

Microsoft

# Microsoft Visual C# 2012

John Sharp



ebook+exercises

# Step by Step



# Microsoft Visual C# 2012 Step by Step

Your hands-on, step-by-step guide to the fundamentals of Visual C# development.

Teach yourself how to build applications with Microsoft Visual C# 2012 and Visual Studio® 2012—one step at a time. Ideal for those with fundamental programming skills, this tutorial provides practical, learn-by-doing exercises for mastering core C# language features and creating working applications and components for Windows®.

## Discover how to:

- Work with variables, statements, operators, and methods
- Write robust code that can catch and handle exceptions
- Respond to user input and gestures
- Handle events arising from multiple sources
- Manipulate data sets using arrays and collections
- Establish new data types by using classes, interfaces, and structures
- Use LINQ expressions to enumerate data
- Optimize processing with tasks and asynchronous operations
- Build your first Windows Store app

## Your *Step by Step* digital content includes:

- Downloadable practice files  
See <http://go.microsoft.com/fwlink/?Linkid=273785>
- Fully searchable online edition of this book—with unlimited access on the web. *Free online account required; see inside book.*

## About the Author

John Sharp is an expert on developing applications with the Microsoft .NET Framework and interoperability issues. He has coauthored guides for the Microsoft Patterns and Practices group, and is the author of *Microsoft Visual C# 2010 Step by Step* and *Microsoft Windows Communication Foundation Step by Step*.

## DEVELOPER ROADMAP

### Start Here!

- Beginner-level instruction
- Easy-to-follow explanations and examples
- Exercises to build your first projects



### Step by Step

- For experienced developers learning a new topic
- Focus on fundamental techniques and tools
- Hands-on tutorial with practice files plus eBook



### Developer Reference

- Professional developers: intermediate to advanced
- Expertly covers essential tools and techniques
- Features extensive, adaptable code examples



### Focused Topics

- For programmers who develop complex or specialized solutions
- Specialized topics, in-depth coverage
- Features extensive, adaptable code examples



[microsoft.com/mspress](http://microsoft.com/mspress)

**U.S.A. \$44.99**  
Canada \$17.99  
(Recommended)

Programming/Microsoft Visual C#

**Microsoft**

# Microsoft® Visual C#® 2012 Step by Step

John Sharp

---

Published with the authorization of Microsoft Corporation by:  
O'Reilly Media, Inc.  
1005 Gravenstein Highway North  
Sebastopol, California 95472

Copyright © 2012 by CM Group, Ltd.  
All rights reserved. No part of the contents of this book may be reproduced or transmitted in any form or by any means without the written permission of the publisher.

ISBN: 978-0-7356-6801-0

1 2 3 4 5 6 7 8 9 QG 7 6 5 4 3 2

Printed and bound in the United States of America.

Microsoft Press books are available through booksellers and distributors worldwide. If you need support related to this book, email Microsoft Press Book Support at [mspinput@microsoft.com](mailto:mspinput@microsoft.com). Please tell us what you think of this book at <http://www.microsoft.com/learning/booksurvey>.

Microsoft and the trademarks listed at <http://www.microsoft.com/about/legal/en/us/IntellectualProperty/Trademarks/EN-US.aspx> are trademarks of the Microsoft group of companies. All other marks are property of their respective owners.

The example companies, organizations, products, domain names, email addresses, logos, people, places, and events depicted herein are fictitious. No association with any real company, organization, product, domain name, email address, logo, person, place, or event is intended or should be inferred.

This book expresses the author's views and opinions. The information contained in this book is provided without any express, statutory, or implied warranties. Neither the authors, O'Reilly Media, Inc., Microsoft Corporation, nor its resellers, or distributors will be held liable for any damages caused or alleged to be caused either directly or indirectly by this book.

**Acquisitions and Development Editor:** Russell Jones

**Production Editor:** Rachel Steely

**Editorial Production:** Zyg Group, LLC

**Technical Reviewer:** John Mueller

**Copyeditor:** Nicole Flores

**Indexer:** BIM Indexing Services

**Cover Design:** Twist Creative

**Cover Composition:** Zyg Group, LLC

**Illustrator:** Rebecca Demarest

---

*I dedicate this book to Diana, my wife and fellow Warwickshire supporter, for keeping me sane and giving me the perfect excuse to spend time watching cricket.*

—JOHN SHARP



# Contents at a Glance

*Introduction*

*xxi*

---

## **PART I      INTRODUCING MICROSOFT VISUAL C# AND MICROSOFT                  VISUAL STUDIO 2012**

---

CHAPTER 1	Welcome to C#	3
CHAPTER 2	Working with Variables, Operators, and Expressions	39
CHAPTER 3	Writing Methods and Applying Scope	67
CHAPTER 4	Using Decision Statements	95
CHAPTER 5	Using Compound Assignment and Iteration Statements	115
CHAPTER 6	Managing Errors and Exceptions	137

---

## **PART II      UNDERSTANDING THE C# OBJECT MODEL**

---

CHAPTER 7	Creating and Managing Classes and Objects	165
CHAPTER 8	Understanding Values and References	189
CHAPTER 9	Creating Value Types with Enumerations and Structures	213
CHAPTER 10	Using Arrays	233
CHAPTER 11	Understanding Parameter Arrays	257
CHAPTER 12	Working with Inheritance	271
CHAPTER 13	Creating Interfaces and Defining Abstract Classes	295
CHAPTER 14	Using Garbage Collection and Resource Management	325

---

## **PART III      DEFINING EXTENSIBLE TYPES WITH C#**

---

CHAPTER 15	Implementing Properties to Access Fields	349
CHAPTER 16	Using Indexers	371
CHAPTER 17	Introducing Generics	389
CHAPTER 18	Using Collections	419
CHAPTER 19	Enumerating Collections	441
CHAPTER 20	Decoupling Application Logic and Handling Events	457
CHAPTER 21	Querying In-Memory Data by Using Query Expressions	491
CHAPTER 22	Operator Overloading	515

---

**PART IV BUILDING PROFESSIONAL WINDOWS 8 APPLICATIONS WITH C#**

---

CHAPTER 23	Improving Throughput by Using Tasks	541
CHAPTER 24	Improving Response Time by Performing Asynchronous Operations	585
CHAPTER 25	Implementing the User Interface for a Windows Store App	627
CHAPTER 26	Displaying and Searching for Data in a Windows Store App	681
CHAPTER 27	Accessing a Remote Database in a Windows Store App	733
	<i>Index</i>	775



# Contents

*Introduction* ..... *xxi*

**PART I    INTRODUCING MICROSOFT VISUAL C#  
          AND MICROSOFT VISUAL STUDIO 2012**

---

<b>Chapter 1</b>	<b>Welcome to C#</b>	<b>3</b>
	Beginning Programming with the Visual Studio 2012 Environment .....	3
	Writing Your First Program .....	8
	Using Namespaces .....	14
	Creating a Graphical Application .....	18
	Examining the Windows Store App .....	30
	Examining the WPF Application .....	33
	Adding Code to the Graphical Application .....	34
	Summary .....	37
	Chapter 1 Quick Reference .....	38
<b>Chapter 2</b>	<b>Working with Variables, Operators, and Expressions</b>	<b>39</b>
	Understanding Statements .....	39
	Using Identifiers .....	40
	Identifying Keywords .....	40
	Using Variables .....	42
	Naming Variables .....	42
	Declaring Variables .....	42

---

**What do you think of this book? We want to hear from you!**

Microsoft is interested in hearing your feedback so we can continually improve our books and learning resources for you. To participate in a brief online survey, please visit:

[microsoft.com/learning/booksurvey](http://microsoft.com/learning/booksurvey)

Working with Primitive Data Types .....	43
Unassigned Local Variables .....	44
Displaying Primitive Data Type Values .....	44
Using Arithmetic Operators .....	52
Operators and Types .....	52
Examining Arithmetic Operators .....	54
Controlling Precedence .....	59
Using Associativity to Evaluate Expressions .....	60
Associativity and the Assignment Operator .....	60
Incrementing and Decrementing Variables .....	61
Prefix and Postfix .....	62
Declaring Implicitly Typed Local Variables .....	63
Summary .....	64
Chapter 2 Quick Reference .....	65

### **Chapter 3 Writing Methods and Applying Scope 67**

Creating Methods .....	67
Declaring a Method .....	68
Returning Data from a Method .....	69
Calling Methods .....	71
Applying Scope .....	74
Defining Local Scope .....	74
Defining Class Scope .....	75
Overloading Methods .....	76
Writing Methods .....	76
Using Optional Parameters and Named Arguments .....	85
Defining Optional Parameters .....	86
Passing Named Arguments .....	87
Resolving Ambiguities with Optional Parameters and Named Arguments .....	87

Summary	92
Chapter 3 Quick Reference	93
<b>Chapter 4 Using Decision Statements</b>	<b>95</b>
Declaring Boolean Variables	95
Using Boolean Operators	96
Understanding Equality and Relational Operators	96
Understanding Conditional Logical Operators	97
Short-Circuiting	98
Summarizing Operator Precedence and Associativity	98
Using if Statements to Make Decisions	99
Understanding if Statement Syntax	99
Using Blocks to Group Statements	100
Cascading if Statements	101
Using switch Statements	107
Understanding switch Statement Syntax	108
Following the switch Statement Rules	109
Summary	113
Chapter 4 Quick Reference	114
<b>Chapter 5 Using Compound Assignment and Iteration Statements</b>	<b>115</b>
Using Compound Assignment Operators	115
Writing while Statements	117
Writing for Statements	123
Understanding for Statement Scope	125
Writing do Statements	125
Summary	134
Chapter 5 Quick Reference	135

<b>Chapter 6</b>	<b>Managing Errors and Exceptions</b>	<b>137</b>
	Coping with Errors .....	137
	Trying Code and Catching Exceptions .....	138
	Unhandled Exceptions .....	139
	Using Multiple catch Handlers .....	140
	Catching Multiple Exceptions .....	141
	Propagating Exceptions .....	147
	Using Checked and Unchecked Integer Arithmetic .....	149
	Writing Checked Statements .....	150
	Writing Checked Expressions .....	151
	Throwing Exceptions .....	154
	Using a finally Block .....	159
	Summary .....	160
	Chapter 6 Quick Reference .....	161

---

**PART II    UNDERSTANDING THE C# OBJECT MODEL**

---

<b>Chapter 7</b>	<b>Creating and Managing Classes and Objects</b>	<b>165</b>
	Understanding Classification .....	165
	The Purpose of Encapsulation .....	166
	Defining and Using a Class .....	166
	Controlling Accessibility .....	168
	Working with Constructors .....	169
	Overloading Constructors .....	170
	Understanding static Methods and Data .....	180
	Creating a Shared Field .....	181
	Creating a static Field by Using the const Keyword .....	182
	Understanding static Classes .....	182
	Anonymous Classes .....	185
	Summary .....	186
	Chapter 7 Quick Reference .....	187

---

**Chapter 8 Understanding Values and References 189**

Copying Value Type Variables and Classes . . . . .189

Understanding Null Values and Nullable Types . . . . .195

    Using Nullable Types . . . . .196

    Understanding the Properties of Nullable Types . . . . .197

Using ref and out Parameters . . . . .198

    Creating ref Parameters . . . . .199

    Creating out Parameters . . . . .200

How Computer Memory Is Organized . . . . .202

    Using the Stack and the Heap . . . . .203

The System.Object Class . . . . .204

Boxing . . . . .205

Unboxing . . . . .206

Casting Data Safely . . . . .207

    The is Operator . . . . .207

    The as Operator . . . . .208

Summary . . . . .210

Chapter 8 Quick Reference . . . . .210

**Chapter 9 Creating Value Types with Enumerations and Structures 213**

Working with Enumerations . . . . .213

    Declaring an Enumeration . . . . .214

    Using an Enumeration . . . . .214

    Choosing Enumeration Literal Values . . . . .215

    Choosing an Enumeration's Underlying Type . . . . .216

Working with Structures . . . . .218

    Declaring a Structure . . . . .220

    Understanding Structure and Class Differences . . . . .221

    Declaring Structure Variables . . . . .222

    Understanding Structure Initialization . . . . .223

    Copying Structure Variables . . . . .227

Summary . . . . .	231
Chapter 9 Quick Reference . . . . .	232

**Chapter 10 Using Arrays 233**

Declaring and Creating an Array . . . . .	233
Declaring Array Variables . . . . .	234
Creating an Array Instance . . . . .	234
Populating and Using an Array . . . . .	235
Creating an Implicitly Typed Array . . . . .	236
Accessing an Individual Array Element . . . . .	237
Iterating Through an Array . . . . .	238
Passing Arrays as Parameters and Return Values for a Method . . . . .	239
Copying Arrays . . . . .	241
Using Multidimensional Arrays . . . . .	242
Creating Jagged Arrays . . . . .	243
Summary . . . . .	254
Chapter 10 Quick Reference . . . . .	255

**Chapter 11 Understanding Parameter Arrays 257**

Overloading: A Recap . . . . .	257
Using Array Arguments . . . . .	258
Declaring a params Array . . . . .	260
Using params object[ ] . . . . .	262
Using a params Array . . . . .	263
Comparing Parameter Arrays and Optional Parameters . . . . .	266
Summary . . . . .	268
Chapter 11 Quick Reference . . . . .	269

---

**Chapter 12 Working with Inheritance 271**

What Is Inheritance? . . . . .271

Using Inheritance . . . . .272

    The System.Object Class Revisited . . . . .274

    Calling Base Class Constructors . . . . .274

    Assigning Classes . . . . .276

    Declaring new Methods . . . . .277

    Declaring virtual Methods . . . . .279

    Declaring override Methods . . . . .280

    Understanding protected Access . . . . .282

Understanding Extension Methods . . . . .288

Summary . . . . .293

Chapter 12 Quick Reference . . . . .293

**Chapter 13 Creating Interfaces and Defining Abstract Classes 295**

Understanding Interfaces . . . . .295

    Defining an Interface . . . . .296

    Implementing an Interface . . . . .297

    Referencing a Class Through Its Interface . . . . .298

    Working with Multiple Interfaces . . . . .299

    Explicitly Implementing an Interface . . . . .300

    Interface Restrictions . . . . .302

    Defining and Using Interfaces . . . . .302

Abstract Classes . . . . .312

    Abstract Methods . . . . .314

Sealed Classes . . . . .314

    Sealed Methods . . . . .315

    Implementing and Using an Abstract Class . . . . .315

Summary . . . . .322

Chapter 13 Quick Reference . . . . .323

---

**Chapter 14 Using Garbage Collection  
and Resource Management 325**

The Life and Times of an Object . . . . .	325
Writing Destructors . . . . .	326
Why Use the Garbage Collector? . . . . .	328
How Does the Garbage Collector Work? . . . . .	330
Recommendations . . . . .	330
Resource Management . . . . .	331
Disposal Methods . . . . .	331
Exception-Safe Disposal . . . . .	332
The using Statement and the IDisposable Interface . . . . .	332
Calling the Dispose Method from a Destructor . . . . .	334
Implementing Exception-Safe Disposal . . . . .	336
Summary . . . . .	345
Chapter 14 Quick Reference . . . . .	345

**PART III   DEFINING EXTENSIBLE TYPES WITH C#**

---

**Chapter 15 Implementing Properties  
to Access Fields 349**

Implementing Encapsulation by Using Methods . . . . .	349
What Are Properties? . . . . .	351
Using Properties . . . . .	354
Read-Only Properties . . . . .	354
Write-Only Properties . . . . .	355
Property Accessibility . . . . .	355
Understanding the Property Restrictions . . . . .	356
Declaring Interface Properties . . . . .	358
Replacing Methods with Properties . . . . .	359
Generating Automatic Properties . . . . .	363
Initializing Objects by Using Properties . . . . .	365
Summary . . . . .	369
Chapter 15 Quick Reference . . . . .	369



---

**Chapter 16 Using Indexers 371**

What Is an Indexer? .....371

    An Example That Doesn't Use Indexers .....371

    The Same Example Using Indexers .....373

    Understanding Indexer Accessors. ....376

    Comparing Indexers and Arrays .....376

Indexers in Interfaces .....378

Using Indexers in a Windows Application .....379

Summary. ....386

Chapter 16 Quick Reference .....386

**Chapter 17 Introducing Generics 389**

The Problem with the object Type.....389

The Generics Solution .....393

    Generics vs. Generalized Classes .....395

    Generics and Constraints .....396

Creating a Generic Class .....396

    The Theory of Binary Trees.....396

    Building a Binary Tree Class by Using Generics .....399

Creating a Generic Method. ....409

    Defining a Generic Method to Build a Binary Tree .....410

Variance and Generic Interfaces.....412

    Covariant Interfaces.....414

    Contravariant Interfaces.....415

Summary.....417

Chapter 17 Quick Reference .....418

**Chapter 18 Using Collections 419**

What Are Collection Classes? .....419

    The List<T> Collection Class.....421

    The LinkedList<T> Collection Class .....423

    The Queue<T> Collection Class.....425

    The Stack<T> Collection Class .....426

The Dictionary<TKey, TValue> Collection Class . . . . .	427
The SortedList<TKey, TValue> Collection Class . . . . .	428
The HashSet<T> Collection Class . . . . .	429
Using Collection Initializers . . . . .	431
The Find Methods, Predicates, and Lambda Expressions . . . . .	431
Comparing Arrays and Collections . . . . .	433
Using Collection Classes to Play Cards . . . . .	434
Summary . . . . .	438
Chapter 18 Quick Reference . . . . .	439
<b>Chapter 19 Enumerating Collections</b>	<b>441</b>
Enumerating the Elements in a Collection . . . . .	441
Manually Implementing an Enumerator . . . . .	443
Implementing the IEnumerable Interface . . . . .	447
Implementing an Enumerator by Using an Iterator . . . . .	450
A Simple Iterator . . . . .	450
Defining an Enumerator for the Tree<TItem> Class by Using an Iterator . . . . .	452
Summary . . . . .	454
Chapter 19 Quick Reference . . . . .	455
<b>Chapter 20 Decoupling Application Logic and Handling Events</b>	<b>457</b>
Understanding Delegates . . . . .	458
Examples of Delegates in the .NET Framework Class Library . . . . .	459
The Automated Factory Scenario . . . . .	461
Implementing the Factory Control System Without Using Delegates . . . . .	461
Implementing the Factory by Using a Delegate . . . . .	462
Declaring and Using Delegates . . . . .	465
Lambda Expressions and Delegates . . . . .	474
Creating a Method Adapter . . . . .	474
The Forms of Lambda Expressions . . . . .	475

Enabling Notifications with Events. . . . .	476
Declaring an Event. . . . .	477
Subscribing to an Event. . . . .	478
Unsubscribing from an Event. . . . .	478
Raising an Event. . . . .	478
Understanding User Interface Events . . . . .	479
Using Events . . . . .	480
Summary. . . . .	487
Chapter 20 Quick Reference . . . . .	488

**Chapter 21 Querying In-Memory Data by Using Query Expressions 491**

What Is Language-Integrated Query?. . . . .	491
Using LINQ in a C# Application . . . . .	492
Selecting Data. . . . .	494
Filtering Data . . . . .	497
Ordering, Grouping, and Aggregating Data . . . . .	497
Joining Data . . . . .	500
Using Query Operators. . . . .	501
Querying Data in Tree<TItem> Objects . . . . .	503
LINQ and Deferred Evaluation. . . . .	509
Summary. . . . .	513
Chapter 21 Quick Reference . . . . .	513

**Chapter 22 Operator Overloading 515**

Understanding Operators . . . . .	515
Operator Constraints . . . . .	516
Overloaded Operators . . . . .	516
Creating Symmetric Operators . . . . .	518
Understanding Compound Assignment Evaluation . . . . .	520
Declaring Increment and Decrement Operators. . . . .	520
Comparing Operators in Structures and Classes. . . . .	521
Defining Operator Pairs . . . . .	522

---

Implementing Operators . . . . .	523
Understanding Conversion Operators . . . . .	530
Providing Built-in Conversions. . . . .	530
Implementing User-Defined Conversion Operators . . . . .	531
Creating Symmetric Operators, Revisited . . . . .	532
Writing Conversion Operators. . . . .	533
Summary. . . . .	535
Chapter 22 Quick Reference . . . . .	536

---

**PART IV BUILDING PROFESSIONAL WINDOWS 8 APPLICATIONS  
WITH C#**

---

**Chapter 23 Improving Throughput by Using Tasks 541**

Why Perform Multitasking by Using Parallel Processing? . . . . .	541
The Rise of the Multicore Processor . . . . .	542
Implementing Multitasking with the .NET Framework. . . . .	544
Tasks, Threads, and the ThreadPool . . . . .	544
Creating, Running, and Controlling Tasks . . . . .	545
Using the Task Class to Implement Parallelism. . . . .	548
Abstracting Tasks by Using the Parallel Class . . . . .	559
When Not to Use the Parallel Class. . . . .	564
Canceling Tasks and Handling Exceptions . . . . .	566
The Mechanics of Cooperative Cancellation. . . . .	566
Using Continuations with Canceled and Faulted Tasks . . . . .	581
Summary. . . . .	582
Chapter 23 Quick Reference . . . . .	583

**Chapter 24 Improving Response Time by Performing  
Asynchronous Operations 585**

Implementing Asynchronous Methods. . . . .	586
Defining Asynchronous Methods: The Problem. . . . .	586
Defining Asynchronous Methods: The Solution. . . . .	589
Defining Asynchronous Methods That Return Values. . . . .	595
Asynchronous Methods and the Windows Runtime APIs. . . . .	596

Using PLINQ to Parallelize Declarative Data Access . . . . .	599
Using PLINQ to Improve Performance While Iterating Through a Collection . . . . .	600
Canceling a PLINQ Query . . . . .	604
Synchronizing Concurrent Access to Data . . . . .	605
Locking Data . . . . .	608
Synchronization Primitives for Coordinating Tasks . . . . .	608
Cancelling Synchronization . . . . .	611
The Concurrent Collection Classes . . . . .	612
Using a Concurrent Collection and a Lock to Implement Thread-Safe Data Access . . . . .	612
Summary . . . . .	623
Chapter 24 Quick Reference . . . . .	624

**Chapter 25 Implementing the User Interface for a Windows Store App 627**

What Is a Windows Store App? . . . . .	628
Using the Blank App Template to Build a Windows Store App . . . . .	632
Implementing a Scalable User Interface . . . . .	634
Applying Styles to a User Interface . . . . .	669
Summary . . . . .	679
Chapter 25 Quick Reference . . . . .	679

**Chapter 26 Displaying and Searching for Data in a Windows Store App 681**

Implementing the Model-View-ViewModel Pattern . . . . .	681
Displaying Data by Using Data Binding . . . . .	682
Modifying Data by Using Data Binding . . . . .	689

---

**What do you think of this book? We want to hear from you!**

Microsoft is interested in hearing your feedback so we can continually improve our books and learning resources for you. To participate in a brief online survey, please visit:

[microsoft.com/learning/booksurvey](http://microsoft.com/learning/booksurvey)

Using Data Binding with a ComboBox Control. . . . .	693
Creating a ViewModel. . . . .	695
Adding Commands to a ViewModel. . . . .	699
Windows 8 Contracts . . . . .	711
Implementing the Search Contract. . . . .	712
Navigating to a Selected Item. . . . .	722
Starting an Application from the Search Charm. . . . .	725
Summary. . . . .	729
Chapter 26 Quick Reference . . . . .	732

**Chapter 27 Accessing a Remote Database in a Windows Store App 733**

Retrieving Data from a Database. . . . .	733
Creating an Entity Model . . . . .	735
Creating and Using a Data Service . . . . .	741
Inserting, Updating, and Deleting Data in a Database. . . . .	754
Performing Insert, Update, and Delete Operations Through a WCF Data Service. . . . .	754
Reporting Errors and Updating the User Interface . . . . .	764
Summary. . . . .	772
Chapter 27 Quick Reference . . . . .	773
<i>Index</i> . . . . .	775

---

# Introduction

Microsoft Visual C# is a powerful but simple language aimed primarily at developers creating applications by using the Microsoft .NET Framework. It inherits many of the best features of C++ and Microsoft Visual Basic, but few of the inconsistencies and anachronisms, resulting in a cleaner and more logical language. C# 1.0 made its public debut in 2001. The advent of C# 2.0 with Visual Studio 2005 saw several important new features added to the language, including generics, iterators, and anonymous methods. C# 3.0, which was released with Visual Studio 2008, added extension methods, lambda expressions, and most famously of all, the Language-Integrated Query facility, or LINQ. C# 4.0, released in 2010, provided further enhancements that improved its interoperability with other languages and technologies. These features included support for named and optional arguments, and the *dynamic* type, which indicates that the language runtime should implement late binding for an object. An important addition in the .NET Framework released concurrently with C# 4.0 was the classes and types that constitute the Task Parallel Library (TPL). Using the TPL, you can build highly scalable applications that can take full advantage of multicore processors quickly and easily. C# 5.0 adds native support for asynchronous task-based processing through the *async* method modifier and the *await* operator.

Another key event for Microsoft has been the launch of Windows 8. This new version of Windows supports highly interactive applications that can share data and collaborate with each other as well as connect to services running in the cloud. The development environment provided by Microsoft Visual Studio 2012 makes all these powerful features easy to use, and the many new wizards and enhancements included in Visual Studio 2012 can greatly improve your productivity as a developer. The combination of Visual Studio 2012, Windows 8, and C# 5.0 provides a comprehensive platform and toolset for building the next generation of powerful, intuitive, and portable applications. However, even if you are not using Windows 8, Visual Studio 2012 and C# 5.0 have much to offer, and they form an invaluable partnership for helping you to build great solutions.

## Who Should Read This Book

This book assumes that you are a developer who wants to learn the fundamentals of programming with C# by using Visual Studio 2012 and the .NET Framework version 4.5. By the time you complete this book, you will have a thorough understanding of C# and

---

will have used it to build responsive and scalable Windows Presentation Foundation (WPF) applications that can run on both Windows 7 and Windows 8.

You can build and run C# 5.0 applications on Windows 7 and Windows 8, although the user interfaces provided by these two operating systems have some significant differences. Consequently, Parts I to III of this book provide exercises and worked examples that will run in both environments. Part IV focuses on the application development model used by Windows 8, and the material in this section provides an introduction to building interactive applications for this new platform.

## Who Should Not Read This Book

This book is aimed at developers new to C#, and as such, it concentrates primarily on the C# language. This book is not intended to provide detailed coverage of the multitude of technologies available for building enterprise-level applications for Windows, such as ADO.NET, ASP.NET, Windows Communication Foundation, or Workflow Foundation. If you require more information on any of these items, you might consider reading some of the other titles in the Step by Step for Developers series available from Microsoft Press, such as *Microsoft ASP.NET 4 Step by Step*, *Microsoft ADO.NET 4 Step by Step*, and *Microsoft Windows Communication Foundation 4 Step by Step*.

## Organization of This Book

This book is divided into four sections:

- Part I, "Introducing Microsoft Visual C# and Microsoft Visual Studio 2012," provides an introduction to the core syntax of the C# language and the Visual Studio programming environment.
- Part II, "Understanding the C# Object Model," goes into detail on how to create and manage new types by using C#, and how to manage the resources referenced by these types.
- Part III, "Defining Extensible Types with C#," includes extended coverage of the elements that C# provides for building types that you can reuse across multiple applications.
- Part IV, "Building Professional Window 8 Applications with C#," describes the Windows 8 programming model, and how you can use C# to build interactive applications for this new model.



- [read By Heresies Distressed online](#)
- [download online \*Le Roman vrai\*](#)
- [read online \*Interaction Flow Modeling Language: Model-Driven UI Engineering of Web and Mobile Apps with IFML \(The MK/OMG Press Series\)\*](#)
- [read The Moral Foundation of Economic Behavior](#)
- [read online Comment c'est pdf, azw \(kindle\), epub, doc, mobi](#)
  
- <http://korplast.gr/lib/By-Heresies-Distressed.pdf>
- <http://betsy.wesleychapelcomputerrepair.com/library/A-Book-of-Abstract-Algebra--2nd-Edition---Dover-Books-on-Mathematics-.pdf>
- <http://betsy.wesleychapelcomputerrepair.com/library/Interaction-Flow-Modeling-Language--Model-Driven-UI-Engineering-of-Web-and-Mobile-Apps-with-IFML--The-MK-OMG-Pr>
- <http://www.experienceolvera.co.uk/library/La-conciencia-uncida-a-la-carne--Diarios-de-madurez-1964-1980--Journals-of-Susan-Sontag--Book-2-.pdf>
- <http://www.1973vision.com/?library/Comment-c-est.pdf>