

Mastering™

Evangelos Petroustos

Database Programming with Visual Basic® 6

Soranaree University of Technology



31851000650776

**Build Client-Server and Three-Tier
Database Applications with Visual Basic**

**In-Depth Coverage of Data Access
with ADO 2.5**



**On the CD: Sample Code,
Microsoft® SQL Server™ 7
Evaluation Edition**



TABLE OF CONTENTS

Introduction

xxix

PART I

Database Basics

1 Database Access: Architectures and Technologies

Databases and Database Management Systems	4
Windows DNA	6
Universal Data Access	7
ADO and OLE DB	11
The ADO Objects	12
Client-Server Architecture	13
The Two-Tier Model	14
Thin and Fat Clients	16
The Three-Tier Model	16
The Layers of a Three-Tier Application	19
Three-Tier Applications on the Web	20
SQL Server	22
SQL Server Tools	24
Installation	24
SQL Server Service Manager	25
Enterprise Manager	25
Databases	26
Data Transformation Services (DTS)	29
Management	29
Security	30
Support Services	30
The Query Analyzer	30
Summary	32

2 Basic Concepts of Relational Databases

Fundamentals of Database Design	37
What Is a Database?	37
Relational Databases	38
Key Fields and Primary and Foreign Keys	39

Who Designs Databases?	39
Exploring the Northwind Database	40
Northwind Database Tables	40
Understanding Relations	46
Viewing Related Rows in Access 2000	48
Querying Relational Databases	49
Retrieving a Customer's Orders	49
Calculating the Total for Each Order	50
Calculating the Total for Each Customer	50
Performing More Complicated Queries	50
Database Objects	51
Tables	51
Creating Tables	52
Entering Data into Tables	54
Null Values	55
Indexes	56
Views	58
Updating Tables and Views	59
Access Views	61
Establishing Relationships	61
Primary and Foreign Keys	61
Viewing and Editing Relationships	63
AutoNumber and Identity Fields	63
More Complicated Relations	64
Normalization Rules	65
Database Design Errors	66
Update and Delete Anomalies	67
First Normal Form	68
Second Normal Form	69
Third Normal Form	70
Database Integrity	71
Domain Integrity	72
Entity Integrity	72
Referential Integrity	72
Enforcing Referential Integrity	73
Cascade Updates and Deletes	74
Triggers	75
The Pubs Database	76
The Biblio Database	78
Importing the Biblio Database into SQL Server	79
Summary	83

3 The Visual Database Tools

A First Look at the Visual Database Tools	86
Connecting to Databases	90
Using Data Link Files	90
Using Connection Strings	91
Connecting to the Northwind Database	94
Using the Data View Window	96
Using the Database Designer	98
The Tables Tab	100
The Relationships Tab	102
The Indexes/Keys Tab	102
Using the Database Diagram	103
Scripting Your Changes	106
Using the Query Designer	108
The Query Designer's Window	108
The Diagram Pane	109
The Grid Pane	109
The SQL Pane	110
The Results Grid	110
Building Simple Queries	110
Building Queries with Aggregate Functions	112
Simple Aggregates	112
Aggregates on Multiple Tables	113
Building Multi-Table Queries	114
Entering SQL Statements	116
The Source Code Editor	118
Working with Stored Procedures	118
Testing SQL Statements with the Query Designer	120
Executing and Debugging a Stored Procedure	120
Working with Triggers	122
Using the Data View Window with Visual Basic	125
Creating Command Objects	125
Displaying Rows on a DataGrid Control	127
Viewing Query Results	129
Summary	130

4 Structured Query Language

Selection and Action Queries	135
Executing SQL Statements	135
The SQLEXEC Application	135

The Query Analyzer	137
Access Queries	138
Data Manipulation Language	140
The WHERE Clause	141
Using Multiple Tables	142
The AS keyword	144
The TOP Keyword	144
The LIKE Operator	145
Locating NULL Values	150
The UNION Operator	151
The DISTINCT Keyword	152
Sorting Rows with the ORDER Keyword	153
Calculated Fields	155
Totaling and Counting	156
Grouping Rows	159
Limiting Groups with HAVING	163
IN and NOT IN Keywords	164
Subqueries	164
The BETWEEN Keyword	167
Examples	168
Books with Multiple Authors	169
Authors with Multiple Books	170
Customers, Orders, Details	171
Publishers, Books, Authors	173
Joining Tables	174
Types of Joins	177
INNER JOIN	179
LEFT JOIN	179
RIGHT JOIN	180
FULL JOIN	181
Joining Titles and Authors	182
Publishers, Books, Authors	183
Customers, Orders, Details	184
Action Queries	187
The DELETE Statement	187
The INSERT Statement	188
The UPDATE Statement	189
Summary	190

5 A First Look at ADO

How Does ADO Work?	195
Connecting to a Database	195
Executing a Command	197
Retrieving and Manipulating Data	199
ADO's Main Objects	201
The Connection Object	202
TheConnectionString Property	202
DSN-Based Connections	203
Setting Up a Data Source for SQL Server	204
Setting Up a Data Source for an Access Database	205
The Open Method	206
The Close Method	206
The Recordset Object	207
Cursor Properties	207
TheCursorType Property	208
The Cursor's Location	210
Concurrency Control	210
Basic Recordset Properties	211
The RecordCount Property	212
The Supports Method	216
The Bookmark Property and CompareBookmarks Method	219
The Fields Collection	220
ActualSize	221
Attributes	221
DataFormat	222
DefinedSize	222
Name	222
NumericScale, Precision	222
OriginalValue	222
Type	222
UnderlyingValue	224
Value	224
Creating Custom Recordsets	225
The Command Object	226
Basic Recordset Operations	227
Navigating through Recordsets	228
EOF and BOF Properties	229

Absolute Positioning in a Recordset	229
The AbsolutePosition Property	230
The PageSize Property	230
The PageCount Property	230
The AbsolutePage Property	230
The CacheSize Property	231
Searching and Filtering Rows	233
The Find Method	233
The Index Property and the Seek Method	236
The Filter Property	237
The Sort Property	238
Saving Recordsets	239
The GetRows Method	239
GetString Method	240
Save Method	241
The GetStringDemo Project	242
Updating Databases	243
Inserting New Rows	244
The Update Method	245
The CancelUpdate Method	245
Editing Rows	245
The EditMode Property	245
Deleting Rows	246
Summary	247

6 Programming with ADO

The DataEnvironment Designer	250
Creating Connection Objects	251
Creating Command Objects	253
Programming the DataEnvironment Objects	256
Updating Tables through the DataEnvironment Objects	260
Building Forms with Data-Bound Controls	262
Binding Controls to Database Fields	263
The Customers Project	266
Using the ADO Data Control	271
Setting up an ADO Data Control	271
The General Tab	272
The RecordSource Tab	273
ADO Data Control Properties	275
The ADODataControl Project	276

The ADO Data Control's Recordset Property	278
The EOFAction Property	278
The BOFAction Property	279
The Data Form Wizard	280
Building a Data-Entry Form with the Wizard	280
The Code behind the Wizard	282
Creating Simple and Functional Data-Entry Forms	285
Data-Aware Controls	288
Populating a Data-Aware Control	289
Looking Up Fields with a Data-Aware Control	289
The Titles Project	291
The Lookup Project	294
Using the DataList Control	295
Examples	297
The AllTitles Project	297
Finding and Filtering Records	300
The ADODCDemo Project	302
The ADODCodeDemo Project	305
Summary	308

7 Transact-SQL

The COMPUTE BY Clause	313
Stored Procedures	317
Writing Access Queries	318
Using Parameters with Access Queries	318
VBA Functions	320
Date and Time Functions	320
Writing T-SQL Stored Procedures	321
Creating and Executing Stored Procedures	322
Executing Command Strings	326
Why Use Stored Procedures?	327
T-SQL: The Language	327
T-SQL Variables	328
Local Variables and Data Types	328
Global Variables	332
Flow-Control Statements	334
IF ... ELSE	334
CASE	335
WHILE	336
CONTINUE and BREAK	337

GOTO and RETURN	337
PRINT	338
RAISERROR	339
T-SQL Functions	340
String Manipulation	341
SOUNDEX Functions	342
Conversion Functions	343
Date and Time Functions	345
Other Functions	347
System Functions	347
Using Arguments	348
Building SQL Statements on the Fly	350
Triggers	352
Implementing Triggers	354
Using Triggers to Implement Cascade Updates and Deletes	356
Transactions	358
BEGIN TRANSACTION	358
COMMIT TRANSACTION	359
ROLLBACK TRANSACTION	359
Implementing Business Rules with Stored Procedures	360
Adding Customers	361
Adding Orders	364
Testing the NewOrder Procedure	367
Summary	368

8 Making the Most of Stored Procedures

Methods for Executing SQL Statements and Stored Procedures	372
The Connection.Execute Method	373
Using the Connection Object	375
The Recordset.Open Method	376
The Command.Execute Method	377
Calling a Simple Stored Procedure from VB	379
Passing Parameters with the Command Object	380
The Parameter Object	381
Setting Up Parameter Objects	383
The CreateParameter Method	385
Passing Multiple Input Parameters to Procedures	386
Calling Access Queries	386
The StoredProcedures Project	387
The Execute Procedure Button	390

Retrieving Parameter Information Directly from Stored Procedures	394
Creating and Executing Stored Procedures with VB	397
Executing Commands Asynchronously	400
The Connection_ExecuteComplete Event	401
The Command.State Property	402
The AsyncExecute Project	403
Implementing Business Rules with Stored Procedures	407
Calling the AddCustomer Procedure from a VB Application	409
Calling the NewOrder Procedure from a VB Application	411
The Add Order Button	412
T-SQL Cursors	415
Cursors versus Recordsets	416
Cursor Types	416
Static Cursors	416
Keyset-Driven Cursors	416
Dynamic Cursors	417
Cursor Navigation	417
Client-Side and Server-Side Cursors	417
Using Cursors	418
Scanning a Cursor	419
The FETCH Statement	420
Cursor Updating	422
Examples	423
Calculating Order Spans	423
Testing the AvgOrderSpan	427
Calculating Order Spans for Each Customer	428
Calculating Book Royalties	431
The BookRoyalties Project	438
Multiple Recordsets	439
Non-Uniform Recordsets	441
Summary	443

9 More ADO Programming

Choosing the Right Cursor Type	446
Cursors and Data-Aware Controls	448
Avoid Wide Cursors	449
Data-Aware Controls Are Not Perfect	450
ADO Error Handling	453

Multiuser Considerations	456
Working with Client-Side Cursors	456
Deleting Rows	457
Updating Rows	459
Updating the Data-Bound Controls	461
Update Anyway!	463
Adding Rows	464
Refreshing the Cursor	464
Working with Server-Side Cursors	465
Deleting Rows	465
Updating Rows	465
Adding Rows	467
How About the ADO Data Control?	468
ADO Events	468
The Will and Complete Events	470
Some Common Event Arguments	471
The adStatus Argument	471
The pError Argument	471
The Object Argument	472
The adReason Argument	472
Transaction Events	473
Connection Events	474
Recordset Events	475
Asynchronous Operations' Events	477
Summary	480

PART II

Advanced Data-Access Techniques

10 Shaping Your Data

Designing Hierarchical Recordsets	488
Specifying Parent-Child Relationships	488
Building a Command Hierarchy	489
The MSHFlexGrid Control	492
Mapping a Command Hierarchy to the MSHFlexGrid Control	493
Using Aggregates	496
The CustomerSales Project	497
Grouping	501
The SHAPE Command	501
Multiple Child Recordsets	503
Nested Hierarchies	504

Using Parameterized Commands	505
Using Stored Procedures with the SHAPE Command	505
Executing SHAPE Commands	506
The AnyShape Project	507
Executing Parameterized SHAPE Commands	508
Scanning Hierarchical Recordsets	510
Mapping Hierarchical Recordsets to TreeView Controls	512
Building Forms with Hierarchical Recordsets	515
The PopulateShape Project	516
Summary	518
11 Remote Data Access	
Custom Recordsets	522
Creating Custom Recordsets	523
Persisting Custom Recordsets	524
Creating and Managing Disconnected Recordsets	525
Batch Updating a Disconnected Recordset	526
The Value, OriginalValue, and UnderlyingValue Properties	527
The Resync Method	528
Handling Update Conflicts	528
Data-Browsing and -Editing with Disconnected Recordsets	529
The Remote Data Services	534
Using the RDSDataControl on the Web	535
Placing an RDSDataControl on a Web Page	535
Retrieving a Recordset	535
Binding DHTML Controls to the RDSDataControl	536
The RDSDataControl's Members	538
A Data-Browsing and -Editing Web Page	541
The RDSTable.htm Page	544
The DataSpace Object	548
Building Classes for RDS	550
ADOR Recordsets	550
The Revised clsCustomers Class	551
Using the RemoteClass	553
Summary	563
12 Data-Aware Classes	
The Third Tier	568
The Web's Three Tiers	570
Implementing a Class	571

The clsCustomers Class	573
The clsCustomers Class Module's Properties	573
Coding the Class' Members	575
Testing the clsCustomers Class	580
More Business Rules	587
Build More Flexible Applications with Classes	588
The SearchTitles Class	589
Testing the TitleSearch Class	596
Using the SearchTitles Class on the Web	598
Summary	602

13 Data-Aware Controls

Building Data-Bound Controls	607
The DBControl Project	607
Using the ActiveX Control Interface Wizard	608
Making the Control Data-Bound	612
Testing the DBControl	613
Building a Data Source Control	616
The FilterDataControl's Interface	617
Designing the Control	617
Filtering the Recordset	620
Testing the FilterDataControl	622
The DataRepeater Control	622
The Data Object Wizard	627
Setting Up a DataEnvironment Object for DOW	628
Write Your Data-Manipulation Stored Procedures	628
Write Your Lookup Stored Procedures	628
Creating Classes with DOW	629
Creating Custom ActiveX Controls with DOW	635
ActiveX Control Types	636
The SaveMode Property	638
The Update and UpdateBatch Methods	638
The GridEditable Property	638
The ResyncRow Method	638
The Navigational Methods	638
Testing the DOW-Generated Controls	639
The ProductDataGridForm	639
The ProductLookupForm	640
The ProductSingleRecord Form	643
Tweaking Your Custom Data-Bound Controls	644
Summary	645

14 Accessing Databases over the Web

Web Applications	651
Typical Web Applications	654
The Structure of Web Applications	655
HTML Forms and Controls	656
The CheckBox Control	657
The RadioButton Control	658
The Text Control	659
The Password Control	660
The TextArea Control	660
The Selection Control	662
The Button Control	663
VBScript	664
The ASP Object Model	668
The Application Object	669
The Session Object	670
The Request Object	671
The Response Object	672
The Write Method	674
The Clear Method	675
The Flush Method	676
The End Method	676
The Server Object	676
The ScriptTimeout Property	676
The MapPath Method	676
The CreateObject Method	677
The URLEncode Method	678
The HTMLEncode Method	678
Using Cookies	678
The ISBNCookies Example	679
Making Queries with ASP Files	683
The GET and POST Methods	683
The Form Collection (Use with POST Method)	684
The QueryString Collection (Use with GET Method)	684
The BOXESGET and BOXESPOST Pages	685
The Apply.asp Example	688
Accessing Databases with ASP	694
Querying Databases	695
The AllCustomers.asp Example	695

The AllCountries Example	697
Taking an Order	701
Updating a Database	707
A Customer Registration Form	708
The File Access Component	713
The FileSystemObject Object	713
CreateTextFile Method	713
OpenTextFile Method	714
The TextStream Object's Methods	714
The TextStream Object's Properties	716
Using the TextStream Object	716
Summary	718
15 Building IIS Applications	
Understanding WebClasses	722
Building an IIS Application	723
Creating HTML Templates	727
Processing Client Requests	729
Connecting Events to WebClasses	731
Calling a Component	734
The WCDemo Project	735
Summary	741
16 Microsoft Transaction Server	
Using MTS as Object Manager	746
Building MTS Components	746
TheObjectContext Interface	746
TheObjectControl Interface	748
MTS-Enabling a Component	748
The Project's Properties	750
Changing the Class's Code	751
Creating MTS Packages	755
Setting the Properties of a Package	757
The General Tab	757
The Advanced Tab	758
The Activation Tab	759
Adding Components to a Package	760
Exporting MTS Packages	762
Summary	763

17 Building an Invoicing Application

The DataEntryDemo Project	768
Flexible Navigational Techniques	769
Designing the Form	772
Programming the Controls	773
Editing the Current Title	776
Manipulating a Title's Authors	779
An Invoicing Application	783
Implementing Transactions with ADO	784
The Jet Version of the Project	790
Implementing Transactions with Stored Procedures	791
The NewOrder Stored Procedure	791
Calling the NewOrder Stored Procedure	795

18 Building an Online Store

Revising the Biblio Database	800
The Web Application	802
Summary	820

<i>Index</i>	821
--------------	-----