



CRC Press  
Taylor & Francis Group

AN A K PETERS BOOK

# Learning C# Programming with Unity 3D

Alex Okita

# Learning C# Programming with Unity 3D

Alex Okita



CRC Press

Taylor & Francis Group

Boca Raton London New York

---

CRC Press is an imprint of the  
Taylor & Francis Group, an **Informa** business



CRC Press  
Taylor & Francis Group  
6000 Broken Sound Parkway NW, Suite 300  
Boca Raton, FL 33487-2742

© 2015 by Taylor & Francis Group, LLC  
CRC Press is an imprint of Taylor & Francis Group, an Informa business

No claim to original U.S. Government works

Printed on acid-free paper  
Version Date: 20140707

International Standard Book Number-13: 978-1-4665-8652-9 (Paperback)

This book contains information obtained from authentic and highly regarded sources. Reasonable efforts have been made to publish reliable data and information, but the author and publisher cannot assume responsibility for the validity of all materials or the consequences of their use. The authors and publishers have attempted to trace the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission to publish in this form has not been obtained. If any copyright material has not been acknowledged please write and let us know so we may rectify in any future reprint.

Except as permitted under U.S. Copyright Law, no part of this book may be reprinted, reproduced, transmitted, or utilized in any form by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying, microfilming, and recording, or in any information storage or retrieval system, without written permission from the publishers.

For permission to photocopy or use material electronically from this work, please access [www.copyright.com](http://www.copyright.com) (<http://www.copyright.com/>) or contact the Copyright Clearance Center, Inc. (CCC), 222 Rosewood Drive, Danvers, MA 01923, 978-750-8400. CCC is a not-for-profit organization that provides licenses and registration for a variety of users. For organizations that have been granted a photocopy license by the CCC, a separate system of payment has been arranged.

**Trademark Notice:** Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

---

**Library of Congress Cataloging-in-Publication Data**

---

Okita, Alex.

Learning C# programming with Unity 3D / Alex Okita.  
pages cm

Summary: "Ideal for game programmers with no prior experience with programming languages, this book covers the basics of programming and explains how C# is used to make a game in Unity3D. Interactive examples give C# code meaning. As more complex aspects of C# are explained the interactivity of example games gains depth. Common programming tasks are taught by way of making a game. The final result is a reader who is capable of understanding how to read and apply C# in Unity3D and apply that knowledge to other development environments that use C#"- Provided by publisher.

Includes bibliographical references and index.

ISBN 978-1-4665-8652-9 (paperback)

1. Computer games--Programming. 2. C# (Computer program language) 3. Unity (Electronic resource) 4. Three-dimensional display systems. I. Title.

QA76.76.C672O43 2014  
794.8'1526--dc23

2014006696

---

Visit the Taylor & Francis Web site at  
<http://www.taylorandfrancis.com>

and the CRC Press Web site at  
<http://www.crcpress.com>

# **Learning C# Programming with Unity 3D**



---

## *Acknowledgments*

---

Over the past two decades I've had the opportunity to work with many amazingly talented artists and engineers.

Those who have inspired me are Edward, JCAB, Joel, and Eric from Ronin Games. Their skill and expertise kept me on my toes and motivated me to learn new skills. Also from Ronin is Ashish, with whom I was able to get started with writing.

More recently regarding my transition from artist to engineer, I thank Dave Tin Nyo, Anka GranovSkaya, David Bennett, and Jordan Patz. The original Float Hybrid group was one of the most creative collectives I've ever had the opportunity to work with. Never before has there been such a talented group of engineers under one roof—nor will there be one such hereafter.

Along the way, I thank my mother Sandi, who has always been an amazing artist. Finally, I thank April, who was the inspiration for my getting started with this book.



---

# *Contents*

---

Acknowledgments.....	ix
<b>1. Introduction: What This Book Is About.....</b>	<b>1</b>
1.1    Why Read a Book: Why This Book May or May Not Be for You.....	1
1.1.1    Do I Need to Know Math?.....	2
1.1.2    Programming as a Form of Expression .....	2
1.1.3    Games as a Stage with Lights .....	2
1.2    Personal Information .....	2
1.3    A Brief History of Computer Programming: How Programming Came to Be .....	3
1.3.1    Mechanical Computers .....	3
1.3.2    Logic .....	3
1.3.3    Computer Science .....	3
1.3.4    Software .....	4
1.3.5    Modern Computer Language .....	4
1.3.6    The Future of Computer Languages .....	4
1.4    C#: A Flexible Programming Language .....	4
1.4.1    C# Paradigm .....	4
1.4.2    Unity 3D: A Brief History of Game Engines .....	5
1.4.3    Why Use Unity 3D to Learn? .....	6
1.4.4    How Does Unity 3D Use C#? .....	6
1.4.4.1    How to Tell Unity 3D What to Do.....	6
1.5    What Is Programming?.....	7
1.5.1    What Does C# Look Like? .....	7
1.5.2    Learning to Copy and Paste.....	8
1.6    Compiling: Turning Words into Computer Instruction.....	9
1.7    What We've Learned .....	9
1.8    Leveling Up.....	9
<b>2. Before You Begin.....</b>	<b>11</b>
2.1    What Will Be Covered in This Chapter .....	11
2.2    Downloading and Installing: It Is Free.....	13
2.3    Unity 3D Overview: What We're Looking At.....	14
2.3.1    The Main Panel.....	15
2.3.1.1    Toolbar .....	15
2.3.1.2    Hierarchy Panel .....	16
2.3.1.3    Scene and Game View.....	16
2.3.1.4    Inspector Panel .....	17
2.3.1.5    Project and Console Panel .....	17
2.3.2    Creating a New Project .....	19
2.3.3    A New Unity 3D Project .....	20
2.3.3.1    Assets Directory .....	20
2.3.3.2    Library Directory .....	21
2.3.3.3    Project Settings Directory .....	22
2.3.3.4    Temp Directory.....	22
2.3.4    Summary.....	23

2.4	Sample Code .....	23
2.4.1	Code Fragments .....	23
2.4.2	Are Errors Bad? .....	24
2.4.2.1	Compile-Time and Run-Time Errors.....	24
2.4.3	How to Follow Along.....	25
2.4.4	Summary .....	25
2.5	Working with C#: Game Engines.....	25
2.5.1	Getting Project Files .....	26
2.5.2	Creating and Assigning a New C# File: Now It's Your Turn .....	27
2.5.3	Naming Your New File .....	30
2.5.4	Using Your New File.....	31
2.5.5	Unity 3D Tools .....	36
2.5.6	Running Live Code .....	38
2.5.7	Saving a Scene .....	39
2.5.8	Opening a Scene .....	39
2.5.9	Summary .....	39
2.6	What We've Learned .....	40
2.7	Leveling Up.....	40
<b>3.</b>	<b>First Steps .....</b>	<b>41</b>
3.1	What Will Be Covered in This Chapter .....	41
3.2	Review.....	41
3.3	Tokens .....	42
3.3.1	Writing C#.....	42
3.3.2	Separator Tokens.....	43
3.3.3	Operator Tokens.....	44
3.3.4	Other Operator Tokens.....	44
3.3.5	Literals .....	44
3.3.6	Transitive and Non-Transitive Operations .....	44
3.3.7	Putting It All Together .....	45
3.3.8	What We've Learned .....	46
3.4	Statements and Expressions.....	46
3.4.1	Expressions .....	46
3.4.2	How Code Is Executed.....	47
3.4.3	Thinking in Algorithms.....	47
3.4.3.1	Wash, Rinse, Repeat.....	49
3.4.4	What We've Learned .....	49
3.5	Keywords .....	49
3.5.1	Class .....	50
3.5.2	What We've Learned .....	51
3.6	White Space .....	51
3.6.1	Pick a Flavor .....	55
3.6.2	What We've Learned .....	56
3.7	Code Blocks .....	56
3.7.1	What We've Learned .....	57
3.8	Classes.....	57
3.8.1	Objects .....	58
3.8.2	What We've Learned .....	61
3.9	Variables .....	61
3.9.1	Identifiers .....	62
3.9.2	Data .....	62

3.9.3	Declaring a Variable .....	62
3.9.3.1	A Basic Example .....	64
3.9.4	Dynamic Initialization .....	65
3.9.5	What We've Learned .....	65
3.10	Variable Names .....	66
3.10.1	Using Variables in Unity 3D .....	68
3.10.2	Variable Assignment .....	69
3.10.3	Putting It Together .....	71
3.10.4	What We've Learned .....	73
3.11	Types: A First Look .....	74
3.11.1	Value and Reference Types .....	74
3.11.2	What We've Learned .....	75
3.12	Strong Typing .....	75
3.12.1	Dynamic Typing .....	76
3.12.2	What We've Learned .....	76
3.13	Type Casting, Numbers .....	77
3.13.1	Explicit versus Implicit Casting .....	78
3.13.1.1	A Basic Example .....	78
3.13.2	What We've Learned .....	80
3.14	Comments .....	81
3.14.1	Line Numbers .....	83
3.14.2	Code Folding .....	84
3.14.3	Summary Comments .....	85
3.14.4	Navigating in Code .....	86
3.14.5	What We've Learned .....	87
3.15	Leveling Up: Moving On to Basics .....	87
<b>4.</b>	<b>Basics: The Building Blocks of Code .....</b>	<b>89</b>
4.1	What Will Be Covered in This Chapter .....	89
4.2	Review .....	89
4.3	Building Up a Game Idea: Working with What You Know .....	90
4.3.1	Design from Experience .....	90
4.3.1.1	Know Yourself .....	90
4.3.2	Primary Activity .....	91
4.3.3	Moment to Moment .....	91
4.3.4	Actions to Functions .....	91
4.3.5	Compromise .....	92
4.3.6	Starting with Controls .....	92
4.3.7	What We've Learned .....	93
4.4	Creating a Class .....	93
4.4.1	Class Declaration .....	94
4.4.1.1	A Basic Example .....	95
4.4.1.2	Value and Reference Types .....	96
4.4.2	Adding Data Fields .....	96
4.4.3	Access Modifiers and the Dot Operator .....	96
4.4.4	Class Scope .....	98
4.4.5	Class Members .....	99
4.4.6	What We've Learned .....	99
4.5	Directives .....	102
4.5.1	Libraries .....	103
4.5.2	Ambiguous NameSpaces .....	108
4.5.3	What We've Learned .....	108

4.6	Functions.....	109
4.6.1	What Are Functions? .....	109
4.6.2	Unity 3D Entry Points.....	110
4.6.3	Writing a Function .....	112
4.6.3.1	A Basic Example .....	112
4.6.4	More on White Space and Tabs .....	113
4.6.5	What We've Learned .....	115
4.7	Order of Operation: What Is Calculated and When .....	115
4.7.1	Evaluating Numbers.....	116
4.7.1.1	Math.....	116
4.7.1.2	Operator Evaluation.....	118
4.7.2	What We've Learned .....	120
4.8	Scope: A First Look.....	120
4.8.1	Class Scope .....	121
4.8.2	Function Scope.....	124
4.8.3	What We've Learned .....	126
4.9	This .....	126
4.9.1	A Basic Example.....	127
4.9.2	When This Is Necessary .....	128
4.9.3	Awkward Names .....	128
4.9.4	What We've Learned .....	129
4.10	Turning Ideas into Code—Part 1.....	129
4.10.1	Mouse Input .....	131
4.10.2	GameObject .....	131
4.10.3	What We've Learned .....	133
4.11	Logic and Operators .....	133
4.11.1	Booleans.....	134
4.11.2	Equality Operators.....	134
4.11.2.1	A Basic Example .....	135
4.11.3	If and Branching .....	135
4.11.3.1	Not! .....	137
4.11.4	Flowcharts.....	137
4.11.5	Relational Operators .....	138
4.11.5.1	Else .....	139
4.11.5.2	Else If.....	140
4.11.6	Rearranging Logic .....	140
4.11.6.1	Flawed Logic .....	143
4.11.6.2	Unreachable Code.....	144
4.11.7	Another Look at Scope .....	145
4.11.8	What We've Learned .....	147
4.12	Loops .....	148
4.12.1	Unary Operators.....	148
4.12.2	While.....	149
4.12.3	For .....	149
4.12.4	Do–While.....	151
4.12.5	Postfix and Prefix Notation .....	152
4.12.6	Using Loops .....	153
4.12.7	Loops within Loops .....	155
4.12.8	Runaway Loops.....	156
4.12.9	Breakpoints: A First Look .....	157
4.12.10	What We've Learned .....	160

4.13	Scope, Again .....	160
4.13.1	Visibility or Accessibility .....	160
4.13.1.1	A Basic Example .....	161
4.13.2	Global Scope .....	161
4.13.3	What We've Learned .....	164
4.14	Warnings versus Errors.....	164
4.14.1	Warnings .....	165
4.14.2	Errors .....	165
4.14.3	Understanding the Debugger .....	165
4.14.4	What We've Learned .....	168
4.15	Leveling Up: Fundamentals.....	168
4.15.1	Style Guides .....	169
<b>5.</b>	<b>Fundamentals .....</b>	<b>171</b>
5.1	What Will Be Covered in This Chapter .....	171
5.2	Review.....	171
5.2.1	Modular Code .....	173
5.3	Inheritance: A First Look .....	175
5.3.1	Class Members.....	176
5.3.2	Instancing.....	178
5.3.2.1	A Basic Example .....	180
5.3.3	Parent and Child .....	180
5.3.4	Object.....	182
5.3.4.1	A Type Is Not an Object .....	183
5.3.5	!= null.....	184
5.3.6	What We've Learned .....	185
5.4	Instancing.....	185
5.4.1	Class Initialization .....	186
5.4.2	New .....	187
5.4.3	Constructors .....	187
5.4.4	What We've Learned .....	190
5.5	Static .....	190
5.5.1	A Basic Example.....	191
5.5.2	Static Variables .....	192
5.5.2.1	A Basic Example .....	193
5.5.3	Static Functions.....	195
5.5.4	Putting It All Together .....	197
5.5.5	What We've Learned .....	201
5.6	Turning Ideas into Code—Part 2.....	201
5.6.1	Input Manager .....	206
5.6.2	What We've Learned .....	214
5.7	Jump Statements .....	214
5.7.1	Return.....	215
5.7.1.1	A Basic Example .....	215
5.7.2	Returning Objects .....	216
5.7.3	A Class Is a Type .....	217
5.7.4	Null Is Not Void .....	219
5.7.5	What We've Learned .....	219
5.8	Operators and Conditions .....	219
5.8.1	Conditional Operators && and    .....	220
5.8.1.1	A Basic Example .....	220
5.8.2	What We've Learned .....	223

5.9	Arrays: A First Look.....	224
5.9.1	Fixed-Sized Arrays .....	224
5.9.1.1	A Basic Example .....	224
5.9.2	Foreach.....	229
5.9.2.1	A Basic Example .....	229
5.9.3	Dynamic Initialization.....	229
5.9.4	Using the While Loop with Arrays.....	230
5.9.4.1	Setting Array Values .....	230
5.9.4.2	Getting Array Values.....	231
5.9.5	What We've Learned .....	231
5.10	Jump Statements: Break and Continue .....	232
5.10.1	A Basic Example.....	232
5.10.1.1	Continue.....	232
5.10.2	ZombieData.....	232
5.10.3	Foreach—Again.....	234
5.10.4	What We've Learned .....	235
5.11	Multidimensional Arrays .....	235
5.11.1	Columns and Rows .....	236
5.11.1.1	A Basic Example .....	236
5.11.2	A Puzzle Board .....	238
5.11.3	Checking Range .....	242
5.11.4	What We've Learned .....	244
5.12	ArrayList.....	245
5.12.1	A Basic Example.....	246
5.12.2	ArrayList.Contains()	248
5.12.3	Remove.....	249
5.12.4	Sort and Reverse .....	250
5.12.5	What We've Learned .....	251
5.13	Strings.....	251
5.13.1	Declaring a String.....	251
5.13.1.1	A Basic Example .....	251
5.13.2	Escape Sequences .....	253
5.13.3	Verbatim Strings: @.....	254
5.13.4	String Format .....	255
5.13.5	What We've Learned .....	255
5.14	Combining What We've Learned .....	255
5.14.1	Timers .....	255
5.14.2	Adding in Classes .....	261
5.14.3	What We've Learned .....	262
5.15	Source Version Control.....	262
5.15.1	Modern Version Control .....	263
5.15.2	The Repository.....	263
5.15.3	GitHub.....	264
5.15.4	What We've Learned .....	264
5.15.5	Project Files .....	264
5.16	Setting Up a Repository .....	264
5.16.1	Push.....	271
5.16.2	Gitignore .....	271
5.16.3	Pull .....	273
5.16.4	Contributors .....	274
5.16.5	What We've Learned .....	275
5.17	Leveling Up: On to the Cool Stuff.....	276

<b>6. Intermediate.....</b>	<b>279</b>
6.1 What Will Be Covered in This Chapter .....	279
6.2 Review.....	279
6.3 Pseudocode .....	280
6.3.1 Thinking It Through .....	280
6.3.2 Class Members.....	281
6.3.2.1 A Basic Example .....	281
6.3.2.2 Thinking like a Programmer.....	282
6.3.3 Return.....	285
6.3.3.1 A Basic Example .....	285
6.3.4 Arguments aka Args (Not Related to Pirates) .....	286
6.3.4.1 The Basic Example .....	286
6.3.4.2 Multiple Args.....	287
6.3.4.3 Using Args .....	288
6.3.5 Assignment Operators.....	290
6.3.5.1 A Basic Example .....	291
6.3.6 What We've Learned .....	292
6.4 Class Constructors .....	292
6.4.1 A Basic Example.....	293
6.4.2 What We've Learned .....	294
6.4.3 What We've Learned .....	296
6.5 Arrays Revisited.....	296
6.5.1 Using Arrays in Unity 3D .....	297
6.5.1.1 Starting with 0 .....	298
6.5.1.2 Mathf .....	301
6.5.1.3 Time .....	301
6.5.2 Instancing with AddComponent(); .....	302
6.5.3 Type Casting Unity 3D Objects .....	303
6.5.4 What We've Learned .....	305
6.6 Enums .....	305
6.6.1 Using Enums .....	306
6.6.2 Combining What We've Learned .....	308
6.6.3 What We've Learned .....	310
6.7 Switch.....	310
6.7.1 A Basic Example.....	311
6.7.2 Default:.....	313
6.7.3 What We've Learned .....	315
6.7.4 Fall Through .....	319
6.7.5 goto Case .....	320
6.7.6 Limitations .....	320
6.7.7 What We've Learned .....	321
6.8 Structs .....	321
6.8.1 Structs .....	322
6.8.2 Struct versus Class .....	322
6.8.3 Without Structs .....	324
6.8.4 Handling Structs .....	324
6.8.5 Accessing Structs .....	326
6.8.6 Global Access.....	327
6.8.7 What We've Learned .....	328
6.9 Class Data .....	328
6.9.1 Character Base Class .....	329
6.9.2 Const .....	330

6.9.3	Readonly .....	330
6.9.4	What We've Learned .....	331
6.10	Namespaces .....	331
6.10.1	A Basic Example.....	331
6.10.2	Directives in Namespaces.....	332
6.10.3	Ambiguous References .....	334
6.10.4	Alias Directives.....	336
6.10.5	Putting Namespaces to Work.....	337
6.10.6	Extending Namespaces.....	338
6.10.7	What We've Learned .....	339
6.11	Functions Again.....	339
6.11.1	Parameter Lists .....	339
6.11.1.1	A Basic Example .....	340
6.11.2	Side Effects .....	340
6.11.3	Multiple Arguments .....	341
6.11.4	Useful Parameters.....	342
6.11.4.1	The Rule of Three.....	342
6.11.5	Foreach versus For .....	343
6.11.6	What We've Learned .....	345
6.12	Unity 3D Execution Order .....	345
6.12.1	A Basic Example.....	346
6.12.2	Component Execution Order .....	349
6.12.3	What We've Learned .....	352
6.13	Inheritance Again .....	352
6.13.1	Function Overrides .....	352
6.13.1.1	A Basic Example .....	352
6.13.2	Class Inheritance.....	355
6.13.2.1	Sharing Common Attributes .....	355
6.13.3	Object.....	358
6.13.4	What We've Learned .....	359
6.14	Type Casting Again .....	360
6.14.1	(<Type>) versus “as” .....	361
6.14.2	User-Defined Type Conversion .....	362
6.14.3	Implicit versus Explicit Type Conversion .....	363
6.14.4	Break .....	363
6.14.5	What We've Learned .....	365
6.15	Working with Vectors .....	365
6.15.1	Vectors Are Objects .....	365
6.15.2	Stepping through MonsterGenerator .....	366
6.15.3	Gizmos .....	368
6.15.3.1	A Basic Example .....	369
6.15.4	Using Gizmos.....	371
6.15.4.1	Building Up Parameters .....	375
6.15.5	Optimizing .....	376
6.15.6	What We've Learned .....	377
6.16	goto Labels.....	377
6.16.1	A Basic Example.....	378
6.16.2	Zombie State Machine .....	379
6.16.3	This as a Reference to Yourself .....	385
6.16.4	HumanState Based on ZombieState .....	388
6.16.5	The Is Keyword.....	389
6.16.6	What We've Learned .....	392

6.17	More on Arrays.....	392
6.17.1	Length and Count.....	392
6.17.1.1	A Basic Example .....	392
6.17.2	Foreach: A Reminder.....	393
6.17.3	Discovery .....	397
6.17.4	Putting It Together .....	397
6.17.5	What We've Learned .....	405
6.18	Out Parameter .....	405
6.18.1	A Basic Example.....	406
6.18.2	Simple Sort (Bubble Sort).....	407
6.18.3	Simple Sort Proof.....	410
6.18.4	What We've Learned .....	410
6.19	Ref Parameter .....	413
6.19.1	A Basic Example.....	414
6.19.2	Code Portability Side Effects.....	415
6.19.3	What We've Learned .....	415
6.20	Type Casting Numbers.....	417
6.20.1	Number Types .....	419
6.20.2	Integers.....	419
6.20.2.1	Signed Numbers .....	419
6.20.3	Floating Point.....	420
6.20.4	What We've Learned .....	420
6.21	Types and Operators .....	420
6.21.1	GetType() .....	421
6.21.2	More Type Casting.....	422
6.21.3	Type Aliasing .....	425
6.21.4	Boxing and Unboxing .....	425
6.22	Operator Overloading .....	426
6.22.1	A Basic Example.....	426
6.22.2	Overloading * .....	428
6.22.3	Overloading < .....	429
6.22.4	What We've Learned .....	430
6.23	Controlling Inheritance.....	430
6.23.1	Sealed.....	431
6.23.1.1	A Basic Example .....	431
6.23.2	Abstract.....	432
6.23.2.1	A Basic Example .....	432
6.23.3	Abstract: Abstract .....	436
6.23.4	Putting This to Use .....	438
6.23.5	What We've Learned .....	441
6.24	Leveling Up.....	442
<b>7.</b>	<b>Advanced.....</b>	<b>443</b>
7.1	What Will Be Covered in This Chapter .....	443
7.2	Review.....	444
7.2.1	Moving Forward .....	444
7.3	MonoDevelop.....	445
7.3.1	Find in Files .....	445
7.3.2	Word Processors.....	447
7.3.3	Mono History .....	448

7.4	Function Overloading .....	448
7.4.1	A Closer Look at Functions .....	448
7.4.1.1	A Basic Example .....	449
7.4.2	Function Signature .....	450
7.4.3	Different Signatures .....	450
7.4.4	Putting It Together .....	451
7.4.5	Not Quite Recursion .....	452
7.4.6	DrawWord .....	452
7.4.7	What We've Learned .....	456
7.5	Accessors (or Properties) .....	456
7.5.1	Value .....	457
7.5.1.1	A Basic Example .....	457
7.5.2	Set Event .....	458
7.5.3	Read-Only Accessor .....	459
7.5.4	Simplification .....	460
7.5.5	What We've Learned .....	460
7.6	Base Classes: Another Look .....	460
7.6.1	Generalization—Base Classes .....	461
7.6.2	Specialization .....	463
7.6.3	Base .....	464
7.6.4	Partial .....	466
7.6.5	Protected, Private, and Public .....	471
7.6.6	What We've Learned .....	472
7.7	Optional Parameters .....	472
7.7.1	Using Optionals .....	474
7.7.1.1	A Basic Example .....	474
7.7.2	Optional Arguments .....	475
7.7.3	Named Parameters .....	476
7.7.3.1	A Basic Example .....	477
7.7.4	Combining What We've Learned .....	478
7.7.5	What We've Learned .....	478
7.8	Delegate Functions .....	479
7.8.1	Delegates .....	479
7.8.1.1	A Basic Example .....	479
7.8.2	Delegate Signatures .....	480
7.8.3	Stacking Delegates .....	481
7.8.4	Using Delegates .....	482
7.8.5	What We've Learned .....	484
7.9	Interface .....	484
7.9.1	Early Planning .....	485
7.9.1.1	A Basic Example .....	485
7.9.1.2	Using Accessors .....	486
7.9.2	Interface Methods .....	489
7.9.2.1	Breaking a Fixing .....	491
7.9.3	Multiple Interfaces .....	491
7.9.4	IComparer .....	492
7.9.5	Using IComparer .....	493
7.9.6	What We've Learned .....	494
7.10	Class Constructors Revisited .....	494
7.10.1	A Basic Example .....	495
7.10.2	When to Create a New Class .....	496
7.10.2.1	Add in a Private zposition Offset .....	499