

THE EXPERT'S VOICE® IN .NET

Includes an  
introduction to  
Microsoft's new  
Team Test software!

# A Tester's Guide to .NET Programming

*Learn how to write automated tests,  
utilities, and test tools in .NET 2005!*

Randal Root and Mary Romero Sweeney

*Foreword by Dr. Magdy Hanna, PhD*

apress®

[www.it-ebooks.info](http://www.it-ebooks.info)

# A Tester's Guide to .NET Programming



Randal Root and  
Mary Romero Sweeney

Apress®

## **A Tester's Guide to .NET Programming**

**Copyright © 2006 by Randal Root and Mary Romero Sweeney**

All rights reserved. No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage or retrieval system, without the prior written permission of the copyright owner and the publisher.

ISBN-13: 978-1-59059-600-5

ISBN-10: 1-59059-600-5

Printed and bound in the United States of America 9 8 7 6 5 4 3 2 1

Trademarked names may appear in this book. Rather than use a trademark symbol with every occurrence of a trademarked name, we use the names only in an editorial fashion and to the benefit of the trademark owner, with no intention of infringement of the trademark.

Lead Editor: Jonathan Hassell

Technical Reviewer: Phil Leder

Editorial Board: Steve Anglin, Dan Appleman, Ewan Buckingham, Gary Cornell, Tony Davis, Jason Gilmore, Jonathan Hassell, Chris Mills, Dominic Shakeshaft, Jim Sumser

Project Manager: Beth Christmas

Copy Edit Manager: Nicole LeClerc

Copy Editor: Linda Marousek

Assistant Production Director: Kari Brooks-Copony

Production Editor: Linda Marousek

Compositor: Susan Glinert Stevens

Proofreader: Kim Burton

Indexer: Valerie Perry

Artist: April Milne

Cover Designer: Kurt Krames

Manufacturing Director: Tom Debolski

Distributed to the book trade worldwide by Springer-Verlag New York, Inc., 233 Spring Street, 6th Floor, New York, NY 10013. Phone 1-800-SPRINGER, fax 201-348-4505, e-mail orders-ny@springer-sbm.com, or visit <http://www.springeronline.com>.

For information on translations, please contact Apress directly at 2560 Ninth Street, Suite 219, Berkeley, CA 94710. Phone 510-549-5930, fax 510-549-5939, e-mail [info@apress.com](mailto:info@apress.com), or visit <http://www.apress.com>.

The information in this book is distributed on an “as is” basis, without warranty. Although every precaution has been taken in the preparation of this work, neither the author(s) nor Apress shall have any liability to any person or entity with respect to any loss or damage caused or alleged to be caused directly or indirectly by the information contained in this work.

The source code for this book is available to readers at <http://www.apress.com> in the Source Code section.

*To my husband and sweetheart, Brian. Thanks for your love and friendship,  
without which I'd never get anything done.*

—Mary Romero Sweeney

*To my wife, Shery, and my children, John, Sasha, and Elaine.  
All of you helped me achieve this, and I am forever grateful.*

—Randal Root



# Contents at a Glance

Foreword .....	xv
About the Authors .....	xvii
About the Technical Reviewer .....	xix
Acknowledgments .....	xxi
Introduction .....	xxiii
■ <b>CHAPTER 1</b> Automated Software Testing with .NET .....	1
■ <b>CHAPTER 2</b> Understanding .NET Testing Choices .....	11
■ <b>CHAPTER 3</b> The Basics of Storing Test Data .....	39
■ <b>CHAPTER 4</b> An Overview of .NET Error Handling .....	87
■ <b>CHAPTER 5</b> Creating a Testing Framework .....	139
■ <b>CHAPTER 6</b> Creating Testware Components .....	185
■ <b>CHAPTER 7</b> Automation with Console-Based Testware .....	251
■ <b>CHAPTER 8</b> Introduction to Database Testing .....	305
■ <b>CHAPTER 9</b> Creating Web-Based Testware .....	349
■ <b>CHAPTER 10</b> Testing COM and Web Services .....	409
■ <b>CHAPTER 11</b> An Introduction to Visual Studio Team Test .....	439
■ <b>APPENDIX A</b> Setting Up Your Computer .....	477
■ <b>APPENDIX B</b> VB .NET and C# Quick Reference .....	485
■ <b>APPENDIX C</b> Resources and References .....	565
■ <b>INDEX</b> .....	569



# Contents

Foreword .....	xv
About the Authors .....	xvii
About the Technical Reviewer .....	xix
Acknowledgments .....	xxi
Introduction .....	xxiii
<b>CHAPTER 1 Automated Software Testing with .NET .....</b>	<b>1</b>
What a Tester Needs to Know About .NET Coding .....	2
Why .NET Languages for Testing? .....	2
Choosing a .NET Language for a Test Project .....	3
What Is Automated Software Testing? .....	4
Technical vs. Nontechnical Testing .....	4
When to Automate? .....	5
Project and Personnel Issues .....	5
Product Issues .....	6
Additional Test-Management Issues .....	7
Building a Team for Automated Testing .....	7
Test Scripts Are Software .....	8
Goals of Good Testing Software .....	9
Limitations of Programming Languages for Testing .....	10
Summary .....	10
<b>CHAPTER 2 Understanding .NET Testing Choices .....</b>	<b>11</b>
Objectives .....	11
.NET Namespaces for Testing .....	12
Creating a Simple Application for Testing .....	16
First Windows Forms Testware Application .....	16
Using Console Applications to Create Testware .....	23
Using Web Applications to Create Testware .....	31
Summary .....	38



<b>CHAPTER 3</b>	<b>The Basics of Storing Test Data</b>	<b>39</b>
	Objectives	39
	Test Results Logging and Project Planning	40
	Working with Text Files on a Test Project	40
	Working with the Windows Registry on a Test Project	59
	Accessing the Windows Registry Programmatically	60
	Working with Database Files on a Test Project	73
	Database Access Basics	73
	Summary	85
<b>CHAPTER 4</b>	<b>An Overview of .NET Error Handling</b>	<b>87</b>
	Objectives	87
	Syntax, Runtime, and Logic Errors	88
	Working with Syntax Errors	88
	Working with Runtime Errors	91
	Working with Logic Errors	91
	Working with Breakpoints	92
	Step Into	93
	Step Over	94
	Step Out	94
	The Debugging Windows	97
	The Locals Window	98
	The Watch Window	98
	The Autos Window	99
	The Immediate and Command Windows	100
	The Call Stack Window	100
	The Data Tips Window	101
	The Just-In-Time Debugger	104
	Using the Try-Catch Statements	109
	Try	110
	Catch	111
	Finally	111
	Scope Issues	112
	Exception Classes	113
	Making an Exception Object	114
	Using Exception Objects	115
	Creating Your Own Exception Class	116
	Throwing Exceptions	117

Using Debug and Trace .....	122
The Debug Class .....	123
The Trace Class .....	125
Trace and Debug Methods .....	126
TraceListeners .....	129
Turning On Trace After an Application Is Deployed .....	135
Summary .....	138
<b>CHAPTER 5   Creating a Testing Framework .....</b>	<b>139</b>
Objectives .....	140
Using Procedures to Create Test Utilities .....	140
Planning Your Procedures .....	142
Launching One Program from Another .....	142
Using Function Procedures .....	148
Procedure Accessibility .....	149
Building a Testing Framework Using a Static Class .....	150
VB .NET Shared Class .....	152
C# Static Class .....	154
Adding Existing Classes to Projects .....	156
Understanding Windows Forms Classes .....	158
Adding Additional Forms to a Project .....	158
Displaying Forms .....	160
Adding Timing to Your Tests .....	165
Basic Test Timing .....	165
Synchronous Timing Using the Shell() Method .....	168
Using the Timer Control .....	171
Simple GUI Testing Using SendKeys() .....	173
Summary .....	183
<b>CHAPTER 6   Creating Testware Components .....</b>	<b>185</b>
Objectives .....	186
Defining Properties and Methods .....	186
Classes and Objects .....	187
Planning Your Bug-Reporter Application .....	187
Creating and Using Procedures .....	193
Adding Error Handling to Methods .....	199
Creating Reusable Classes .....	204
Creating Class Members .....	207
Creating a Class .....	212

Separating Different Classes into Different Files . . . . .	222
Validation Code . . . . .	222
Separating the UI and Processing Components . . . . .	229
Private and Shared Assemblies . . . . .	232
Extending and Changing Your Components . . . . .	236
Summary . . . . .	249
<b>CHAPTER 7 Automation with Console-Based Testware . . . . .</b>	<b>251</b>
Objectives . . . . .	251
Using Console Applications . . . . .	251
Using Arguments . . . . .	252
Creating a Simple Example . . . . .	254
Creating a Test Lab Setup . . . . .	269
Running One Program from Another . . . . .	269
Checking for Software Requirements . . . . .	270
Installing Application Files from a Network Share . . . . .	272
Creating a Network Share . . . . .	273
Copying the Files from the Share . . . . .	278
Saving Testware Reports to a Central Network Share . . . . .	280
Completing the Application . . . . .	281
Reporting Status on the Local Computer . . . . .	283
Using Batch Files . . . . .	300
Using Windows Scheduler . . . . .	301
Summary . . . . .	303
<b>CHAPTER 8 Introduction to Database Testing . . . . .</b>	<b>305</b>
Objectives . . . . .	306
Database Application Testing Using the Database Explorer (or Server Explorer) . . . . .	306
Using the Database Explorer Window for Field-Level Integrity Testing . . . . .	307
Executing Database Queries Using the Query Designer . . . . .	312
SQL Statements for Testing . . . . .	315
Database References vs. Database Connections . . . . .	317
Automated Database Testing Using ADO.NET . . . . .	318
ADO.NET Basics . . . . .	319
Using the Connection and Command Objects . . . . .	321
Using the DataReader Object . . . . .	324

Database Testing Using the ASP.NET Data Source Controls . . . . .	332
Using the Access Data Source Control . . . . .	333
Working with DataGrids . . . . .	335
Setting Up the DataAdapter . . . . .	335
Summary . . . . .	347
<b>CHAPTER 9 Creating Web-Based Testware . . . . .</b>	<b>349</b>
Objectives . . . . .	349
Web Technology Overview . . . . .	349
Two-Tier Applications . . . . .	353
Three-Tier Applications . . . . .	355
N-Tier Applications . . . . .	359
Creating Web-Based Testware . . . . .	361
Understanding the Default Web Page Code . . . . .	362
Code-Behind vs. Single-File Options . . . . .	364
Inserting Data to a Database . . . . .	368
Viewing Data from a Database . . . . .	373
Adding Validation Code . . . . .	387
Reusing Existing Components . . . . .	388
Debugging a Web Application . . . . .	396
The Trace Class . . . . .	399
Deploying an ASP.NET Application . . . . .	404
Using the Copy Web and the Publish Web Options . . . . .	408
Summary . . . . .	408
<b>CHAPTER 10 Testing COM and Web Services . . . . .</b>	<b>409</b>
Objectives . . . . .	409
Web Services vs. COM Components . . . . .	409
Understanding Web Services . . . . .	410
Creating a Web Service . . . . .	411
Testing Web Services . . . . .	417
Database Access with Web Services . . . . .	422
Running Remote Testware with Web Services . . . . .	423
Understanding and Testing COM . . . . .	427
Referencing a COM Library . . . . .	427
Accessing and Testing a COM Library . . . . .	428
Finding Your Project's COM Libraries . . . . .	435
Summary . . . . .	436

<b>CHAPTER 11</b>	<b>An Introduction to Visual Studio Team Test</b> .....	439
	Objectives .....	439
	Team Test Edition Overview .....	440
	Team Test Windows .....	441
	Types of Tests Available .....	446
	Unit Testing .....	446
	Data-Driven Unit Testing .....	456
	Creating Manual Tests .....	462
	Organizing Tests and Managing Test Runs .....	464
	Creating Ordered Tests .....	465
	Web Testing .....	466
	Load Testing .....	471
	Summary .....	475
<b>APPENDIX A</b>	<b>Setting Up Your Computer</b> .....	477
	Hardware Requirements .....	477
	Software Requirements .....	478
	FrontPage Extensions Issues .....	479
	Unsupported Operating Systems .....	479
	Setup Instructions .....	480
	Uninstalling Visual Studio or Express Beta Editions .....	481
	Choosing Between Visual Studio 2005 or Express Editions .....	481
	The Exercise Files .....	482
	Technical Support .....	483
	Business Address .....	483
<b>APPENDIX B</b>	<b>VB .NET and C# Quick Reference</b> .....	485
	Setting Up to Test the Samples .....	485
	Programming Basics .....	488
	Comments .....	488
	Methods .....	489
	Organizing Code into Classes and Namespaces .....	489
	Shared and Static .....	490
	The Main() Method .....	492
	Namespaces .....	492
	Directives .....	495
	Holding Data .....	495

Declaring Constants .....	496
Declaring Variables .....	496
Choosing Types .....	497
Reference Types and Value Types .....	499
Data Conversions .....	501
The Convert Class.....	501
Built-In Conversion Methods.....	502
The C# Cast Operator.....	503
The VB .NET CType().....	503
Implicit Conversions .....	504
Working with Groups of Data .....	504
Enumerations .....	504
Structures .....	506
Classes .....	508
Arrays.....	511
Collections .....	523
More on Objects .....	524
Working with String .....	527
String Can Act Like an Array .....	527
Strings Cannot Be Changed Once Their Data Is Set.....	527
Adding Two Strings Together .....	528
Strings Can Use Special Characters (Escape Sequences).....	528
C# Can Use String Literals by Adding the @ Symbol .....	529
Programming Statements .....	530
Conditional Statements .....	530
Iteration and Jump Statements .....	536
The For-Each Loop .....	536
The For Loop (C# Only).....	537
The For-Next Loop (VB .NET Only) .....	538
The While Loop .....	539
The Do-While Loop.....	539
The Do-Until Loop (VB .NET Only).....	540
The GoTo Jump Statement .....	541
The Continue Jump Statement .....	541
The Break or Exit Jump Statements.....	542
The Return Jump Statement .....	543
The Scope of Variables Inside Loops .....	543
Operations .....	544

Operators .....	545
The Dot Operator .....	545
The Parentheses Operator .....	545
The Bracket Operator .....	546
The Pre and Post Increment Operators (C# Only) .....	546
The Negation Operator (C# Only) .....	546
The Multiplicative Operators .....	547
The Additive Operators .....	548
The Concatenation Operators .....	548
The Relational Operators .....	549
More on the Equality Operators .....	549
The Logical Operators .....	551
The Substitution Parameter Operator .....	554
The Ternary Operator .....	555
More on Methods .....	556
Methods Can Return Values .....	556
Some Methods Do Not Return Values .....	557
Methods Can Include Parameters .....	557
Value and Reference Types Affect Parameters .....	558
You Can Change the Way Value Type Parameters Behave .....	560
String Parameters Behave Like Value Types .....	561
VB .NET Has Optional Parameters .....	562
Using Multiple Versions of a Method .....	562
Using Properties .....	563
Summary .....	564
<b>APPENDIX C Resources and References .....</b>	<b>565</b>
Testing Books .....	565
.NET Books (VB .NET and C#) .....	565
Journals/Periodicals .....	566
Recommended Testing Websites .....	566
Other Recommended Websites .....	567
Recommended Database Design and SQL Resources .....	567
Resources on Additional Topics of Interest .....	568
<b>INDEX .....</b>	<b>569</b>

# Foreword

**F**or many years and through my work as the Chairman and CEO of the International Institute for Software Testing (IIST), I have been trying to find ways to help test professionals gain the technical skills they need in order to test applications that use modern development technologies. I learned about Mary Sweeney's ability to address this need through her first book *Visual Basic for Testers* (Apress, 2001) and, as a result, added her to our faculty. Mary has been a faculty member of IIST for the last two years, teaching testers topics in programming concepts and in testing database applications. Mary's abilities to address technical subjects in software testing are unique and have been additionally proven through her writing of this book. Although I do not normally have the time to write forewords for books, I did not want to pass the opportunity to write the foreword for this book because the topic is an important one to today's test professionals. In fact, this book is long overdue!

I am especially excited about the new opportunities this book will bring to test professionals who really need to master the process of testing .NET applications. The fact is testing a .NET application today can be very difficult in that it can be extremely complex. This complexity makes it highly likely that, in many cases, developers will not have time to test everything in the application. So they will have to rely on professional testers to perform complete testing at all levels. Therefore, this book is a *must read* for every test professional working on a .NET project. Testing .NET applications represents a technical challenge for software developers and test professionals. The methods and techniques presented in this book will certainly help developers, as well as testers, improve the quality of their .NET applications. The hands-on nature of the book makes it easy for test professionals to follow. In my opinion, the authors have done a remarkable job in bringing highly technical concepts to a level that can be easily understood by all test professionals. This did not come as a surprise to me based on what I know about Mary's teaching style. I particularly like the exercises in each chapter. They provide a great learning adjunct to master this very technical subject.

I strongly believe that this book fills a big gap in the knowledge body that test professionals and developers need to master in order to assure the delivery of high quality .NET applications.

Dr. Magdy Hanna, PhD  
*Chairman and CEO*  
*International Institute for Software Testing*  
*www.iist.org*



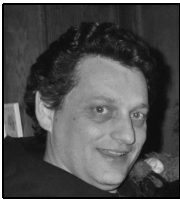


# About the Authors



**MARY ROMERO SWEENEY** has been developing, using, and testing software systems for over 20 years for companies, including Boeing and Software Test Labs.

She's the author of *Visual Basic for Testers* (Apress, 2001) and a frequent speaker at major software testing conferences. Mary is a college professor and also performs independent consultation and training through her company Sammamish Software ([www.sammamishsoftware.com](http://www.sammamishsoftware.com)). She has degrees in Mathematics and Computer Science from Seattle University, is an MCP in SQL Server, and is on the board and faculty of the International Institute of Software Testing (IIST).



**RANDAL ROOT** owns a consulting company, Root Source ([www.rootsource4training.com](http://www.rootsource4training.com)), specializing in technical education. For the last six years, he has provided training at both businesses and schools, including Microsoft and Bellevue Community College. His subjects include Windows, web, and database programming, as well as networking and administration. Randal holds several Microsoft professional certifications including MCSE, MCP+I, MCDBA, and MCAD and has worked in the industry as a network administrator and programmer since the 1980s.



# About the Technical Reviewer



**PHIL R. LEDER** was born November 1, 1979, in Bothell, WA. He is currently a Programmer/Systems Analyst specializing in Client Server Systems at Boeing's Future Combat Systems. He graduated from Central Washington University with a BS in Computer Science.