# Beginning ASP.NET 1.0 with C#

Rob Birdwell
Matt Butler
Ollie Cornes
Chris Goode
Gary Johnson
John Kauffman
Ajoy Krishnamoorthy
Juan T. Llibre
Christopher L. Miller
Neil Raybould
Srinivasa Sivakumar
David Sussman
Chris Ullman



# Beginning ASP.NET 1.0 with C#

Rob Birdwell
Matt Butler
Ollie Cornes
Chris Goode
Gary Johnson
John Kauffman
Ajoy Krishnamoorthy
Juan T. Llibre
Christopher L. Miller
Neil Raybould
Srinivasa Sivakumar
David Sussman
Chris Ullman



#### Beginning ASP.NET 1.0 with C#

Published by Wiley Publishing, Inc. 10475 Crosspoint Boulevard Indianapolis, IN 46256 www.wiley.com

Copyright © 2003 by Wiley Publishing, Inc., Indianapolis, Indiana

Published simultaneously in Canada

Library of Congress Card Number: 2003107065

ISBN: 0-7645-4370-9

Manufactured in the United States of America

10987654321

1B/QZ/QW/QT/IN

No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except as permitted under Sections 107 or 108 of the 1976 United States Copyright Act, without either the prior written permission of the Publisher, or authorization through payment of the appropriate per-copy fee to the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, (978) 750-8400, fax (978) 646-8700. Requests to the Publisher for permission should be addressed to the Legal Department, Wiley Publishing, Inc., 10475 Crosspoint Blvd., Indianapolis, IN 46256, (317) 572-3447, fax (317) 572-4447, E-Mail: permcoordinator@wiley.com.

LIMIT OF LIABILITY/DISCLAIMER OF WARRANTY: WHILE THE PUBLISHER AND AUTHOR HAVE USED THEIR BEST EFFORTS IN PREPARING THIS BOOK, THEY MAKE NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO THE ACCURACY OR COMPLETENESS OF THE CONTENTS OF THIS BOOK AND SPECIFICALLY DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. NO WARRANTY MAY BE CREATED OR EXTENDED BY SALES REPRESENTATIVES OR WRITTEN SALES MATERIALS. THE ADVICE AND STRATEGIES CONTAINED HEREIN MAY NOT BE SUITABLE FOR YOUR SITUATION. YOU SHOULD CONSULT WITH A PROFESSIONAL WHERE APPROPRIATE. NEITHER THE PUBLISHER NOR AUTHOR SHALL BE LIABLE FOR ANY LOSS OF PROFIT OR ANY OTHER COMMERCIAL DAMAGES, INCLUDING BUT NOT LIMITED TO SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR OTHER DAMAGES.

For general information on our other products and services or to obtain technical support, please contact our Customer Care Department within the U.S. at (800) 762-2974, outside the U.S. at (317) 572-3993 or fax (317) 572-4002.

Wiley also publishes its books in a variety of electronic formats. Some content that appears in print may not be available in electronic books.

**Trademarks:** Wiley, the Wiley Publishing logo, Wrox, the Wrox logo, the Wrox Programmer to Programmer logo and related trade dress are trademarks or registered trademarks of Wiley in the United States and other countries, and may not be used without written permission. All other trademarks are the property of their respective owners. Wiley Publishing, Inc., is not associated with any product or vendor mentioned in this book.

## **Trademark Acknowledgments**

Wrox has endeavored to provide trademark information about all the companies and products mentioned in this book by the appropriate use of capitals. However, Wrox cannot guarantee the accuracy of this information.

#### **Credits**

Authors Rob Birdwell

Matt Butler Ollie Cornes

Chris Goode Gary Johnson

John Kauffman

Ajoy Krishnamoorthy

Juan T. Llibre

Christopher L. Miller Neil Raybould

Srinivasa Sivakumar David Sussman Chris Ullman

**Additional Material** 

Jon Duckett James Hart Matt Reynolds Dan Squier

**Technical Architect** 

Dan Squier

**Lead Technical Editor** 

Ewan Buckingham

**Technical Editors** 

Alastair Ewins Jake Manning **Managing Editor** 

Louay Fatoohi

Index

Michael Brinkman

John Collin

**Production Coordinator** 

Abbie Forletta

Cover

Natalie O'Donnell

**Proof Reader** 

Chris Smith

**Author Agent** 

Cilmara Lion

**Project Manager** 

Christianne Bailey

**Technical Reviewers** 

Rob Birdwell

Maxime Bombadier

Daniel Cazzulino

Cristian Darie

Robin Dewson

John Kauffman

Larry Schoeneman

Marc H. Simkin

### **About the Authors**

#### **Rob Birdwell**

Rob Birdwell makes his home in Corvallis, Oregon along with his wife and three beautiful children. He works at HP and moonlights as a musician, composer, and songwriter. He first became interested in programming when he discovered he could make a machine play one of his musical melodies. His current interests include all facets of .NET technology and especially the C# language. His hobbies include swimming, tennis, and playing his trumpet in various ensembles.

Rob would like to thank his wife, Christel, and children for their patience and support while he endeavored to make a small contribution to this wonderful book.

## Matt (.MAtt) Butler

Matt Butler is lead technical brain at Left Ear Design and specializes in .NET, Windows DNA, and Java.

.MAtt went from being a homeless, starving jazz musician to a software architect holding numerous certifications, including MCSD, Sun Java Certified Programmer, BEA Certified Programmer (Java / Weblogic), and a few other miscellaneous certifications. He rode the wave of the .COM craze working on sizable profile-based search engines and transactional e-commerce applications using the Windows DNA architecture in return for 'stock options' and pizza.

.MAtt's interests include all things computer oriented (especially .NET and security), math, science, physics, spoken word, composing, and improvising introspective music.

Thanks to Daisey for being a loyal, supportive life-partner and muse and thanks to Morgan for being a wonderful daughter and talented friend. Thanks to the Left Ear crew (Matt Cribbs, James McIntosh, Jennifer Ricker, Tim Parmentier, and Brandon Stromberg) for being talented visionaries with integrity. Thanks to Gary for being a great friend and learning partner. Thanks to my family, and the people at Wrox for being so good at what they do, and, ultimately, thanks to all of the musicians with whom I have had the chance to associate with and learn from – especially my current quartet - Joseph Yorio, Sean Tarleton, Tim Stombaugh.

You can reach .MAtt at matt@biodigitalmusic.com.

## **Ollie Cornes**

Ollie Cornes has been working with the Internet and the Microsoft platform since the early 90's. In 1999 he co-founded a business-to-business Internet company and until recently was its Chief Technical Officer.

Prior to that his various roles involved programming, technical authoring, network management, writing, leading development projects, and consulting. He has worked with Demon Internet, Microsoft, Saab, Travelstore, and Vodafone. Ollie holds a degree in computer science and is Microsoft certified.

When he's not working he spends his time devouring books on human potential and practicing Chinese internal martial arts, meditation, and healing. He also juggles fire and knives.

#### **Chris Goode**

Chris is currently an editor in the Microsoft team at Wrox. She lives in Birmingham (that's UK, not Alabama), and has a house full of old computers. Chris started programming at the age of 10 on her Atari 65XE, and has always enjoyed spending time with as much technology as possible. She has a degree in Mechanical Engineering, but decided that the engineering world wasn't for her. She's now back firmly in the world of computers, and finding that life at Wrox combines the fun stuff with the work stuff pretty well.

I'd like to thank my family for putting up with me over the years, and for buying me my first computer. Thanks to Ewan for all the time and hard work he's invested in this book, and for not objecting too loudly to my chapters. Special thanks go to James for finally popping the question, and for being so supportive.

## **Gary Johnson**

Gary Johnson is a transplanted hillbilly currently residing in Florida. He has programmed the Web since 1995 using a myriad of technologies (mostly VB/ASP/DNA type stuff prior to .NET).

When not chained to the machine, he likes spending time with CoCo the dog or practicing the elusive art of photography. Gary would like to thank John, Nestor, Matt, and Daisey for their unwavering wonder and enthusiasm for the world.

To Diane who makes my house a home. My home is anywhere you are.

#### John Kauffman

John's first publications, some 20 years ago, explained sail trimming and tactics to yacht racers. He then returned to the printed page to describe his discovery of a genomic sequence in plants that could be controlled by light.

Today, he splits his time between Asia and North America where he teaches and writes for Wrox about Microsoft technologies for connecting databases to the Web. While teaching he keeps a list of students questions and mistakes, then uses that information as the basis for organizing future editions of his books. John also designed and wrote portions of *Beginning ASP Databases* and *Beginning SQL Programming*.

John dedicates his portions of the book to the master teachers from whom he has learned the art of explaining science and technology; including the faculties of science at ELCO High School and Kutztown, Millersville, Penn State, and the Rockefeller Universities

## **Ajoy Krishnamoorthy**

Ajoy Krishnamoorthy is a consultant with over five years of experience, working in Microsoft technologies such as ASP, VB, IIS, MTS, and most recently .NET. He writes regularly for leading online publications. He received a Bachelors degree in Electronics and Communication and a Masters degree in Systems and information. He is currently working for his Masters in Business Administration at Fisher College of Business, Ohio State University. His interests include writing, hanging out with friends, and travel. He is originally from Chennai, India and currently lives in Columbus, Ohio with his wife Vidhya. He can be reached at ajoyk@ajoys.net.

This would not have been possible, without an understanding and supportive wife. Thank you Vidhya, you are the best. I also want to thank my family for their support and encouragement. Finally, thanks to Wrox Press and its wonderful people for this opportunity.

#### Juan T. Llibre

Juan T. Llibre is the Director of the Computer Sciences and Distance Education departments at Universidad Nacional Pedro Henríquez Ureña in Santo Domingo, Dominican Republic.

He has been a consultant to the Caribbean Export Development Agency and the Dominican Republic's Central Bank and is currently the Technical Architect for the Caribbean Virtual University, a Distance Education consortium composed of 30 Caribbean Universities, which will go online in 2002. He's also planning what he calls a "killer app" for Caribbean Tourism.

Juan has been an Active Server Pages Microsoft MCP for four years and can regularly be found in the newsgroups and mailing lists, offering advice on ASP and ASP.NET in English and Spanish.

He co-authored Wrox's *Beginning ASP 2.0* and *Beginning ASP 3.0*, and has been a Technical Reviewer for over a dozen books on ASP and its related technologies.

When he isn't writing, reviewing, seeing students and running the school, producing Distance Education courses, or hanging out with developers, he takes off to a beach hut with a high-speed connection, because "...a man must have some fun, too!"

He has three daughters, Jonquil, Anthea, and Isabelle, and two grandsons, David and Keenan.

## **Christopher Miller**

Christopher Miller began his development in the early 1980's with Atari Basic, migrating to GW Basic, QuickBasic, and finally to Visual Basic, where he's lived and breathed, since 1992. He is currently a business consultant with cs|enlign inc. (formerly Crossoft Inc) of Pittsburgh, PA, specializing in Intranet architecture and design. He's also president of the Pittsburgh .NET User Group (http://www.pghdotnet.org).

His current projects include an adaptive intranet framework tool and other .NET-based Web Service applications. He holds a business degree from Pensacola Christian College of Florida, and all major Microsoft certifications (MCSE+I, MCSD, MCT, MCDBA).

Thanks to my wife, Stacy, for all the support. Couldn't do it without you.

## **Neil Raybould**

Neil is working as a software developer and technical writer with cs|enlign, north of Pittsburgh, Pennsylvania. He has given several presentations on ASP and ASP.NET related topics in the Pittsburgh area. Growing up in Emporia, Virginia, Neil used lawn mowing profits in 1981 to buy a Commodore VIC-20. His current interests have progressed to include .NET and wireless applications. But, sometimes, Neil still longs for the days of CBM Basic, tape cassette drives, PEEKs and POKEs, and 3.5 K RAM.

Neil has a BS (Virginia Tech), an MBA (Duquesne University), and MCSD and MCDBA certifications.

To my wife Vicky and my daughter Abigail. You are such blessings to me. Thank you both so much for your encouragement and patience.

## Srinivasa Sivakumar

Srinivasa Sivakumar is a software consultant, developer and author. He specializes in Web and Mobile technologies using Microsoft solutions. He currently works in Chicago for TransTech, Inc.

He has co-authored Professional ASP.NET Web Services, ASP.NET Mobile Controls, .NET Compact Framework and ASP.NET Security for Wrox Press and written technical articles for ASPToday.com, CSharpToday.com, .NET Developer, and others.

In his free time he likes to watch Tamil movies and list to Tamil sound tracks (Especially one's sung by Mr. S.P Balasubramaniyam).

I'd like the dedicate my section of this book to my dear sister Vijaya Ramkumar and my brother-in-law Mr. Ramkumar for their help and outstanding support. Vijaya and Ramkumar, thanks a lot for all your help. Many congratulations for your new arrival.

#### **David Sussman**

David Sussman spent most of his professional life as a developer before realizing that writing was far more fun. He specializes in Internet and data access technologies, and spends much of his time delving into beta technologies. He's just moved house, so now has no money left to add more components to his ludicrously expensive hi-fi. You can reach him at davids@ipona.co.uk.

#### **Chris Ullman**

Chris Ullman is a Computer Science Graduate who worked for Wrox for six and half years before branching out on his own. Now the father of a seven month old baby, Nye, he divides his time between being a human punchbag for Nye, trying to write extra chapters with a baby on his lap, and in rare moments of spare time, either playing keyboards in psychedelic band the Bee Men (http://www.beemen.com), tutoring his cats in the art of peaceful co-existence and not violently mugging each other on the stairs.

A selection of Chris's non-computer related writings on music, art, and literature can be found at http://www.atomicwise.com.



## **Table of Contents**

Introduction	1
What does this Book Cover?	1
Who is this Book For?	3
What do you Need to use This Book?	4
Conventions	4
Customer Support  How to Download the Sample Code for the Book  Errata  E-mail Support  p2p.wrox.com  Why this System Offers the Best Support	<b>5</b> 5 6 6 7 7
Chapter 1: Getting Started with ASP.NET	9
What is a Static Web Page?	10
How are Static Web Pages Served?  The Limitations of Static Web Pages What is a Web Server?	<b>11</b> 12 13
How are Dynamic Web Pages Served?  Two Ways of Providing Dynamic Web Page Content Client-Side Dynamic Web Pages Server-Side Dynamic Web Pages An Overview of the Technologies Client-Side Technologies for Providing Dynamic Content Server-Side Technologies for Providing Dynamic Content	13 14 14 15 17 17
What is ASP.NET?	22
How does ASP.NET Differ from ASP?	22
I'm Still Confused about ASP, ASP.NET, and C#	23
The Installation Process Installing the IIS 5.x Web Server Working with IIS Testing your Installation	<b>23</b> 24 27 28

## Table of Contents

Identifying your Web Server's Name	29
Browsing to a Page on your Web Server	30 33
Managing Directories on your Web Server  Virtual Directories	34
Permissions	39
Confiduring Directory Security	42
Configuring Directory Security Prerequisites for Installing ASP.NET	<b>42</b>
Installing ASP.NET and the .NET Framework SDK	46
Troubleshooting Hints and Tips	50
ASP.NET Test Example	50
ASP.NET Troubleshooting	53
Program Not Found, the Result of the ASP.NET Isn't Being Displayed, or The Browser Tries to Download the File	53
Page Cannot Be Displayed: HTTP Error 403	55
Page Cannot Be Found: HTTP Error 404	56
Web Page Unavailable while Offline	58
l Just Get a Blank Page	58
The Page Displays the Message but not the Time	58
I Get an Error Statement Citing a Server Error	59
I Have a Different Problem	59
Summary	60
Chapter 2: Anatomy of an ASP.NET Page	63
What is .NET?	63
From Your Code to Machine Code	65
Introducing a Common Intermediate Language	66
Objects, Objects Everywhere	66
The .NET Base Classes	67
The Class Browser	68
How ASP.NET Works	69
Saving your ASP.NET Files with an ASPX Suffix	69
Inserting ASP.NET Code into our Web Pages	70
The <script> Tags</td><td>70</td></tr><tr><td>Inline Code Blocks (the <% %> Delimiters)</td><td>76</td></tr><tr><td>Server Controls</td><td>77</td></tr><tr><td>ASP.NET in Action</td><td>79</td></tr><tr><td>Binding to a Database</td><td>79</td></tr><tr><td>Binding to a Simple XML File</td><td>83</td></tr><tr><td>Summary</td><td>85</td></tr><tr><td>Chapter 3: Forms and HTML Server Controls</td><td>87</td></tr><tr><td>Forms in the Real World</td><td>88</td></tr><tr><td>Web Pages, HTML Forms, and Web Forms</td><td>88</td></tr></tbody></table></script>	

Simple Web Theory	90
The HTTP Protocol	93
Where ASP.NET Fits in with the .NET Framework	92
HTML Forms	93
The <form> Tag</form>	93
The action Attribute	94
The method Attribute	94
HTML Form Controls	96
How the <form> Tag Works in ASP.NET</form>	97
ASP.NET Server Controls	98
The <asp:label> Control</asp:label>	98
Control Attributes	102
The <asp:dropdownlist> Control</asp:dropdownlist>	103
The <asp:listbox> Control</asp:listbox>	110
The <asp:textbox> Control</asp:textbox>	113
The <asp:radiobutton> and <asp:radiobuttonlist> Controls  The <asp:radiobutton> and <asp:radiobuttonlist> Controls</asp:radiobuttonlist></asp:radiobutton></asp:radiobuttonlist></asp:radiobutton>	117 121
The <asp:checkbox> and <asp:checkboxlist> Controls</asp:checkboxlist></asp:checkbox>	
Summary	125
Exercises	125
napter 4: Storing Information in C#	127
What is a Variable?	128
Declaration	128
Data Types	132
Numeric Types	133
Suffixes	135
Character Data Types	135
The string Type	135
The char Type	137
Escape Sequences	101
Boolean Type	137
The Object Type	
Handling Dates	137 139 139
	137 139 139 139
Naming Variables	137 139 139
Naming Variables Case Issues	137 139 139 139 140
_	137 139 139 139 140
Case Issues	137 139 139 139 140
Case Issues Hungarian Notation	137 139 139 139 140 142 142 <b>143</b>
Case Issues Hungarian Notation  Operators	137 139 139 139 140 142 142
Case Issues Hungarian Notation  Operators Assignment Operator Arithmetic Operations Operator Precedence	137 139 139 139 140 142 142 <b>143</b> 144 145
Case Issues Hungarian Notation  Operators Assignment Operator Arithmetic Operations	137 139 139 139 140 142 142 <b>143</b>
Case Issues Hungarian Notation  Operators Assignment Operator Arithmetic Operations Operator Precedence Concatenating Strings  Converting Between Data Types	137 139 139 139 140 142 142 <b>143</b> 144 145 146 148
Case Issues Hungarian Notation  Operators Assignment Operator Arithmetic Operations Operator Precedence	137 139 139 139 140 142 142 <b>143</b> 144 145

## **Table of Contents**

Invalid Casts	152
Data Conversion	153
String Output	154
Data Input	155
What if Conversions Fail?	156
Constants	160
Structured Data Types	161
Arrays	161
Multi-Dimensional Arrays	165
Jagged Arrays	167
Structs	168
Enumerations	171
Summary	173
Exercises	173
Chapter 5: Introducing XML	177
The Format of XML	177
Tags and Elements	178
Attributes	179
Examples of Markup Languages	180
SGML	180
HTML	181
Drawbacks of HTML	182
How XML Came About	182
Creating an XML Document	183
Beyond Data Display	188
Well-Formed vs. Valid Documents	189
Well-Formed Documents	189
Valid Documents	196
Styling XML	197
Why Use Style Sheets?	198
Cascading Style Sheets	199
Using XML with ASP.NET	204
Summary	204
Exercises	205
Chapter 6: Control Structures and Procedural Programming	209
A Quick Look at Control Structures	210
Overview of Branching Structures	210
Overview of Looping Structures	210
·	

Overview of Functions	211
When to Use a Particular Control Structure	211
Branching Structures in Detail	212
Comparison Operators	213
Logical Comparisons Using if	213
Logical Operators	214
Extending if Statements Using else if and else	216
The Conditional or Ternary Operator	219
Comparing Strings	220
A Word about Nested ifs and Indenting	220
Conditional Statements Using switchcase  Another Note on Nesting and Indenting	227 230
Looping Structures in Detail	233
The for Loop	234
The while Loop The dowhile Loop	239 242
The foreach Loop	243
Break and Continue	243
Functions in Detail	244
Defining Functions	244
Return Types and Parameters	244
Calling Functions	246
Variable Scope	251
Local Variables	252
Global Variables	255
Summary	257
Exercises	258
Chapter 7: Event-driven Programming and Postback	261
What is an Event?	262
What is Event-driven Programming?	263
ASP.NET Events	263
Events in HTML	267
Server Control Events in ASP.NET	269
The ASP.NET button Server Control	272
Event-Driven Programming and Postback	275
The IsPostBack Test	280
Changing the Way we Program on the Web	280
Summary	286
Exercises	286

hapter 8: Introduction to Objects	289
Organizing Your Code	290
So, What's an Object?	291
Abstraction – Modeling the Real World	293
Encapsulation – The Black Box	294
Object Properties	295
Object Methods	295
Using Objects	296
Where do Objects Come From?	296
Defining a class	297
Creating Objects	300
Setting Objects to null	301
Using Methods and Properties	302
Initializing Objects with Constructors	311
Overloaded Methods	316
Operator Overloading	324
An Example of Operator Overloading	327
More on Operator Overloading	328
Summary	329
Exercises	330
napter 9: Shared Members and Class Relationships	333
Shared Members	334
Shared Properties	334
Shared Methods	337
Class Relationships	342
Association – 'Uses A'	342
Containment – A 'Has a' Relationship	349
Containment in .NET	352
Inheritance – 'Is A'	354
Terminology for Inheritance	357
The Pros and Cons of Inheritance	358
System.Object – The Ultimate Base Class	358
The Limitations of Inheritance	363
Advanced Inheritance Concepts	363
Virtual Functions	365
Referring to the Current Object – The this Reference	367
Abstract Classes and Interfaces	367
Converting between Object Types	369
Implicit Conversions	370
Explicit Conversions	371
Boxing and Unboxing	372
User-Defined Conversions	374

Summary	377
Exercises	378
Chapter 10: Objects in ASP.NET	381
Namespaces	382
Namespaces for ASP.NET	384
The Page Class Redirecting the User to Another Page	<b>384</b> 387
ASP.NET Core Objects	391
Request Object	392
Response Object	397
Server Object	402
State Handling	409
Application State	410
Session State	415
Cookies	421
How Do Cookies Work? Shelf Life – How Long Do Cookies Last?	421 421
Sessions and Cookies	427
Summary	428
Exercises	428
Chapter 11: Objects and Structured Data	431
What is a Collection?	431
Different Types of Collection	432
Arrays as Collections	433
Searching an Array	436
Working on Multiple Elements in an Array	439
Data Binding Pros and Cons of Working with Arrays	442 443
Getting More from Collections	444
ArrayList	444
Some More ArrayList Techniques	448
Hashtable	450
Using a Hashtable	452
SortedList	455
Summary	458
Exercises	459

Chapter 12: Reading from Data Sources	461
Understanding Modern Databases	461
Data Models	462
Normalization and Relational Databases	463
ADO.NET	465
.NET Data Providers	467
ADO.NET Objects	468
The Connection Object	469
Connecting to Northwind	470
The Command Object and DataReader	476
Simple Data Binding The DataSet and DataTable Objects	482 485
Microsoft SQL Server and ADO.NET	489
Catching Errors	492
Summary	496
Exercises	497
2.0.0.000	
Chapter 13: Manipulating Data Sources	499
Disconnected Data	500
Methods of Updating Data	500
DataSets and DataTables	501
The DataRow Object	503
Updating the Original Data Source	511
The Command Object	511
The DataAdapter Object	512
The CommandBuilder Object The DataAdapter.Update Method	514 518
Referential Integrity	523
Updating Data – Summary	523
Using SQL	524
Adapting the DataAdapter Commands	524
Using Stored Procedures	525
Direct SQL Commands	527
Using SQL – Summary	529
XML	529
XML into Strings	533
XML in a DataSet	533
What to Study Next	536
Summary	537
Exercises	537

Chapter 14: ASP.NET Server Controls	541
Other Types of Controls	543
HTML Server Controls	543
HTML Server Controls vs. ASP.NET Server Controls	544
User Controls	545
ASP.NET Server Controls	546
Rich Object Model	546
Automatic Browser Detection	546
Properties	547
Events	548
Page Lifecycle	551
Page_Load	551
Event Handling	552
Page_Unload	552
Control Families	561
Intrinsic Controls	563
Validation Controls	562
Rich Controls	563
Data Rendering Controls	566
The XML Source – MyCalendar.xml	570
The Web Form – MyCalendar.aspx	572
Editing the Data Using Templates	585
Summary	600
Exercises	601
Chapter 15: Reusable Code for ASP.NET	603
Encapsulation	603
Components	604
Why use Components?	605
Applying Component Theory to our Applications	606
Applying component meory to our applications	000
User Controls	607
When Should we use User Controls?	608
Code Behind	621
Using Code Behind	625
	020
Inheritance	628
Summary	630
Exercises	631

hapter 16:.NET Assemblies and Custom Controls	633
Three-Tier Application Design	634
ASP.NET Application Design	635
.NET Assemblies	636
What is Compilation?	638
Accessing a Component from within an ASP.NET Page	642
XCopy Deployment	645
Accessing Assemblies in Other Locations	646
Writing Code in Other Languages	647
Data Access Components	650
Custom Server Controls	659
What are Custom Controls?	659
How are Custom Controls Different from User Controls?	659
How are Custom Controls different from Business Objects?	659
How It All Fits Together	663
Summary	669
Exercises	669
hapter 17: Debugging and Error Handling	673
A Few Good Habits	674
Good Coding Practice	674
How and from where do Errors Arise?	677
Syntax Errors	677
Logical Errors	679
Trapping Invalid Data	682
System Errors	686
Finding Errors	687
Debug mode	688
Tracing	690
Page-Level Tracing	690
Writing to the trace log	693
Application-Level Tracing	695
Handling Errors	696
On Error Goto?	697
Structured Error Handling	697
Exceptions	698
Using trycatchfinally	
Multiple catch Blocks	699
What You Can Put in a catch Block	700
And finally	700 702
•	700 702 703
Generating Exceptions using throw Nested try Blocks	700 702