First Steps in Programming

Data Types, Variables, Conditional Statements

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Have a Question?

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What is Programming?

Introduction

What is Programming?

- Programming is the process of **giving instructions** to a computer to perform specific tasks or solve problems
- It involves **writing code** using a programming language, which serves as a **set of commands** and instructions that the computer can understand and execute
- Programming involves creating **step-by-step algorithms** that outline the **logical sequence of operations** to achieve a desired outcome

What is a Programming Language?

- A programming language is a **set of instructions** that allows humans to communicate with computers
- It serves as an **intermediary between human logic and machine operations**, enabling programmers to write code to perform specific tasks
- Each programming language has its **unique syntax**, which defines the rules and structure for writing code

What is a Computer Program?

- A computer program is a **set of instructions** written in a programming language that directs a computer to perform specific tasks or operations
- These instructions are **executed sequentially or conditionally**, and the program's logic determines how the computer responds to different inputs
- Computer Programs are written in text format:
  - The text of the program is called **source code**
- The source code is compiled into an executable file:
  - For example: **Program.cs** is compiled to **Program.exe**

Integrated Development Environment

Visual Studio

IDE – Integrated Development Environment

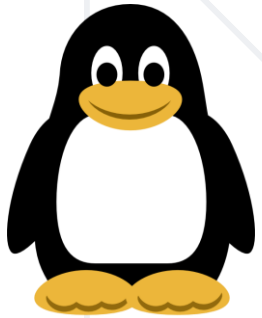
- An **Integrated Development Environment** (**IDE**) is used to streamline and enhance the software development process by providing programmers with tools for coding, debugging, testing, and project management, all within a single unified interface
- An Integrated Development Environment (IDE) is a software application that provides programmers with a comprehensive and **user-friendly platform for developing software**

Visual Studio

- **Visual Studio** is a powerful and widely-used IDE that will be your primary tool throughout this course
- Visual Studio is a development environment for the C# programming language
- Install Visual Studio on your computer:
  - Installation guide

Visual Studio - Platforms

- Visual Studio is available on **multiple platforms**, making it accessible to a wide range of developers
  - Windows
  - MacOS
  - Linux

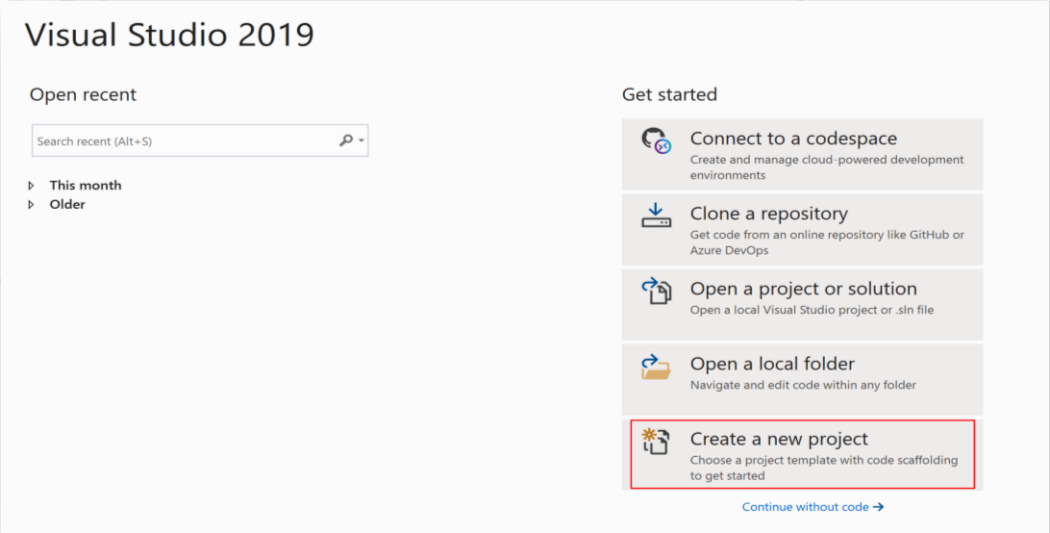


First Console Program

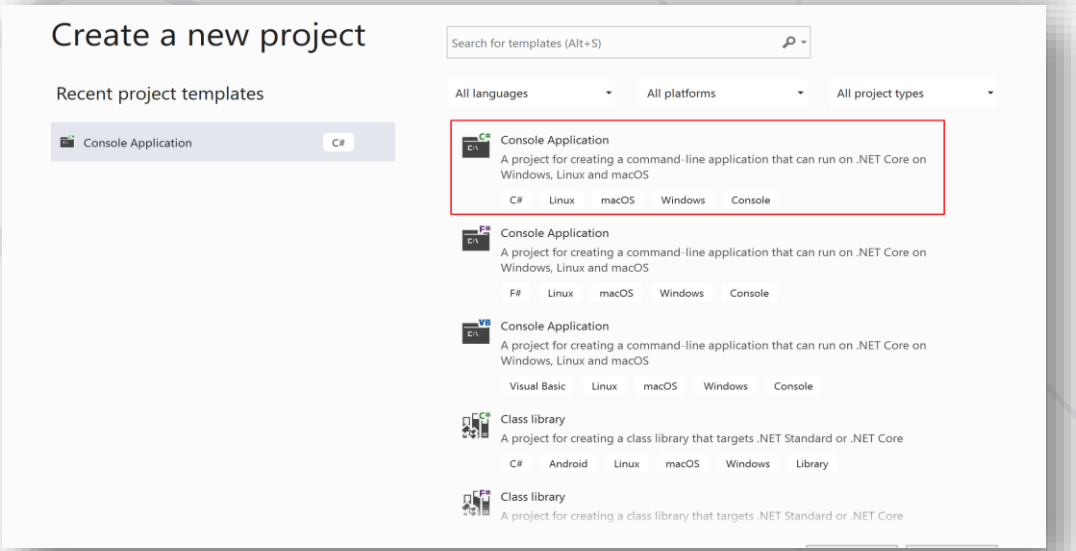
Hello, World!

Creating a Console Program (1)

- Start Visual Studio
- Select Create a new project

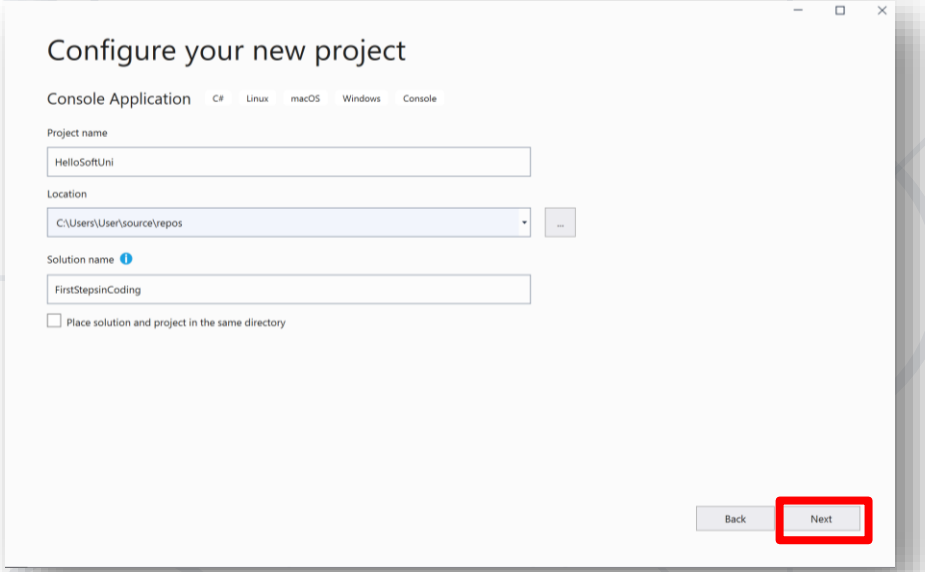


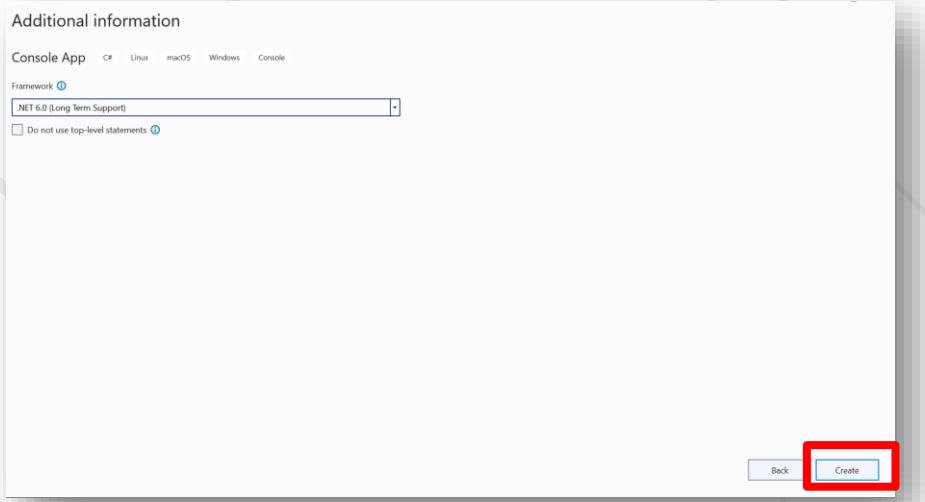
- Select Console Application
- Click Next



Creating a Console Program (2)

- Enter a **proper project name** and **choose** the desired **directory for the new project**
- Choose **Next**
- **Select the .NET 6.0 framework**
- Choose **Create**





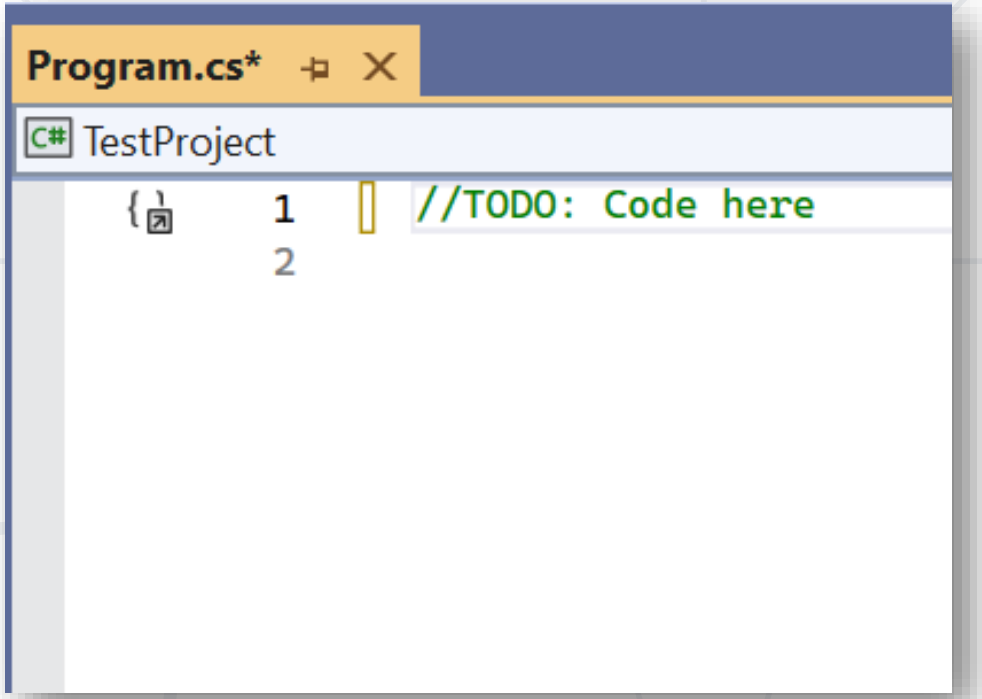
Writing Source Code (1)

- We **used to** write the source code in the following section, so far: `Main(string[] args)`
  - Between the curly braces `{ }`
- Hit [Enter] after the opening bracket `{`
- The source code should be written **indented**

```
namespace HelloSoftUni
{
    0 references
    class Program
    {
        0 references
        static void Main(string[] args)
        {
            // TODO: Code here
        }
    }
}
```

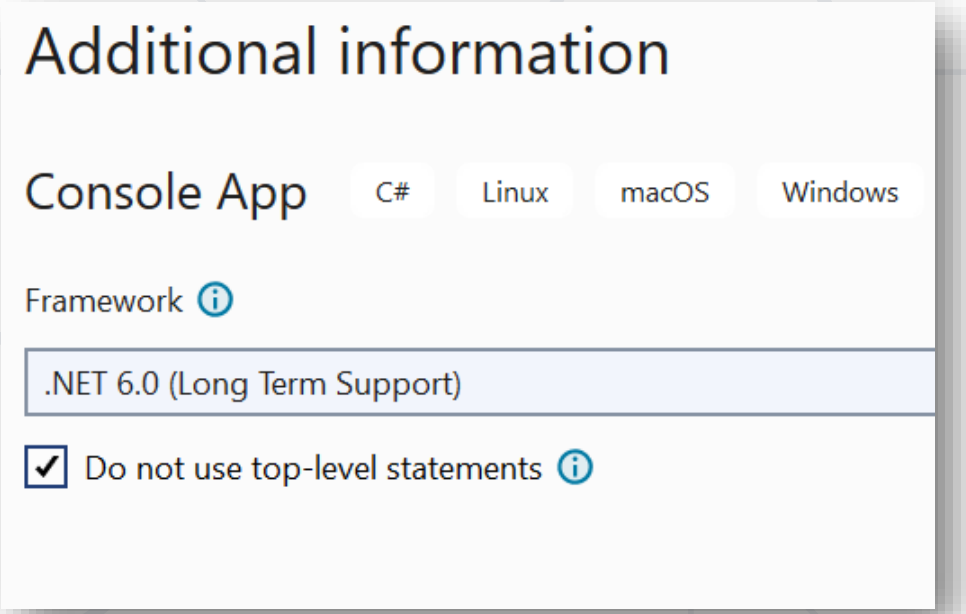
Writing Source Code (2)

- In **.NET 6.0**, a new approach simplifies your first console program, **using top-level statements**
- Instead of the traditional **Main** method, you start writing code directly, making it more intuitive
- Just start typing your code, and .NET 6.0 framework will handle the setup and the execution for you



Writing Source Code (3)

- While .NET 6.0 introduces the convenience of top-level statements, we'll begin by understanding the foundational concepts of **traditional C# programming**
- We'll start with the familiar structure of the **Main** method, encapsulating our code within it
- Starting **without top-level statements**, gives you a deeper appreciation for the structure and logic behind every line of code



Problem – First Console Program

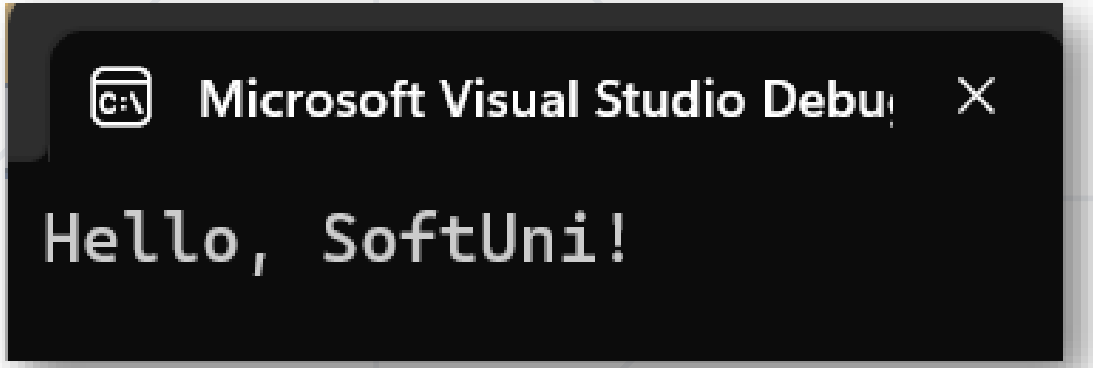
- Congratulations! It's time to write your very first C# program
- Locate the Main method, enclosed by curly brackets
- Inside the Main method, add the following code:

```
Console.WriteLine("Hello, SoftUni!");
```

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

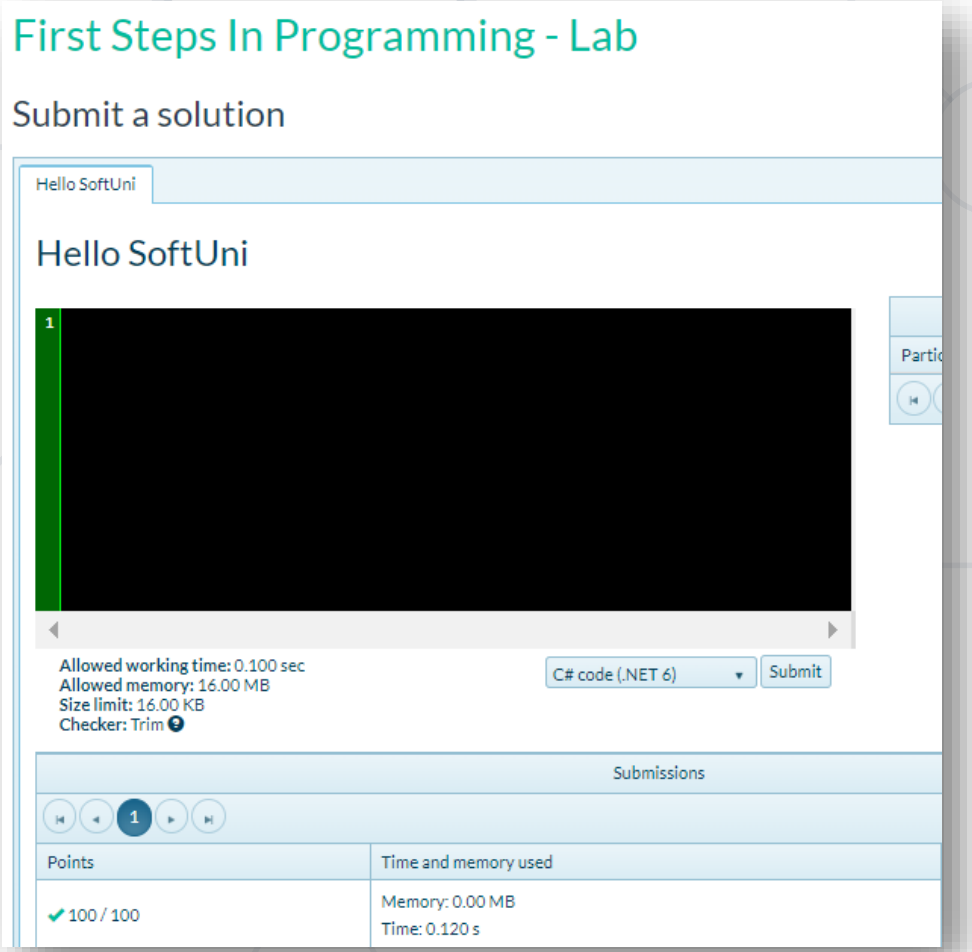
Build And Run The Program

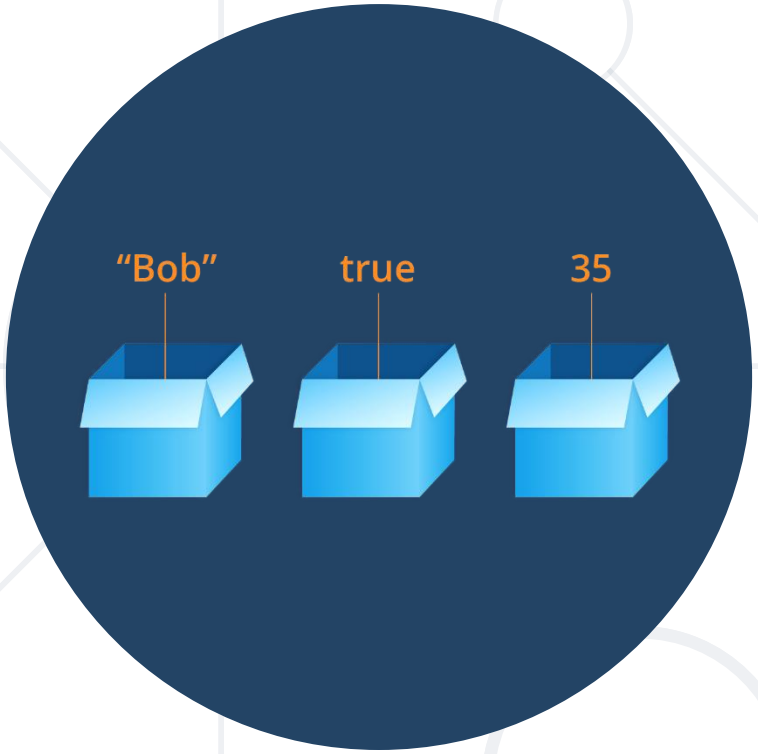
- Press **Ctrl + F5** to build and run the program
- If no exceptions are thrown, your program will execute
- The desired result will be displayed in the console:



Testing the Project

- Test your code online in the Judge system:





Variables & Data Types

Variables

- Computers are machines that process **data**
  - Data is stored in the computer memory using **variables**
  - Variables have **name**, **type** and **value**
- **Defining** a variable and **assigning** a value:

Type

Name of the variable

```
int count = 5;
```

Value

Data Types

- Variables store **values of a given type**
  - number, letter, text (string), date, color, image, list, …
- Data Types - examples:
  - `int` - integer: **1**, **2**, **3**, **4**, **5**, …
  - `double` – floating-point number: **0.5**, **3.14**, **-1.5**…
  - `string` – text: **"Hello"**, **"Hi"**, **"Car"**, …
  - `char` - character: **'A'**, **'#'**, **'@'**, **'+'**, …

Working with the Console

Reading Text

- Everything **received** from the Console, comes in **text format**
- Everything **printed** on the Console is **transformed into text**
- Command for reading from the console:

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

  - Returns the text entered by the user

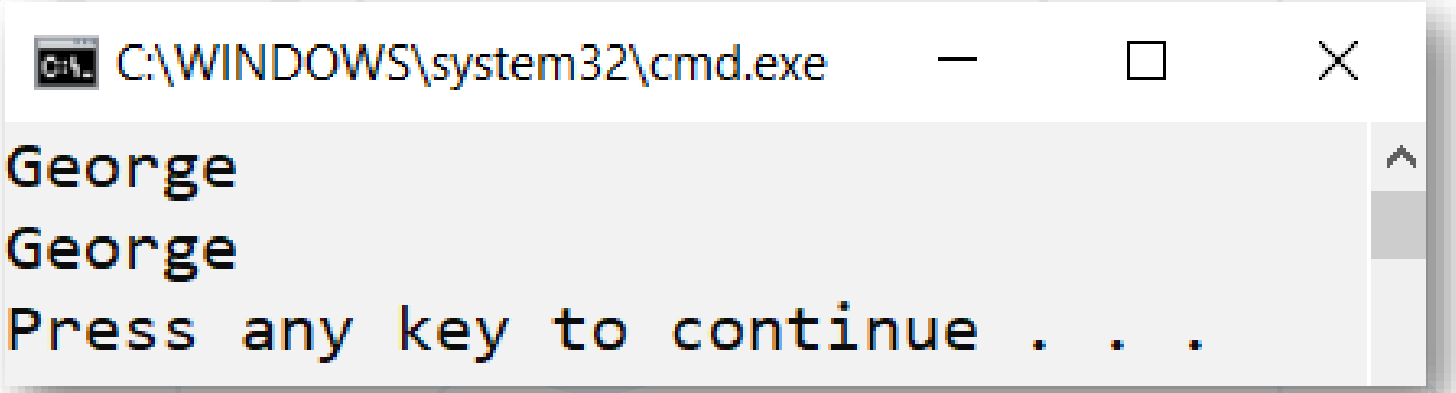
Problem - Text Reading

A program, that **reads** a name from the Console and **prints** it:

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

Example input

Output



Reading Numbers

- Reading an integer value:

```
string input = Console.ReadLine();
int num = int.Parse(input);
```

- Example: calculating the area of a square with side length **a**:

```
int a = int.Parse(Console.ReadLine());
int area = a * a;
Console.WriteLine(area);
```

Reading a integer value on a single line

Reading floating point number

- Reading a floating-point number from the Console:

```
string input = Console.ReadLine();
double num = double.Parse(input);
```

- Example: convert inches to centimeters

```
double inches = double.Parse(Console.ReadLine());
double centimeters = inches * 2.54;
Console.WriteLine(centimeters);
```

Reading a floating point number on a single line

Expressions

Arithmetical operations: + and -

- Adding numbers (**operator +**):

```
int a = 5;
int b = 7;
int sum = a + b;  // 12
```

- Subtracting numbers (**operator -**):

```
int a = int.Parse(Console.ReadLine());
int b = int.Parse(Console.ReadLine());
int result = a - b;
Console.WriteLine(result);
```

Arithmetical operations: * and /

- Multiplication of numbers (**operator ***):

```
int a = 5;
int b = 7;
int product = a * b;  // 35
```

- Division of numbers (**operator /**):

```
int a = 25;
int b = a / 4;   // 6 – the fractional part is cut off
double c = a / 4.0;  // 6.25 – fractional division
int error = a / 0;   // Error: division by 0
```

Division of numbers - particularities

- When dividing integers, the result is **integer**:

```
int a = 25;
Console.WriteLine(a / 4);    // Integer result: 6
Console.WriteLine(a / 0);    // Error: division by 0
```

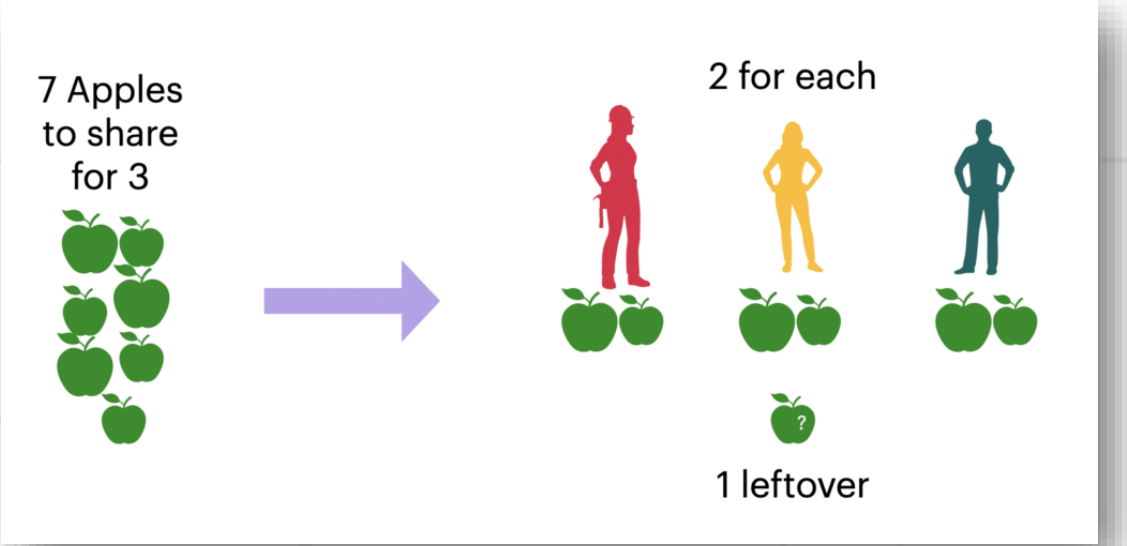
- When dividing floating point numbers, the result is **floating point number (double, decimal, float)**:

```
double a = 15;
Console.WriteLine(a / 2.0);    // Floating point: 7.5
Console.WriteLine(a / 0.0);    // Result: Infinity
Console.WriteLine(0.0 / 0.0); // Result: NaN
```

Arithmetical operations: %

- Modulo / remainder of integer division of numbers (**operator %**):

```
int a = 7;
int b = 3;
int product = a % b; // 1
```




```
int odd = 3 % 2;      // 1 - number 3 is odd
int even = 4 % 2;     // 0 - number 4 is even
int error = 3 % 0;    // Error: division by 0
```

Conditional Statements

if-else, switch case

Comparing Numbers

- In computer programming, we can compare values:

```
var a = 5;
var 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
```

Operator < (less than)

Operator > (greater than)

Operator <= (less than or equal)

Operator == (equal)

Comparing Operators

Operator	Designation	Can be used with
Equality check	==	numbers, text, date
Difference check	!=	
Greater than	>	numbers, date, other comparable types
Greater than or equal	>=	
Less than	<	
Less than or equal	<=	

- Example:

```
var result = (5 <= 6);
Console.WriteLine(result); // True
```

Simple Verifications

- In computer programming, we often **check conditions** and perform various actions based on the result of the check
  - **Example**: We enter a grade and check if it is excellent

```
double grade = double.Parse(Console.ReadLine());
if (grade >= 5.50)
{
   Console.WriteLine("Excellent!");
}
```

If-else conditional statements

- Enter a grade and check if it is excellent or not

```
double grade = double.Parse(Console.ReadLine());
if (grade >= 5.50)
{
   Console.WriteLine("Excellent!");
}
else
{
   Console.WriteLine("Not excellent.");
}
```

Curly braces { } after If / Else

- The curly braces { } initiate a block (group of commands)
  - Without the braces after **if** the following lines will be executed:

```
string color = "red";
if (color == "red")
  Console.WriteLine("tomato");
else
  Console.WriteLine("banana");
  Console.WriteLine("bye");
```

tomato
bye

```
string color = "red";
if (color == "red")
{
  Console.WriteLine("tomato");
}
else
{
  Console.WriteLine("banana");
  Console.WriteLine("bye");
}
```

tomato

Even or Odd – Problem example

- Verification if an integer value is even or odd:

```
int num = int.Parse(Console.ReadLine());
if (num % 2 == 0)
{
   Console.WriteLine("even");
}
else
{
   Console.WriteLine("odd");
}
```

The Greater Number – Problem example

- Write a program that reads **two integers** from the Console and outputs the greater of the two numbers
  - **Constraints:** Numbers should not be equal

```
int num1 = int.Parse(Console.ReadLine());
int num2 = int.Parse(Console.ReadLine());
if (num1 > num2)
  { Console.WriteLine("Greater number: " + num1); }
else
  { Console.WriteLine("Greater number: " + num2); }
```

Chain of Probabilities

- The construction **if-else-if-else…** might be in a sequence:
  - Example: write the names of the numbers in order (1 to 10)

```
int num = int.Parse(Console.ReadLine());
if (num == 1)
   { Console.WriteLine("one"); }
else if (num == 2)
   { Console.WriteLine("two"); }
else if (num == 3)
   { Console.WriteLine("three"); } // TODO: add more checks
else
   { Console.WriteLine("number out of range"); }
```

Conditional statement Switch-case

- **Switch-case** works just as the sequence **if-else-if-else** does
- **Example**: Print on the console the day of the week, depending on the input number (1…7)

```
int day = int.Parse(Console.ReadLine());
switch (day)
{
  case 1: Console.WriteLine("Monday"); break;
  case 2: Console.WriteLine("Tuesday"); break;
  …
  case 7: Console.WriteLine("Sunday"); break;
  default: Console.WriteLine("Error"); break;
}
```

Multiple conditions in Switch-case

- Write a computer program, that prints on the Console the type of the animal, depending on its name: dog → mammal; crocodile, tortoise, snake → reptile; others → unknown

```
switch (animal)
{
  case "dog": Console.WriteLine("mammal"); break;
  case "crocodile":
  case "tortoise":
  case "snake": Console.WriteLine("reptile"); break;
  default: Console.WriteLine("unknown"); break;
}
```

Debugging

Basic Debugging Techniques

Debugging

- The process of "attaching" to the program's execution allows us to trace the execution process, enabling us to detect errors in the program (bugs)

```
1   using System;
2
3   class Program
4   {
5       static void Main()
6       {
7           var number = int.Parse(Console.ReadLine());
8
9           number += number;   ≤ 4,319ms elapsed
10          Console.WriteLine(number);
11      }
12  }
13
```

84 %

Locals

Name	Value
System.Console.ReadLine returned	"10"
int.Parse returned	10
number	10

Debugging in Visual Studio

- Pressing [F10] will start the program in debug mode
- We can proceed to the next step using [F10]
- We can create breakpoints with [F9]
  - We can reach them directly using [F5]

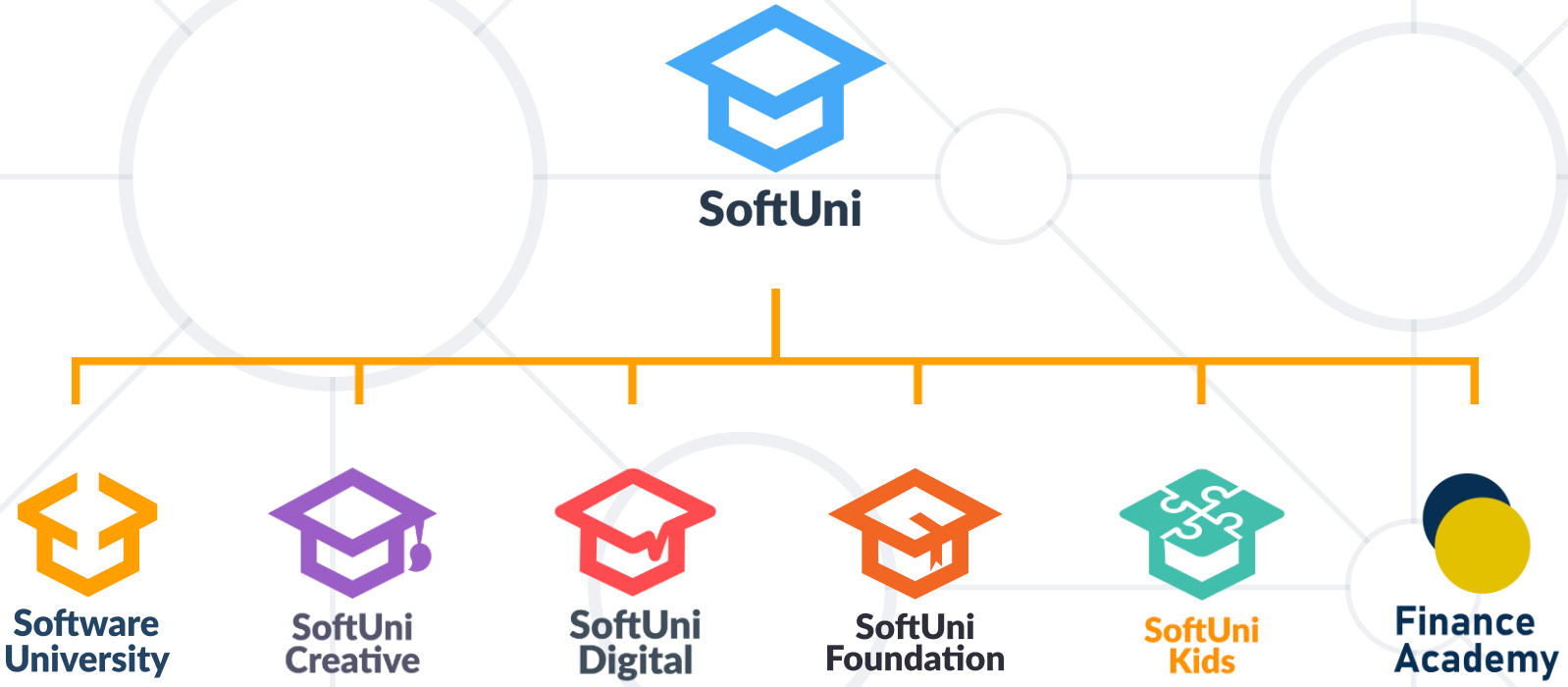
Summary (1)

- Explored the **concept of Programming** and its significance
- Familiarized ourselves with **IDE**s and the role of **Visual Studio**
- Practiced working with the **Console** for **input** and **output**
- Learned how to write and **execute Commands** and **Simple Operations**

Summary (2)

- Explored **Variables**, **Expressions** and performed **Simple Calculations**
- Gained the understanding of **Conditional Statements** and decision making
- Acquired basic **Debugging Techniques** for identifying and fixing errors

Questions?



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