

# Contents at a Glance

<b>1 Introduction to C# Coding and Debugging</b>	<b>3</b>
<b>2 Variables, Constants, Arrays, and Enumerations</b>	<b>25</b>
<b>3 Numeric Operators and Routines</b>	<b>45</b>
<b>4 Methods and Scope</b>	<b>57</b>
<b>5 Conditional Structures and Loops</b>	<b>73</b>
<b>6 String Manipulation</b>	<b>97</b>
<b>7 Date and Time Handling</b>	<b>117</b>
<b>8 Encapsulation Through Object-Oriented Programming</b>	<b>133</b>
<b>9 Inheritance</b>	<b>161</b>
<b>10 Generic Types and Collections</b>	<b>185</b>
<b>11 Delegates, Anonymous Functions, and Events</b>	<b>211</b>
<b>12 Interfaces</b>	<b>223</b>
<b>13 Database Setup</b>	<b>241</b>

<b>14 The Entity Framework</b>	<b>253</b>
<b>15 LINQ to Entities: Query Syntax</b>	<b>273</b>
<b>16 LINQ to Entities: Method-Based Syntax</b>	<b>293</b>
<b>17 Join Queries with LINQ to Entities</b>	<b>307</b>
<b>18 Traditional Database Development</b>	<b>333</b>
<b>19 File Input Output</b>	<b>361</b>
<b>20 XML Handling</b>	<b>377</b>
<b>21 JSON Handling</b>	<b>403</b>
<b>22 Attributes</b>	<b>419</b>
<b>23 Operator Overloading</b>	<b>435</b>
<b>A FoodStore Database Reference</b>	<b>443</b>
<b>Index</b>	<b>447</b>

# Contents

ACKNOWLEDGMENTS .....	xxi
INTRODUCTION .....	xxiii

## **PART I Programming Basics**

<b>1 Introduction to C# Coding and Debugging .....</b>	<b>3</b>
Brief History of C# .....	4
Understanding Basic Code Terminology .....	5
Comments .....	5
Syntax .....	6
Indentation .....	6
Writing and Running a Program .....	7
Writing and Editing Your Code .....	7
Program Compilation and Execution .....	7
Try This 1-1: Creating Your First C# Program .....	8
Using the Integrated Development Environment .....	10
Creating a Console Application Project .....	10
Compiling and Running a Program .....	10
Stopping the Application .....	10
Saving the Solution .....	11
Exiting the Solution .....	11

Opening the Solution .....	11
Renaming a Code File .....	11
Renaming Code Structures .....	11
Incorporating Debugging Techniques .....	13
Errors and Warnings .....	14
Breakpoints .....	15
Resuming Program Execution .....	16
Tooltips .....	16
Stepping into Methods .....	16
Stepping over Methods .....	16
The Call Stack Window .....	17
The Locals Window .....	17
Try This 1-2: Inspecting Your Code .....	17
The Watch Window .....	19
Try-Catch Blocks .....	19
Logging Data .....	21
Chapter 1 Self Test .....	23
<b>2 Variables, Constants, Arrays, and Enumerations .....</b>	<b>25</b>
Data Types .....	26
Numeric Literals .....	27
Variables .....	28
Variable Types .....	28
Variable Syntax .....	28
Variable Names .....	29
Constants .....	30
Constant Syntax .....	30
Constant Names .....	30
Try This 2-1: Practice with Variable and Constant Structures .....	31
Explicit Variable Conversion (Casting) .....	32
Implicit Variable Conversion .....	32
Arrays .....	32
Array Syntax .....	32
Try This 2-2: Practice with Arrays .....	35
Array Length .....	36
Sorting Arrays .....	36
Multidimensional Arrays .....	37
Enumerations .....	39
Enumeration Syntax .....	40
Enumeration Naming .....	40
Enumeration Methods .....	40
Chapter 2 Self Test .....	43

<b>3</b>	<b>Numeric Operators and Routines</b>	<b>45</b>
	Basic Calculations	46
	Addition	46
	Subtraction	46
	Multiplication	47
	Division	47
	Remainder	47
	Exponentiation	47
	Square Root	47
	Increment Operator	48
	Pre-Increment Expressions	48
	Post-Increment Expressions	48
	Try This 3-1: Operator Practice	48
	Decrement Operator	49
	Pre-Decrement Expressions	49
	Post-Decrement Expressions	49
	Randomization	50
	The Default Random Constructor	50
	The Seeded Random Constructor	52
	Try This 3-2: Reusing a Seed Value	53
	Chapter 3 Self Test	55
<b>4</b>	<b>Methods and Scope</b>	<b>57</b>
	Method Syntax	58
	Calling a Method	59
	Indentation	60
	Try This 4-1: Method Implementation Practice	61
	Method Overloads	62
	Passing Arguments by Value and by Reference	63
	Passing Arguments by Value	64
	Passing Arguments by Reference	64
	Passing Arguments Explicitly by Reference	65
	Passing Uninitialized Variables by Reference	66
	Scope	68
	Class Scope	68
	Method Scope	68
	Block Scope	68
	Variable Precedence	69
	Try This 4-2: Examining Scope	70
	Chapter 4 Self Test	70

<b>5</b>	<b>Conditional Structures and Loops</b>	<b>73</b>
	Control Structures	74
	Indentation and Alignment	74
	Nesting	75
	Comparison Operators	76
	Equals and Not Equals Operators	76
	Less Than and Greater Than Operators	76
	AND and OR Operators	77
	Conditional Structures	78
	If-Else Statements	78
	Try This 5-1: Comparison Operator and If-Else Statement Practice	80
	Conditional (Ternary) Operators	82
	Switches	83
	Loops	85
	For Loops	85
	Try This 5-2: Nested Loops	88
	While Loops	88
	Do While Loops	89
	Foreach Loops	90
	Comparing Loop Types	91
	Break Statements	91
	Continue Statement	93
	Chapter 5 Self Test	94
<b>6</b>	<b>String Manipulation</b>	<b>97</b>
	Numeric Format Specifiers	98
	Raw Text	98
	Rounding	99
	Rounding with a Thousands Separator	99
	Displaying Local Currency	99
	Parsing Strings	99
	Length	99
	IndexOf()	100
	LastIndexOf()	101
	Substring	101
	Split()	101
	Try This 6-1: String Formatting and Parsing Exercise	102
	Join()	102
	StartsWith()	102
	Contains()	103
	Editing Strings	103
	Trim()	103
	Concatenation	104

Adjusting Letter Case .....	104
Replace() .....	104
Insert() .....	105
Remove() .....	105
Escape Sequences .....	105
Verbatim String Literals .....	106
Regular Expressions .....	106
Introductory Expressions .....	107
More Regular Expression Operators .....	109
Try This 6-2: Regular Expression Exercise .....	112
Converting Strings to Other Formats .....	113
Convert .....	114
TryParse() .....	114
Chapter 6 Self Test .....	115
<b>7 Date and Time Handling .....</b>	<b>117</b>
TimeSpan Syntax .....	118
TimeSpan Properties .....	119
TimeSpan Calculations .....	120
TimeSpan Addition .....	120
TimeSpan Subtraction .....	121
TimeSpan Comparison .....	121
Try This 7-1: TimeSpan Practice .....	122
DateTime Syntax .....	122
System Time .....	122
DateTime Properties .....	122
Formatting DateTime Output .....	124
DateTime Calculations .....	126
Adding Units of Time .....	126
Try This 7-2: DateTime Practice .....	127
DateTime Subtraction .....	128
DateTime Comparison .....	129
Chapter 7 Self Test .....	130

## **PART II Object-Oriented Programming**

<b>8 Encapsulation Through Object-Oriented Programming .....</b>	<b>133</b>
Encapsulation .....	134
Accessibility .....	134
Classes .....	135
Objects .....	136
Class Declarations .....	136
Keyword This .....	137
Constructors .....	137

Try This 8-1: Class Creation, Constructor, and Accessor Exercise .....	140
Properties .....	141
Destructors .....	143
Static Structures .....	145
Declaring Static Structures .....	145
Try This 8-2: Examining Static Structures .....	148
Structs .....	150
Namespaces .....	152
Partial Classes .....	157
Chapter 8 Self Test .....	159
<b>9 Inheritance .....</b>	<b>161</b>
Inheritance Introduction .....	162
Declaring a Child Class .....	163
Protected Members .....	163
Try This 9-1: Inheritance Exercise .....	166
Inherited Constructor Overloading .....	167
Virtual Inheritance .....	169
Declaring Virtual Methods .....	169
Overriding Virtual Methods .....	170
Declaring Virtual Properties .....	170
Overriding Virtual Properties .....	170
Abstract Inheritance .....	172
Declaring Abstract Classes .....	172
Declaring Abstract Methods .....	172
Overriding Abstract Methods .....	172
Declaring Abstract Properties .....	173
Overriding Abstract Properties .....	173
Virtual and Abstract Comparison .....	174
Try This 9-2: Abstraction Exercise .....	175
Polymorphism .....	176
Sealed Modifiers .....	179
Sealing Classes .....	180
Sealing Members .....	180
Chapter 9 Self Test .....	182
<b>10 Generic Types and Collections .....</b>	<b>185</b>
Generic Types .....	186
Declaring Generic Templates .....	186
Generic Constructors .....	187
Declaring and Initializing Objects of a Generic Class or Struct .....	187
Generic Methods .....	188
Generic Properties .....	188
Generic Variables .....	188



Try This 10-1: Practice with Generic Types .....	191
List Collections .....	191
List Methods .....	192
Try This 10-2: Practice with List Collections .....	194
ArrayList Collections .....	195
Determining Object Types .....	196
ArrayList Methods .....	196
KeyValuePair Types .....	199
Dictionary Collections .....	200
Dictionary Methods .....	201
Iterating Through Dictionary Items .....	201
Hashtable Collections .....	203
Hashtable Methods .....	203
Iterating Through Hashtable Items .....	204
Chapter 10 Self Test .....	205

### **PART III Advanced Structures**

<b>11 Delegates, Anonymous Functions, and Events .....</b>	<b>211</b>
Delegates .....	212
Delegate Syntax .....	212
Try This 11-1: Practice with Delegates .....	214
Anonymous Functions .....	214
Anonymous Functions with Delegates .....	214
Try This 11-2: Practice with Delegates and Anonymous Functions .....	216
Anonymous Functions with Func<T,TResult> Delegates .....	216
Events .....	218
Event Declaration Syntax .....	218
Subscribing to an Event .....	219
Raising an Event .....	219
Unsubscribing from an Event .....	219
Chapter 11 Self Test .....	221
<b>12 Interfaces .....</b>	<b>223</b>
Interface Syntax .....	224
Try This 12-1: Interface Exercise .....	226
Try This 12-2: Generating Code from the Interface .....	226
Explicit Interface Implementation .....	227
Implicit Interface Implementation .....	229
Interface Hierarchies .....	230
Generic Interfaces .....	231
Existing .NET Interfaces .....	233
ICollection .....	233
IComparable .....	234
Chapter 12 Self Test .....	236

**PART IV Data-Driven Development**

<b>13 Database Setup</b> .....	<b>241</b>
Accessing Database Resources for This Book .....	242
Creating a Database Connection String .....	242
Browsing Database Content with Visual Studio .....	248
Try This 13-1: Examining Table Data .....	250
Examining Database Column Detail .....	250
Try This 13-2: Examining Database Column Detail .....	251
Chapter 13 Self Test .....	251
<b>14 The Entity Framework</b> .....	<b>253</b>
The Entity Data Model .....	254
Adding an Entity Data Model to Your Code Project .....	254
Querying Database Objects with the Entity Data Model .....	260
DbContext .....	260
Entities .....	260
DbSet .....	260
Querying Entities .....	261
Try This 14-1: Querying Entities with the Entity Data Model .....	262
Updating the Entity Data Model .....	263
Replacing the Entity Data Model .....	264
LINQ to Entities Introduction .....	265
Lazy Loading and Deferred Execution .....	265
Immediate (Eager) Data Loading .....	266
LINQPad .....	267
Try This 14-2: Observing Query Differences with LINQPad .....	270
Chapter 14 Self Test .....	271
<b>15 LINQ to Entities: Query Syntax</b> .....	<b>273</b>
Read Queries .....	275
Referencing Properties of an Object .....	275
Assigning Custom Property Names .....	276
Try This 15-1: Reading Data with Query Syntax .....	277
Lazy Loading vs. Immediate Data Loading .....	278
Filtering .....	278
Reading One Object Only .....	281
Sorting .....	281
Subselection .....	283
Try This 15-2: Inspecting Combined Queries .....	284
Merging Similar Queries with a Union .....	285
Aggregate Summary Queries .....	286
Adding Objects .....	288

Updating Objects .....	289
Deleting Objects .....	289
Chapter 15 Self Test .....	290
<b>16 LINQ to Entities: Method-Based Syntax .....</b>	<b>293</b>
Lambda Syntax .....	295
Read Queries .....	295
Filtering .....	296
Try This 16-1: Basic Extension Methods .....	297
Filtering with a Collection of Values .....	297
Retrieving Similar Matches .....	298
Selecting Distinct Rows .....	299
Sorting .....	299
Subselection .....	300
Merging Similar Queries with a Union .....	301
Aggregate Summary Queries .....	301
Try This 16-2: Aggregate Queries with Simple Grouping .....	302
Inserting, Updating, and Deleting Objects .....	303
Chapter 16 Self Test .....	304
<b>17 Join Queries with LINQ to Entities .....</b>	<b>307</b>
Introductory Relational Database Theory .....	309
Primary Keys .....	309
Composite Primary Key .....	309
Foreign Keys .....	309
Cardinality .....	310
Navigation Properties .....	312
Try This 17-1: Testing Your Knowledge of Database Theory .....	312
Equal Joins .....	313
Equal Joins with Query Syntax .....	313
Equal Joins with Method-Based Syntax .....	314
Equal Joins with Navigation Properties .....	315
Try This 17-2: Practice with Equal Joins .....	316
Equal Joins on Composite Keys .....	317
Outer Joins .....	319
Left Outer Joins .....	319
Right Outer Joins .....	321
Full Outer Joins .....	322
Joining More Than Two Collections in One Query .....	324
Bridging Many-to-Many Relationships .....	325
Querying Bridge Table Objects .....	327
Inserting Bridge Table Objects .....	328
Deleting Bridge Table Objects .....	330
Chapter 17 Self Test .....	331

<b>18 Traditional Database Development</b>	<b>333</b>
SQL	334
Stored Procedures	335
.NET Classes for Managing Database Data	335
DataTable	335
DataColumn	335
DataRow	336
Try This 18-1: Constructing and Using Your Own DataTable	338
Referencing Your Connection String in C#	339
Memory-Based Database Management with the SqlDataAdapter Class	341
Initializing a SqlDataAdapter Object	341
Retrieving Data with the SqlDataAdapter Class	341
Timing Out	341
Try This 18-2: Executing SQL from Your C# Code	343
Managing Stored Procedures with the SqlDataAdapter Class	344
Streaming Data with the SqlDataReader Class	349
Managing the Database Connection	349
Chapter 18 Self Test	358
<b>19 File Input Output</b>	<b>361</b>
Writing and Reading Plain Text	362
StreamWriter	362
StreamReader	364
Try This 19-1: Writing, Reading, and Extracting Text Data	367
Writing and Reading Binary Data	367
FileMode	368
BinaryWriter	368
BinaryReader	368
Try This 19-2: Writing and Reading Binary Data	371
Reading Buffered Binary Data	371
Randomly Accessing Binary Data	374
Chapter 19 Self Test	375
<b>20 XML Handling</b>	<b>377</b>
XML Introduction	378
XML Elements and Attributes	379
Element Hierarchy	380
Adding an XML Document to a Visual Studio Project	380
Well-Formed XML	381
LINQ to XML Introduction	382
XElement	382
XAttribute	383
Querying Elements	383

Try This 20-1: Querying XML with LINQ	385
Additional Element Selection Methods and Properties	387
Try This 20-2: Querying XML with LINQ, Continued	388
Creating XML Elements and Attributes	389
Creating Attributes	389
Creating Elements	389
Adding Elements to Existing Documents	390
Updating XML Elements and Attributes	391
Deleting XML Elements	393
XML Serialization and Deserialization	394
Serialization	394
Deserialization	397
Chapter 20 Self Test	399
<b>21 JSON Handling</b>	<b>403</b>
JSON Introduction	404
Json.NET	405
Creating Dynamic JSON Objects	406
Dynamic Types	406
Creating JSON Arrays	407
Try This 21-1: JSON Object and Array Creation	409
Dynamic Parsing	410
Referencing Properties	410
Referencing Arrays	410
Serialization	411
Try This 21-2: Creating JSON Through Serialization	413
Customizing Property Names During Serialization	414
Deserialization	414
Mapping to Custom Property Names During Deserialization	415
Chapter 21 Self Test	415

## PART V Stand-alone Topics

<b>22 Attributes</b>	<b>419</b>
.NET Framework Attributes	420
Try This 22-1: Implementing Attributes Practice	421
Creating and Implementing Custom Attributes	423
Inheriting from the Attribute Class	423
Optional AttributeUsage Attributes	423
Implementing Custom Attributes	424
Querying Attributes	424
Try This 22-2: Implementing and Querying Custom Attributes	426
Reflection Introduction	427
Querying Attribute Targets	430
Chapter 22 Self Test	434

<b>23 Operator Overloading</b> .....	<b>435</b>
Operator Overloading Introduction .....	436
Operator Overload Method Requirements .....	437
Operators that Can Be Overloaded .....	437
Try This 23-1: Creating and Using a * Operator Overload .....	439
Try This 23-2: Creating and Using a – Operator Overload .....	441
Chapter 23 Self Test .....	442
<b>A FoodStore Database Reference</b> .....	<b>443</b>
<b>Index</b> .....	<b>447</b>