

WRITTEN BY
MICHAEL ALEXANDER
DICK KUSLEIKA
JOHN WALKENBACH

Microsoft®
Excel® 2019
BIBLE

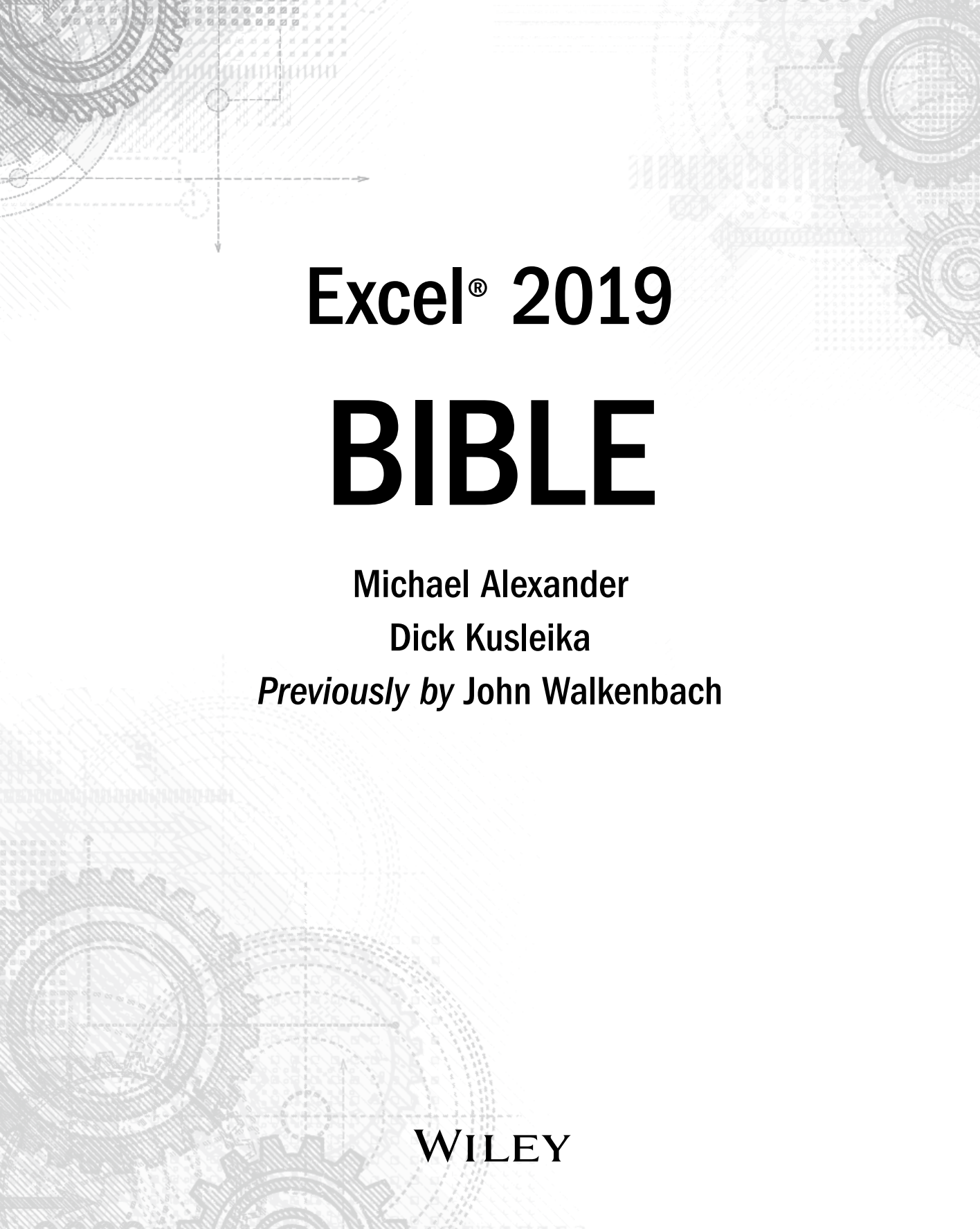
THE COMPREHENSIVE TUTORIAL RESOURCE

EXPLORE THE LATEST
TOOLS AND FEATURES

MASTER INSIDE TRICKS
AND BEST PRACTICES

DISCOVER WHAT YOU NEED,
WHEN YOU NEED IT

WILEY

The background of the cover is a light gray, semi-transparent graphic. It consists of several interlocking gears of various sizes, some with teeth and some without. Overlaid on these gears are technical drawings, including dashed lines, circles, and arrows, suggesting a mechanical or engineering theme. The overall aesthetic is clean and professional.

Excel® 2019

BIBLE

Michael Alexander

Dick Kusleika

Previously by John Walkenbach

WILEY

Excel® 2019 Bible

Published by
John Wiley & Sons, Inc.
10475 Crosspoint Boulevard
Indianapolis, IN 46256
www.wiley.com

Copyright © 2019 by John Wiley & Sons, Inc., Indianapolis, Indiana

Published simultaneously in Canada

ISBN: 978-1-119-51478-7
ISBN: 978-1-119-51477-0 (ebk)
ISBN: 978-1-119-51476-3 (ebk)

Manufactured in the United States of America

10 9 8 7 6 5 4 3 2 1

No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except as permitted under Sections 107 or 108 of the 1976 United States Copyright Act, without either the prior written permission of the Publisher, or authorization through payment of the appropriate per-copy fee to the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, (978) 750-8400, fax (978) 646-8600. Requests to the Publisher for permission should be addressed to the Permissions Department, John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, (201) 748-6011, fax (201) 748-6008, or online at <http://www.wiley.com/go/permissions>.

Limit of Liability/Disclaimer of Warranty: The publisher and the author make no representations or warranties with respect to the accuracy or completeness of the contents of this work and specifically disclaim all warranties, including without limitation warranties of fitness for a particular purpose. No warranty may be created or extended by sales or promotional materials. The advice and strategies contained herein may not be suitable for every situation. This work is sold with the understanding that the publisher is not engaged in rendering legal, accounting, or other professional services. If professional assistance is required, the services of a competent professional person should be sought. Neither the publisher nor the author shall be liable for damages arising herefrom. The fact that an organization or Web site is referred to in this work as a citation and/or a potential source of further information does not mean that the author or the publisher endorses the information the organization or website may provide or recommendations it may make. Further, readers should be aware that Internet websites listed in this work may have changed or disappeared between when this work was written and when it is read.

For general information on our other products and services please contact our Customer Care Department within the United States at (877) 762-2974, outside the United States at (317) 572-3993 or fax (317) 572-4002.

Wiley publishes in a variety of print and electronic formats and by print-on-demand. Some material included with standard print versions of this book may not be included in e-books or in print-on-demand. If this book refers to media such as a CD or DVD that is not included in the version you purchased, you may download this material at <http://booksupport.wiley.com>. For more information about Wiley products, visit www.wiley.com.

Library of Congress Control Number: 2018954472

Trademarks: Wiley and the Wiley logo are trademarks or registered trademarks of John Wiley & Sons, Inc. and/or its affiliates, in the United States and other countries, and may not be used without written permission. Microsoft and Excel are registered trademarks of Microsoft Corporation. All other trademarks are the property of their respective owners. John Wiley & Sons, Inc. is not associated with any product or vendor mentioned in this book.

About the Authors

Michael Alexander is a Microsoft Certified Application Developer (MCAD) and author of several books on advanced business analysis with Microsoft Access and Microsoft Excel. He has more than 20 years of experience consulting and developing Microsoft Office solutions. Mike has been named a Microsoft MVP for his ongoing contributions to the Excel community. You can find Mike at www.datapigtechnologies.com.

Dick Kusleika is a 12-time Microsoft Excel MVP and has been working with Microsoft Office for more than 20 years. Dick develops Access- and Excel-based solutions for his clients and has conducted training seminars on Office products in the United States and Australia. Dick also writes a popular Excel-related blog at www.dailydoseofexcel.com.

John Walkenbach is a best-selling Excel author who has published more than 50 spreadsheet books. He lives amid the saguaros, javelinas, rattlesnakes, bobcats, and Gila monsters in Southern Arizona, but the critters are mostly scared away by his clawhammer banjo playing. For more information, Google him.

About the Technical Editors

Jordan Goldmeier is an internationally recognized analytics professional and data visualization expert, author, speaker, and CEO. He is the owner of Cambia Factor, a data consulting agency, and the author of *Advanced Excel Essentials* (Apress, 2014) and co-author of *Dashboards for Excel* (Apress, 2015), both on developing advanced analytics with Excel. He has consulted with and provided training for the NATO Training Mission, Pentagon, Air Force and Navy, Financial Times, and the University of Cincinnati, among others. His work has been cited by and quoted in the Associated Press, Bloomberg BusinessWeek, Dice News, and American Express OPEN Forum. He holds the prestigious MVP award from Microsoft since 2013, and he is an owner and producer of Excel.TV, an online community devoted to sharing stories, setbacks, and lessons from experts and practitioners in Excel, business intelligence, big data, and analytics. He has provided technical editing and review for Wiley, O'Reilly, and others.

Joyce J. Nielsen has worked in the publishing industry for more than 25 years as an author, development editor, technical editor, and project manager specializing in Microsoft Office, Windows, Internet, and general technology titles for leading educational and retail publishers. She is the author or co-author of more than 40 computer books and has edited several hundred IT publications and more than 2,000 online articles. Joyce holds a bachelor of science degree in quantitative business analysis from Indiana University's Kelley School of Business in Bloomington. Joyce currently resides in Arizona.

Doug Holland is an architect evangelist at Microsoft Corporation, working with partners to drive digital transformation through technologies such as the Microsoft Cloud, Office 365, and HoloLens. He holds a master's degree in software engineering from Oxford University and lives in Northern California with his wife and five children.

Guy Hart-Davis is the author of an improbable number of computer books on a bizarre range of topics. If you had been wondering who was responsible for the *Word 2000 Developer's Handbook*, *AppleScript: A Beginner's Guide*, *iMac Portable Genius*, or *Samsung Galaxy S8 Maniac's Guide*, you need wonder no more.



Credits

Project Editor

Gary Schwartz

Technical Editors

Jordan Goldmeier

Joyce J. Nielsen

Doug Holland

Guy Hart-Davis

Production Editor

Barath Kumar Rajasekaran

Copy Editor

Kim Wimpsett

Production Manager

Kathleen Wisor

**Content Enablement and Operations
Manager**

Pete Gaughan

Marketing Manager

Christie Hilbrich

Associate Publisher

Jim Minatel

Senior Editorial Assistant

Devon Lewis

Project Coordinator, Cover

Brent Savage

Proofreader

Amy J. Schneider

Indexer

John Sleeva

Cover Designer

Wiley

Cover Image

iStockphoto.com/Aleksandar

Acknowledgments

Our deepest thanks to the professionals at John Wiley & Sons for all the hours of work put into bringing this book to life. Thanks also to Jordan Goldmeier, Joyce Nielsen, Doug Holland, and Guy Hart-Davis for suggesting numerous improvements to the examples and text in this book. A special thank-you goes out to our families for putting up with all the time spent locked away on this project. Finally, we'd like to thank John Walkenbach for his many years of work on the previous editions of this book. His efforts in curating Excel knowledge have been instrumental, not only in helping millions of Excel users to achieve their learning goals but in inspiring countless Excel MVPs to share their expertise with the Excel community.

Contents at a Glance

Introduction	xli
Part I: Getting Started with Excel	1
Chapter 1: Introducing Excel	3
Chapter 2: Entering and Editing Worksheet Data	29
Chapter 3: Performing Basic Worksheet Operations.....	51
Chapter 4: Working with Excel Ranges and Tables.....	71
Chapter 5: Formatting Worksheets	117
Chapter 6: Understanding Excel Files and Templates.....	153
Chapter 7: Printing Your Work	173
Chapter 8: Customizing the Excel User Interface	195
Part II: Working with Formulas and Functions	205
Chapter 9: Introducing Formulas and Functions	207
Chapter 10: Using Formulas for Common Mathematical Operations.....	239
Chapter 11: Using Formulas to Manipulate Text.....	253
Chapter 12: Using Formulas with Dates and Times	269
Chapter 13: Using Formulas for Conditional Analysis	295
Chapter 14: Using Formulas for Matching and Lookups	315
Chapter 15: Using Formulas for Financial Analysis.....	333
Chapter 16: Using Formulas for Statistical Analysis	365
Chapter 17: Using Formulas with Tables and Conditional Formatting.....	385
Chapter 18: Understanding and Using Array Formulas	399
Chapter 19: Making Your Formulas Error-Free	423
Part III: Creating Charts and Other Visualizations	443
Chapter 20: Getting Started with Excel Charts	445
Chapter 21: Using Advanced Charting Techniques	489
Chapter 22: Creating Sparkline Graphics	523
Chapter 23: Visualizing with Custom Number Formats and Shapes	537
Chapter 24: Implementing Excel Dashboarding Best Practices.....	567

Part IV: Managing and Analyzing Data	577
Chapter 25: Importing and Cleaning Data	579
Chapter 26: Using Data Validation	613
Chapter 27: Creating and Using Worksheet Outlines	627
Chapter 28: Linking and Consolidating Worksheets	637
Chapter 29: Introducing PivotTables	655
Chapter 30: Analyzing Data with PivotTables	679
Chapter 31: Performing Spreadsheet What-If Analysis	715
Chapter 32: Analyzing Data Using Goal Seeking and Solver	733
Chapter 33: Analyzing Data with the Analysis ToolPak	755
Chapter 34: Protecting Your Work	769
Part V: Understanding Power Pivot and Power Query	781
Chapter 35: Introducing Power Pivot	783
Chapter 36: Working Directly with the Internal Data Model	807
Chapter 37: Adding Formulas to Power Pivot	817
Chapter 38: Introducing Power Query	835
Chapter 39: Transforming Data with Power Query	859
Chapter 40: Making Queries Work Together	887
Chapter 41: Enhancing Power Query Productivity	903
Part VI: Automating Excel	915
Chapter 42: Introducing Visual Basic for Applications	917
Chapter 43: Creating Custom Worksheet Functions	947
Chapter 44: Creating UserForms	961
Chapter 45: Using UserForm Controls in a Worksheet	983
Chapter 46: Working with Excel Events	997
Chapter 47: Seeing Some VBA Examples	1011
Chapter 48: Creating Custom Excel Add-Ins	1027
Index	1037

Contents

Introduction.....	xli
Part I: Getting Started with Excel	1
Chapter 1: Introducing Excel	3
Understanding What Excel Is Used For	3
Looking at What's New in Excel 2019	4
Understanding Workbooks and Worksheets	4
Moving around a Worksheet.....	7
Navigating with your keyboard.....	8
Navigating with your mouse.....	9
Using the Ribbon	10
Ribbon tabs.....	10
Contextual tabs.....	12
Types of commands on the Ribbon	12
Accessing the Ribbon by using your keyboard	14
Using Shortcut Menus	16
Customizing Your Quick Access Toolbar.....	17
Working with Dialog Boxes	18
Navigating dialog boxes.....	19
Using tabbed dialog boxes.....	20
Using Task Panes	20
Creating Your First Excel Workbook	22
Getting started on your worksheet	22
Filling in the month names.....	23
Entering the sales data	23
Formatting the numbers	24
Making your worksheet look a bit fancier.....	25
Summing the values	26
Creating a chart	26
Printing your worksheet	26
Saving your workbook	27
Chapter 2: Entering and Editing Worksheet Data	29
Exploring Data Types.....	29
Numeric values.....	29

Contents

Text entries	30
Formulas.....	31
Entering Text and Values into Your Worksheets	31
Entering numbers.....	31
Entering text	32
Using Enter mode	33
Entering Dates and Times into Your Worksheets.....	33
Entering date values.....	33
Entering time values.....	34
Modifying Cell Contents	34
Deleting the contents of a cell.....	34
Replacing the contents of a cell.....	35
Editing the contents of a cell	35
Learning some handy data-entry techniques.....	37
Automatically moving the selection after entering data.....	37
Selecting a range of input cells before entering data	37
Using Ctrl+Enter to place information into multiple cells simultaneously.....	37
Changing modes	38
Entering decimal points automatically.....	38
Using AutoFill to enter a series of values	39
Using AutoComplete to automate data entry	40
Forcing text to appear on a new line within a cell	41
Using AutoCorrect for shorthand data entry.....	41
Entering numbers with fractions.....	42
Using a form for data entry	42
Entering the current date or time into a cell.....	44
Applying Number Formatting.....	44
Using automatic number formatting	46
Formatting numbers by using the Ribbon.....	46
Using shortcut keys to format numbers.....	46
Formatting numbers by using the Format Cells dialog box	48
Adding your own custom number formats	50
Chapter 3: Performing Basic Worksheet Operations	51
Learning the Fundamentals of Excel Worksheets	51
Working with Excel windows	51
Moving and resizing windows	52
Switching among windows.....	53
Closing windows	54
Activating a worksheet.....	54
Adding a new worksheet to your workbook.....	55
Deleting a worksheet you no longer need	55
Changing the name of a worksheet	56
Changing a sheet tab color.....	57
Rearranging your worksheets	57
Hiding and unhiding a worksheet.....	58

Controlling the Worksheet View	59
Zooming in or out for a better view.....	59
Viewing a worksheet in multiple windows	60
Comparing sheets side by side	61
Splitting the worksheet window into panes.....	62
Keeping the titles in view by freezing panes	62
Monitoring cells with a Watch Window.....	65
Working with Rows and Columns.....	65
Inserting rows and columns	66
Deleting rows and columns.....	67
Changing column widths and row heights	67
Changing column widths	68
Changing row heights.....	68
Hiding rows and columns.....	69
Chapter 4: Working with Excel Ranges and Tables	71
Understanding Cells and Ranges.....	71
Selecting ranges.....	72
Selecting complete rows and columns	73
Selecting noncontiguous ranges	73
Selecting multisheet ranges	74
Selecting special types of cells	77
Selecting cells by searching	79
Copying or Moving Ranges.....	81
Copying by using Ribbon commands	82
Copying by using shortcut menu commands	83
Copying by using shortcut keys.....	83
Copying or moving by using drag-and-drop	85
Copying to adjacent cells	86
Copying a range to other sheets	87
Using the Office Clipboard to paste	87
Pasting in special ways.....	89
Using the Paste Special dialog box.....	90
Performing mathematical operations without formulas.....	92
Skipping blanks when pasting	92
Transposing a range.....	92
Using Names to Work with Ranges	93
Creating range names in your workbooks	94
Using the Name box	94
Using the New Name dialog box.....	94
Using the Create Names from Selection dialog box	95
Managing names	97
Adding Comments to Cells	98
Formatting comments.....	99
Changing a comment's shape	100

Contents

Reading comments	101
Hiding and showing comments	101
Editing comments	101
Deleting comments	102
Working with Tables	102
Understanding a table's structure	102
The header row	103
The data body	103
The total row	103
The resizing handle	104
Creating a table	104
Adding data to a table	105
Sorting and filtering table data	105
Sorting a table	106
Filtering a table	108
Filtering a table with slicers	110
Changing the table's appearance	112
Chapter 5: Formatting Worksheets.	117
Getting to Know the Formatting Tools	117
Using the formatting tools on the Home tab	118
Using the Mini toolbar	118
Using the Format Cells dialog box	119
Formatting Your Worksheet	120
Using fonts to format your worksheet	120
Changing text alignment	122
Choosing horizontal alignment options	123
Choosing vertical alignment options	125
Wrapping or shrinking text to fit the cell	125
Merging worksheet cells to create additional text space	125
Displaying text at an angle	127
Using colors and shading	127
Adding borders and lines	128
Using Conditional Formatting	131
Specifying conditional formatting	131
Using graphical conditional formats	131
Using data bars	131
Using color scales	133
Using icon sets	134
Creating formula-based rules	137
Understanding relative and absolute references	137
Conditional formatting formula examples	138
Identifying weekend days	139

Highlighting a row based on a value.....	139
Displaying alternate-row shading.....	140
Creating checkerboard shading.....	140
Shading groups of rows.....	141
Working with conditional formats.....	141
Managing rules.....	142
Copying cells that contain conditional formatting.....	142
Deleting conditional formatting.....	142
Locating cells that contain conditional formatting.....	142
Using Named Styles for Easier Formatting.....	143
Applying styles.....	143
Modifying an existing style.....	144
Creating new styles.....	145
Merging styles from other workbooks.....	146
Controlling styles with templates.....	146
Understanding Document Themes.....	147
Applying a theme.....	148
Customizing a theme.....	149
Chapter 6: Understanding Excel Files and Templates	153
Creating a New Workbook.....	153
Opening an Existing Workbook.....	154
Filtering filenames.....	156
Choosing your file display preferences.....	157
Saving a Workbook.....	157
Using AutoRecover.....	159
Recovering versions of the current workbook.....	159
Recovering unsaved work.....	160
Configuring AutoRecover.....	160
Password-Protecting a Workbook.....	161
Organizing Your Files.....	162
Other Workbook Info Options.....	162
Protect Workbook options.....	162
Check for Issues options.....	163
Manage Workbook options.....	163
Browser View options.....	163
Compatibility Mode section.....	164
Closing Workbooks.....	164
Safeguarding Your Work.....	164
Working with Templates.....	165
Exploring Excel templates.....	165
Viewing templates.....	165
Creating a workbook from a template.....	166
Modifying a template.....	168

Using default templates	168
Using the workbook template to change workbook defaults.....	169
Creating a worksheet template.....	170
Editing your template	170
Resetting the default workbook	170
Using custom workbook templates	170
Creating custom templates.....	170
Saving your custom templates	171
Using custom templates.....	172
Chapter 7: Printing Your Work	173
Doing Basic Printing	173
Changing Your Page View.....	174
Normal view.....	175
Page Layout view	175
Page Break Preview.....	176
Adjusting Common Page Setup Settings	178
Choosing your printer.....	180
Specifying what you want to print	180
Changing page orientation	181
Specifying paper size.....	181
Printing multiple copies of a report	181
Adjusting the page margins	181
Understanding page breaks	183
Inserting a page break	183
Removing manual page breaks	183
Printing row and column titles.....	183
Scaling printed output.....	185
Printing cell gridlines.....	185
Printing row and column headers	185
Using a background image.....	185
Adding a Header or a Footer to Your Reports	187
Selecting a predefined header or footer	188
Understanding header and footer element codes	189
Exploring other header and footer options	190
Exploring Other Print-Related Topics	190
Copying Page Setup settings across sheets	190
Preventing certain cells from being printed	191
Preventing objects from being printed	191
Creating custom views of your worksheet.....	192
Creating PDF files	194
Chapter 8: Customizing the Excel User Interface	195
Customizing the Quick Access Toolbar	195
About the Quick Access toolbar	196

Adding new commands to the Quick Access toolbar.....	197
Other Quick Access toolbar actions	199
Customizing the Ribbon	201
Why you may want to customize the Ribbon	201
What can be customized	201
How to customize the Ribbon.....	202
Creating a new tab.....	202
Creating a new group	203
Adding commands to a new group.....	203
Resetting the Ribbon.....	204

Part II: Working with Formulas and Functions **205**

Chapter 9: Introducing Formulas and Functions	207
Understanding Formula Basics	207
Using operators in formulas.....	208
Understanding operator precedence in formulas	209
Using functions in your formulas	211
Examples of formulas that use functions	212
Function arguments.....	213
More about functions.....	214
Entering Formulas into Your Worksheets.....	214
Entering formulas manually	216
Entering formulas by pointing.....	216
Pasting range names into formulas.....	216
Inserting functions into formulas.....	217
Function entry tips	219
Editing Formulas.....	219
Using Cell References in Formulas	220
Using relative, absolute, and mixed references.....	221
Changing the types of your references	223
Referencing cells outside the worksheet.....	223
Referencing cells in other worksheets	223
Referencing cells in other workbooks	224
Using Formulas in Tables	225
Summarizing data in a table	225
Using formulas within a table	227
Referencing data in a table	228
Correcting Common Formula Errors.....	229
Handling circular references	230
Specifying when formulas are calculated.....	231
Using Advanced Naming Techniques.....	232
Using names for constants	233
Using names for formulas.....	233

Contents

Using range intersections.....	234
Applying names to existing references.....	236
Working with Formulas.....	236
Not hard-coding values	236
Using the Formula bar as a calculator.....	237
Making an exact copy of a formula	237
Converting formulas to values	238
Chapter 10: Using Formulas for Common Mathematical Operations	239
Calculating Percentages.....	239
Calculating percent of goal.....	239
Calculating percent variance	241
Calculating percent variance with negative values	242
Calculating a percent distribution	243
Calculating a running total.....	244
Applying a percent increase or decrease to values	244
Dealing with divide-by-zero errors.....	245
Rounding Numbers.....	247
Rounding numbers using formulas.....	247
Rounding to the nearest penny	247
Rounding to significant digits.....	248
Counting Values in a Range.....	250
Using Excel's Conversion Functions.....	251
Chapter 11: Using Formulas to Manipulate Text	253
Working with Text	253
Using Text Functions.....	254
Joining text strings.....	254
Setting text to sentence case	256
Removing spaces from a text string	257
Extracting parts of a text string.....	258
Finding a particular character in a text string.....	259
Finding the second instance of a character	261
Substituting text strings	262
Counting specific characters in a cell.....	263
Adding a line break within a formula.....	264
Cleaning strange characters from text fields.....	265
Padding numbers with zeros.....	266
Formatting the numbers in a text string	266
Using the DOLLAR function.....	268
Chapter 12: Using Formulas with Dates and Times.	269
Understanding How Excel Handles Dates and Times	269
Understanding date serial numbers.....	269
Entering dates.....	270
Understanding time serial numbers	271

Entering times	272
Formatting dates and times.....	273
Problems with dates	273
Excel's leap year bug	274
Pre-1900 dates	274
Inconsistent date entries.....	275
Using Excel's Date and Time Functions.....	275
Getting the current date and time	275
Calculating age	276
Calculating the number of days between two dates	277
Calculating the number of workdays between two dates	277
Using NETWORKDAYS.INTL.....	278
Generating a list of business days excluding holidays	278
Extracting parts of a date	280
Calculating number of years and months between dates	282
Converting dates to Julian date formats.....	282
Calculating the percent of year completed and remaining.....	284
Returning the last date of a given month.....	285
Using the EOMONTH function.....	286
Calculating the calendar quarter for a date.....	286
Calculating the fiscal quarter for a date	287
Returning a fiscal month from a date.....	288
Calculating the date of the Nth weekday of the month.....	289
Calculating the date of the last weekday of the month.....	290
Extracting parts of a time	290
Calculating elapsed time	291
Rounding time values	292
Converting decimal hours, minutes, or seconds to a time.....	293
Adding hours, minutes, or seconds to a time	294
Chapter 13: Using Formulas for Conditional Analysis	295
Understanding Conditional Analysis	295
Checking if a simple condition is met.....	295
Checking for multiple conditions	296
Validating conditional data	298
Looking up values.....	298
Checking if Condition1 AND Condition2 are met.....	299
Referring to logical conditions in cells	301
Checking if Condition1 OR Condition2 are met	302
Performing Conditional Calculations.....	303
Summing all values that meet a certain condition	303
Summing greater than zero	305
Summing all values that meet two or more conditions.....	306
Summing if values fall between a given date range	307

Using SUMIFS	308
Getting a count of values that meet a certain condition	309
Getting a count of values that meet two or more conditions	310
Finding nonstandard characters.....	311
Getting the average of all numbers that meet a certain condition	311
Getting the average of all numbers that meet two or more conditions	312
Chapter 14: Using Formulas for Matching and Lookups	315
Introducing Lookup Formulas	315
Leveraging Excel's Lookup Functions	316
Looking up an exact value based on a left lookup column.....	316
Looking up an exact value based on any lookup column	318
Looking up values horizontally.....	320
Hiding errors returned by lookup functions.....	321
Finding the closest match from a list of banded values.....	323
Finding the closest match with the INDEX and MATCH functions.....	324
Looking up values from multiple tables	325
Looking up a value based on a two-way matrix	328
Using default values for match.....	329
Finding a value based on multiple criteria.....	330
Returning text with SUMPRODUCT.....	331
Finding the last value in a column.....	331
Finding the last number using LOOKUP	332
Chapter 15: Using Formulas for Financial Analysis	333
Performing Common Business Calculations.....	333
Calculating gross profit margin and gross profit margin percent	333
Calculating markup.....	334
Calculating EBIT and EBITDA	335
Calculating cost of goods sold.....	336
Calculating return on assets.....	337
Calculating return on equity.....	337
Calculating break even.....	338
Calculating customer churn.....	340
Calculating annual churn rate.....	341
Calculating average customer lifetime value	341
Calculating employee turnover	342
Leveraging Excel's Financial Functions	343
Converting interest rates	343
Computing effective rate with FV.....	345
Creating a loan payment calculator	345
Creating an amortization schedule	346
Creating a variable-rate mortgage amortization schedule	348
Using dates instead of payment numbers	350

Calculating depreciation	351
Calculating accelerated depreciation	352
Calculating present value	354
Calculating the present value of future payments.....	355
Calculating net present value	356
Calculating positive and negative cash flows.....	357
Calculating an internal rate of return	358
Calculating nonperiodic future cash flows.....	359
Performing financial forecasting	360
Chapter 16: Using Formulas for Statistical Analysis	365
Working with Weighted Averages.....	365
Smoothing Data with Moving Averages	367
Applying exponential smoothing to volatile data.....	369
Using Functions to Create Descriptive Statistics	371
Getting the largest or smallest value.....	372
Getting the Nth largest or smallest value	373
Calculating mean, median, and mode.....	375
Bucketing Data into Percentiles	377
Identifying Statistical Outliers with an Interquartile Range.....	379
Creating a Frequency Distribution	383
An alternative to the FREQUENCY function.....	384
Chapter 17: Using Formulas with Tables and Conditional Formatting	385
Highlighting Cells That Meet Certain Criteria	385
Highlighting cells based on the value of another cell	387
Highlighting Values That Exist in List1 but Not List2	389
Highlighting Values That Exist in List1 and List2	391
Highlighting Based on Dates.....	393
Highlighting days between two dates	395
Highlighting dates based on a due date.....	397
Chapter 18: Understanding and Using Array Formulas	399
Understanding Array Formulas.....	399
A multicell array formula	400
A single-cell array formula	401
Creating an Array Constant.....	403
Understanding the Dimensions of an Array.....	404
One-dimensional horizontal arrays	404
One-dimensional vertical arrays	405
Two-dimensional arrays	405
Naming Array Constants.....	407
Working with Array Formulas.....	408
Entering an array formula.....	408
Selecting an array formula range.....	408

Editing an array formula.....	409
Expanding or contracting a multicell array formula	410
Using Multicell Array Formulas	411
Creating an array from values in a range	411
Creating an array constant from values in a range	411
Performing operations on an array.....	412
Using functions with an array.....	413
Transposing an array.....	414
Generating an array of consecutive integers.....	415
Using Single-Cell Array Formulas.....	416
Counting characters in a range.....	416
Summing the three smallest values in a range	417
Counting text cells in a range	418
Eliminating intermediate formulas	419
Using an array instead of a range reference.....	421
Chapter 19: Making Your Formulas Error-Free	423
Finding and Correcting Formula Errors.....	423
Mismatched parentheses	424
Cells are filled with hash marks	425
Blank cells are not blank	425
Extra space characters	426
Formulas returning an error	426
#DIV/0! errors	427
#N/A errors.....	428
#NAME? errors	428
#NULL! errors	428
#NUM! errors	429
#REF! errors.....	429
#VALUE! errors.....	430
Operator precedence problems	430
Formulas are not calculated.....	431
Problems with decimal precision.....	431
“Phantom link” errors.....	432
Using Excel Auditing Tools.....	432
Identifying cells of a particular type	432
Viewing formulas	433
Tracing cell relationships	433
Identifying precedents.....	434
Identifying dependents.....	434
Tracing error values.....	435
Fixing circular reference errors.....	435
Using the background error-checking feature	435
Using Formula Evaluator	436

Searching and Replacing	438
Searching for information	438
Replacing information	439
Searching for formatting	439
Spell-checking your worksheets.....	440
Using AutoCorrect.....	441

Part III: Creating Charts and Other Visualizations **443**

Chapter 20: Getting Started with Excel Charts **445**

What Is a Chart?	445
How Excel handles charts.....	446
Embedded charts.....	447
Chart sheets.....	449
Parts of a chart	450
Chart limitations.....	452
Basic Steps for Creating a Chart	453
Creating the chart.....	453
Switching the row and column orientation.....	454
Changing the chart type.....	456
Applying a chart layout	456
Applying a chart style	456
Adding and deleting chart elements	457
Formatting chart elements.....	458
Modifying and Customizing Charts.....	459
Moving and resizing a chart.....	460
Converting an embedded chart to a chart sheet.....	460
Copying a chart.....	461
Deleting a chart	461
Adding chart elements.....	461
Moving and deleting chart elements	462
Formatting chart elements.....	462
Copying a chart's formatting.....	463
Renaming a chart.....	463
Printing charts	464
Understanding Chart Types.....	464
Choosing a chart type.....	465
Column charts.....	467
Bar charts.....	469
Line charts	469
Pie charts	471
XY (scatter) charts	474
Area charts	474
Radar charts	476

Surface charts.....	477
Bubble charts.....	477
Stock charts.....	477
New Chart Types for Excel.....	479
Histogram charts	479
Pareto charts	481
Waterfall charts	481
Box & whisker charts.....	482
Sunburst charts	483
Treemap charts	484
Funnel charts.....	484
Map charts.....	486
Chapter 21: Using Advanced Charting Techniques	489
Selecting Chart Elements.....	489
Selecting with the mouse.....	490
Selecting with the keyboard.....	491
Selecting with the Chart Elements control.....	491
Exploring the User Interface Choices for Modifying Chart Elements	492
Using the Format task pane.....	493
Using the chart customization buttons	494
Using the Ribbon.....	494
Using the Mini toolbar.....	495
Modifying the Chart Area	495
Modifying the Plot Area	496
Working with Titles in a Chart	497
Working with a Legend.....	498
Working with Gridlines.....	500
Modifying the Axes.....	501
Modifying the value axis	501
Modifying the category axis.....	506
Working with Data Series.....	509
Deleting or hiding a data series	510
Adding a new data series to a chart	510
Changing data used by a series.....	511
Changing the data range by dragging the range outline.....	511
Using the Edit Series dialog box.....	512
Editing the Series formula	512
Displaying data labels in a chart	513
Handling missing data.....	515
Adding error bars	516
Adding a trendline	517
Creating combination charts	518
Displaying a data table	521
Creating Chart Templates.....	522

Chapter 22: Creating Sparkline Graphics	523
Sparkline Types	523
Creating Sparklines	525
Customizing Sparklines	527
Sizing Sparkline cells.....	528
Handling hidden or missing data	528
Changing the Sparkline type.....	529
Changing Sparkline colors and line width.....	529
Highlighting certain data points	529
Adjusting Sparkline axis scaling.....	530
Faking a reference line	531
Specifying a Date Axis	533
Auto-Updating Sparklines.....	535
Displaying a Sparkline for a Dynamic Range	535
Chapter 23: Visualizing with Custom Number Formats and Shapes	537
Visualizing with Number Formatting	537
Doing basic number formatting	537
Using shortcut keys to format numbers	538
Using the Format Cells dialog box to format numbers	539
Getting fancy with custom number formatting.....	540
Formatting numbers in thousands and millions.....	542
Hiding and suppressing zeros.....	543
Applying custom format colors.....	544
Formatting dates and times	545
Using symbols to enhance reporting	546
Using Shapes and Icons as Visual Elements	550
Inserting a shape	550
Inserting SVG icon graphics	551
Formatting shapes and icons	552
Enhancing Excel reports with shapes	554
Creating visually appealing containers with shapes	554
Layering shapes to save space.....	556
Constructing your own infographic widgets with shapes.....	556
Creating dynamic labels.....	557
Creating linked pictures.....	558
Using SmartArt and WordArt	561
SmartArt basics.....	561
WordArt basics	562
Working with Other Graphics Types	563
About graphics files.....	563
Inserting screenshots	564
Displaying a worksheet background image	564
Using the Equation Editor.....	565

Chapter 24: Implementing Excel Dashboarding Best Practices	567
Preparing for a Dashboard Project	567
Establishing the audience and purpose for the dashboard	568
Delineating the measures for the dashboard	568
Cataloging the required data sources	569
Defining the dimensions and filters for the dashboard	569
Determining the need for drill-down features	569
Establishing the refresh schedule	570
Implementing Dashboard Modeling Best Practices	570
Separating data, analysis, and presentation	570
Starting with appropriately structured data	571
Spreadsheet reports make for ineffective data models	571
Flat data files lend themselves nicely to data models	572
Avoiding turning your data model into a database	572
Documenting and organizing your data model	573
Implementing Dashboard Design Best Practices	574
Keep it simple.....	574
Don't turn your dashboard into a data repository	574
Avoid the fancy formatting	575
Limit each dashboard to one printable page.....	575
Format numbers effectively	576
Use titles and labels effectively	576

Part IV: Managing and Analyzing Data **577**

Chapter 25: Importing and Cleaning Data	579
Importing Data	579
Importing from a file	580
Spreadsheet file formats	580
Database file formats.....	580
Text file formats	581
HTML files	582
XML files	582
Importing vs. opening	582
Importing a text file.....	583
Copying and pasting data	587
Cleaning Up Data	587
Removing duplicate rows	587
Identifying duplicate rows	589
Splitting text.....	589
Using Text to Columns.....	591
Using Flash Fill.....	592
Changing the case of text	595