Preface

Welcome to the Visual Basic® 2010 programming language and the world of Microsoft® Windows® and Internet programming with Microsoft's .NET platform!

At the heart of the book is the Deitel signature "live-code approach." Concepts are presented in the context of working programs, rather than in code snippets. Each code example is accompanied by one or more sample executions. All the source code is available at `www.deitel.com/books/vb2010htp/`.

As you read the book, if you have questions, send an e-mail to `deitel@deitel.com`; we'll respond promptly. For updates on this book and its supporting Visual Basic software, visit `www.deitel.com/books/vb2010htp/`, follow us on Facebook (`www.deitel.com/deitelfan`) and Twitter (`@deitel`), and subscribe to the *Deitel® Buzz Online* newsletter (`www.deitel.com/newsletter/subscribe.html`).

New and Updated Features

Here are the updates we've made for *Visual Basic® 2010 How to Program*:

- ***Late objects approach.*** We now defer the discussion of creating custom classes until Chapter 9, but in the early chapters, we still use lots of existing objects. Chapter 10 discusses how to create powerful new classes quickly by using inheritance to "absorb" the capabilities of existing classes, and presents the crucial concepts of polymorphism, abstract classes and interfaces.
- ***Shorter printed book with optional online advanced chapters.*** The printed book contains the core content for introductory Visual Basic courses. Several *optional* online chapters are included for second courses and professionals. These are available in searchable PDF format on the book's password-protected Companion Website—see the access card in the front of this book. If you are an instructor with a complimentary review copy that did not come with an access card, contact your Pearson Education/Prentice-Hall representative.
- ***Focus on business and personal utility examples.***
- ***Windows Forms GUI is integrated throughout the core chapters.*** We replaced all console applications in the core content with GUI applications.
- ***Making a Difference exercises set.*** We encourage you to use computers and the Internet to research and solve problems that of social significance. These new exercises are meant to increase awareness of important issues the world is facing. We hope you'll approach them with your own values, politics and beliefs.
- ***Up-to-date with Visual Basic 2010, the Visual Studio 2010 IDE and .NET 4.0.***
- The code will run on ***Windows 7***, ***Windows Vista*** and ***Windows XP***. We'll post any issues on `www.deitel.com/books/vb2010htp/`.

- We include ***VideoNotes*** for most of the programs in the core book.
- ***Integrated Using the Debugger sections and exercises*** in the core printed book. Students use the debugger to locate and fix logic errors.
- ***Files and databases are covered earlier. ASP.NET is in the core book.***
- ***New design.*** The book has a new interior design that graphically organizes, clarifies and highlights the information, and enhances the book's pedagogy.
- We added ***new exercise types*** including "What does this code do?", "What's wrong with this code?" and "Using the Debugger."
- We added ***multiple-choice Self-Review Exercises and answers*** to many of the chapters in the printed book.
- We added a ***multiple-choice Quick Quiz*** in many chapters.
- ***We now present graphics in the context of Windows Forms with GDI+.*** We moved the WPF graphics chapter to the online section.
- ***We titled the programming exercises*** to help instructors select assignments.
- ***Larger programs are presented in small increments.***

Other features of *Visual Basic 2010 How to Program* include:

- ***We use LINQ (Language Integrated Query) to query files, databases, XML and collections.*** The introductory LINQ chapter in the core printed book is intentionally brief to encourage instructors to cover this important technology. The online chapters continue the discussion of LINQ.
- ***Databases.*** We use Microsoft's free SQL Server Express (which installs with the free Visual Basic Express) to teach the fundamentals of database programming. Chapters 12, 13, 22 and 23 use database and LINQ fundamentals in the context of an address-book desktop application and web-based guestbook, bookstore and airline reservation system applications, respectively.
- ***ASP.NET 4.0.*** Microsoft's .NET server-side technology, ASP.NET, enables you to create robust, scalable web-based applications. In Chapter 13, you'll build several applications, including a web-based guestbook application that uses ASP.NET, LINQ and a `LinqDataSource` to store data in a database and display data in a web page. The chapter also discusses the ASP.NET Development Server for testing your web applications on your local computer.
- ***Local type inference.*** When you initialize a local variable in its declaration, you can now omit the variable's type—the compiler infers it from the initializer value.
- ***Optional parameters.*** You can specify method parameters with default values—if a corresponding method argument is not provided in the method call, the compiler inserts the optional parameter's default value in the call.
- ***Object initializers.*** For new objects, you can use object initializer syntax (similar to array initializer syntax) to assign values to the new object's properties.
- ***"Quick Fix" window.*** We show how to use the IDE's **Error Correction Options** window to quickly fix certain common programming errors simply by clicking the suggested fix, which is displayed in a window in the code editor.

- *We emphasize the IDE's* **IntelliSense** *feature* that helps you write code faster and with fewer errors.
- *We show how to use* **DataTips** *and visualizers* to view object contents in the code window during debugging.
- *Appendix F, Creating Console Applications.* This online appendix is referenced by the online chapters that contain some console applications.

Our Text + Digital Approach to Content

We surveyed hundreds of instructors teaching Visual Basic courses and learned that most want a book with content focused on their introductory courses. With that in mind, we moved many of the intermediate and advanced chapters to the web. Having this content in digital format makes it easily searchable, and gives us the ability to fix errata and add new content as appropriate. The book's Companion Website at

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www.pearsonhighered.com/deitel/
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(see the access card at the front of the book) contains the following chapters and appendices in *searchable* PDF format:

- Chapters 16–18 extend the core coverage of ***exception handling, strings and files***.
- The .NET framework provides an extensive set of ***pre-built collections***, so you rarely need to create your own data structures. Chapter 25 discusses collections.
- ***WPF (Windows Presentation Foundation) GUI, graphics and multimedia.*** We extend the core book's coverage of GUI and graphics in Chapters 19–20, respectively, with an introduction to Windows Presentation Foundation (WPF)—Microsoft's new framework that integrates GUI, graphics and multimedia capabilities. We implement a painting application, a text editor, a color chooser, a book-cover viewer, a television video player, various animations, and speech synthesis and speech recognition applications.
- ***ASP.NET 4.0 and ASP.NET AJAX.*** Chapter 22 extends Chapter 13's ASP.NET discussion with a case study on building a password-protected, web-based bookstore application. We also introduce ASP.NET AJAX controls and use them to add AJAX functionality to web applications to improve their responsiveness.
- ***WCF (Windows Communication Foundation) Web Services (Chapter 23).*** Web services enable you to package application functionality in a manner that turns the web into a library of reusable software components. We include case studies on building an airline reservation web service, a blackjack web service and a math question generator web service that's called by a math tutor application.
- ***Silverlight.*** Chapter 24 introduces Silverlight, which enables you to create visually stunning, multimedia-intensive user interfaces for web applications. The chapter presents powerful multimedia applications, including a weather viewer, Flickr photo viewer, deep zoom book-cover collage and video viewer.
- ***Visual Basic XML capabilities.*** Use of the Extensible Markup Language (XML) is exploding in the software-development industry and in e-business, and is pervasive throughout the .NET platform. Visual Basic has many features that integrate XML with the language. In Chapter 21, we use XML axis properties to

manipulate elements of an XML document by their element names. We also demonstrate Visual Basic's new support for XML literals—this enables you to embed XML documents and elements directly in your Visual Basic code. In addition, we use LINQ to manipulate XML data.

- ***Optional Case Study: Using the UML to Develop an Object-Oriented Design of an ATM.*** The UML™ (Unified Modeling Language™) has become the preferred graphical modeling language for designing object-oriented systems. This edition includes an optional online case study on object-oriented design using the UML. We design and implement the software for a simple automated teller machine (ATM). We analyze a typical requirements document that specifies the system to be built. We determine the classes needed to implement that system, determine the attributes the classes need to have, determine the behaviors the classes need to exhibit and specify how the classes must interact with one another to meet the system requirements. From the design we produce a working Visual Basic implementation.
- ***Index.*** The index posted on the Companion Website includes the content from the printed book *and* the online content. The print book index covers only the material in the printed book.

Dependency Charts

The charts in Figs. 1–2 show the dependencies among the chapters to help instructors plan their syllabi. The core printed book focuses on introductory courses (Fig. 1). The online chapters include intermediate and advanced content for second courses (Fig. 2).

Teaching Approach

Visual Basic 2010 How to Program contains a rich collection of examples. We concentrate on building good software, and stress program clarity.

Live-Code Approach. The book is loaded with "live-code" examples. Most new concepts are presented in the context of complete working Visual Basic applications, followed by one or more executions showing program inputs and outputs.

Syntax Shading. For readability, we syntax shade the code, similar to the way most integrated-development environments and code editors syntax color code. Our syntax-shading conventions are:

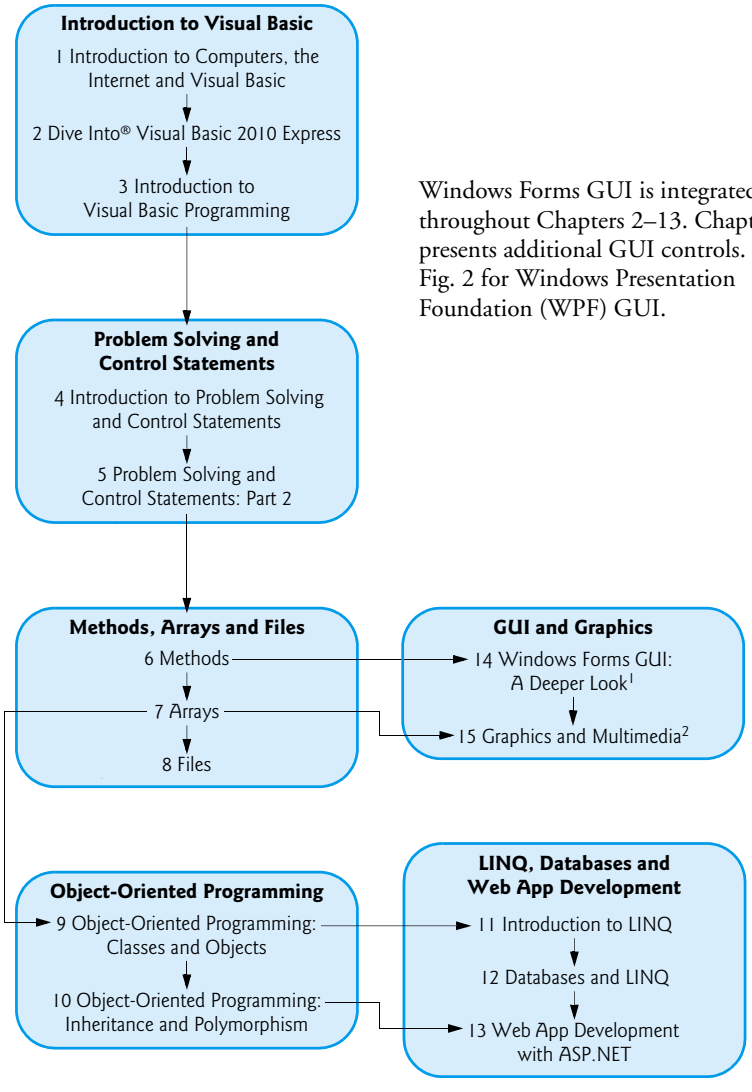
```
comments appear like this
keywords appear like this
constants and literal values appear like this
all other code appears in black
```

Code Highlighting. We place gray rectangles around each program's key code.

Using Fonts for Emphasis. We place the key terms and the index's page reference for each defining occurrence in **bold blue** text for easy reference. We emphasize on-screen components in the **bold Helvetica** font (for example, the **File** menu) and Visual Basic program text in the `Lucida` font (for example, `Dim count As Integer = 5`).

Objectives. The opening quotes are followed by a list of chapter objectives.

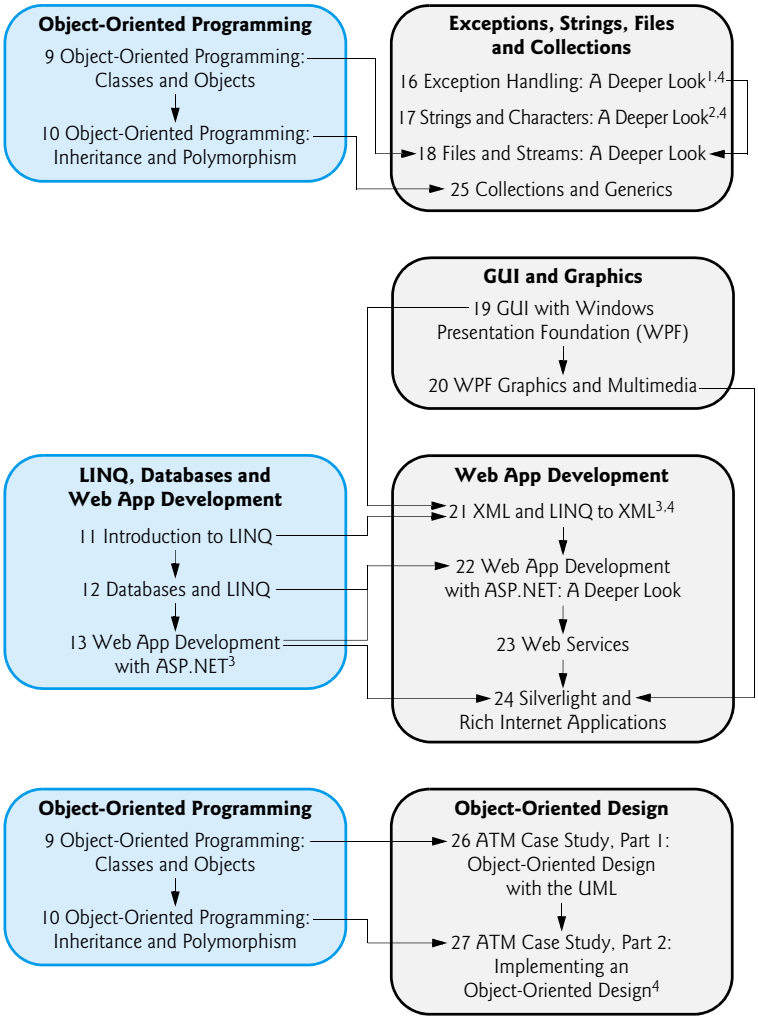
Dependency Chart for Print Chapters



1. Section 14.7 requires the `Using` statement, which is presented in Chapter 8. Section 14.14 requires concepts presented in Chapter 9. Section 14.15 requires inheritance concepts from Chapter 10.
2. Several Chapter 15 examples override `Form` method `OnPaint`. Method overriding is presented in Chapter 10. To use graphics sooner, students can mimic `OnPaint` as shown in the examples. Sections 15.9 and 15.12 use `Imports` statements, which are introduced in Chapter 8.

Fig. 1 | Chapter dependency chart.

Dependency Chart for Online Chapters



1. Most of Chapter 16 can be covered after Chapter 6. Section 16.8 requires concepts from Chapter 9.
2. Most of Chapter 17 can be covered after Chapter 6, but a couple of examples require one-dimensional arrays (Chapter 7).
3. Chapter 21 depends on the introduction to XML in Sections 19.3–19.5.
4. Online Appendix F shows how to create console applications. Parts of Chapters 16, 17, 21 and 27 use console applications.

Fig. 2 | Chapter dependency chart for the online chapters.

Illustrations/Figures. Abundant tables, line drawings, UML diagrams, programs and program outputs are included.

Programming Tips. We include programming tips to help you focus on important aspects of program development. These tips and practices represent the best we've gleaned from a combined seven decades of programming and teaching experience.

Good Programming Practice

The Good Programming Practices *call attention to techniques that will help you produce programs that are clearer, more understandable and more maintainable.*

Common Programming Error

Pointing out these Common Programming Errors *reduces the likelihood that you'll make them.*

Error-Prevention Tip

These tips contain suggestions for exposing and removing bugs from your programs; many describe aspects of Visual Basic that prevent bugs from getting into programs.

Performance Tip

These tips highlight opportunities for making your programs run faster or minimizing the amount of memory that they occupy.

Portability Tip

The Portability Tips *help you write code that will run on a variety of platforms.*

Software Engineering Observation

The Software Engineering Observations *highlight architectural and design issues that affect the construction of software systems, especially large-scale systems.*

Look-and-Feel Observation

These observations help you design attractive, user-friendly graphical user interfaces that conform to industry norms.

Summary Bullets. We present a section-by-section, bullet-list summary of each chapter.

Terminology. We include an alphabetized list of the important terms defined in each chapter with the page number of each term's defining occurrence for easy reference.

Self-Review Exercises and Answers. Extensive self-review exercises *and* answers are included for self-study. We've added many new multiple-choice exercises and answers.

Exercises. Each chapter concludes with additional exercises including:

- simple recall of important terminology and concepts
- What's wrong with this code?
- What does this code do?
- Using the Debugger

- writing individual statements and small portions of methods and classes
- writing complete methods, classes and programs
- major projects.

Please do not write to us requesting access to the Pearson Instructor's Resource Center which contains the book's instructor supplements, including the exercise solutions. Access is limited strictly to college instructors teaching from the book. Instructors may obtain access only through their Pearson representatives. Solutions are *not* provided for "project" exercises. Check out our Programming Projects Resource Center for lots of additional exercise and project possibilities (`www.deitel.com/ProgrammingProjects/`).

Index. We've included an extensive index for reference. Defining occurrences of key terms are highlighted with a **bold blue** page number.

Student Resources and Software

This book includes the Microsoft® Visual Studio® 2010 Express Editions All-in-One DVD, which contains the Visual Basic® 2010 Express Edition (and other Microsoft development tools). These tools are also downloadable from

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www.microsoft.com/express/Windows
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We wrote *Visual Basic 2010 How to Program* using Visual Basic® Express Edition. You can learn more about Visual Basic® at `msdn.microsoft.com/en-us/vbasic/default.aspx`.

Deitel Online Resource Centers

Our website `www.deitel.com` provides Resource Centers on various topics of interest to our readers—see the list of Resource Centers in the first few pages of this book and visit `www.deitel.com/ResourceCenters.html`. We've found many exceptional resources online, including tutorials, documentation, software downloads, articles, blogs, podcasts, videos, code samples, books, e-books and more—most are free. Some of the Resource Centers you might find helpful while studying this book are Visual Basic, ASP.NET, ASP.NET AJAX, LINQ, .NET, Silverlight, SQL Server, Web Services, Windows Communication Foundation, Windows Presentation Foundation, Windows 7, UML, Code Search Engines and Code Sites, Game Programming and Programming Projects.

Instructor Supplements

The following supplements are available to qualified instructors only through Pearson Education's Instructor Resource Center (`www.pearsonhighered.com/irc`):

- *Solutions Manual* with solutions to most of the end-of-chapter exercises.
- *Test Item File* of multiple-choice questions (approximately two per book section)
- *Customizable PowerPoint® slides* containing all the code and figures in the text, plus bulleted items that summarize key points. The slides also include links to the project files for the code examples so that you can click to open the corresponding project in Visual Basic Express or Visual Studio and execute the program.

If you're not a registered faculty member, contact your Pearson representative or visit `www.pearsonhighered.com/educator/replocator/`.

CourseSmart Web Books

Today's students and instructors have increasing demands on their time and money. Pearson has responded to that need by offering digital texts and course materials online through CourseSmart. CourseSmart allows faculty to review course materials online saving time and costs. It is also environmentally sound and offers students a high-quality digital version of the text for as much as 50% off the cost of a print copy of the text. Students receive the same content offered in the print textbook enhanced by search, note-taking, and printing tools. For more information, visit `www.coursesmart.com`.

Microsoft Developer Network Academic Alliance (MSDNAA) and Microsoft DreamSpark

Microsoft Developer Network Academic Alliance (MSDNAA)—Free Microsoft Software for Academic and Research Purposes

The MSDNAA provides free software for academic and research purposes. For software direct to faculty, visit `www.microsoft.com/faculty`. For software for your department, visit `www.msdnaa.com`.

Microsoft DreamSpark—Professional Developer and Designer Tools for Students

Microsoft provides many of its developer tools to students for free via a program called DreamSpark (`www.dreamspark.com`). See the website for details on verifying your student status so you take advantage of this program.

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Reviewers

We wish to acknowledge the efforts of our reviewers. Adhering to a tight schedule, they scrutinized the text and the programs and provided countless suggestions for improving the presentation: Huanhui Hu (Microsoft Corporation), Narges Kasiri (Oklahoma State University), Charles Liu (University of Texas at San Antonio), Dr. Hamid R. Nemati (The University of North Carolina at Greensboro), Jeffrey P. Scott (Blackhawk Technical College) and José Antonio González Seco (Parliament of Andalusia, Spain).

Previous Edition Reviewers

Douglas B. Bock (MCSD.NET, Southern Illinois University Edwardsville), Dan Crevier (Microsoft), Amit K. Ghosh (University of Texas at El Paso), Marcelo Guerra Hahn (Microsoft), Kim Hamilton (Software Design Engineer at Microsoft and co-author of *Learn-*

ing UML 2.0), Huanhui Hu, Vitek Karas (Microsoft), James Edward Keysor (Florida Institute of Technology), Helena Kotas (Microsoft), Chris Lovett (Software Architect at Microsoft), Bashar Lulu (INETA Country Leader, Arabian Gulf), John McIlhinney (Spatial Intelligence; Microsoft MVP 2008 Visual Developer, Visual Basic), Ged Mead (Microsoft Visual Basic MVP, DevCity.net), Anand Mukundan (Architect, Polaris Software Lab Ltd.), Timothy Ng (Microsoft), Akira Onishi (Microsoft), José Antonio González Seco (Parliament of Andalusia), Joe Stagner (Senior Program Manager, Developer Tools & Platforms), Erick Thompson (Microsoft) and Jesús Ubaldo Quevedo-Torrero (University of Wisconsin–Parkside, Department of Computer Science)

Well, there you have it! Visual Basic 2010 is a powerful programming language that will help you write programs quickly and effectively. It scales nicely into the realm of enterprise-systems development to help organizations build their business-critical and mission-critical information systems. As you read the book, we'd appreciate your comments, criticisms, corrections and suggestions for improvement. Please address all correspondence to:

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deitel@deitel.com
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We'll respond promptly. We hope you enjoy working with *Visual Basic 2010 How to Program* as much as we enjoyed writing it!

Paul Deitel and Harvey Deitel
February 2010 Maynard, Massachusetts

About the Authors

Paul J. Deitel, CEO and Chief Technical Officer of Deitel & Associates, Inc., is a graduate of MIT's Sloan School of Management, where he studied Information Technology. Through Deitel & Associates, Inc., he has delivered Visual Basic, C#, Java, C++, C and Internet programming courses to industry clients, including Cisco, IBM, Sun Microsystems, Dell, Lucent Technologies, Fidelity, NASA at the Kennedy Space Center, the National Severe Storm Laboratory, White Sands Missile Range, Rogue Wave Software, Boeing, SunGard Higher Education, Stratus, Cambridge Technology Partners, One Wave, Hyperion Software, Adra Systems, Entergy, CableData Systems, Nortel Networks, Puma, iRobot, Invensys and many more. He and his co-author, Dr. Harvey M. Deitel, are the world's best-selling programming-language textbook authors.

Dr. Harvey M. Deitel, Chairman and Chief Strategy Officer of Deitel & Associates, Inc., has 48 years of experience in the computer field. Dr. Deitel earned B.S. and M.S. degrees from MIT and a Ph.D. from Boston University. He has extensive college teaching experience, including earning tenure and serving as the Chairman of the Computer Science Department at Boston College before founding Deitel & Associates, Inc., with his son, Paul J. Deitel. He and Paul are the co-authors of dozens of books and multimedia packages and they are writing many more. With translations published in Japanese, German, Russian, Chinese, Spanish, Korean, French, Polish, Italian, Portuguese, Greek, Urdu and Turkish, the Deitels' texts have earned international recognition. Dr. Deitel has delivered hundreds of professional seminars to major corporations, academic institutions, government organizations and the military.