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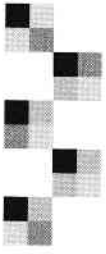

Essential C# 7.0

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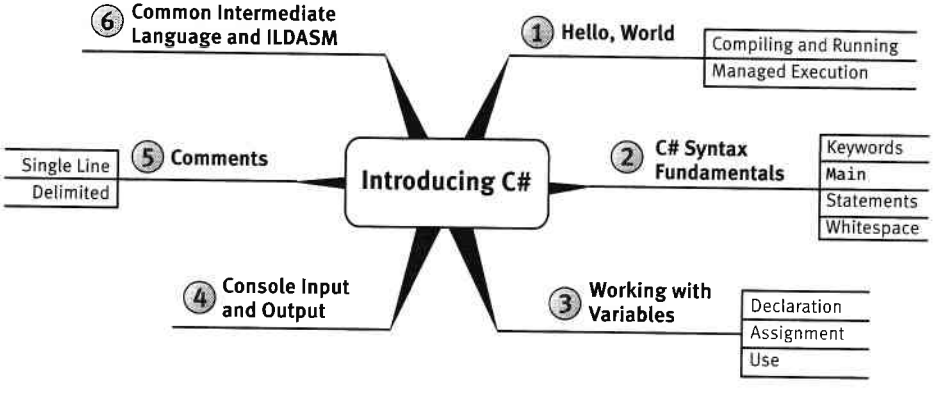
1 Introducing C#

C# IS NOW A WELL-ESTABLISHED LANGUAGE that builds on features found in its predecessor C-style languages (C, C++, and Java), making it immediately familiar to many experienced programmers.[1] Furthermore, the C# programming language can be used to build software components and applications that run on a wide variety of operating systems (platforms).



This chapter introduces C# using the traditional `HelloWorld` program. It focuses on C# syntax fundamentals, including defining an entry point into the C# program, which will familiarize you with the C# syntax style

1. The first C# design meeting took place in 1998.

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and structure and enable you to produce the simplest of C# programs. Prior to the discussion of C# syntax fundamentals is a summary of managed execution context, which explains how a C# program executes at runtime. This chapter ends with a discussion of variable declaration, writing and retrieving data from the console, and the basics of commenting code in C#.

Hello, World

The best way to learn a new programming language is to write code. The first example is the classic `HelloWorld` program. In this program, you will display some text to the screen.

Listing 1.1 shows the complete `HelloWorld` program; in the following sections, you will compile and run the code.

LISTING 1.1: `HelloWorld` in C#[2]

```
class HelloWorld
{
 static void Main()
 {
   System.Console.WriteLine("Hello. My name is Inigo Montoya.");
 }
}
```

> **NOTE**
>
> C# is a case-sensitive language: Incorrect case prevents the code from compiling successfully.

Those experienced in programming with Java, C, or C++ will immediately see similarities. Like Java, C# inherits its basic syntax from C and C++.[3] Syntactic punctuation (such as semicolons and curly braces), features (such as case sensitivity), and keywords (such as `class`, `public`, and `void`) are familiar to programmers experienced in these languages. Beginners and programmers from other languages will quickly find these constructs intuitive.

2. Refer to the movie *The Princess Bride* if you're confused about the Inigo Montoya references.
3. When creating C#, the language creators reviewed the specifications for C/C++, literally crossing out the features they didn't like and creating a list of the ones they did like. The group also included designers with strong backgrounds in other languages.

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Creating, Editing, Compiling, and Running C# Source Code

Once you have written your C# code, it is time to compile and run it. You have a choice of which .NET implementation(s) to use—sometimes referred to as the **.NET framework**(s). Generally, the implementation is packaged into a **software development kit (SDK)**. The SDK includes the compiler, the runtime execution engine, the framework of pragmatically accessible functionality that the runtime can access (see "Application Programming Interface" later in the chapter), and any additional tooling (such as a build engine for automating build steps) that might be bundled with the SDK. Given that C# has been publicly available since 2000, there are several different .NET frameworks to choose from (see "Multiple .NET Frameworks" later in the chapter).

For each .NET framework, the installation instructions vary depending on which operating system you are developing on and which .NET framework you select. For this reason, I recommend you visit https://www.microsoft.com/net/download for download and installation instructions, selecting first the .NET framework and then the package to download based on which operating system you will be developing for. While I could provide further details here, the .NET download site has the most updated instructions for each combination supported.

If you are unsure about which .NET framework to work with, choose .NET Core by default. It works on Linux, macOS, and Microsoft Windows and is the implementation where the .NET development teams are applying the majority of their investments. Furthermore, because of the cross-platform capabilities, I will favor .NET Core instructions inline within the chapters.

There are also numerous ways to edit your source code, including with the most rudimentary of tools, such as Notepad on Windows, TextEdit on Mac/macOS, or vi on Linux. However, you're likely to want something more advanced so that at least your code is colorized. Any programming editor that supports C# will suffice. If you don't already have a preference, I recommend you consider the open source editor Visual Studio Code (https://code.visualstudio.com). Or, if you are working on Windows or Mac, consider Microsoft Visual Studio 2017 (or later)—see https://www.visualstudio.com. Both are available free of charge.

In the next two sections, I provide instructions for both editors. For Visual Studio Code, we rely on the command line (Dotnet CLI) for creating the initial C# program scaffolding in addition to compiling and running the program. For Windows and Mac, we focus on using Visual Studio 2017.

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Begin 7.0

With Dotnet CLI

The Dotnet command, `dotnet.exe`, is the Dotnet command-line interface, or Dotnet CLI, and it may be used to generate the initial code base for a C# program in addition to compiling and running the program. (To avoid ambiguity between CLI referring to the Common Language Infrastructure or the command-line interface, throughout the book I will prefix CLI with Dotnet when referring to the Dotnet CLI. CLI without the Dotnet prefix refers to Common Language Infrastructure.) Once you have completed the installation, verify that `dotnet` is an available command from the command prompt—thus verifying your installation.

Following are the instructions for creating, compiling, and executing the `HelloWorld` program from the command line on Windows, macOS, or Linux:

1. Open a command prompt on Microsoft Windows or the Terminal application on Mac/macOS. (Optionally, consider using the cross-platform command-line interface PowerShell.)[4]
2. Create a new directory where you would like to place the code. Consider a name such as `./HelloWorld` or `./EssentialCSharp/HelloWorld`. From the command line, use

   ```
   mkdir ./HelloWorld
   ```

3. Navigate into the new directory so that it is the command prompt's current location.

   ```
   cd ./HelloWorld
   ```

4. Execute `dotnet new console` from within the `HelloWorld` directory to generate the initial scaffolding for your program. While several files are generated, the two main files are `Program.cs` and the project file:

   ```
   dotnet new console
   ```

5. Run the generated program. This will compile and run the default `Program.cs` created by the `dotnet new console` command. The content of `Program.cs` is similar to Listing 1.1, but it outputs "Hello World!" instead.

   ```
   dotnet run
   ```

4. https://github.com/PowerShell/PowerShell

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Even though we don't explicitly request the application to compile (or build), that step still occurs because it is invoked implicitly when the `dotnet run` command is executed.

6. Edit the `Program.cs` file and modify the code to match what is shown in Listing 1.1. If you use Visual Studio Code to open and edit `Program.cs`, you will see the advantage of a C#-aware editor, as the code will be colorized indicating the different types of constructs in your program. (Output 1.1 shows an approach using the command line that works for Bash and PowerShell.)
7. Rerun the program:

```
dotnet.exe run
```

Output 1.1 shows the output following the preceding steps.[5]

OUTPUT 1.1

```
1>
2> mkdir ./HelloWorld
3> cd ./HelloWorld/
4> dotnet new console
The template "Console Application" was created successfully.

Processing post-creation actions...
Running 'dotnet restore' on ...\EssentialCSharp\HelloWorld\
HelloWorld.csproj...
  Restoring packages for ...\EssentialCSharp\HelloWorld\
HelloWorld.csproj...
  Generating MSBuild file ...\EssentialCSharp\HelloWorld\obj\
HelloWorld.csproj.nuget.g.props.
  Generating MSBuild file ...\EssentialCSharp\HelloWorld\obj\
HelloWorld.csproj.nuget.g.targets.
  Restore completed in 184.46 ms for ...\EssentialCSharp\
HelloWorld\HelloWorld.csproj.

Restore succeeded.
5> dotnet run
Hello World!
6> echo '
class HelloWorld
{
 static void Main()
 {
   System.Console.WriteLine("Hello. My name is Inigo Montoya.");
 }
}
' > Program.cs
7> dotnet run
Hello. My name is Inigo Montoya.
8>
```

End 7.0

5. The bold formatting in an Output indicates the user-entered content.

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With Visual Studio 2017

With Visual Studio 2017, the procedure is similar, but instead of using the command line, you use an **integrated development environment** (**IDE**), which has menus you can choose from rather than executing everything from the command line:

1. Launch Visual Studio 2017.
2. Open the New Project dialog using the **File->New Project** (Ctrl+Shift+N) menu.
3. From the **Search box** (Ctrl+E), type *Console App* and select the **Console App (.NET Core)—Visual C#** item. For the **Name** text box, use *HelloWorld*, and for the **Location**, select a working directory of your choosing. See Figure 1.1.

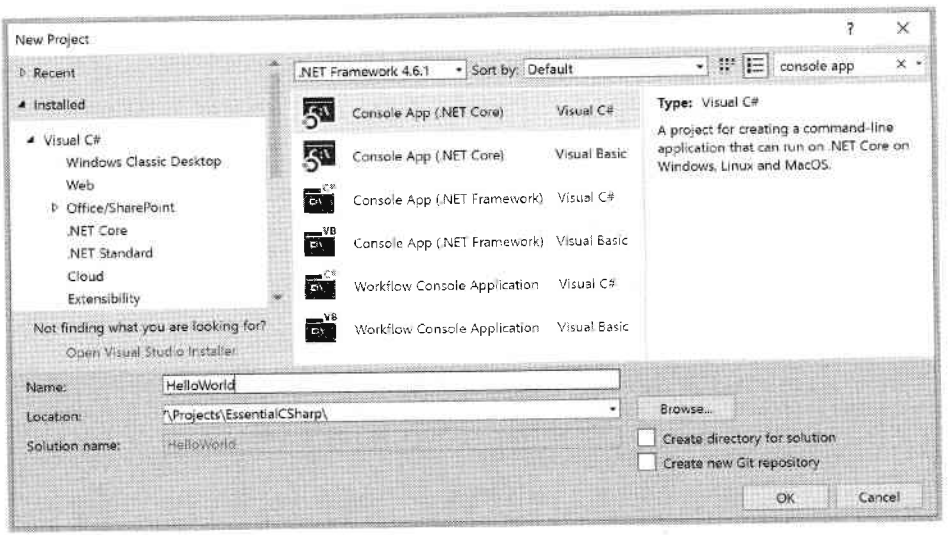

FIGURE 1.1: The New Project Dialog

4. Once the project is created, you should see a `Program.cs` file, as shown in Figure 1.2.
5. Run the generated program using the **Debug->Start Without Debugging** (Ctrl+F5) menu. This will display the command window with the text shown in Output 1.2 except the first line will display only "Hello World!".

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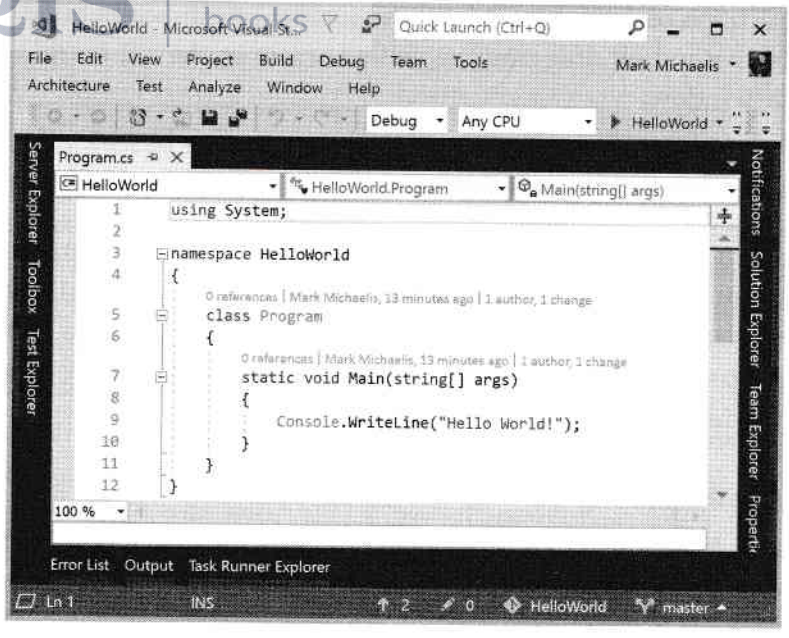

FIGURE 1.2: Dialog That Shows the `Program.cs` File

6. Modify `Program.cs` to match Listing 1.1.
7. Rerun the program to see the output shown in Output 1.2.

OUTPUT 1.2

```
> Hello. My name is Inigo Montoya.
Press any key to continue . . .
```

One significant feature of using an IDE is its support for debugging. To try it out, follow these additional steps:

8. Locate your cursor on the `System.Console.WriteLine` line and click the **Debug->Toggle Breakpoint** menu item to activate a breakpoint on that line.
9. Click the **Debug->Start Debugging** menu to relaunch the application but this time with debugging activated. Note that it will stop execution on the line where you set the breakpoint. You can then hover over a variable (e.g., `args`) to see its value. You can also move the current