Table of Contents

Preface xi

1. Introducing C# and the .NET Framework 1

Object Orientation 1
Type Safety 2
Memory Management 2
Platform Support 3
C#'s Relationship with the CLR 3
The CLR and .NET Framework 3
C# and Windows Runtime 5
What's New in C# 5.0 6
What's New in C# 4.0 6
What's New in C# 3.0 7

2. C# Language Basics 9

A First C# Program 9
Syntax 12
Type Basics 15
Numeric Types 23
Boolean Type and Operators 30
Strings and Characters 32
Arrays 34
Variables and Parameters 38
Expressions and Operators 47
Statements 51
Namespaces 59

3. Creating Types in C# 67
Classes 67
Inheritance 80
The object Type 89
Structs 93
Access Modifiers 94
Interfaces 96
Enums 102
Nested Types 105
Generics 106

4. Advanced C# 119
Delegates 119
Events 128
Lambda Expressions 135
Anonymous Methods 139
try Statements and Exceptions 140
Enumeration and Iterators 148
Nullable Types 153
Operator Overloading 158
Extension Methods 162
Anonymous Types 164
Dynamic Binding 165
Attributes 173
Caller Info Attributes (C# 5) 175
Unsafe Code and Pointers 177
Preprocessor Directives 180
XML Documentation 182

5. Framework Overview 187
The CLR and Core Framework 189
Applied Technologies 194

6. Framework Fundamentals 201
String and Text Handling 201
Dates and Times 214
Dates and Time Zones 221
Formatting and Parsing 227
Standard Format Strings and Parsing Flags 233
Other Conversion Mechanisms 240
Globalization 244
Working with Numbers 245
Enums 249
Tuples 252
The Guid Struct 253

Equality Comparison 254
Order Comparison 264
Utility Classes 267

7. Collections 271
Enumeration 271
The ICollection and IList Interfaces 279
The Array Class 282
Lists, Queues, Stacks, and Sets 291
Dictionaries 299
Customizable Collections and Proxies 306
Plugging in Equality and Order 312

8. LINQ Queries 319
Getting Started 319
Fluent Syntax 321
Query Expressions 328
Deferred Execution 332
Subqueries 338
Composition Strategies 342
Projection Strategies 345
Interpreted Queries 347
LINQ to SQL and Entity Framework 354
Building Query Expressions 368

9. LINQ Operators 375
Overview 377
Filtering 379
Projecting 383
Joining 395
Ordering 403
Grouping 406
Set Operators 409
Conversion Methods 410
Element Operators 413
Aggregation Methods 415
Quantifiers 419
Generation Methods 420

10. LINQ to XML 423
Architectural Overview 423
X-DOM Overview 424
Instantiating an X-DOM 427
Navigating and Querying 430
Updating an X-DOM 435

Working with Values 438
Documents and Declarations 441
Names and Namespaces 444
Annotations 450
Projecting into an X-DOM 450

11. Other XML Technologies 457
XmlReader 458
XmlWriter 467
Patterns for Using XmlReader/XmlWriter 469
XmlDocument 473
XPath 477
XSD and Schema Validation 481
XSLT 484

12. Disposal and Garbage Collection 485
IDisposable, Dispose, and Close 485
Automatic Garbage Collection 490
Finalizers 493
How the Garbage Collector Works 497
Managed Memory Leaks 501
Weak References 505

13. Diagnostics and Code Contracts 509
Conditional Compilation 509
Debug and Trace Classes 512
Code Contracts Overview 516
Preconditions 520
Postconditions 524
Assertions and Object Invariants 527
Contracts on Interfaces and Abstract Methods 528
Dealing with Contract Failure 529
Selectively Enforcing Contracts 531
Static Contract Checking 533
Debugger Integration 535
Processes and Process Threads 536
StackTrace and StackFrame 537
Windows Event Logs 538
Performance Counters 541
The Stopwatch Class 545

14. Concurrency & Asynchrony 547
Introduction 547
Threading 548
Tasks 565

Principles of Asynchrony 573
Asynchronous Functions in C# 5.0 578
Asynchronous Patterns 594
Obsolete Patterns 601

15. Streams and I/O 605
Stream Architecture 605
Using Streams 607
Stream Adapters 621
Compression Streams 629
Working with Zip Files 631
File and Directory Operations 632
File I/O in Windows Runtime 642
Memory-Mapped Files 644
Isolated Storage 647

16. Networking 653
Network Architecture 653
Addresses and Ports 655
URIs 656
Client-Side Classes 658
Working with HTTP 671
Writing an HTTP Server 677
Using FTP 680
Using DNS 682
Sending Mail with SmtpClient 683
Using TCP 683
Receiving POP3 Mail with TCP 687
TCP in Windows Runtime 689

17. Serialization 691
Serialization Concepts 691
The Data Contract Serializer 695
Data Contracts and Collections 705
Extending Data Contracts 707
The Binary Serializer 710
Binary Serialization Attributes 712
Binary Serialization with ISerializable 715
XML Serialization 719

18. Assemblies 729
What's in an Assembly 729
Strong Names and Assembly Signing 734
Assembly Names 737
Authenticode Signing 739

The Global Assembly Cache 743
Resources and Satellite Assemblies 745
Resolving and Loading Assemblies 754
Deploying Assemblies Outside the Base Folder 759
Packing a Single-File Executable 760
Working with Unreferenced Assemblies 762

19. Reflection and Metadata 765
Reflecting and Activating Types 766
Reflecting and Invoking Members 773
Reflecting Assemblies 785
Working with Attributes 786
Dynamic Code Generation 792
Emitting Assemblies and Types 799
Emitting Type Members 803
Emitting Generic Methods and Types 808
Awkward Emission Targets 810
Parsing IL 814

20. Dynamic Programming 821
The Dynamic Language Runtime 821
Numeric Type Unification 823
Dynamic Member Overload Resolution 824
Implementing Dynamic Objects 830
Interoperating with Dynamic Languages 833

21. Security 837
Permissions 837
Code Access Security (CAS) 842
Allowing Partially Trusted Callers 845
The Transparency Model 847
Sandboxing Another Assembly 855
Operating System Security 858
Identity and Role Security 861
Cryptography Overview 862
Windows Data Protection 863
Hashing 864
Symmetric Encryption 865
Public Key Encryption and Signing 870

22. Advanced Threading 875
Synchronization Overview 876
Exclusive Locking 876
Locking and Thread Safety 884
Non-Exclusive Locking 890

Signaling with Event Wait Handles 895
The Barrier Class 903
Lazy Initialization 904
Thread-Local Storage 907
Interrupt and Abort 909
Suspend and Resume 910
Timers 911

23. Parallel Programming 915
Why PFX? 915
PLINQ 918
The Parallel Class 931
Task Parallelism 938
Working with AggregateException 947
Concurrent Collections 949
BlockingCollection<T> 952

24. Application Domains 957
Application Domain Architecture 957
Creating and Destroying Application Domains 958
Using Multiple Application Domains 960
Using DoCallBack 962
Monitoring Application Domains 963
Domains and Threads 963
Sharing Data Between Domains 965

25. Native and COM Interoperability 971
Calling into Native DLLs 971
Type Marshaling 972
Callbacks from Unmanaged Code 975
Simulating a C Union 975
Shared Memory 976
Mapping a Struct to Unmanaged Memory 979
COM Interoperability 983
Calling a COM Component from C# 985
Embedding Interop Types 988
Primary Interop Assemblies 989
Exposing C# Objects to COM 990

26. Regular Expressions 991
Regular Expression Basics 992
Quantifiers 996
Zero-Width Assertions 997
Groups 1000
Replacing and Splitting Text 1001

Cookbook Regular Expressions 1003
Regular Expressions Language Reference 1006

Index **1011**