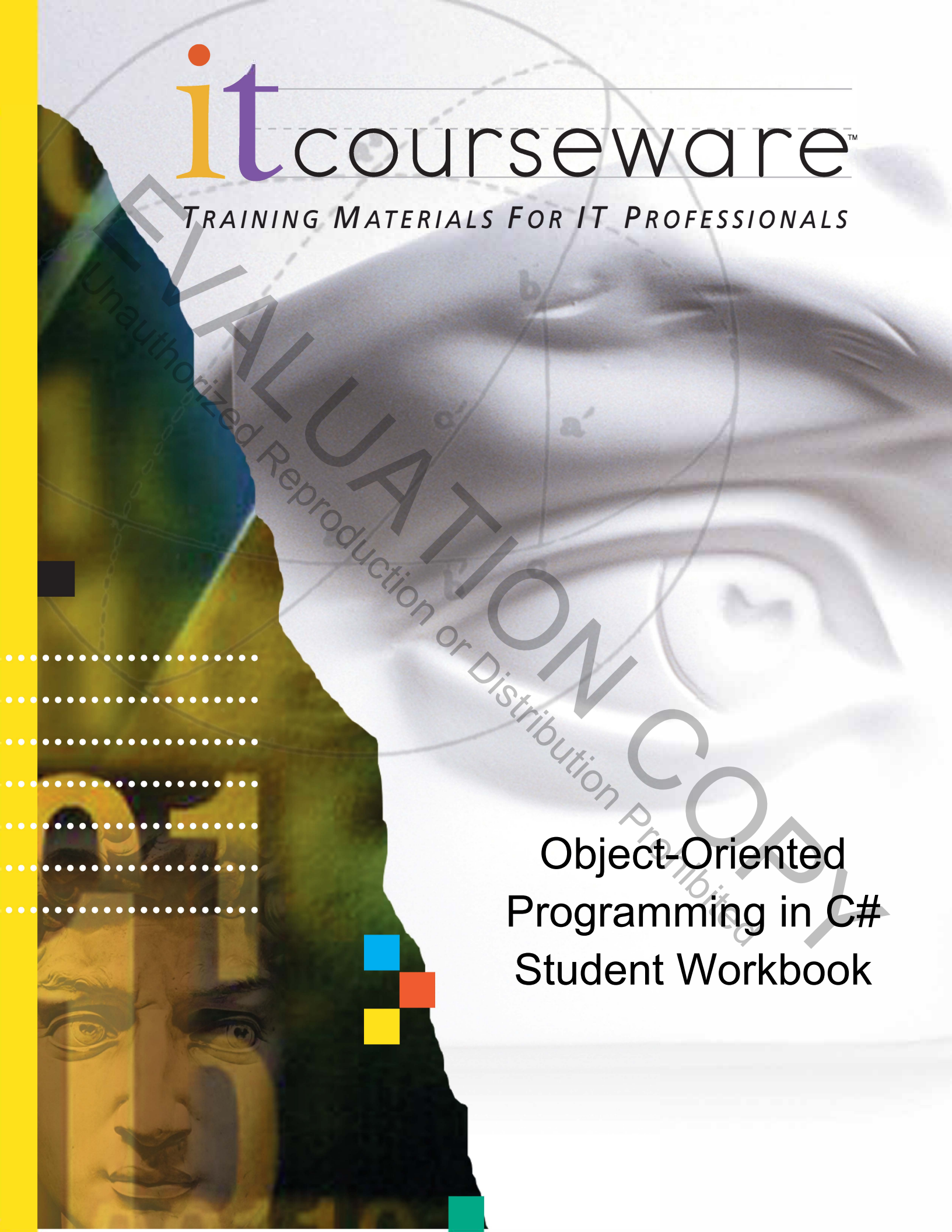

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TRAINING MATERIALS FOR IT PROFESSIONALS

Object-Oriented Programming in C# Student Workbook

Object-Oriented Programming in C#

Student Guide

Revision 6.0

Object Innovations Course 4001

Object-Oriented Programming in C#
Rev. 6.0

Student Guide

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Table of Contents (Overview)

Electronic File Supplements

Directory Structure

- **The course software installs to the root directory *C:\OIC\CSharp*.**
  - Example programs for each chapter are in named subdirectories of chapter directories **Chap01**, **Chap02**, and so on.
  - The **Labs** directory contains one subdirectory for each lab, named after the lab number. Starter code is frequently supplied, and answers are provided in the chapter directories.
  - The **CaseStudy** directory contains a case study in multiple steps.
  - The **Demos** directory is provided for performing in-class demonstrations led by the instructor.
  - Supplementary course content is provided in PDF files in the **Supplements** directory. Code examples for the supplements are in directories **Supp1**, **Supp2** and **Supp3**.

Table of Contents (Detailed)

Chapter 1

Introduction to .NET

Introduction to .NET

Objectives

After completing this unit you will be able to:

- **Give a high-level overview of .NET, with a focus on .NET 6.0, the basis of .NET implementation going forward.**
- **Outline the architectural components of .NET.**
- **Describe the essentials of creating and running a program in the .NET environment.**
- **Build and run a simple C# program.**
- **Use Visual Studio 2022 as an effective environment for creating C# programs.**
- **Use the .NET documentation.**

What is .NET?

- **.NET is Microsoft's software platform for building applications for many environments.**
  - Originally proprietary and restricted to Microsoft Windows, .NET is now open source and cross-platform.
- **.NET applications can be built using multiple languages.**
  - C# and Visual Basic are object-oriented languages.
  - F# is a functional language which also supports object-oriented and imperative programming.
- **.NET Framework is the original implementation of .NET, running on Windows.**
- **.NET Core is a package-based implementation that is cross-platform, running on Mac and Linux besides Windows.**
- **.NET 6 is the successor of .NET Core.**
  - It is the basis of .NET implementation going forward.
- **.NET Framework 4.8 is the latest version of the classical .NET Framework.**
  - It will continue to be distributed with future releases of Windows. As long as it is installed on a supported version of Windows, .NET Framework 4.8 will continue to also be supported.

Libraries and Tools

- **Microsoft and third parties provide many libraries to extend .NET.**
  - Many libraries are furnished through NuGet packages.
  - NuGet is a package manager specifically designed for .NET.
- **Microsoft and third parties provide many libraries to extend .NET.**
- **Visual Studio is a full-featured IDE running on Windows for building all types of .NET applications.**
  - Visual Studio 2022 is required for .NET 6.
- **Visual Studio for Mac runs on Mac computers.**
  - It can be used for building iOS and macOS.
  - It can also be used for ASP.NET Core apps and services.
- **Visual Studio Code is a lightweight code editor available for Windows, macOS and Linux.**
  - It comes with built in support for JavaScript and extensions for many languages, including C#, C++, Java, Python, PHP, and others.

Application Models

- **Web applications and services**
  - Classical ASP.NET supports web applications on Windows
  - ASP.NET Core is cross-platform, targeting Windows, macOS and Linux
- **Mobile applications**
  - Cross-platform targeting iOS, Android and Windows
- **Desktop**
  - Windows desktop applications using Windows Forms or Windows Presentation Foundation (WPF).
  - Mac desktop applications
- **Microservices -- a design pattern in which apps are composed of small, independent modules.**
  - Docker containers combine microservices into single deployable units.

Managed Code

- **.NET apps run *managed code*.**
- **Compilers for .NET languages generate *intermediate language* (IL).**
- **An IL program does not run directly on hardware but on a virtual machine, called a *runtime.***
  - The .NET runtime is known as the Common Language Runtime, or CLR.
- **The runtime provides various services such as automatic memory management, type safety, and so on.**

.NET Programming in a Nutshell

1. Write your program in a high-level .NET language, such as C#.
2. Compile your program into IL.
3. Run your IL program, which will launch the runtime (CLR) to execute your IL, using its just-in-time compiler to translate your program to native code as it executes.

- **We will look at a simple example of a C# program, and run it under .NET.**
  - See **Chap01\SimpleCalc\Old**.
  - Here is the main code:

```
static void Main(string[] args)
{
   int width = 20;
   int height = 5;
   int area;
   area = width * height;
   Console.WriteLine("width = {0}", width);
   Console.WriteLine("height = {0}", height);
   Console.WriteLine("area = {0}", area);
}
```

  - Here is the output when the program is run:

```
width = 20
height = 5
area = 100
```

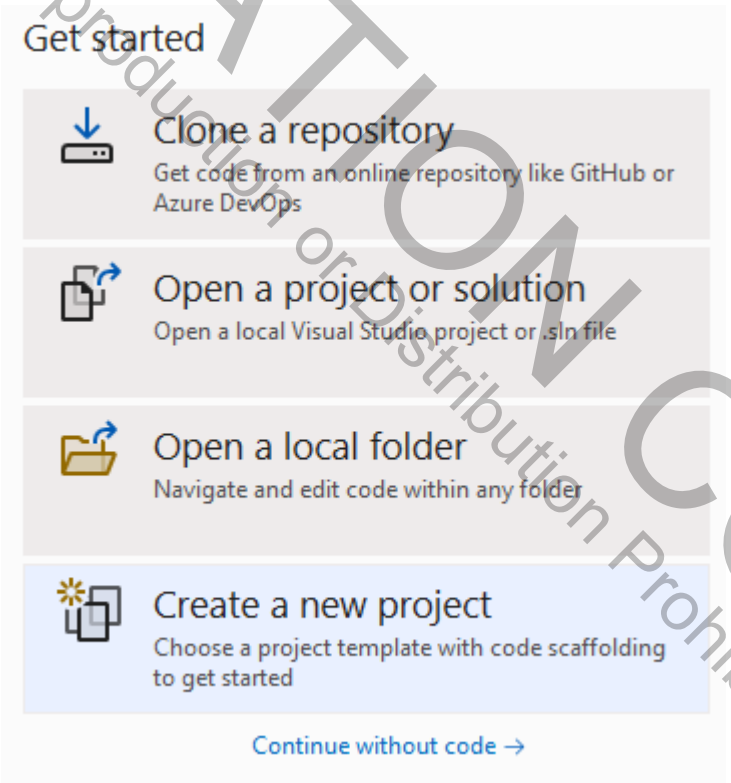
Visual Studio 2022

- **While it is possible to write C# programs using any text editor, and compile them with the command-line compiler, it is very tedious to program that way.**
- **An IDE makes the process of writing software much easier.**
  - An IDE provides convenience items, such as a syntax-highlighting editor.
  - An IDE reduces the tedium of keeping track of configurations, environment settings and file organizations.
- **You may use Visual Studio 2022 throughout this course to create and compile your C# programs.**
- **Visual Studio 2022 is discussed in more detail in Appendix A.**
- **In this course you may use any version of VS 2022, including the free Visual Studio 2022 Community.**

Visual Studio Demo

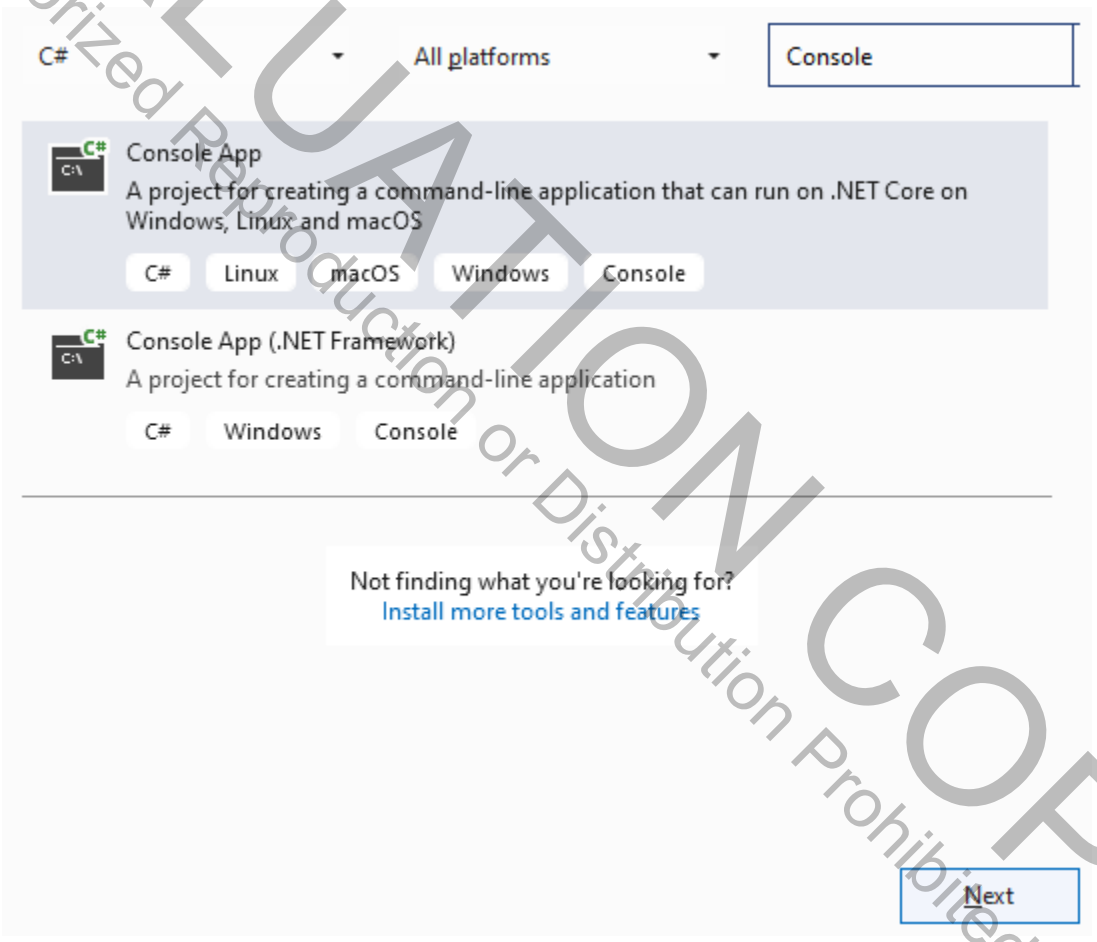
- **We will now create a simple console application using Visual Studio.**
  - Our program is the simple calculator whose code we showed earlier.

1. From the Visual Studio start page click on "Create a new project". This will bring up the New Project dialog. (You can also use the menu File | New | Project when the main Visual Studio window is open.)



Creating a Console App (Cont'd)

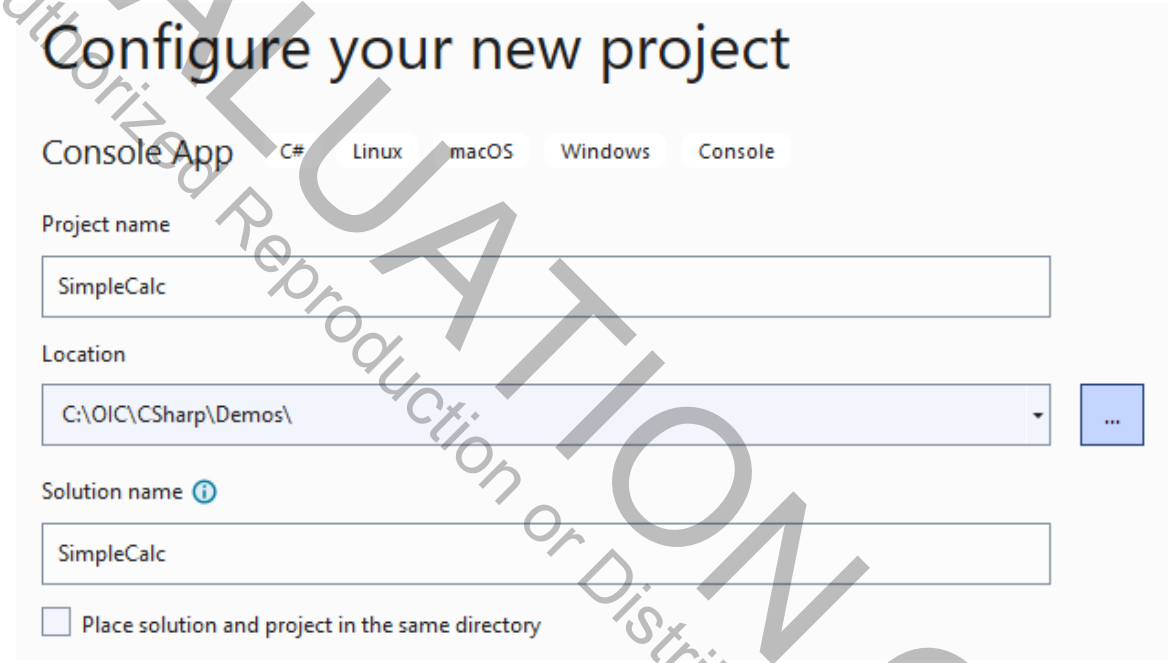
2. Choose Console App with language C#. We filtered the language to be C# and the project type to be Console.
   - Note that Console App (.NET Framework) would generate an app using the classical .NET Framework that runs only on Windows.



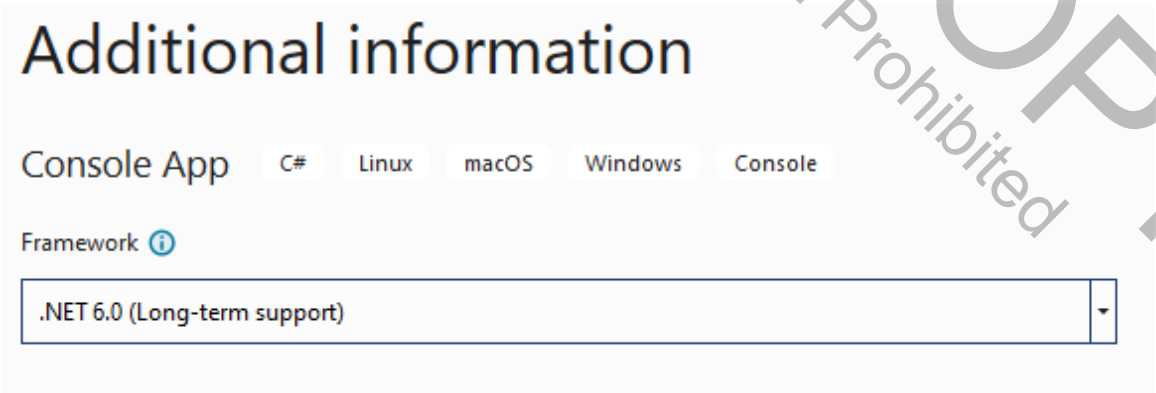
3. Click Next.

Configure Your New Project

4. In the Project name field, type **SimpleCalc** and for Location browse to **C:\OIC\CSharp\Demos**. Leave Solution name as SimpleCalc. Leave unchecked "Place solution and project in the same directory."



5. Click Next. Under “Additional Information” accept the suggested .NET 6.0 (Long-term support) for Framework.



New Console Template

6. Look at the **Program.cs** file that is created. If you are familiar with .NET from earlier versions, you are in for a big surprise!

```
// See https://aka.ms/new-console-template for more information
Console.WriteLine("Hello, World!");
```

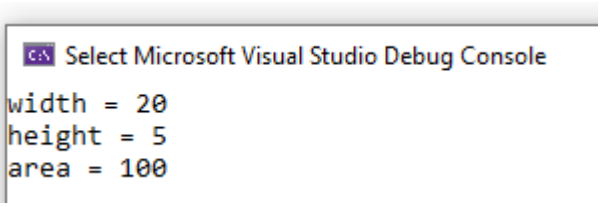
You can follow the link for more information about the new template. Essentially, the new template uses new features in C# that allow the compile to automatically generate a lot of boiler plate code.

However for most of this course we will not use these newest features, instead focus first on the fundamentals. Then, with a proper foundation, we will explain the new features. Stay tuned!

7. In the meantime, let's finish the demo using the new template. Just replace the supplied **Console.WriteLine()** statement with the code for computing the area of a hard-coded rectangle:

```
int width = 20;
int height = 5;
int area;
area = width * height;
Console.WriteLine("width = {0}", width);
Console.WriteLine("height = {0}", height);
Console.WriteLine("area = {0}", area);
```

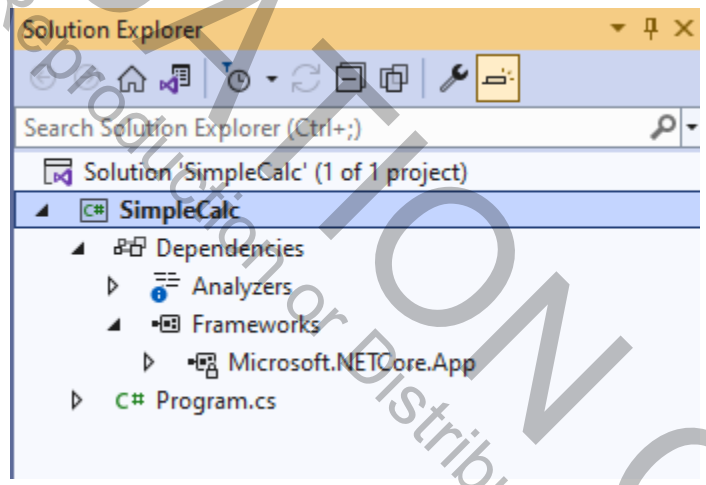
8. Build and run without debugging (Ctrl + F5)



9. Program is saved in **Chap01\Simple\Calc\New**.

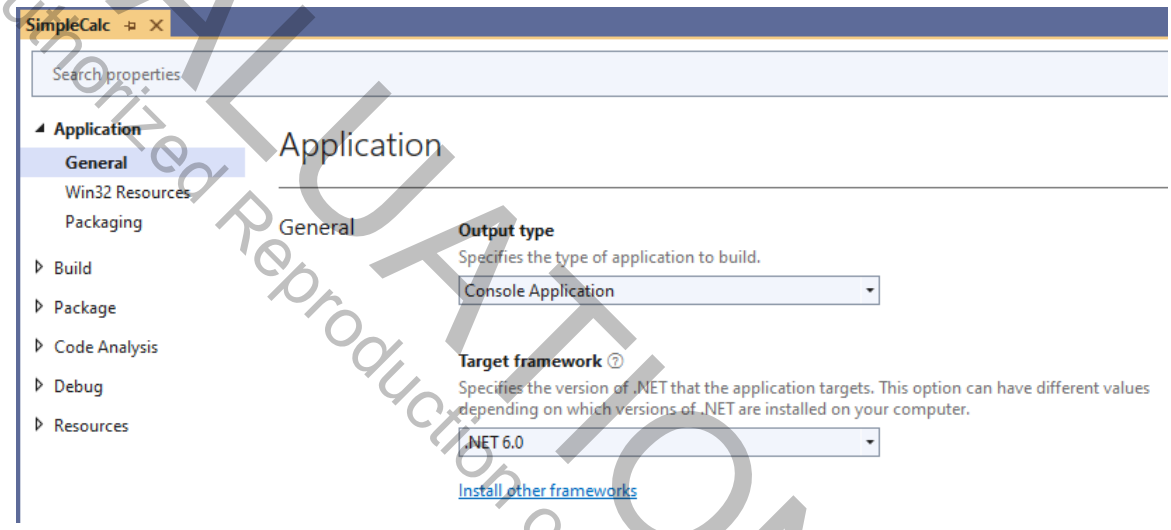
Old Console Template

- **Open up the solution in *Chap01\SimpleCalc\Old*.**
  - The solution file is **SimpleCalc.sln**.
  - This project was created in Visual Studio 2019 and updated to .NET 6.0
- **Examine the solution in Solution Explorer, containing one project.**



Project Properties

8. Right-click over the SimpleCalc project (shown highlighted in the screen capture) and select Properties. Observe that .NET 6.0 is the Target framework, under the Application | General properties.



   – Don’t worry about the other project properties for now.

   – The Properties window is set up to work with the build system and to have convenient default properties.

9. Close the project file. Open the file **Program.cs,** in the Visual Studio editor.

Using the Visual Studio Text Editor

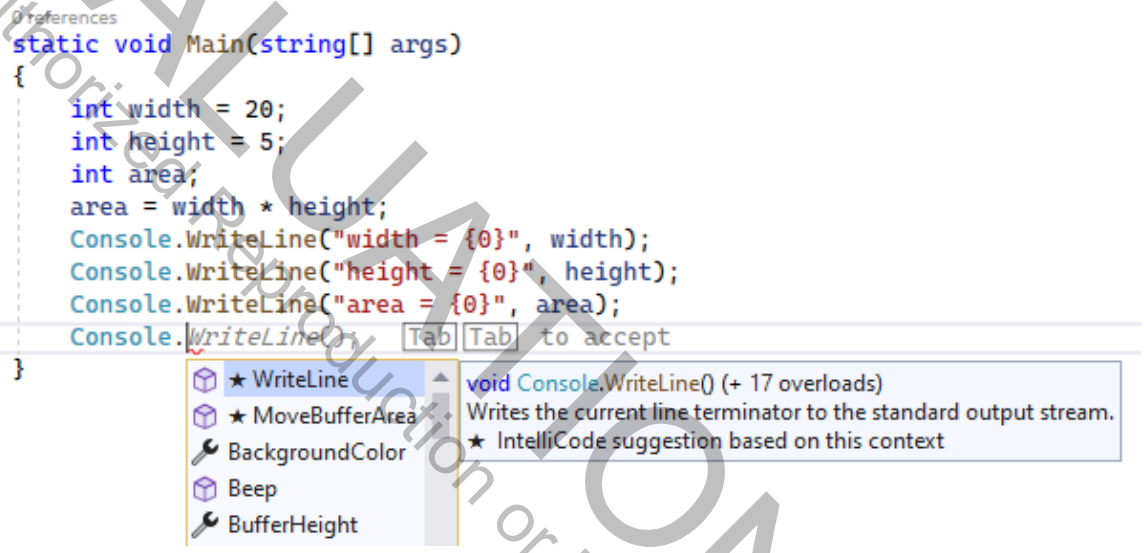
- **The file *Program.cs* will be open in the Visual Studio text editor. The starter code for *Main()* has been replaced with the highlighted code shown below:**

```
using System;

namespace SimpleCalc
{
    class Program
    {
        static void Main(string[] args)
        {
            int width = 20;
            int height = 5;
            int area;
            area = width * height;
            Console.WriteLine("width = {0}", width);
            Console.WriteLine("height = {0}", height);
            Console.WriteLine("area = {0}", area);
        }
    }
}
```

  - All the non-highlighted code is supplied automatically when using the new program template.

IntelliSense

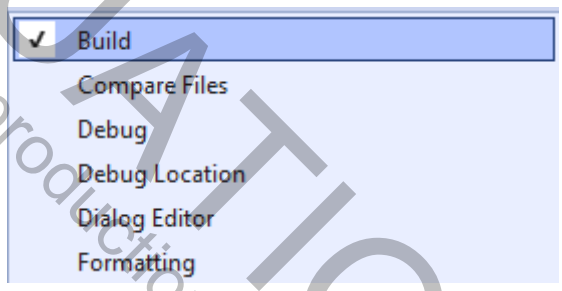
- **A powerful feature of Visual Studio is *IntelliSense*.**
  - IntelliSense will automatically pop up a list box allowing you to easily insert language elements directly into your code.



  - Don't actually add another **WriteLine()** statement. This was only a demonstration of IntelliSense.

Build the Project

- **Building a project means compiling the individual source files and linking them together with any library files to create an IL executable .EXE file.**
- **To make it easier to build, add the Build toolbar (if it is not already present) by a right-click over the toolbar area. Check Build.**



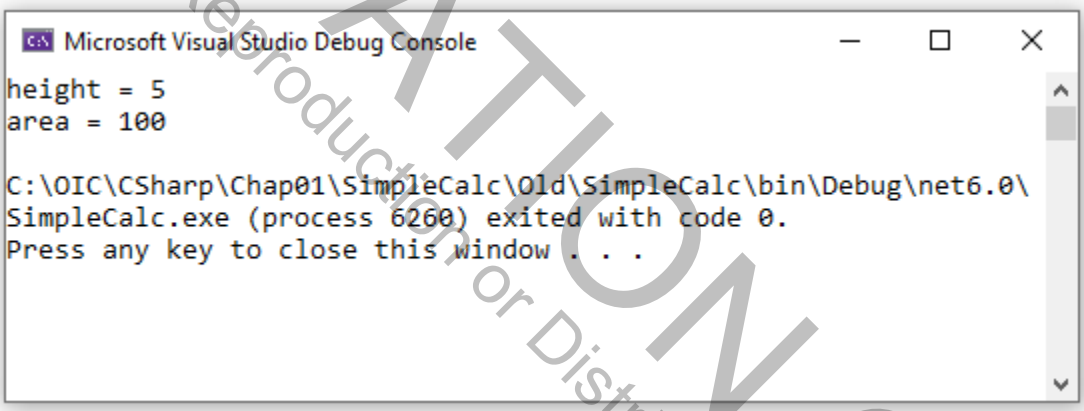
  - This will add the Build toolbar to the Standard and Text Editor toolbars that are shown by default.

- **Then you can build the project by using one of the following:**
  - Menu Build | Build Solution or toolbar button or keyboard shortcut Ctrl+Shift+B. (This builds all the projects in the solution.)
  - Menu Build | Build SimpleCalc or toolbar button . (This just builds the project SimpleCalc)[1].
- **Both forms of Start (see next page) will automatically build the project if not already built.**

[1] The two are the same in this case, because the solution has only one project, but some solutions have multiple projects, and then there is a difference.

Run the Project

- **You can run the program without the debugger by using one of the following:**
  - Menu Debug | Start Without Debugging
  - Toolbar button  (This button is provided by default in Visual Studio 2022.)
  - Keyboard shortcut Ctrl + F5



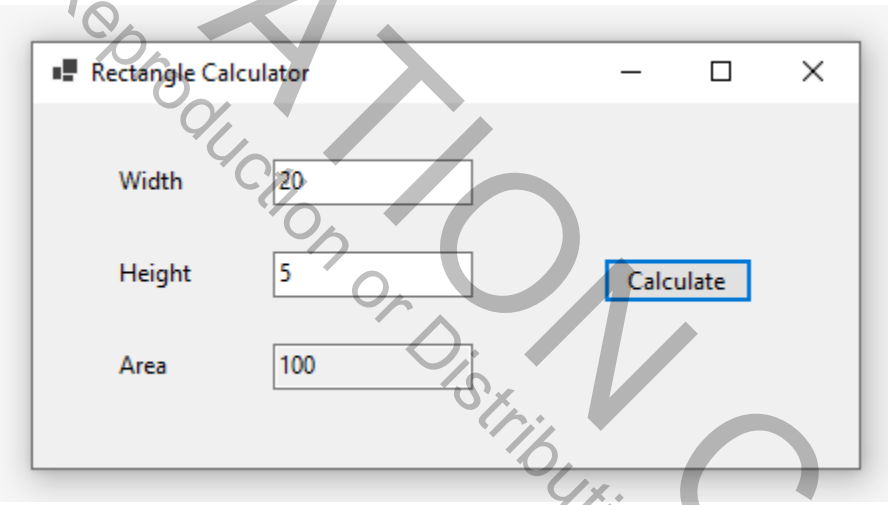
- **You can run the program in the debugger by using one of the following:**
  - Menu Debug | Start Debugging
  - Toolbar button 

  - Keyboard shortcut F5.
- **We will discuss debugging later.**

Visual C# and GUI Programs

- **Microsoft's implementation of the C# language, Visual C#, works very effectively in a GUI environment.**
  - Using Windows Forms (available in .NET Core with .NET 5.0 and above), it is easy to create Windows GUI programs in C#.

  Example: See **Chap01\SimpleCalcGui**



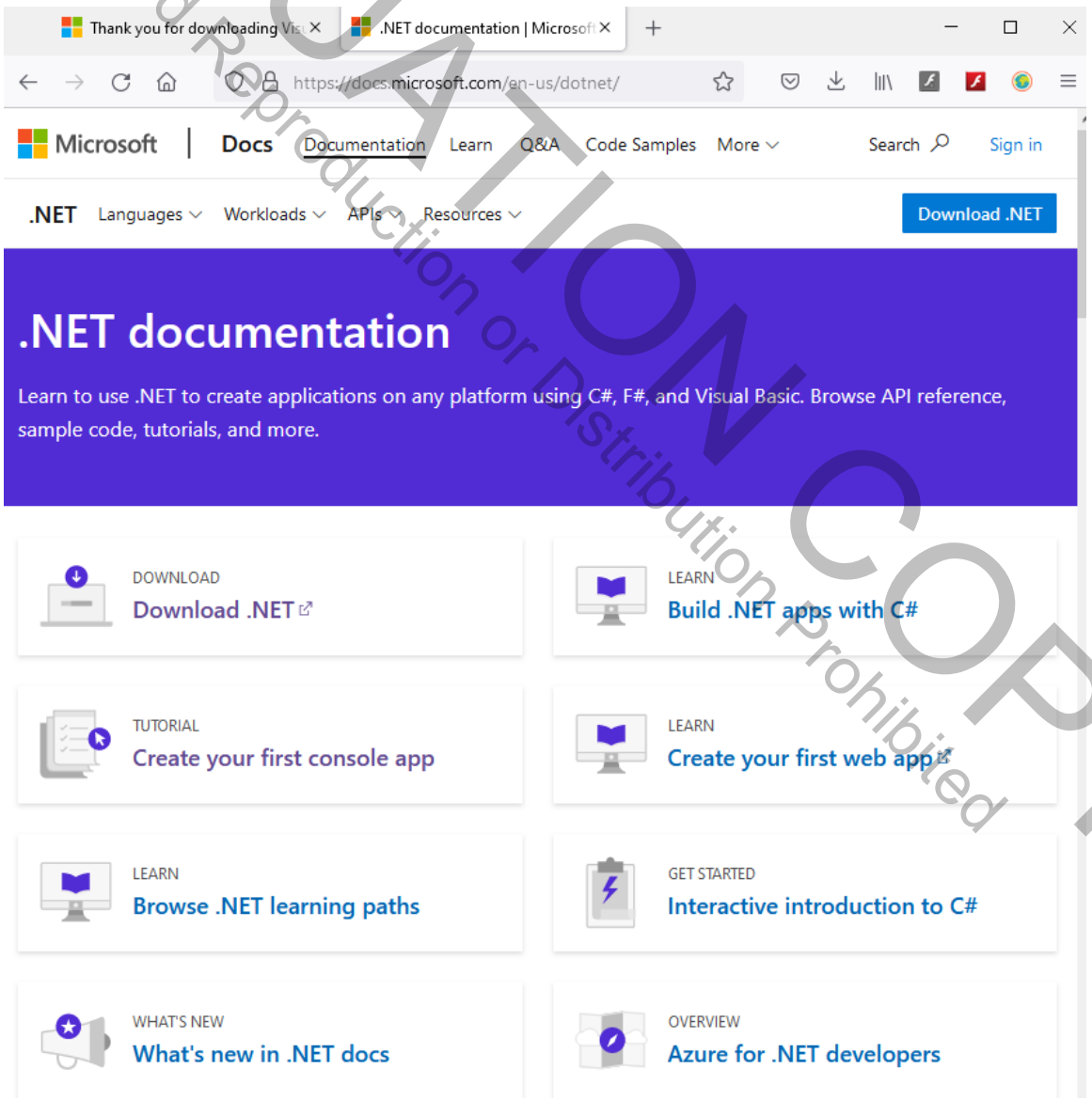
- **We will discuss GUI programming using C# in Chapter 6.**

.NET Documentation

- **.NET documentation is available online.**
- **It is now part of comprehensive Microsoft documentation at**

https://docs.microsoft.com

  - Select .NET.



Summary

- **.NET is Microsoft's software platform for building applications for many environments.**
- **.NET applications can be built using multiple languages, including C#.**
  - C# is an object-oriented language designed by Microsoft for .NET.
- **The basis of .NET going forward is .NET 6.0, the most recent version of the cross-platform .NET Core.**
- **The classical .NET Framework 4.8 is being maintained.**
- **Visual Studio is a full-featured IDE running on Windows for building all types of .NET applications.**
- **With Visual Studio it is easy to create and run programs using C#.**
- **With the new Console Template in Visual Studio 2022 and new features in C#, a lot of boiler plate code is supplied automatically by the compiler.**
- **Windows Forms is supported in .NET 6.0 as an easy means of creating GUI programs.**
- **You can access extensive .NET documentation online.**

Chapter 2

First C# Programs

First C# Programs

Objectives

After completing this unit you will be able to:

- **Write a basic "Hello, World" program in C#.**
- **Compile and run C# programs in your local development environment.**
- **Describe the basic structure of C# programs.**
- **Describe how related C# classes can be grouped into namespaces.**
- **Use variables and simple expressions in C# programs.**
- **Write C# programs that can perform simple calculations.**
- **Perform simple input and output in C#.**
- **Describe objects and classes in C#.**
- **Use an input wrapper class to perform input in C#.**

Hello, World

- **Whenever learning a new programming language, a good first step is to write and run a simple program that will display a single line of text.**
  - Such a program demonstrates the basic structure of the language, including output.
  - You must learn the pragmatics of compiling and running the program.
- **When you create a new C# Console application Visual Studio will create a Hello World program for you!**
  - We have added a comment to the (**old template**) starter code.

```
// Hello World demo

using System;

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

  - See **Hello** in the **Chap02** directory[1]**.**

[1] Example programs using the old Console template were created via Visual Studio 2019 and then updated to use .NET 6.0.

Program Structure

```
...
   class Program
   {
         ...
   }
...
```

- **Every C# program has at least one *class*.**
  - A class is the foundation of C#'s support of object-oriented programming.
  - A class encapsulates data (represented by **variables**) and behavior (represented by **methods**).
  - All of the code defining the class (its variables and methods) will be contained between the curly braces.
  - We will discuss classes in detail later.
- **Note the *comment* at the beginning of the program.**
  - A line beginning with a double slash is present only for documentation purposes and is ignored by the compiler.
- **C# files have the extension *.cs*.**

Program Structure (Cont'd)

```
...
    class Program
    {
        static void Main(string[] args)
        {
            ...
        }
    }
...
```

- **There is a distinguished class which has a method whose name must be *Main()*.**
  - The method should be **static**.
  - An **int** exit code can be returned to the operating system.

```
static int Main(string[] args)
```

  - Use **void** if you do not return an exit code.
  - Command line arguments are passed as an array of strings.
  - The argument list can be empty:
  - The runtime will call this **Main()** method—it is the entry point for the program.
  - All of the code for the **Main()** method will be between the curly braces.
  - Note that in C#, it is not necessary for the file name to be the same as the name of the class containing the **Main()** method.

Program Structure (Cont'd)

```
...
    class Program
    {
        static void Main(string[] args)
        {
            Console.WriteLine("Hello World!");
        }
    }
...
```

- **Every method in C# has one or more *statements*.**
- **A statement is terminated by a semicolon.**
  - A statement may be spread out over several lines.
- **The *Console* class provides support for standard output and standard input.**
  - The method **WriteLine()** displays a string, followed by a new line.

Namespaces

- **Much standard functionality in C# is provided through many classes in the .NET Framework.**
- **Related classes are grouped into *namespaces*.**
- **Visual Studio 2019 automatically generated a namespace when a Console program is created.**
  - With the new Console Template in Visual Studio 2022, it is the compiler that generates a namespace,

```
using System;
namespace Hello
{
    class Program
    {
        static void Main(string[] args)
        {
            Console.WriteLine("Hello World!");
        }
    }
}
```

- **Note: For simplicity we will typically omit the enclosing namespace in code listings. Thus**

```
using System;

class Program
{
    static void Main(string[] args)
    {
        Console.WriteLine("Hello World!");
    }
}
```

Namespaces (Cont'd)

- **The fully qualified name of a class is specified by the namespace, followed by a dot, followed by class name.**

```
System.Console
```

- **A *using* statement allows a class to be referred to by its class name alone.**

```
using System;

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

Variables

- **In C#, you can define *variables* to hold data.**
- **Variables represent storage locations in memory.**
- **In C#, variables are of a specific data *type*.**
  - Some common types are **int** for integers and **double** for floating point numbers.
  - You must declare variables before you can use them.
- **A variable declaration reserves memory space for the variable and may optionally specify an initial value.**

```
int kilo = 1024;        // reserves space and assigns
                        // an intial value
int mega;               //reserves space but does
                        // not initialize
```

  - If a variable is not initialized in its declaration, it should be assigned prior to being used.

```
int kilo;
kilo = 1024;
// Now you may use kilo
```

Expressions

- **You can combine variables and constants (or "literals") via *operators* to form *expressions*.**
- **Examples of operators include the standard arithmetic operators:**

```
+       addition
-       subtraction
*       multiplication
/       division
```

- **Here are some examples of expressions:**

```
kilo * 1024
(fahrenheit – 32) * 5 / 9
3.1416 * radius * radius
```

Assignment

- **You can assign a value to a variable by using the = symbol.**
  - On the left hand side is a variable.
  - On the right hand side is an expression.
  - The expression is evaluated and its value is assigned to the variable on the left.
  - Assignment is a statement and must be terminated by a semicolon.

```
mega = kilo * 1024;
celsius = (fahrenheit – 32) * 5 / 9;
area = 3.1416 * radius * radius;
```

- **Note that the same variable can be used on both sides of an assignment statement.**

```
int item = 5;
int total = 30;
total = total + item;
```

  - The expression **total + item** evaluates to 35, using the old value of **total**, and this value is assigned to **total**, creating a new value.

Calculations Using C#

- **You can easily use C# to perform calculations by adding code to the *Main()* method of a C# class.**
  - Declare whatever variables you need.
  - Create expressions and assign values to your variables.
  - Print out the answer using **Console.WriteLine()**.
- **You can easily perform labeled output, relying on two features of C#:**
  - The operator + performs concatenation for **string** data.
  - There is an automatic, implicit conversion available that converts numeric data to string data when required.
  - Hence this code ...

```
int total = 35;
System.Console.WriteLine("The total is " + total);
```

  - ... will produce this output:

```
The total is 35
```

Sample Program

- **This program will convert temperature from Fahrenheit to Celsius.**
  - See **ConvertTemp\Step1**.

```
// ConvertTemp - Step 1
//
// Program converts a hardcoded temperature in
// Fahrenheit to Celsius

using System;

class Program
{
    public static void Main(string[] args)
    {
        int fahr = 86;
        int celsius = (fahr - 32) * 5 / 9;
        Console.WriteLine("fahrenheit = " + fahr);
        Console.WriteLine("celsius = " + celsius);
    }
}
```

More about Output in C#

- **The *Console* class in the *System* namespace supports two simple methods for performing output:**
  - **WriteLine()** writes out a string followed by a new line.
  - **Write()** writes out just the string without the new line.

```
int x = 24;
int y = 5;
int z = x * y;
Console.Write("Product of " + x + " and " + y);
Console.WriteLine(" is " + z);
Console.WriteLine("The product is {0}", z);
```

  - The output is all on one line:

```
Product of 24 and 5 is 120
```

- **A more convenient way to build up an output string is to use *placeholders* {0}, {1}, etc.**
  - An equivalent way to do the output shown above is:

```
Console.WriteLine("Product of {0} and {1} is {2}",
   x, y, z);
```

  - The program **OutputDemo** illustrates the output operations just discussed.
  - Later in the course we will see how to control formatting of output, and occasionally in examples we will throw in some simple use of formatting.

Input in C#

- **Our first *ConvertTemp* program is not too useful, because the Fahrenheit temperature is hard-coded.**
  - To convert a different temperature, you would have to edit the source file and recompile.
- **What we really want to do is allow the user of the program to enter a value at runtime for the Fahrenheit temperature.**
- **Although simple console input in C# is fairly easy, we can make it even easier using object-oriented programming.**
  - We can encapsulate or "wrap" the details of input in a class.
  - It will be easy to use the wrapper class.

More about Classes

- **Although we will discuss classes in more detail later, there is a little more you need to know now.**
- **A class can be thought of as a template for creating objects.**
  - An **object** is an instance of a **class**.
- **A class specifies data and behavior.**
  - The data is different for each object instance.
- **In C#, you instantiate a class by using the *new* keyword.**

```
InputWrapper iw = new InputWrapper();
```

  - This code creates the object instance **iw** of the **InputWrapper** class.

InputWrapper Class

- **The *InputWrapper* class "wraps" interactive input for several basic data types.**
  - The supported data types are **int**, **double**, **decimal** and **string**.
  - Methods **getInt()**, **getDouble()**, **getDecimal()** and **getString()** are provided.
  - A prompt string is passed as an input parameter.
  - See files **InputWrapper.cs** in directory **TestInputWrapper,** which implements the class, and **TestInputWrapper.cs,** which tests the class.
- **Although the code is quite short, it is a little complex, involving a number of different methods from different .NET Framework classes.**
- **However, you do not need to be familiar with the implementation of *InputWrapper* in order to use it.**
  - That is the beauty of "encapsulation"—complex functionality can be hidden by an easy-to-use interface.

Echo Program

- **We illustrate interactive input by a simple "echo" program.**
  - The program prompts the user for a name, and then prints out a personalized greeting.
  - See **Echo**.
- **This directory has two files, each defining a class.**
  - **InputWrapper.cs** defines the wrapper class. There is no **Main()** method in this class.
  - **EchoName.cs** has a class **Echo,** with a **Main()** method.

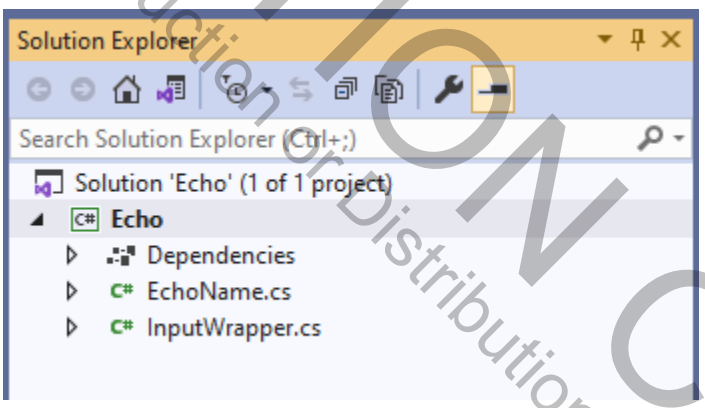
```
// EchoName.cs
//
// Prompts user to enter name and then
// prints out greeting using name

using System;

class Echo
{
 public static void Main(string[] args)
 {
   InputWrapper iw = new InputWrapper();
   string name = iw.getString("Enter your name: ");
   Console.WriteLine("Hello, " + name);
 }
}
```

Using InputWrapper

- **The bolded statements illustrate how to use the *InputWrapper* class.**
  - Instantiate an **InputWrapper** object **iw** by using **new**.
  - Prompt to obtain input data by calling the appropriate **getXXX()** method.

Multiple Files in Visual Studio

- **It is very easy to work with Visual Studio projects that have multiple files.**
- **As an example, open the Visual Studio *solution* that is specified by the file *Chap02\Echo\Echo.sln*.**
- **A solution can contain one or more *projects*.**
  - In this case there is a single project file **Echo.csproj**.
- **You can see all the files in a solution through the *Solution Explorer*.**



- **When you build the solution via the toolbar button , you will build all the projects in the solution.**
  - You can also build just the current project via the toolbar button .

The .NET Framework[2]

- **The .NET Framework has a very large class library (several thousand classes).**
- **To make all of this functionality more manageable, the classes are partitioned into *namespaces*.**
- **The root namespace is *System*, which directly contains many useful classes, among them:**
  - **Console** provides access to standard input, output and error streams for I/O.
  - **Convert** provides conversions among base data types.
  - **Math** provides mathematical constants and functions.

[2] We are using the term ".NET Framework" in a general sense, referring to both the new cross-platform implementation of the framework built on .NET Core as well as the classical .NET Framework that runs only on Windows. This framework used in this course is the new one.

The .NET Framework (Cont'd)

- **Underneath *System*, there are other namespaces, among them:**
  - **System.Data** contains classes constituting the ADO.NET architecture for accessing databases.
  - **System.Xml** provides standards-based support for processing XML.
  - **System.Drawing** contains classes providing GDI+ graphics functionality.
  - **System.Windows.Forms** provides support for creating applications with rich Windows-based interfaces.
  - **System.Web** provides support for browser/server communication.
  - **System.IO** provides support for reading and writing with streams and files. Both synchronous and asynchronous I/O are supported.
  - **System.Net** provides support for several standard network protocols.

Lab 2

C# Programs for Calculation

In this lab you modify or implement several C# programs to perform calculations. You need to perform input (through a wrapper class), perform a calculation, and output the result. Do as many of these exercises as time permits. If you have extra time, do some of the optional experiments suggested in some of the exercises, or make up some experiments on your own.

Detailed instructions are contained in the Lab 2 write-up at the end of the chapter.

Suggested time: 30 minutes

Summary

- **Every C# application has a class with a method *Main*, which is the entry point into the application.**
- **The *System* class includes methods for performing output, such as *WriteLine()*.**
- **Expressions in C# are formed from literals, variables and operators.**
- **With the assignment statement, you can assign a value computed by an expression to a variable.**
- **Input in C# is a little more complicated than output, but you can use a wrapper class that encapsulates the required C# classes and presents a simple programming interface.**
- **The .NET Framework has a large class library that is partitioned into namespaces.**

Lab 2

C# Programs for Calculation

Introduction

In this lab, you modify or implement several C# programs to perform calculations. You need to perform input (through a wrapper class), perform a calculation, and output the result. Do as many of these exercises as time permits. If you have extra time, do some of the optional experiments suggested in some of the exercises, or make up some experiments on your own.

Suggested Time: 30 minutes

Root Directory: **OIC\CSharp**

Directories:	**Labs\Lab2\ConvertTemp**	(Exercise 1 work)
	Chap02\ConvertTemp\Step1	(Backup of Exercise 1 starter files)
	Chap02\ConvertTemp\Step2	(Answer to Exercise 1)
	Chap02\TestInputWrapper	(**InputWrapper** class)
	Labs\Lab2	(Exercise 2 work)
	Chap02\Circle	(Exercise 2 answer)

Exercise 1. Fahrenheit to Celsius Conversion

Examine the code of the starter program. Build and run. Notice that the Fahrenheit temperature to be converted is hard-coded. Modify the program to prompt the user for a Fahrenheit temperature, read in the value entered by the user, and print out the result. Make use of the wrapper class **InputWrapper** that was discussed in this chapter.

The starter program uses **int** as the data type for temperatures. An optional experiment is to use **double** as the data type. Could you input the Fahrenheit temperature as an **int** and calculate the Celsius temperature as a **double**?

Exercise 2. Calculate the Area of a Circle

1. Use Visual Studio to create a C# Console App project. Click Next.

2. Assign project name **Circle** and for Location navigate to the **Lab2** folder. Click Next.

3. For Framework choose .NET 6.0 and click Create. This will use the new Console template.

4. Copy the file **InputWrapper.cs** from Exercise 1 into the new project.

5. Delete the starter WriteLine() of “Hello, World!”.

6. Provide C# code to prompt the user for the radius, read in the value entered by the user, calculate the area of the circle, and print out the result. For pi, use the approximation 3.1416. What is an appropriate data type to use for radius and area? (Remember your high school geometry! Area = Pi * radius squared.)

7. As an optional experiment, use the class **Math** (in the namespace **System**) for a more accurate value of pi.

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