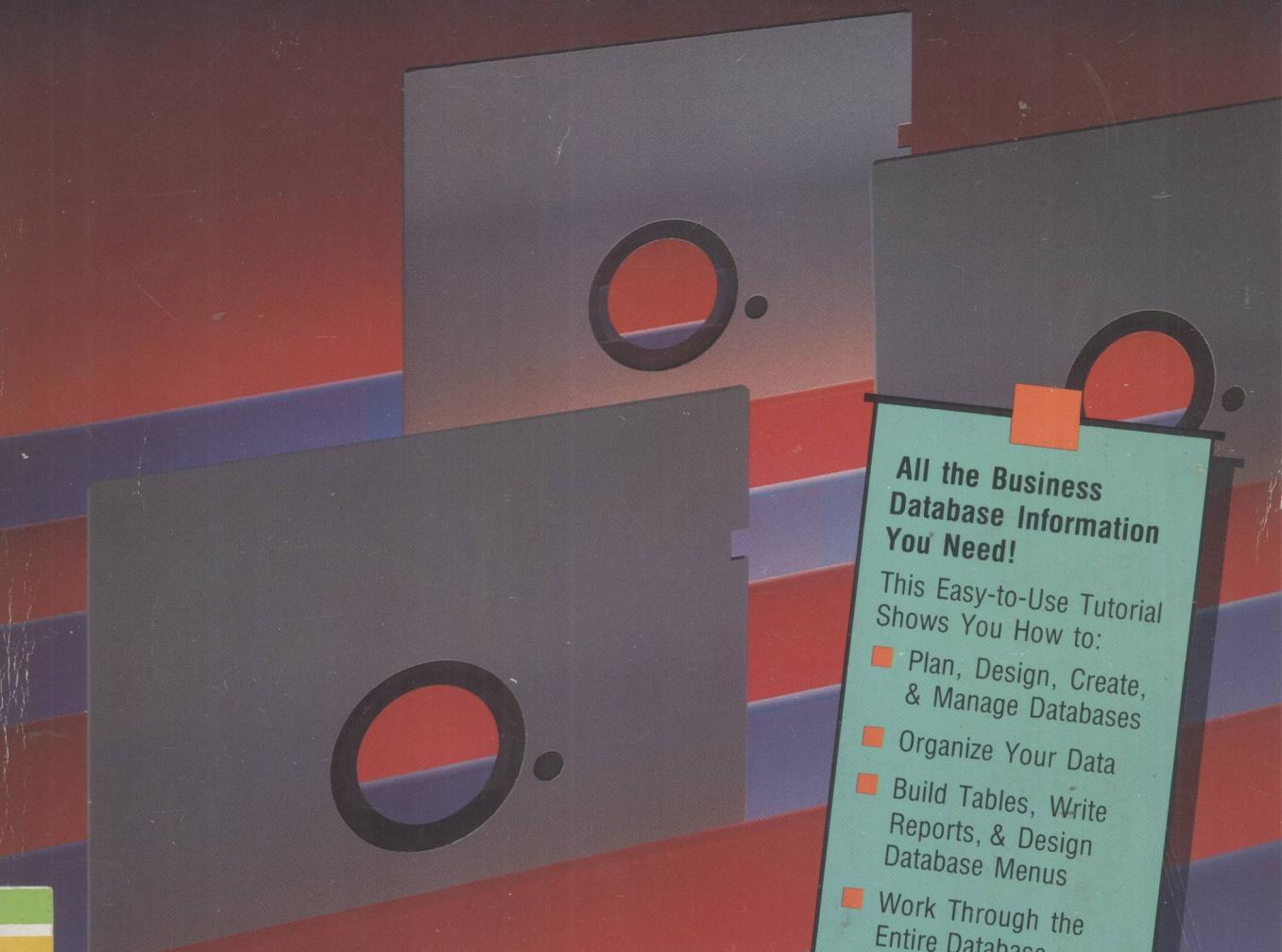


INTRODUCTION TO DATABASES



All the Business
Database Information
You Need!

This Easy-to-Use Tutorial
Shows You How to:

- Plan, Design, Create,
& Manage Databases
- Organize Your Data
- Build Tables, Write
Reports, & Design
Database Menus
- Work Through the
Entire Database
Development Cycle

QUE®

9761488

TP311.13
T747



Introduction to Databases

James J. Townsend



E9761488

QUE

Introduction to Databases

Copyright © 1992 by Que Corporation.

All rights reserved. Printed in the United States of America. No part of this book may be used or reproduced in any form or by any means, or stored in a database or retrieval system, without prior written permission of the publisher except in the case of brief quotations embodied in critical articles and reviews. Making copies of any part of this book for any purpose other than your own personal use is a violation of United States copyright laws. For information, address Que Corporation, 11711 N. College Ave., Carmel, IN 46032.

Library of Congress Catalog No.: 91-67629

ISBN: 0-88022-840-7

This book is sold *as is*, without warranty of any kind, either express or implied, respecting the contents of this book, including but not limited to implied warranties for the book's quality, performance, merchantability, or fitness for any particular purpose. Neither Que Corporation nor its dealers or distributors shall be liable to the purchaser or any other person or entity with respect to any liability, loss, or damage caused or alleged to be caused directly or indirectly by this book.

94 93

4 3

Interpretation of the printing code: the rightmost double-digit number is the year of the book's printing; the rightmost single-digit number, the number of the book's printing. For example, a printing code of 92-1 shows that the first printing of the book occurred in 1992.

Screens reproductions in this book were created by using Collage Plus from Inner Media, Inc., Hollis, NH.

Publisher: Lloyd J. Short

Acquisitions Manager: Rick Ranucci

Project Development Manager: Thomas H. Bennett

Managing Editor: Paul Boger

Book Designers: Scott Cook and Michele Laseau

Production Team: Brad Chinn, Jeanne Clark, Keith Davenport, Mark Enochs, Dennis Clay Hager, Carrie Keesling, Betty Kish, Bob LaRoche, Laurie Lee, Jay Lesandrini, Linda Quigley, Linda Seifert, Louise Shinault, Kevin Spear, Allan Wimmer, Phil Worthington, Christine Young

Dedication

For Marcella

Product Director

Timothy S. Stanley

Production Editor

Frances R. Huber

Editors

Sara Allaei

Lorna Gentry

Susan Pink, TechRight MS

Editorial Services

Susan M. Shaw

Diane L. Steele

Barbara Tilly

Colleen Totz

Acquisitions Editor

Tim Ryan

Technical Editor

Mark P. Marchi

*Composed in Cheltenham and
MCPdigital by Que Corporation*

About the Author

James J. Townsend is president of Information Strategies, a database consulting firm in Washington, DC. He designs custom database applications for business and government, including major U.S. government agencies and Fortune 100 companies. Before joining Information Strategies, he was a fellow at the Georgetown University Center for Strategic and International Studies. He may be contacted at Information Strategies at (202) 462-1290 or via CompuServe address 70304,2750.

Trademark Acknowledgments

Que Corporation has made every effort to supply trademark information about company names, products, and services mentioned in this book. Trademarks indicated below were derived from various sources. Que Corporation cannot attest to the accuracy of this information.

ALPHA Four is a registered trademark of ALPHA Software Corporation.

Apple, Mac, and Macintosh are registered trademarks of Apple Computers, Inc.

Ashton-Tate, dBASE, dBASE II, and dBASE IV are registered trademarks of Ashton-Tate Corporation.

Clipper and Nantucket are trademarks of Nantucket, Inc.

COMPAQ is a registered trademark of COMPAQ Computer Corporation.

DataEase is a registered trademark of DataEase International, Inc.

DataPerfect and DrawPerfect are registered trademarks of WordPerfect Corporation.

DECnet is a registered trademark of Digital Equipment Corporation.

FASTBACK is a registered trademark of Fifth Generation Systems, Inc.

File Express and Novell are trademarks of Novell, Inc.

FoxPro is a trademark of Fox Holdings, Inc.

IBM and OS/2 are registered trademarks of International Business Machines, Inc.

Lotus is a registered trademark of Lotus Development Corporation.

Microsoft, LAN Manager, and SQL Server are registered trademarks, and Windows is a trademark of Microsoft Corporation.

Norton Utilities is a registered trademark of Symantec Corporation.

ORACLE is a registered trademark of Oracle Corporation.

Paradox, Quattro Pro, and Reflex are registered trademarks of Borland International, Inc.

PC-File is a registered trademark of Buttonware, Inc., and is also a trademark of Jim Button.

PC Tools is a trademark of Central Point Software.

Professional File is a trademark of Software Publishing Corporation.

Q&A is a registered trademark of Symantec Corporation.

Quicksilver is a trademark of WordTech Systems, Inc.

R:BASE is a registered trademark of Microrim, Inc.

SpinRite is a trademark of Gibson Research Corporation.

UNIX is a registered trademark of AT&T.

Trademarks of other products mentioned in this book are held by the companies producing them.

Acknowledgments

Thanks to everyone at Que Corporation for taking a chance on a book not devoted to a specific software product. Special thanks to:

Tim Ryan, acquisitions editor, for returning my phone calls and pleading the cases for this book.

Tim Stanley, product development editor, for providing comments on early drafts of the manuscript.

Mark Marchi, technical editor, for providing a knowledgeable technical review.

Fran Huber, production editor, for indefatigable editing of the manuscript and for guiding me through my first editorial review at Que.

All the others at Que—editors Sara Allaei, Lorna Gentry, Susan Pink, Susan Shaw, Barbara Tilly, and Colleen Totz, and the production and business departments—for being on the team that made this book possible.

Thanks to the manufacturers who provided software, including Lotus Corporation, Ashton-Tate, Alpha Software, Borland, DataEase International, and Symantec.

I am grateful to all those who read drafts of the manuscript, including John Batdorf, Howard Berger, Christa Carpentiere, Joan Carpentiere, Joe Carpentiere, Tina Carpentiere, Steven Duffield, Martin Fox, Chris Guziak, Laurel Lamb, Bill McHenry, Shelby Smith, Phil Winkler, and many electronic interlocutors on CompuServe who provided a wish list of topics for this book.

Special thanks to Jeff Chapski of Information Strategies for patiently wading through the thickets of my prose, patiently matching figures and tables to the text, and sticking with the project from start to finish.

Finally, to the clients of Information Strategies, for providing the opportunity to put all these theories to the test, exposing me to more problems and challenges than I possibly could have come up with on my own.

—J.T.

Contents at a Glance

Introduction	1
Chapter 1 Why Use a Database?	7
Chapter 2 Analyzing a Project	25
Chapter 3 Planning Your Database	53
Chapter 4 Organizing Your Data	63
Chapter 5 Building Tables	89
Chapter 6 Building Forms	123
Chapter 7 Using Views	155
Chapter 8 Generating Reports	187
Chapter 9 Honing Your Reporting Skills	231
Chapter 10 Designing Menus	243
Chapter 11 Testing Your Database	265
Chapter 12 Creating System Documentation	273
Chapter 13 Database Administration	283
Chapter 14 Choosing Database Software	293
Chapter 15 Client-Server Architecture	319
Glossary	327
Bibliography	339
Index	347

Table of Contents

Introduction	1
Who Should Read This Book?	2
Why Should You Read This Book?	2
Which Database Software Should I Use?	3
What Is Covered in This Book?	3
Conventions Used in This Book	5
1 Why Use a Database?	7
Untapped Power	8
The Benefits of Using a Database	11
Software Tools	13
Word Processing Software	13
Spreadsheets	13
Databases	15
A Database Checklist	16
Custom Database Applications	16
What Skills Do You Need?	18
Why Build Your Own Database?	18
A Sample Database Session	20
Summary	23
2 Analyzing a Project	25
How Much is Enough?	25
Approaches to Analysis	27
Levels of Analysis	27
Goals of Analysis	28
Rules for Conducting User Interviews	30

The Interview	32
Defining Terminology: Entities and Attributes	33
Input Versus Output	37
Database Jargon	39
Sampling an Interview	39
Reporting Requirements	40
Processing Requirements	41
Relationships	42
Using Schemas	44
Creating a Service Call Tracking Schema	46
Levels of Detail	49
Back to the Drawing Board	50
Summary	51
 3 Planning Your Database	53
Have a Master Plan	54
Managing Personnel	57
Prototyping	57
Testing	59
Preparing Documentation	60
Keep It Simple	60
Summary	61
 4 Organizing Your Data	63
Using Multiple Tables	63
Understanding the Goals of Normalization	64
Common Normalization Problems	66
The Concept of Uniqueness	68
Defining Normal Forms	68
First Normal Form	70
Second Normal Form	72
Third Normal Form	73
Reaching Normalization	74
Integration	75
Decomposition	77

Avoiding Overnormalization	81
Using Alternatives to Normalization	83
Entity-Relationship Modeling	83
The Date-Wilson Technique	84
Using Normalization Exercises	84
Summary	86
5 Building Tables	89
Field Characteristics	90
Field Types	91
Choosing Field Types	96
Using Codes for Fields	100
How Fields are Filled	102
Integrity Checks	102
Table and Field Security	103
Required Fields	103
The Field Definition Screen	104
Indexed Fields	104
Deciding When to Index	107
Maintaining an Index	108
Primary Key Fields	109
Derivation Formulas	112
Field Names	113
Reserved Words	114
Using the Data Dictionary	115
Required Fields	120
Style Standards	121
Summary	121
6 Building Forms	123
Learning Form Design	124
Field Colors	125
Screen Layout	128
Field Labels	130
Field Order	132

Typical Form Design	132
Adding Function Key Help	134
Validating Data	141
Templates	141
Picture Functions	145
Choice Fields	146
Adding Virtual (Calculated) Fields	148
Adding Field Help	151
Testing the Form	151
Using a Style Guide	152
Summary	153
7 Using Views	155
Using Single-Table Views	156
Using Multitable Views	157
Programming dBASE Multiforms	162
Creating Multiforms in DataEase	177
Creating Views in Paradox	180
Substituting Views for Printed Reports	182
Using Views for Security	184
Maintaining Referential Integrity	184
Summary	186
8 Generating Reports	187
Designing Reports	188
Writing Reports	192
Selecting Records	193
Using the AND, OR, and NOT Operators	195
Using Other Record Selection Operators	199
Listing Fields	202
Sorting Data	203
Grouping Data	206
Using Functions to Create Fields	208
Arithmetic Functions	208
Relational Mathematical Functions	209
String Functions	211

Defining the Report Format	213
Printing the Report	217
Selecting Printer Orientation	219
Using Printer Fonts	219
Looking at Sample Reports	220
Mailing Labels	220
Form Letters	228
Summary	230
9 Honing Your Reporting Skills	231
Standardizing Your Reports	231
Documenting Queries	232
Using Data-Entry Forms to Generate Reports	233
Achieving Data-Driven Reporting	233
Recycling Reports	234
Retrieving Data through Alternate Methods	236
Optimizing Queries	236
Understanding Processing Procedures	237
Using Data-Entry Routines	237
Maintaining Data Security	238
Importing and Exporting Files	238
ASCII Fixed-Length	239
ASCII Delimited or Variable Length	239
dBASE Format (.DBF)	240
Lotus 1-2-3 Format (.WK1)	240
Data Interchange Format (.DIF)	240
Archiving	240
Packing the Database	240
Debugging	241
Summary	242
10 Designing Menus	243
Why Use Menus?	243
The Myth of Intuition	245
Choosing Menu Options	246

Grouping Menu Options	247
Grouping by Function	248
Grouping by Work Flow	248
Grouping by Other Methods	249
Ordering Menu Options	249
Frequency of Use	250
Alphabetical Order	250
Chronological Order	251
Numerical Order	251
Choosing Menu Styles	252
Bar Menus	252
Pop-Up Menus	258
Pull-Down Menus	259
Free-Form Menus	259
Context-Sensitive Menus	260
Consistency and Clarity	261
Presenting Options	261
Selecting Options	262
Avoiding Redundant Menus	262
Recycling Menus	262
Consistency with Other Applications	262
Summary	263

11 Testing Your Database**265**

Making a Checklist	266
Testing Menus	267
Testing Data Entry	267
Generating Reports	269
Processing Procedures	269
Finding Testers	270
Developers as Testers	270
Users as Testers	271
Using Feedback	271
Summary	272

12 Creating System Documentation 273

Why Write Documentation?	273
Maintaining the Application	274
Training Users	274
Revealing Shortcomings of the Application	274
Types of Documentation.....	275
User Documentation	275
Long User Documentation	275
Short User Documentation	276
System Documentation	276
Packaging Options.....	277
Goals of Documentation	278
What To Avoid	279
What To Include	279
Reviewers	282
Summary	282

13 Database Administration 283

Backing Up the Database	284
Maintaining Data Security	286
Performance Tuning	287
Archiving.....	288
Providing User Support	289
Hardware and Software Troubleshooting	290
Maintaining the Data Dictionary	291
Strategic Planning.....	291
Summary	292

14 Choosing Database Software 293

Understanding the DBMS Marketing Environment	293
Determining Your Needs	295
Choosing between a Flat-File and Relational Database	296

Understanding Relational Databases	297
Understanding Database Interfaces	299
The Programming Interface	300
Advantages of the Programming Interface	301
Drawbacks of the Programming Interface	303
The Spreadsheet Interface	304
Advantages of the Spreadsheet Interface	305
Drawbacks of the Spreadsheet Interface	305
The Form-Oriented Interface	305
Advantages of the Form-Oriented Interface	305
Drawbacks of the Form-Oriented Interface	306
Choosing a DBMS	306
Considering Your Hardware	307
Applying Evaluation Criteria	308
Consulting the Experts	313
Evaluating the Choices	313
Making Your Final Choice	315
Considering Special Features	316
Summary	316
 15 Client-Server Architecture.....	319
Components of Client-Server Architecture	320
Division of Labor in Client-Server Architecture	322
Structured Query Language	322
Benefits of Client-Server Architecture	323
Costs of Client-Server Architecture	325
Summary	326
 Glossary	327