

# Chapter 1

## Introduction

During my years of teaching database programming at the college level, it was difficult to find a good textbook on this topic. I have had to combine a few different professional books together as references to teach this course. Most of these books are specially designed for programmers or software engineers, which cover a lot of programming strategies and present huge blocks of code, which can give a terrible headache to the college students or beginning programmers who are new to Visual Studio.NET and database programming. I have had to prepare class presentations and develop homework problems and exercises for my students. I used to dream that one day I would find a good textbook that would be suitable for college students or beginning programmers and help them to learn and master database programming with Visual C#.NET easily and conveniently. Finally, I decided to do something myself about filling this lack of a good textbook.

Another reason for writing this book is the job market. As you know, most industrial and commercial companies in the United States are database applications businesses such as manufactures, banks, hospitals, and retailers. The majority of them need professional people to develop and build database-related applications, but not database management and design systems. To enable our students to become good candidates for these companies, we need to create a book like this one.

Unlike most database programming books on the current market, which discuss and present database programming techniques with huge blocks of programming codes from the first page to the last page, this book uses a new writing style to show readers, especially college students, how to develop professional and practical database programs in Visual C# 2008 by using Visual Studio.NET 2008 Design Tools and Wizards related to ADO.NET 3.5 and to apply codes that are autogenerated by using Wizards. By using this new style, the headaches caused by using huge blocks of programming code can be eliminated. Instead, a simple and easy way to create database programs using the design tools can be developed to enable students to build professional and practical database programs in more efficient and interesting ways.

There are many different database programming books available on the market. However, rarely do you find a book like this one that implements a novel writing style to attract students interested in this topic. To meet the needs of some experienced or advanced students or software engineers, the book contains two programming

methods: the fundamental database programming method—Visual Studio.NET 2008 Design Tools and Wizards—and an advanced database programming method—the runtime objects method. In the second method, all database-related objects are created and applied during or when your project is running by utilizing quite few blocks of code.

## **OUTSTANDING FEATURES OF THE BOOK**

1. A novel writing style is adopted to try to attract students and beginning programmers interesting in learning and developing practical database programs, and to avoid the headaches caused by using huge blocks of code in the traditional database programming books.
2. Covers both fundamental and advanced database programming techniques for both beginning and experienced students as well as programmers.
3. Three types of popular databases are covered and discussed in detail with practical examples: Microsoft Access 2007, SQL Server 2005 Express SP2, and Oracle Database 10g Express Edition Release 2. Unlike traditional database programming books, in which some classical commercial databases such as Northwind are used, three customer-built databases, CSE\_DEPT.accdb, CSE\_DEPT.mdf, and the Oracle version of CSE\_DEPT, are created and implemented in all sample projects throughout the whole book.
4. The new database query technique, LINQ API, which includes LINQ to Objects, LINQ to DataSet, LINQ to SQL, LINQ to Entities, and LINQ to XML, is discussed, analyzed, and implemented in actual projects with line-by-line explanations.
5. The various actual data providers are discussed and implemented in the sample projects, such as the SQL Server and Oracle data providers. Instead of using the OleDb to access the SQL Server or Oracle databases, the real SQL Server and Oracle data providers are utilized to connect to the Visual C#.NET 2008 directly to perform data operations.
6. More than 60 real sample database programming projects are covered with detailed illustrations and explanations to help students understand key techniques and programming technologies.
7. Homework and selected solutions are provided for each chapter to strengthen and improve student learning and understanding.
8. PowerPoint teaching slides are also provided to help instructors in teaching and organizing their classes.
9. It is a good textbook for college students and a good reference book for programmers, software engineers, and academic researchers.

## **TARGET AUDIENCE**

This book is designed for college students and software programmers who want to develop practical and commercial database programming with Visual C#.NET 2008 and relational databases such as Microsoft Access, SQL Server 2005, and Oracle Database 10g XE. Fundamental knowledge and understanding of Visual C#.NET and Visual Studio.NET IDE is assumed.

## TOPICS COVERED

Nine chapters are included in this book. The contents of each chapter is summarized as follows:

- Chapter 1 provides an introduction and summary of the whole book.
- Chapter 2 provides a detailed discussion and analysis of the structure and components about relational databases. Some key technologies in developing and designing databases are also discussed. The procedures and components used to develop a practical relational database with three database versions such as Microsoft Access, SQL Server 2005, and Oracle Database 10g XE are analyzed in detail with some real data tables in the sample database CSE\_DEPT.
- Chapter 3 provides an introduction to ADO.NET, which includes the architecture, organization, and components of ADO.NET 2.0 as well as ADO.NET 3.5. Detailed discussions and descriptions are provided to give readers both fundamental and practical ideas and pictures on how to use components in ADO.NET to develop professional data-driven applications. Two ADO.NET architectures are discussed to enable users to follow the directions to design and build their own projects based on the different organizations of ADO.NET. Four popular data providers, such as OleDb, ODBC, SQL Server, and Oracle, are discussed in detail. The basic ideas and implementation examples of DataTable and DataSet are also analyzed and described with some real coding examples. The new query technique, LINQ to ADO.NET, is introduced and discussed in detail with some actual sample projects. The latest version of ADO.NET, ADO.NET 3.5, is discussed with some examples given in the last section. The properties and functionalities of ADO.NET 3.5 Entity Framework (EF) and ADO.NET 3.5 Entity Framework Tools (EFT) are discussed in detail. The core of ADO.NET 3.5 EF, Entity Data Model, and associated Item template, Wizard and Designer, is also discussed and analyzed with a real project example EDMModel.
- Chapter 4 provides a detailed discussion and analysis about the Language-Integrated Query (LINQ), which includes LINQ to Objects, LINQ to DataSet, LINQ to SQL, LINQ to Entities, and LINQ to XML. An introduction to the LINQ general programming guide is provided in the first part in this chapter. Some popular interfaces widely used in LINQ, such as IEnumerable, IEnumerable<T>, IQueryable, and IQueryable<T>, and Standard Query Operators (SQO) including the deferred and nondeferred SQO, are discussed. An introduction to LINQ Query is given in the second section of this chapter. Following this introduction, a detailed discussion and analysis about the LINQ queries implemented for different data sources are provided in detail.
- Starting in Chapter 5, the real database programming techniques with Visual C#.NET 2008 such as data selection queries are provided and discussed. This chapter is divided into two parts: Part I contains the detailed descriptions on how to develop professional data-driven applications with the help of the Visual Studio.NET design tools and wizards with some real projects, and this part contains a lot of hidden codes that are created by Visual Studio.NET 2008 automatically when using these design tools and wizards. Therefore, the coding for this part is very simple and easy. Part II covers an advanced technique, the runtime objects method, used in developing and building professional data-driven applications. Detailed discussions and descriptions about how to build professional and practical database applications using this runtime method are provided combined with four real projects. New query techniques, such as LINQ to DataSet and LINQ to SQL, are also discussed and implemented with some real sample projects.

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- Chapter 6 provides detailed discussions and analyses about three popular data insertion methods with three different databases—Microsoft Access, SQL Server 2005, and Oracle:
  - Using the TableAdapter DBDirect method and TableAdapter.Insert() method
  - Using the TableAdapter Update() method to insert new records that have already been added into the DataTable in the DataSet
  - Using the Command object ExecuteNonQuery() method

This chapter is also divided into two parts: Methods 1 and 2 are related to Visual Studio.NET design tools and wizards and therefore are covered in Part I. The third method is related to runtime objects and therefore is covered in Part II. Nine actual projects are used to illustrate how to perform the data insertion into three different databases: Microsoft Access, SQL Server 2005, and Oracle Database 10g XE. Some professional and practical data validation methods are also discussed in this chapter to confirm the data insertion. LINQ to DataSet and LINQ to SQL queries are introduced and implemented in this chapter with some real sample projects.

- Chapter 7 provides discussions and analyses on three popular data updating and deleting methods with seven actual project examples:
  - Using TableAdapter DBDirect methods such as TableAdapter.Update() and TableAdapter.Delete() to update and delete data directly from the databases
  - Using TableAdapter.Update() method to update and execute the associated TableAdapter's properties such as UpdateCommand or DeleteCommand to save changes made for the tables in the DataSet to the tables in the database
  - Using the runtime objects method to develop and execute the Command's method ExecuteNonQuery() to update or delete data in the database directly

Chapter 7 is also divided into two parts: Methods 1 and 2 are related to Visual Studio.NET design tools and wizards and therefore are covered in Part I. The third method is related to runtime objects and is covered in Part II. Seven actual projects are used to illustrate how to perform updating and deleting data against three different databases: Microsoft Access, SQL Server 2005, and Oracle Database 10g XE. Some professional and practical data validation methods are also discussed in this chapter to confirm the data updating and deleting actions. The key points in performing the data updating and deleting actions against a relational database such as the order to execute data updating and deleting between the parent and child tables are also discussed and analyzed. Updating and deleting data using LINQ to DataSet and LINQ to SQL queries are also discussed and implemented in this chapter with some real sample projects.

- Chapter 8 provides introductions and discussions about the developments and implementations of ASP.NET Web applications in the Visual C#.NET 2008 environment. At the beginning of this chapter, a detailed and completed description about ASP.NET and .NET Framework is provided, and this part is especially useful and important to students and programmers who do not have any knowledge or background in the Web application development and implementation. Following the introduction section, a detailed discussion on how to install and configure the environment to develop ASP.NET Web applications is provided. Some essential tools such as the Web server, IIS, and FrontPage Server Extension 2000, as well as the installation process of these tools, are introduced and discussed in detail. Starting from Section 8.3, the detailed development and building process of ASP.NET Web applications to access databases are discussed with six actual Web application projects. Two popular databases, SQL Server and Oracle, are utilized as the target databases for those development and building processes. LINQ to DataSet and LINQ to SQL queries are also discussed and involved in the Web application projects.

- Chapter 9 provides an introduction and discussions about the development and implementation of ASP.NET Web services in the Visual C#.NET 2008 environment. A detailed discussion and analysis about the structure and components of the Web services is provided at the beginning of this chapter. Two popular databases, SQL Server and Oracle, are discussed and used for three pairs of example Web service projects, which include:
  - WebServiceSQLSelect and WebServiceOracleSelect
  - WebServiceSQLInsert and WebServiceOracleInsert
  - WebServiceSQLUpdateDelete and WebServiceOracleUpdateDelete

Each Web service contains different Web methods that can be used to access different databases and perform the desired data actions such as Select, Insert, Update, and Delete via the Internet. To implement these Web services, different Web service client projects are also developed in this chapter. Both Windows-based and Web-based Web service client projects are discussed and built for each kind of Web service listed above. Eighteen projects, including the Web service projects and the associated Web service client projects, are developed in this chapter. All projects have been debugged and tested and can be run in any Windows-compatible operating systems such as Windows 95, 98, 2000, XP, and Vista.

## **ORGANIZATION OF THE BOOK AND HOW TO USE IT**

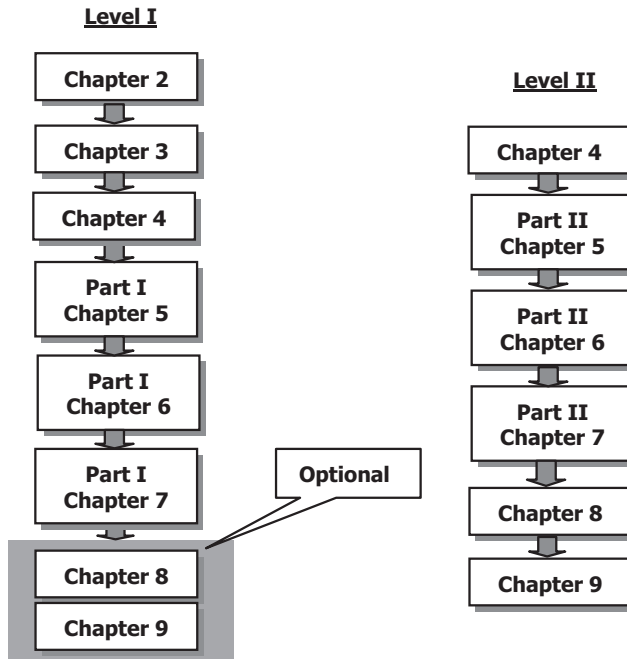
This book is designed for both college students who are new to database programming with Visual C#.NET and professional database programmers who have professional experience with this topic.

Chapters 2 and 3 provide the fundamentals on database structures and components, ADO.NET, and components it covers. Chapter 4 covers the introduction and implementation of LINQ queries, which include popular LINQ queries, such as LINQ to Objects, LINQ to ADO.NET, and LINQ to XML, with sample projects. Chapters 5, 6, and 7 are each divided into two parts: a fundamental part and an advanced part. The data-driven applications developed with design tools and wizards provided by Visual Studio .NET, which can be considered as the fundamental part, have less coding loads and therefore are more suitable for students and programmers who are new to database programming with Visual C#.NET. Part II contains the runtime objects method and covers a lot of coding developments to perform the different data actions against the database, and this method is more flexible and convenient for experienced programmers.

Chapters 8 and 9 give a full discussion and analysis of the development and implementation of ASP.NET Web applications and Web services. These technologies are necessary to students and programmers who want to develop and build Web applications and Web services to access and manipulate data via the Internet.

Based on the organization described above, this book can be used as two categories such as Level I and Level II, which is shown in Figure 1.1.

For undergraduate college students or beginning software programmers, it is highly recommended to learn and understand the contents of Chapters 2, 3, and 4 and Part I of Chapters 5, 6, and 7 since these cover the fundamental techniques in database programming with Visual C#.NET 2008. Chapters 8 and 9 are optional depending on the time and schedule.



**Figure 1.1** Two levels in this book.

In Chapter 2, a detailed introduction on how to design and build a practical relational sample database CSE\_DEPT with three database versions is provided. Step by step, a detailed description is given to illustrate how to design and set up relationships between parent and child tables using the primary key and foreign keys for Microsoft Access 2007, SQL Server 2005 SP2, and Oracle Database 10g XE Release 2 databases. In Part I of Chapters 5 to 7, Visual Studio.NET design tools and wizards are discussed and analyzed in detail to show readers how to use them to design and build professional database programs with Visual C#.NET easily and conveniently.

For experienced college students and software programmers who have already some knowledge of database programming, it is recommended to learn and understand the contents of Part II of Chapters 5 to 7 as well as Chapters 4, 8, and 9 since the runtime data objects method and some sophisticated database programming techniques such as LINQ queries, joined-table query, nested stored procedures, and Oracle Package are discussed and illustrated with real examples. Also the ASP.NET Web applications and ASP.NET Web services are discussed and analyzed with 24 real database program examples for SQL Server 2005 and Oracle Database 10g XE.

## HOW TO USE THE SOURCE CODE AND SAMPLE DATABASES

All source codes for each actual project developed in this book are available. All projects are categorized into the associated chapters that are located in the folder **DBProjects**

located at [ftp://ftp.wiley.com/public/sci\\_tech\\_med/practical\\_database](ftp://ftp.wiley.com/public/sci_tech_med/practical_database). You can copy or download these codes into your computer and run each project as you like. To successfully run these projects on your computer, the following conditions must be met:

- Visual Studio.NET 2008 or higher must be installed on your computer.
- Three databases management systems—Microsoft Access 2007 (Microsoft Office 2007), Microsoft SQL Server 2005 Management Studio Express, and Oracle Database 10g Express Edition (XE)—must be installed on your computer.
- Three versions of sample database—CSE\_DEPT.accdb, CSE\_DEPT.mdf, and Oracle version of CSE\_DEPT—must be installed on your computer in the appropriate folders.
- To run projects developed in Chapters 8 and 9, in addition to conditions listed above, an Internet Information Services (IIS) such as FrontPage Server Extension 2000 or 2002 must be installed on your computer. It works as a pseudoserver for those projects.

The following appendices are useful when one needs some references and practical knowledge to install database management systems and develop actual database application projects:

- **Appendix A:** Provides a completed SQL commands reference.
- **Appendix B:** Provides detailed descriptions about download and installation of Microsoft SQL Server 2005 Express SP2.
- **Appendix C:** Provides detailed descriptions about download and installation of Oracle Database 10g Express Edition (XE) Release 2.
- **Appendix D:** Provides detailed discussions on how to create user database in Oracle Database 10g XE and how to duplicate Oracle 10g user database using Unload and Load methods.
- **Appendix E:** Provides detailed discussions on how to add and connect Oracle 10g XE database into Visual C#.NET applications using the Visual Studio.NET design tools and wizards.
- **Appendix F:** Provides detailed discussions on how to use three sample databases: CSE\_DEPT.accdb, CSE\_DEPT.mdf, and Oracle version of CSE\_DEPT.

All of these appendices can be found in the folder **Appendix** located at [ftp://ftp.wiley.com/public/sci\\_tech\\_med/practical\\_database](ftp://ftp.wiley.com/public/sci_tech_med/practical_database).

Three sample database files, such as **CSE\_DEPT.accdb**, **CSE\_DEPT.mdf**, and Oracle version of **CSE\_DEPT**, are located at the different folders, such as **Access**, **SQLServer**, and **Oracle**, which are subfolders and under the folder **Database**, which is located at [ftp://ftp.wiley.com/public/sci\\_tech\\_med/practical\\_database](ftp://ftp.wiley.com/public/sci_tech_med/practical_database). To use these databases for your applications or sample projects, refer to Appendix F.

## INSTRUCTOR AND CUSTOMER SUPPORT

The teaching materials for all chapters have been extracted and represented by a sequence of Microsoft PowerPoint files, one file for each chapter. The interested instructors can find those teaching materials in the folder **TeachingPPT**, which located at [ftp://ftp.wiley.com/public/sci\\_tech\\_med/practical\\_database](ftp://ftp.wiley.com/public/sci_tech_med/practical_database).

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Email support is available to readers of this book. When you send email to us, please provide the following information:

- The detailed description about your problems, including the error message and debug message, as well as the error or debug number if it is provided.
- Your name, job title, and company name.

Please send all questions to the email address: [baidbbook@bellsouth.net](mailto:baidbbook@bellsouth.net).

### **HOMEWORK SOLUTIONS**

Selected homework solutions are available to instructors or preferred readers. This solution is user name/password protected, and instructors need to send a request to the publisher to get a valid user name/password if they want to access it. Then you can download homework solutions from the folder **HWSolutions** located at [ftp://ftp.wiley.com/public/sci\\_tech\\_med/practical\\_database](ftp://ftp.wiley.com/public/sci_tech_med/practical_database).

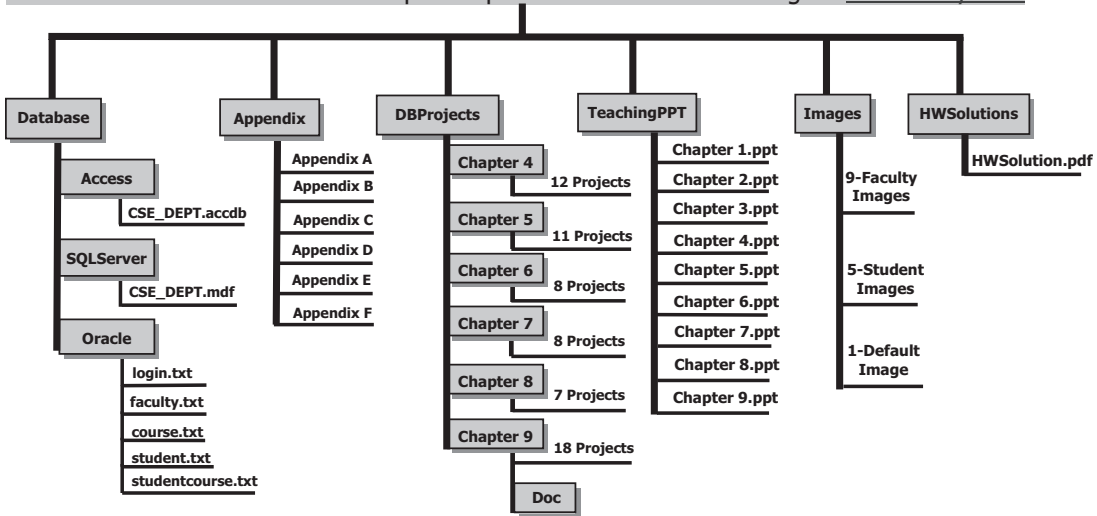
Figure 1.2 shows where the materials related to this book can be found on the web.



# The Book Related Materials on the Web Sites

## FOR INSTRUCTORS:

Instructor materials are available upon request from the book's listing on [www.wiley.com](http://www.wiley.com)



## FOR STUDENTS:

[ftp://ftp.wiley.com/public/sci\\_tech\\_med/practical\\_database](ftp://ftp.wiley.com/public/sci_tech_med/practical_database)

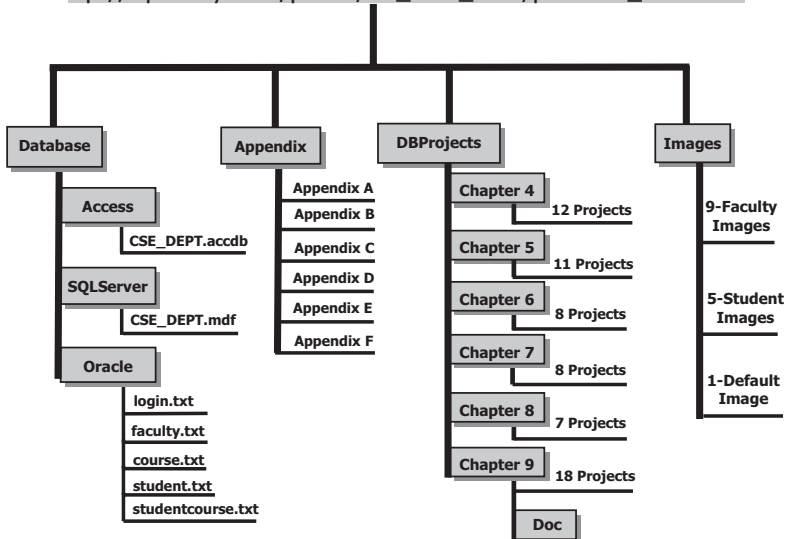


Figure 1.2

