, USA
  - Spanish → Spain, Argentina, Mexico
  - other → unknown

England	English
Spain	Spanish

Check your solution here: https://alpha.judge.softuni.org/contests/basic-syntax-conditional-statements-and-loops-lab/1188/practice#5

Solution: Foreign Languages

```
switch (country)
{
  case "USA":
  case "England": Console.WriteLine("English"); break;
  case "Spain":
  case "Argentina":
  case "Mexico": Console.WriteLine("Spanish"); break;
  default: Console.WriteLine("unknown"); break;
}
```

Check your solution here: https://alpha.judge.softuni.org/contests/basic-syntax-conditional-statements-and-loops-lab/1188/practice#5

&&

Logical Operators

Writing More Complex Conditions

Logical Operators

- Logical operators give us the ability to write multiple conditions in one `if` statement
- They return a boolean value and compare boolean values

Operator	Notation in C#	Example
Logical NOT	!	!false → true
Logical AND	&&	true && false → false
Logical OR	||	true || false → true

Problem: Theatre Promotions

- A theatre has the following ticket prices according to the age of the visitor and the type of day
  - If the age is < 0 or > 122, print "Error!":

Day / Age	0 <= age <= 18	18 < age <= 64	64 < age <= 122
Weekday	12$	18$	12$
Weekend	15$	20$	15$
Holiday	5$	12$	10$

```
Weekday
42
```
→
```
18$
```

```
Holiday
-12
```
→
```
Error!
```

Check your solution here: https://alpha.judge.softuni.org/contests/basic-syntax-conditional-statements-and-loops-lab/1188/practice#6

Solution: Theatre Promotions

```
var day = Console.ReadLine().ToLower();
var age = int.Parse(Console.ReadLine());
var price = 0;
if (day == "weekday")
{
  if ((age >= 0 && age <= 18) || (age > 64 && age <= 122))
  {
    price = 12;
  }
  // TODO: Add else statement for the other group
} // Continues on the next slide…
```

Solution: Theatre Promotions

```
else if (day == "weekend")
{
  if ((age >= 0 && age <= 18) || (age > 64 && age <= 122))
  {
    price = 15;
  }
  else if (age > 18 && age <= 64)
  {
    price = 20;
  }
} // Continues on the next slide…
```

Solution: Theatre Promotions

```
else if (day == "holiday")
{
  if (age >= 0 && age <= 18)
    price = 5;
  // TODO: Add the statements for the other cases
}
if (price != 0)
  Console.WriteLine(price + "$");
else
  Console.WriteLine("Error!");
```

Check your solution here: https://alpha.judge.softuni.org/contests/basic-syntax-conditional-statements-and-loops-lab/1188/practice#6

Loops

Code Block Repetition

Loop: Definition

- A loop is a control statement that repeats the execution of a block of statements. The loop can
  - Execute a code block a fixed number of times
    - `for` loop
  - Execute a code block while a given condition returns true
    - `while`
    - `do…while`

For Loops

Managing the Count of the Iteration

For Loops

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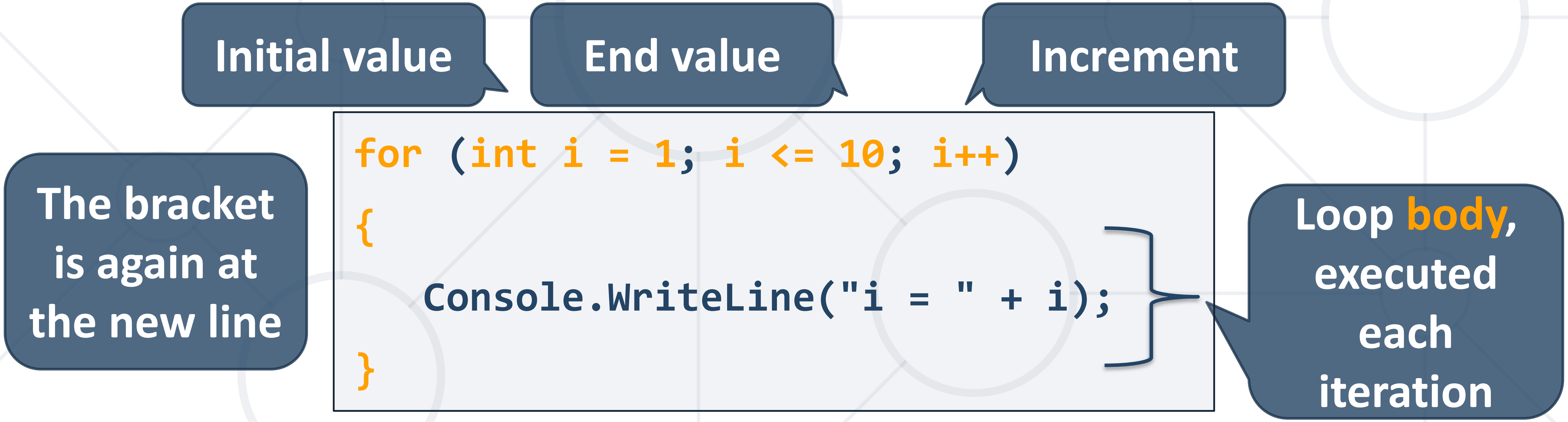
- The **for** loop executes statements a fixed number of times:


Initial value
End value
Increment
The bracket is again at the new line
Loop body, executed each iteration

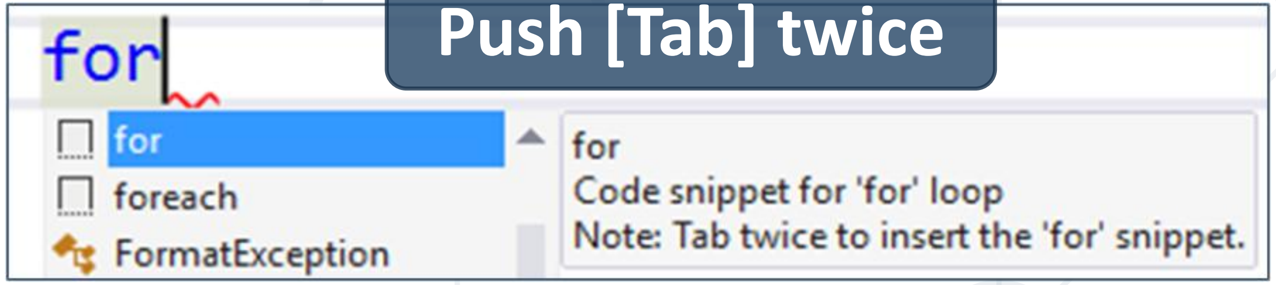
```
for (int i = 1; i <= 10; i++)
{
    Console.WriteLine("i = " + i);
}
```

Example: Divisible by 3

- Print the numbers from 1 to 100 that are divisible by 3

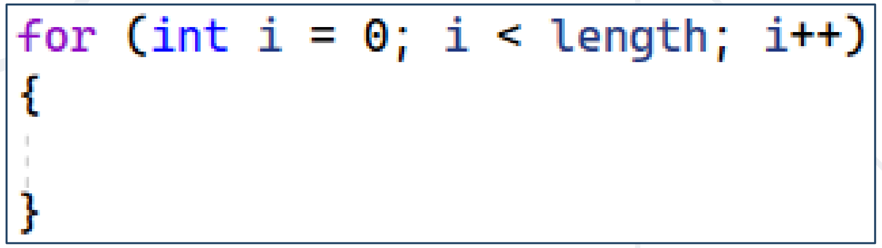
```
for (var i = 3; i <= 100; i += 3)
{
  Console.WriteLine(i);
}
```

- You can use "**for**" code snippet in Visual Studio



```
for
```

for
Code snippet for 'for' loop
Note: Tab twice to insert the 'for' snippet.



```
for (int i = 0; i < length; i++)
{

}
```

Problem: Sum of Odd Numbers

- Write a program to print the first **n** odd numbers and their sum

```
5
```

```
1
3
5
7
9
Sum: 25
```

```
3
```

```
1
3
5
Sum: 9
```

Check your solution here: https://alpha.judge.softuni.org/contests/basic-syntax-conditional-statements-and-loops-lab/1188/practice#8

Solution: Sum of Odd Numbers

```
var n = int.Parse(Console.ReadLine());
var sum = 0;

for (int i = 1; i <= n; i++)
{
  Console.WriteLine("{0}", 2 * i - 1);
  sum += 2 * i - 1;
}
Console.WriteLine("Sum:{0}", sum);
```

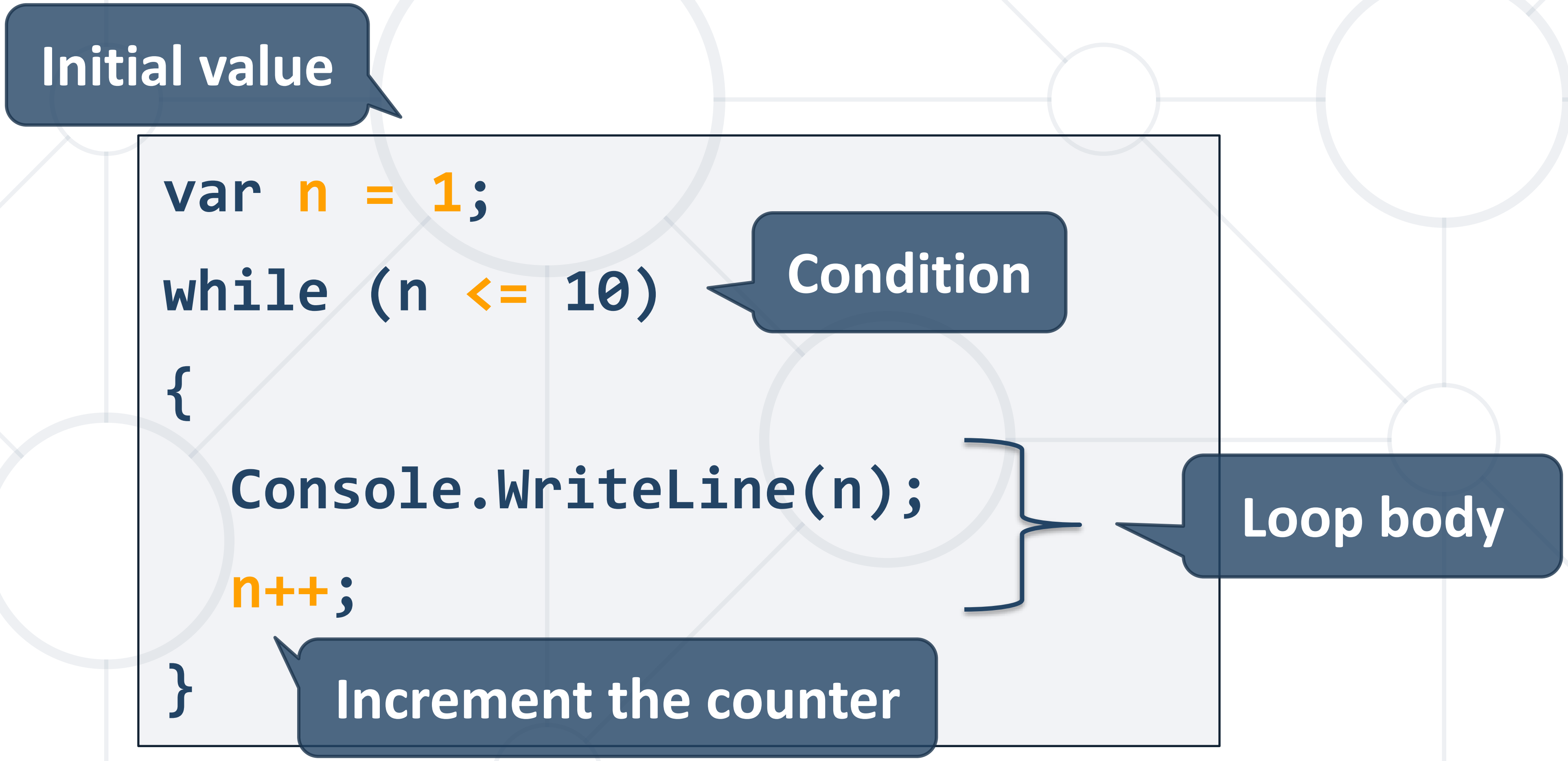
Check your solution here: https://alpha.judge.softuni.org/contests/basic-syntax-conditional-statements-and-loops-lab/1188/practice#8

Iterations While a Condition is True

While Loops

While Loops

- Executes commands **while** the **condition** is **true**



```
var n = 1;
while (n <= 10)
{
   Console.WriteLine(n);
   n++;
}
```

Problem: Multiplication Table

- Print a table holding number*1, number*2, …, number*10

```
var number = int.Parse(Console.ReadLine());
var times = 1;
while (times <= 10)
{
  Console.WriteLine(
    $"{number} X {times} = {number * times}");
  times++;
}
```

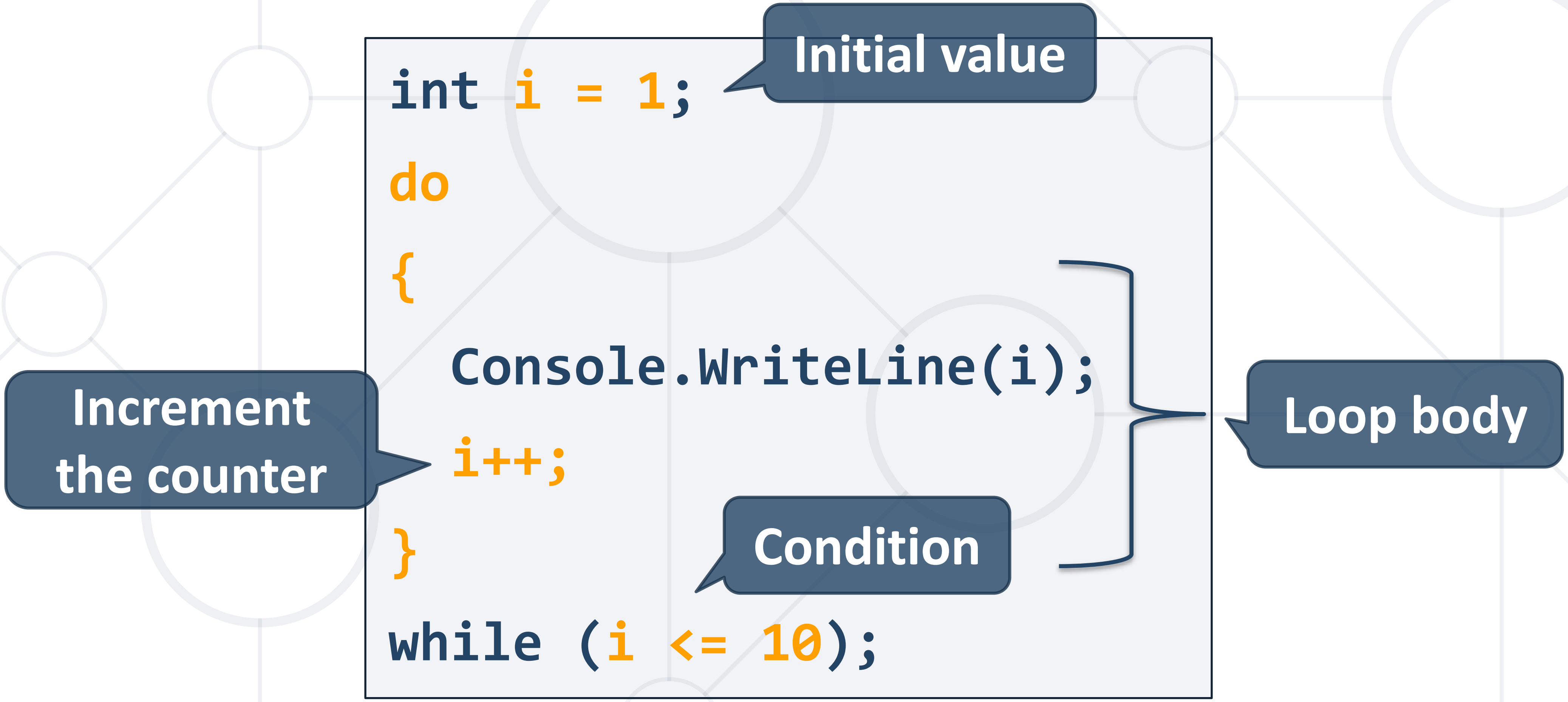
Check your solution here: https://alpha.judge.softuni.org/contests/basic-syntax-conditional-statements-and-loops-lab/1188/practice#9

Do…While Loop

Executes Code Block One or More Times

Do...While Loop

- Similar to the **while** loop, but always executes at least once



```
int i = 1;
do
{
  Console.WriteLine(i);
  i++;
}
while (i <= 10);
```

Problem: Multiplication Table 2.0

- Upgrade your program and take the initial times from the console

```
int number = int.Parse(Console.ReadLine());
int times = int.Parse(Console.ReadLine());
do
{
  Console.WriteLine(
    $"{number} X {times} = {number * times}"
  );
  times++;
} while (times <= 10);
```

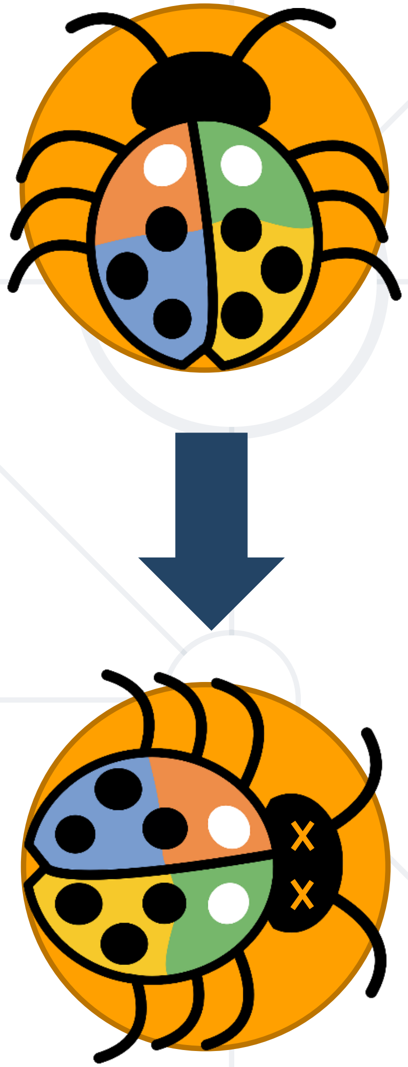
Check your solution here: https://alpha.judge.softuni.org/contests/basic-syntax-conditional-statements-and-loops-lab/1188/practice#10

Debugging and Troubleshooting

Using the Visual Studio Debugger

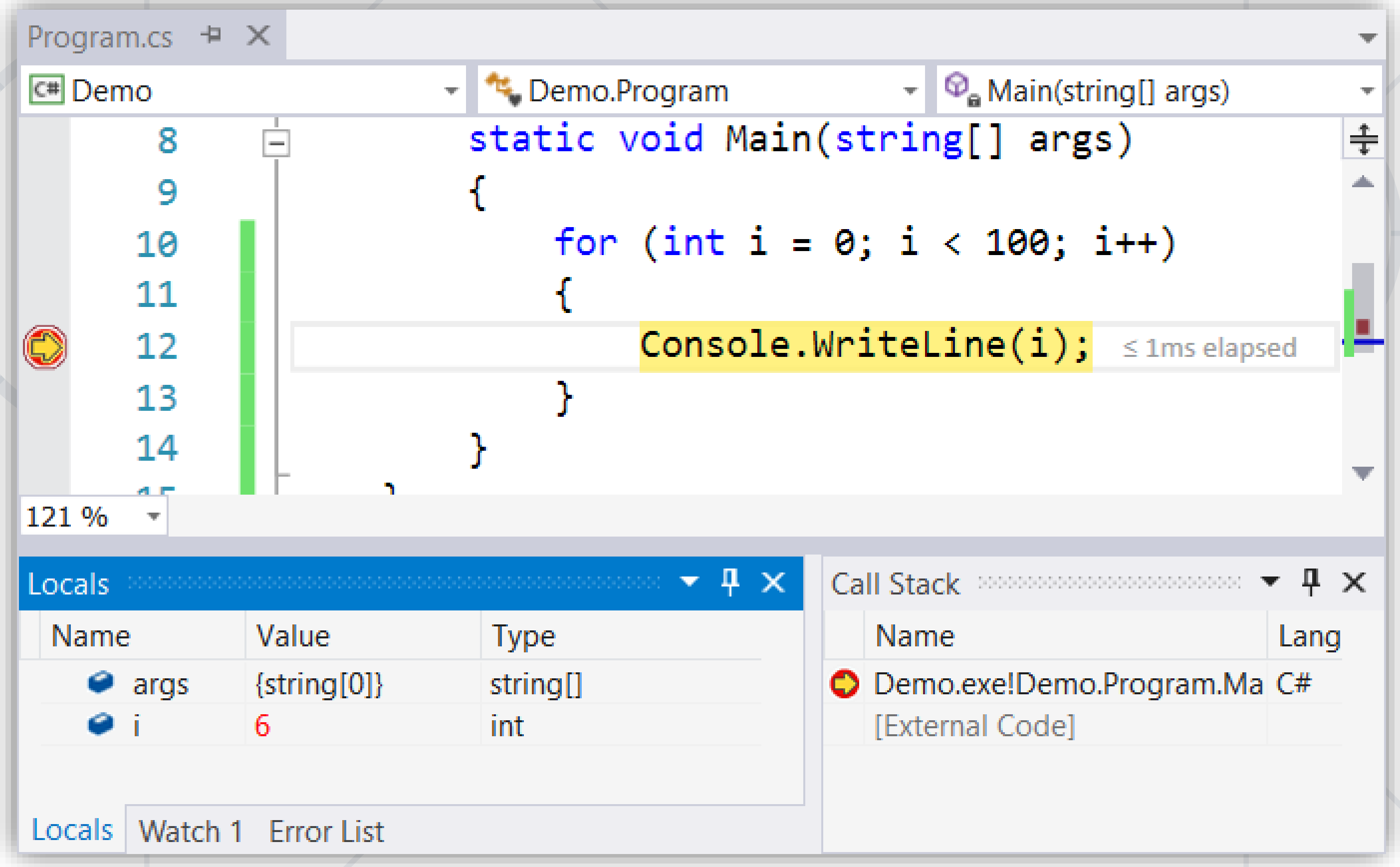
Debugging the Code

- The process of **debugging an application** includes
  - Spotting an error
  - Finding the lines of code that cause the error
  - Fixing the error in the code
  - Testing to check if the error is gone and no new errors are introduced
- Iterative and continuous process



Debugging in Visual Studio

- Visual Studio has a built-in **debugger**
- It provides
  - **Breakpoints**
  - Ability to **trace** the code execution
  - Ability to **inspect** variables at runtime



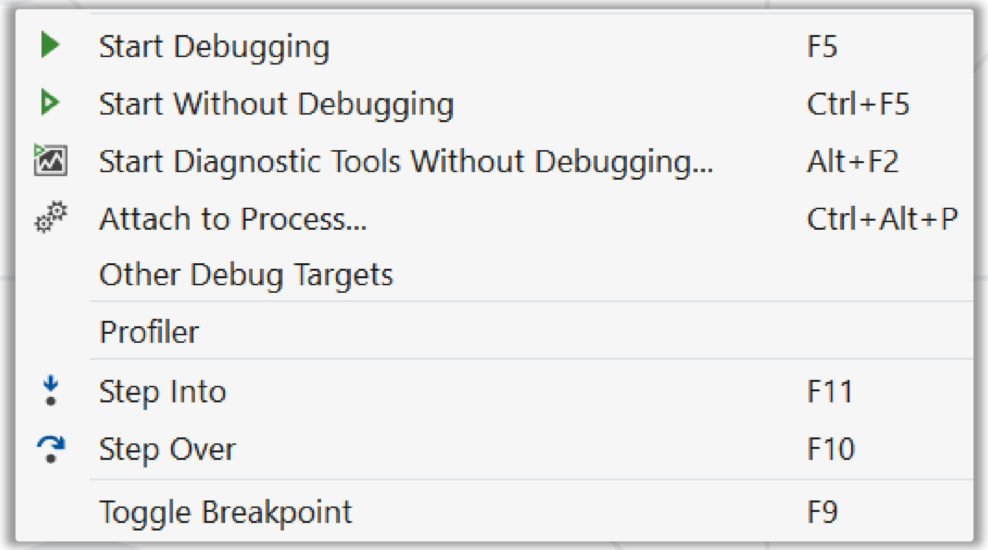
```
static void Main(string[] args)
{
    for (int i = 0; i < 100; i++)
    {
        Console.WriteLine(i);
    }
}
```

Name	Value	Type
args	{string[0]}	string[]
i	6	int

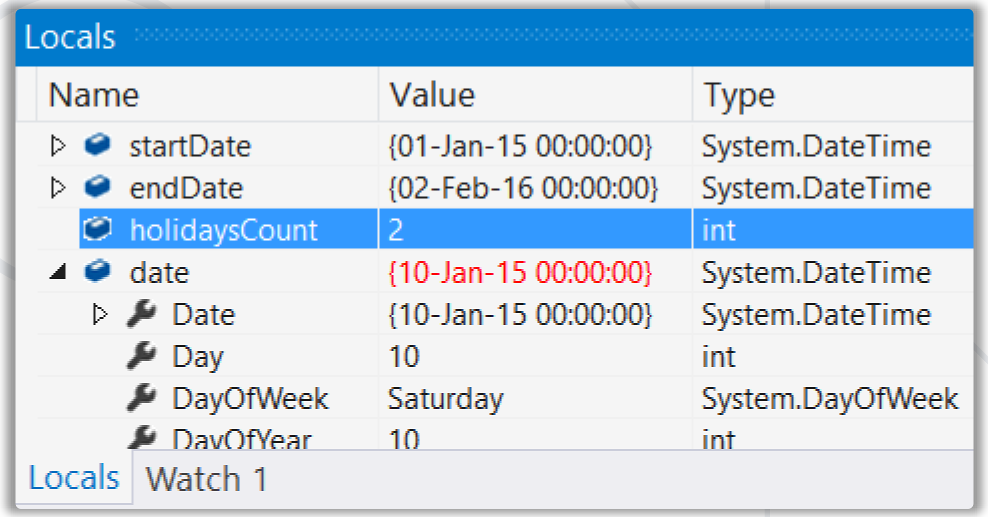
Name	Lang
Demo.exe!Demo.Program.Ma	C#
[External Code]	

Using the Debugger in Visual Studio

- Start without Debugger: **[Ctrl+F5]**
- Toggle a breakpoint: **[F9]**
- Start with the Debugger: **[F5]**
- Trace the program: **[F10]** / **[F11]**
- Using the **Locals** / **Watches**
- Conditional breakpoints
- Enter debug mode after exception



Start Debugging	F5
Start Without Debugging	Ctrl+F5
Start Diagnostic Tools Without Debugging...	Alt+F2
Attach to Process...	Ctrl+Alt+P
Other Debug Targets	
Profiler	
Step Into	F11
Step Over	F10
Toggle Breakpoint	F9



Locals

Name	Value	Type
▷ startDate	{01-Jan-15 00:00:00}	System.DateTime
▷ endDate	{02-Feb-16 00:00:00}	System.DateTime
holidaysCount	2	int
◢ date	{10-Jan-15 00:00:00}	System.DateTime
▷ Date	{10-Jan-15 00:00:00}	System.DateTime
Day	10	int
DayOfWeek	Saturday	System.DayOfWeek
DayOfYear	10	int

Summary

- Declaring Variables
- Using Console – Reading and Writing
- Conditional Statements allow implementing programming logic
- Loops repeat code block multiple times
- Using the debugger