C# 7.1 and .NET Core 2.0 – Modern Cross-Platform Development

Table of Contents

Preface What this book covers Part 1 - C# 7.1 Part 2 - .NET Core 2.0 and .NET Standard 2.0 Part 3 - App Models What you need for this book Who this book is for Conventions Reader feedback Customer support Downloading the example code Downloading the color images of this book Errata Piracy Questions Hello, C#! Welcome, .NET Core! Setting up your development environment Using alternative C# IDEs Deploying cross-platform Installing Microsoft Visual Studio 2017 Choosing workloads

> Choosing additional components Installing Microsoft Visual Studio Code

> > Installing Microsoft Visual Studio Code for macOS

Installing .NET Core SDK for macOS

Installing Node Package Manager for macOS

Installing the Visual Studio Code extension for C# Installing Visual Studio for Mac

Installing Xcode

Downloading and installing Visual Studio for Mac Understanding .NET

Understanding .NET Framework

Understanding the Mono and Xamarin projects

Understanding .NET Core

Understanding .NET Standard

Understanding .NET Native

Comparing .NET technologies Writing and compiling code using the .NET Core CLI tool Writing code using a simple text editor

If you are using Windows Notepad

If you are using macOS TextEdit Creating and compiling apps using the .NET Core CLI tool

Creating a console application at Command Prompt

Restoring packages, compiling code, and running the application

Fixing compiler errors

Understanding intermediate language Writing and compiling code using Visual Studio 2017

Writing code using Microsoft Visual Studio 2017

Compiling code using Visual Studio 2017

Fixing mistakes with the error list

Adding existing projects to Visual Studio 2017

Autoformatting code

Experimenting with C# Interactive

Other useful windows

Writing and compiling code using Visual Studio Code

Writing code using Visual Studio Code

Compiling code using Visual Studio Code

Autoformatting code

Writing and compiling code using Visual Studio for Mac

Next steps Managing source code with GitHub Using Git with Visual Studio 2017

Using the Team Explorer window

Cloning a GitHub repository

Managing a GitHub repository Using Git with Visual Studio Code

Configuring Git at the command line

Managing Git with Visual Studio Code Practicing and exploring

Exercise 1.1 - Test your knowledge

Exercise 1.2 - Practice C# anywhere

Exercise 1.3 - Explore topics

Summary

- 2. Part 1, C# 7.1
- 3. Speaking C# Understanding C# basics

Using Visual Studio 2017

Using Visual Studio Code on macOS, Linux, or Windows C# grammar

Statements

Comments

Blocks

C# vocabulary

Help for writing correct code

Verbs are methods

Nouns are types, fields, and variables Revealing the extent of the C# vocabulary

Building and running with Visual Studio 2017

Building and running with Visual Studio Code

 $\label{eq:Adding more types with Visual Studio 2017 and Visual Studio Code \\ \end{tabular} Declaring variables$

Naming variables

Literal values

Storing text Storing numbers

Storing whole numbers

C# 7 improvements Storing real numbers

Using Visual Studio 2017

Using Visual Studio Code Writing code to explore numbers

Comparing double and decimal types

Storing Booleans

The object type

The dynamic type Local variables

Specifying the type of a local variable

Inferring the type of a local variable

Making a value type nullable Understanding nullable reference types

The billion-dollar mistake

Changing the defaults for nullable types in C# 8.0

Checking for null

Storing multiple values in an array Exploring console applications further

Displaying output to the user

Getting input from the user

Importing a namespace

Simplifying the usage of the console Reading arguments and working with arrays

Passing arguments with Visual Studio 2017

Passing arguments with Visual Studio Code

Viewing the output Enumerating arguments

Running on Windows

Running on macOS

Handling platforms that do not support an API Operating on variables

Experimenting with unary operators

Experimenting with arithmetic operators

Comparison and Boolean operators

Practicing and exploring

Exercise 2.1 - Test your knowledge

Exercise 2.2 - Practice number sizes and ranges

Exercise 2.3 - Explore topics

Summary

4. Controlling the Flow and Converting Types Selection statements

Using Visual Studio 2017

Using Visual Studio Code on macOS, Linux, or Windows The if statement

The code

Pattern matching with the if statement The switch statement

The code

Pattern matching with the switch statement Iteration statements

The while statement

The do statement

The for statement

The foreach statement Casting and converting between types Casting from numbers to numbers

Casting numbers implicitly

Casting numbers explicitly

Using the convert type

Rounding numbers

Converting from any type to a string

Converting from a binary object to a string

Parsing from strings to numbers or dates and times Handling exceptions when converting types

The try statement

Catching all exceptions

Catching specific exceptions Checking for overflow

The checked statement

The unchecked statement Looking for help

Microsoft Docs and MSDN

Go to definition

Stack Overflow

Google

Subscribing to blogs Design patterns

Singleton pattern Practicing and exploring

Exercise 3.1 - Test your knowledge

Exercise 3.2 - Explore loops and overflow

Exercise 3.3 - Practice loops and operators

Exercise 3.4 - Practice exception handling

Exercise 3.5 - Explore topics

Summary

5. Writing, Debugging, and Testing Functions Writing functions

Writing a times table function

Writing a function that returns a value Writing mathematical functions

Formatting numbers for output

Calculating factorials with recursion Debugging an application during development

Creating an application with a deliberate bug

Setting a breakpoint

The debugging toolbar

Debugging windows

Stepping through code

Customizing breakpoints Logging during development and runtime Instrumenting with Debug and Trace

Writing to the default trace listener

Configuring trace listeners

Switching trace levels Unit testing functions

Creating a class library that needs testing with Visual Studio 2017

Creating a unit test project with Visual Studio 2017

Creating a class library that needs testing with Visual Studio Code

Writing unit tests

Running unit tests with Visual Studio 2017

Running unit tests with Visual Studio Code

Practicing and exploring

Exercise 4.1 - Test your knowledge

Exercise 4.2 – Practice writing functions with debugging and unit test

ing

Exercise 4.3 - Explore topics

Summary

6. Building Your Own Types with Object-Oriented Programming

Talking about OOP Building class libraries

Creating a class library with Visual Studio 2017

Creating a class library with Visual Studio Code

Defining a class Instantiating a class

Referencing an assembly using Visual Studio 2017

Referencing an assembly using Visual Studio Code

Importing a namespace

Managing multiple projects with Visual Studio Code

Inheriting from System.Object Storing data with fields Defining fields

Understanding access modifiers

Storing a value using the enum keyword

Storing multiple values using collections

Making a field static

Making a field constant

Making a field read-only

Initializing fields with constructors

Setting fields with default literal Writing and calling methods

Combining multiple values with tuples

Defining methods with tuples

Naming the fields of a tuple

Inferring tuple names

Deconstructing tuples

Defining and passing parameters to methods

Overloading methods

Optional parameters and named arguments

Controlling how parameters are passed

Splitting classes using partial Controlling access with properties and indexers

Defining read-only properties

Defining settable properties

Defining indexers Practicing and exploring

Exercise 5.1 - Test your knowledge

Exercise 5.2 - Explore topics

Summary

7. Implementing Interfaces and Inheriting Classes Setting up a class library and console application

Using Visual Studio 2017

Using Visual Studio Code

Defining the classes Simplifying methods with operators

Implementing some functionality with a method

Implementing some functionality with an operator

Defining local functions Raising and handling events

> Calling methods using delegates Defining events

> > Using Visual Studio 2017

Using Visual Studio Code

Using Visual Studio 2017 or Visual Studio Code Implementing interfaces

Common interfaces Comparing objects when sorting Attempting to sort objects without a method to compare

Defining a method to compare

Defining a separate comparer Making types more reusable with generics

Making a generic type

Making a generic method Managing memory with reference and value types

Defining a struct type

Releasing unmanaged resources

Ensuring that dispose is called Inheriting from classes

Extending classes

Hiding members Overriding members

Using Visual Studio 2017

Using Visual Studio 2017 or Visual Studio Code

Preventing inheritance and overriding

Polymorphism Casting within inheritance hierarchies

Implicit casting

Explicit casting

Handling casting exceptions Inheriting and extending .NET types

> Inheriting from an exception Extending types when you can't inherit

> > Using static methods to reuse functionality

Using extension methods to reuse functionality Practicing and exploring

Exercise 6.1 - Test your knowledge

Exercise 6.2 – Practice creating an inheritance hierarchy

Exercise 6.3 - Explore topics

Summary

8. Part 2 – .NET Core 2.0 and .NET Standard 2.0

9. Understanding and Packaging .NET Standard Types Understanding assemblies and namespaces Base Class Libraries and CoreFX

Assemblies, NuGet packages, and platforms

Namespaces Understanding dependent assemblies

Using Visual Studio 2017

Using Visual Studio Code

Using Visual Studio 2017 and Visual Studio Code Relating assemblies and namespaces

Browsing assemblies with Visual Studio 2017

Using Visual Studio 2017 or Visual Studio Code

Importing a namespace

Relating C# keywords to .NET types Sharing code cross-platform with .NET Standard 2.0 class libraries Creating a .NET Standard 2.0 class library

Using Visual Studio 2017

Using Visual Studio Code Understanding NuGet packages

Understanding metapackages

Understanding frameworks

Fixing dependencies Publishing your applications for deployment

Creating a console application to publish

Publishing with Visual Studio 2017 on Windows

Publishing with Visual Studio Code on macOS Packaging your libraries for NuGet distribution

> Understanding dotnet commands Adding a package reference

> > Using Visual Studio Code

Using Visual Studio 2017

Packaging a library for NuGet Testing your package

Using Visual Studio Code

Using Visual Studio 2017

Using Visual Studio 2017 and Visual Studio Code Porting from .NET Framework to .NET Core

Could you port?

Should you port?

Differences between .NET Framework and .NET Core

Understanding the .NET Portability Analyzer

Using non-.NET Standard libraries Practicing and exploring

Exercise 7.1 - Test your knowledge

Exercise 7.2 - Explore topics

Summary

10. Using Common .NET Standard Types

Working with numbers

Working with big integers

Working with complex numbers

Working with text

Getting the length of a string

Getting the characters of a string

Splitting a string

Getting part of a string

Checking a string for content

Other string members

Building strings efficiently Pattern matching with regular expressions

The syntax of a regular expression

Examples of regular expressions Working with collections

Common features of all collections Understanding collections

Lists

Dictionaries

Stacks

Queues

Sets

Working with lists

Working with dictionaries

Sorting collections

Using specialized collections

Using immutable collections Working with network resources

Working with URIs, DNS, and IP addresses

Pinging a server Working with types and attributes

Versioning of assemblies

Reading assembly metadata

Creating custom attributes

Doing more with reflection Internationalizing your code

Globalizing an application Practicing and exploring

Exercise 8.1 - Test your knowledge

Exercise 8.2 - Practice regular expressions Exercise 8.3 - Practice writing extension methods Exercise 8.4 - Explore topics

Summary

11. Working with Files, Streams, and Serialization Managing the filesystem Handling cross-platform environments and filesystems

Using Windows 10

Using macOS

Managing drives

Managing directories

Managing files

Managing paths

Getting file information

Controlling files Reading and writing with streams Writing to text and XML streams

Writing to text streams

Writing to XML streams Disposing of file resources

Implementing disposal with try statement

Simplifying disposal with the using statement

Compressing streams

Encoding text

Encoding strings as byte arrays

Encoding and decoding text in files Serializing object graphs

Serializing with XML

Deserializing with XML

Customizing the XML

Serializing with JSON

Serializing with other formats Practicing and exploring

Exercise 9.1 – Test your knowledge

Exercise 9.2 - Practice serializing as XML

Exercise 9.3 - Explore topics

Summary

12. Protecting Your Data and Applications Understanding the vocabulary of protection Keys and key sizes

IVs and block sizes

Salts

Generating keys and IVs Encrypting and decrypting data Encrypting symmetrically with AES

Using Visual Studio 2017

Using Visual Studio Code

Creating the Protector class

Hashing data

Hashing with the commonly used SHA256 Signing data

Signing with SHA256 and RSA

Testing the signing and validating Generating random numbers

Generating random numbers for games

Generating random numbers for cryptography

Testing the random key or IV generation Authenticating and authorizing users

Implementing authentication and authorization

Testing authentication and authorization

Protecting application functionality Practicing and exploring

Exercise 10.1 - Test your knowledge

Exercise 10.2 – Practice protecting data with encryption and hashing

Exercise 10.3 - Practice protecting data with decryption

Exercise 10.4 - Explore topics

Summary

13. Working with Databases Using Entity Framework Core Understanding modern databases

> Using a sample relational database Using Microsoft SQL Server

> > Connecting to SQL Server

Creating the Northwind sample database for SQL Server

Managing the Northwind sample database with Server Explorer Using SQLite

Creating the Northwind sample database for SQLite

Managing the Northwind sample database with SQLiteStudio Setting up Entity Framework Core

Choosing an EF Core data provider Connecting to the database Using Visual Studio 2017

Using Visual Studio Code Defining Entity Framework Core models

EF Core conventions

EF Core annotation attributes

EF Core Fluent API Building an EF Core model

Defining the Category entity class

Defining the Product entity class

Defining the Northwind database context class Querying an EF Core model

Logging EF Core

Pattern matching with Like

Defining global filters Loading patterns with EF Core

Eager and lazy loading entities

Explicit loading entities Manipulating data with EF Core

Inserting entities

Updating entities

Deleting entities

Pooling database contexts

Transactions

Defining an explicit transaction Practicing and exploring

Exercise 11.1 - Test your knowledge

Exercise 11.2 – Practice exporting data using different serialization

formats

Exercise 11.3 - Explore the EF Core documentation

Summary

14. Querying and Manipulating Data Using LINQ Writing LINQ queries

Extending sequences with the enumerable class Filtering entities with Where

Targeting a named method

Simplifying the code by removing the explicit delegate instantia

tion

Targeting a lambda expression Sorting entities

Sorting by a single property using OrderBy

Sorting by a subsequent property using ThenBy

Filtering by type

Working with sets Using LINQ with EF Core

Projecting entities with Select

Building an EF Core model

Joining and grouping

Aggregating sequences

Sweetening the syntax with syntactic sugar

Using multiple threads with parallel LINQ

Creating your own LINQ extension methods Working with LINQ to XML

Generating XML using LINQ to XML

Reading XML using LINQ to XML Practicing and exploring

Exercise 12.1 - Test your knowledge

Exercise 12.2 - Practice querying with LINQ

Exercise 12.3 - Explore topics

Summary

15. Improving Performance and Scalability Using Multitasking Monitoring performance and resource usage

> Evaluating the efficiency of types Monitoring performance and memory use

> > Using Visual Studio 2017

Using Visual Studio Code

Creating the Recorder class

Measuring the efficiency of processing strings

Understanding processes, threads, and tasks Running tasks asynchronously

Running multiple actions synchronously

Running multiple actions asynchronously using tasks

Waiting for tasks

Continuing with another task

Nested and child tasks Synchronizing access to shared resources

Accessing a resource from multiple threads

Applying a mutually exclusive lock to a resource

Understanding the lock statement

Making operations atomic

Applying other types of synchronization Understanding async and await

Improving responsiveness for console apps

Improving responsiveness for GUI apps

Improving scalability for web applications and web services

Common types that support multitasking

await in catch blocks

Practicing and exploring

Exercise 13.1 - Test your knowledge

Exercise 13.2 - Explore topics

Summary

16. Part 3 – App Models

17. Building Web Sites Using ASP.NET Core Razor Pages Understanding web development

Understanding HTTP

Client-side web development Understanding ASP.NET Core

Classic ASP.NET versus modern ASP.NET Core

Creating an ASP.NET Core project with Visual Studio 2017

Creating an ASP.NET Core project with Visual Studio Code

Reviewing the ASP.NET Core Empty project template

Testing the empty website

Enabling static files

Enabling default files Exploring Razor Pages

Enabling Razor Pages

Defining a Razor Page Using shared layouts with Razor Pages

Setting a shared layout

Defining a shared layout

Using code-behind files with Razor Pages Using Entity Framework Core with ASP.NET Core Creating Entity models for Northwind

Creating a class library for the Northwind entity classes

Defining the entity classes Creating a class library for Northwind database context

Using Visual Studio 2017

Using Visual Studio Code

Defining the database context class

Creating the Northwind database in the website

Configure Entity Framework Core as a service

Manipulating data Practicing and exploring

Exercise 14.1 - Practice building a data-driven website

Exercise 14.2 - Explore topics

Summary

18. Building Web Sites Using ASP.NET Core MVC Setting up an ASP.NET Core MVC website Creating an ASP.NET Core MVC website

Using Visual Studio 2017

Using Visual Studio Code

Reviewing the ASP.NET Core MVC project template Performing database migrations

Using Visual Studio 2017

Using Visual Studio Code

Testing the ASP.NET MVC website

Reviewing authentication with ASP.NET Identity Understanding an ASP.NET Core MVC website

ASP.NET Core startup

Understanding the default route

Understanding ASP.NET Core MVC controllers Understanding ASP.NET Core MVC models

Configuring an EF Core entity data model

Creating view models for requests

Fetch the model in the controller Understanding ASP.NET Core MVC views

Rendering the Home controller's views

Sharing layouts between views

Defining custom styles

Defining a typed view

Passing parameters using a route value

Passing parameters using a query string

Practicing and exploring

Exercise 15.1 - Practice improving scalability by understanding and im

plementing async action methods

Exercise 15.2 - Explore topics

Summary

19. Building Web Services and Applications Using ASP.NET Core Building web services using ASP.NET Core Web API

> Understanding ASP.NET Core controllers Creating an ASP.NET Core Web API project

> > Using Visual Studio 2017

Using Visual Studio Code

Using Visual Studio 2017 and Visual Studio Code Creating a web service for the Northwind database

Using Visual Studio 2017

Using Visual Studio Code

Using Visual Studio 2017 and Visual Studio Code Creating data repositories for entities

Configuring and registering the customers repository

Creating the Web API controller Documenting and testing web services using Swagger

Testing GET requests with any browser

Testing POST, PUT, and DELETE requests with Swagger Installing a Swagger package

Using Visual Studio 2017

Using Visual Studio Code

Using Visual Studio 2017 and Visual Studio Code

Testing GET requests with Swagger UI

Testing POST requests with Swagger UI Building SPAs using Angular Understanding the Angular project template

Understanding the Angular project tempi

Using Visual Studio 2017

Using Visual Studio Code

Using Visual Studio 2017 and Visual Studio Code Calling NorthwindService

Using Visual Studio 2017

Using Visual Studio Code

Using Visual Studio 2017 and Visual Studio Code

Modifying the home component to call NorthwindService Testing the Angular component calling the service

Using Visual Studio 2017

Using Visual Studio Code

Using Visual Studio 2017 and Visual Studio Code Using other project templates

Installing additional template packs Practicing and exploring

Exercise 16.1 - Practice with React and Redux

Exercise 16.2 - Explore topics

Summary

20. Building Windows Apps Using XAML and Fluent Design Understanding the modern Windows platform

> Understanding Universal Windows Platform Understanding Fluent Design System

> > Filling user interface elements with acrylic brushes

Connecting user interface elements with animations

Parallax views and Reveal lighting Understanding XAML Standard 1.0

Simplifying code using XAML

Choosing common controls Creating a modern Windows app

Enabling developer mode

Creating a UWP project

Exploring common controls and acrylic brushes

Exploring Reveal

Installing more controls Using resources and templates

Sharing resources

Replacing a control template

Data binding

Binding to elements Binding to data sources

Modifying the NorthwindService

Creating the Northwind app Building apps using Windows Template Studio

Installing Windows Template Studio

Selecting project types, frameworks, pages, and features

Retargeting the project

Customizing some views

Testing the app's functionality Practicing and exploring

Exercise 17.1 - Explore topics

Summary

21. Building Mobile Apps Using XAML and Xamarin.Forms Understanding Xamarin and Xamarin.Forms

How Xamarin.Forms extends Xamarin

Mobile first, cloud first

Building mobile apps using Xamarin.Forms

Adding Android SDKs

Creating a Xamarin.Forms solution

Creating a model

Creating an interface for dialing phone numbers

Implement the phone dialer for iOS

Implement the phone dialer for Android Creating views for the customers list and customer details

Creating the view for the list of customers

Creating the view for the customer details

Testing the mobile app with iOS

Adding NuGet packages for calling a REST service

Getting customers from the service Practicing and exploring

Exercise 18.1 - Explore topics

Summary

22. Summary

Good luck!

23. Answers to the Test Your Knowledge Questions

Chapter 1 - Hello, C#! Welcome, .NET Core! Chapter 2 - Speaking C# Chapter 3 - Controlling the Flow and Converting Types Chapter 4 - Writing, Debugging, and Testing Functions Chapter 5 - Building Your Own Types with Object-Oriented Programming Chapter 6 - Implementing Interfaces and Inheriting Classes Chapter 7 - Understanding and Packaging .NET Standard Types Chapter 8 - Using Common .NET Standard Types Chapter 9 - Working with Files, Streams, and Serialization Chapter 10 - Protecting Your Data and Applications Chapter 11 - Working with Databases Using Entity Framework Core Chapter 12 - Querying and Manipulating Data Using LINQ Chapter 13 - Improving Performance and Scalability Using Multitasking