# C# Basics

# IDE Environment Introduction

In this article, we are going to talk about what the IDE is and how can we use VisualStudio to create a new project.

## Integrated Development Environment (IDE)

An IDE is an environment tool which helps us writing the code for our programs. For this complete tutorial, we are going to use VisualStudio 2017. To download it, visit [VisualStudio Download Page](https://visualstudio.microsoft.com/downloads/?utm_medium=microsoft&utm_source=docs.microsoft.com&utm_campaign=button+cta&utm_content=download+vs2017). VisualStudio has a support for different programming languages, which makes it a very popular development tool.

After the installation, we can start a new project by clicking the File menu and choosing New => Project:



For this tutorial, we will use the console application project the most, so let's choose that option:



After we click on OK button, we are going to see our created project. The main file to work with is the Program.cs and very soon we are going to talk more about it:



## Watch Window

In some examples we are going to use this window to examine results. To open it we need to place a brake point on any code line first (by clicking left mouse button):



Then start our application by pressing F5, and finally to open the watch window:



## Conclusion

Now we know the basics and how to create a new project. Very soon we are going to use this knowledge in our applications.

# Data Types, Declarations and Variable Definitions

Different data types are registered differently and different actions are allowed to execute upon them as well. For different data types, a certain amount of space is reserved on our computer.

With data type we define:

* How to register data in memory
* The possible values for that data
* Possible actions on the data

## Data Type Registration

Data types that represent the whole numbers could be expressed with a certain number of bits. For unsigned numbers, the representation is from 0 to 2N-1. But for signed number the representation is from -2N-1 to 2N-1-1. So if the data type has a size of 8 bits like the sbyte data type, we can represnt its range like this: from -27 to 27-1 => from -128 to 127.

In the next table, we will show the different data types that represent the whole numbers:

| Type | Size (bits) | Range (values) |
| --- | --- | --- |
| byte | 8 | 0 to 255 |
| sbyte | 8 | -128 to 127 |
| int | 32 | -2,147,483,648 to 2,147,483,647 |
| uint | 32 | 0 to 4294967295 |
| short | 16 | -32,768 to 32,767 |
| ushort | 16 | 0 to 65,535 |
| long | 64 | -9,223,372,036,854,775,808 to 9,223,372,036,854,775,807 |
| ulong | 64 | 0 to 18,446,744,073,709,551,615 |

Letter u in front of the type means that type can’t contain negative numbers, it is unsigned.

Above mentioned types are the whole number types. But in C#, we have the number types with the floating point.

We can present them in a table as well:

| Type | Size (bits) | Range (values) |
| --- | --- | --- |
| float | 32 | -3.402823e38 to 3.402823e38 |
| double | 64 | -1.79769313486232e308 to 1.79769313486232e308 |
| decimal | 128 | (+ or -)1.0 x 10e-28 to 7.9 x 10e28 |

Next to all of this types, in C# we have two more basic type data:

| Type | Size (bits) | Range (values) |
| --- | --- | --- |
| char | 16 | Single Unicode sign, a whole number from 0 to 65535 |
| bool | 8 | false, true |

To use char type in our code we must place it inside the single quotes: ’a’ or ’A’ or ’3’...

One more type that is often introduced as the basic data type is the **string** type. But the string is not a value type it is referent type. To use a string in our code we must place the value inside the double quotes: „This is the string type“ or „3452“...

So, we saw we have the value types and referent types, and it is time to talk more about those types and variables as well.

## Variables in C#

Variable is a name of a memory location in which application stores values.

We should create our variables by following examples:

* studentName
* subject
* work\_day ...

The wrong examples would be

* student Name
* work-day
* 1place...

We must mention that C# is case sensitive language so the **studentName** is not the same as the **StudentName**.

The C# language has its own set of reserved words, so-called keywords. We can't use them as a name for our variables. For the list of keywords you can visit: [keyword-list](https://docs.microsoft.com/en-us/dotnet/csharp/language-reference/keywords/).

In C#, we have variables divided into two categories: **Value** type and **Reference** type. The difference is that the value type variables stores their values inside their own memory locations, but the memory location for the reference type variables contains only address to the dynamic memory location where the value is stored.

Let’s see how the value types behave in a graphic example:



Let’s do the same for the reference types:



## Variable Declarations and Expressions

We can accomplish variable declaration in following way:

<data type> <variable name> ; or <data type> <variable name>, <variable name> ... ;

So few examples would be:

class Program

{

static void Main(string[] args)

{

int age;

double temperature, change;

Student student;

}

}

Just with the declaration, we can't assign a value to a value type variables. To do that, we need to use expressions in addition:

<data type> <variable name> = <expression> ;

class Program

{

static void Main(string[] args)

{

int x = 5;

int y = 145 + x;

char p = 'p';

p = 'A';

}

}

To add a value for the referent type of variable, we need to use the **new** keyword in expression part:

class Program

{

static void Main(string[] args)

{

Student student = new Student("John", 25);

}

}

## Conclusion

Now we have learned how to declare our variables and how to assign values to them as well.

In a next post, we are going to talk about operators in C#.

# Operators in C#

The most used operators in C# are:

|  |  |
| --- | --- |
| Category | Operators |
| Aritmetic | + - \* / % |
| Relational | == != < <= > >= |
| Logical | ! && || |

## Arithmetic Operators

Arithmetic operators are defined for all the numeric data types. Operators +, -, \*, / represent the basic binary arithmetic operations (addition, subtraction, multiplication and division). Operator % is the remainder after division. Important thin to notice is that the + operator behaves differently with the number and string types. With numbers 5 + 5 is 10. But with strings „5“ + „5“ is „55“. So with the number type it is addition operator but with the string type it is concatination operator.

## Relational Operators

All the relational operators return a true or false result. They are used to compare expressions or variables from both sides of the relational operator. These operators have a lower priority than arithmetic ones. So in the following example: x\*a-8\*b>y+5\*z; the left side is calculated first then the right side and then they are compared.

For the value type variables and the strings, the == (equality) operator will return true only if they are the same, otherwise, it will return false. But if variables are of referent types then the == operator will return true only if those two variables point to the same memory location, otherwise, it will return false.

So let's see this through an example:



We see that a and b are the equal as well as the s1 and s2. But the student1 and student2 are not equal because they point to different memory locations. But if we create another variable of type Student and assign the value of student1 variable to it, the == operator will return true:



## Logical Operators

The logical operators && (and) and || (or) serve to connect logical values. Expression <expression1>&&<expression2> is true only if both expressions are true. Expression <expression1>||<expression2> is false only if both expressions are false, otherwise, it is true.

The ! (negation) operator negates logical value it is applied on. It has the highest priority of all the operators mentioned. So the expression !logicalValue will be false only if logicalValue is true and vice verse.

## Increment and Decrement Operators

In the C# language, we can use operators than increments and decrements the variable value by 1. Those operators are ++ and --. So, the better way of writing this code:

static void Main(string[] args)

{

int a = 15;

a = a + 1; //now it is 16

}

Is to write it like this:

static void Main(string[] args)

{

int a = 15;

a++; //now it is 16

}

The same applies for the -- operator.

These two operators have the prefix --variable, ++variable and suffix variable--, variable++ notations. Even though both notations will change the value by 1, the result will be different. This is easier to explain through an example:



What we notice is that the prefix notation will decrement the value of "a" variable first and then assign that value to the "b" variable. But the expression with suffix notation is different. The value of the "c" variable is assigned to the "d" variable first and then decremented by 1.

The same applies for the increment operator:



Excellent. Now we have more knowledge about operators in C#. In a next part we are going to talk about the type conversions in C#.

# Type Conversion

In C#, data can be converted from one type to another by using implicit conversion (automatic) and explicit conversion (programmers take control of this conversion).

## Implicit Conversion

Many different data could be interpreted by using different types. For example, number 74 can be interpreted as an integer but also as double (74.0). We can differentiate two situations in which implicit conversion applies.

The first one is when we calculate an expression, the compiler automatically adapt data types that we use in that expression:

class Program

{

static void Main(string[] args)

{

double b = 12.45;

int x = 10;

b = b + x;

}

}

In the code above the „b“ variable is of type double and „x“ is of type int. In the expression b + x, the compiler implicitly converts "x" from int to double and then it assigns a result to the "b".

The second situation for a conversion is when the compiler store the result to a variable:



In this example, we see that both „x“ and „y“ are of type int, but the result is of type double.

## Explicit Conversion

For the explicit conversion, we need to write additional code to convert one type to another. We have two different ways, by using cast operator or by using class Convert.

Let's look at the following example:



The compiler complains about an invalid conversion. What we are missing here is the cast operator, so let's use it:



By using the cast „(int)“ operator, our compiler is not complaining anymore. But what we see is that our result is not what we have expected. But this is the correct result. It is very important to understand that the cast operator can shrink data when we convert the type with the larger value scope to a type with the smaller value scope.

As we said, we can use the Convert class with its static methods, to explicitly convert one base type to another base type:



# Linear Structures

In this article, we are going to show how to solve simple problems by using linear structures. We are going to accept inputs, work with them and print the output to the console window.

So let’s start.

Example 1: We need to print out the sum of two integer values which user inputs in the console window.

Let’s create a new console application and name it SumGenerator. Then let’s type this code inside the Main method:

namespace SumGenerator

{

class Program

{

static void Main(string[] args)

{

Console.WriteLine("Write the first integer:");

int first = Convert.ToInt32(Console.ReadLine());

Console.WriteLine("Write the second integer:");

int second = Convert.ToInt32(Console.ReadLine());

int result = first + second;

Console.WriteLine($"The result is {result}");

Console.ReadKey();

}

}

}

With the Console.WriteLine() statement, we display the message on the console window and move to the next line. TheConsole.ReadLine() statement will read our input, but it is of type string and what we need is an int type. So, we need to convert it with the Convert.ToInt32() statement. Finally, we calculate the sum and print it out. The Console.ReadKey() statement is here just to keep our console window open.

Let’s press F5 to start our application and enter two integer numbers:



Example 2: Write an application which for two provided inputs (name and last name), prints out the full name in a format name <space> last name.

Let’s create a new console application and to write this code:

namespace FullNameGenerator

{

class Program

{

static void Main(string[] args)

{

Console.WriteLine("What is your first name:");

string name = Console.ReadLine();

Console.WriteLine("What is your last name:");

string lastName = Console.ReadLine();

string fullName = name + " " + lastName;

Console.WriteLine($"Your full name is: {fullName}");

Console.ReadKey();

}

}

}

Excellent.

Now we know how to manipulate with inputs in our programmes and how to display the result in the console window.