

LEARNING MADE EASY



6th Edition

Excel[®] VBA Programming

for
dummies[®]
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by automating with VBA

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Create applications and
be the office hero

—
Learn VBA to get the
most out of Excel

Dick Kusleika



Excel[®] VBA Programming

6th Edition

by Dick Kusleika

for
dummies[®]
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Excel® VBA Programming For Dummies®

Published by: **John Wiley & Sons, Inc.**, 111 River Street, Hoboken, NJ 07030-5774, www.wiley.com

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Published simultaneously in Canada

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Library of Congress Control Number: 2021951691

ISBN 978-1-119-84307-8 (pbk); ISBN 978-1-119-84308-5 (ebk); ISBN 978-1-119-84309-2 (ebk)

Contents at a Glance

Introduction	1
Part 1: Starting Excel VBA Programming	7
CHAPTER 1: Getting to Know VBA	9
CHAPTER 2: Building Simple Macros	17
Part 2: Employing VBA with Excel	29
CHAPTER 3: Working in the Visual Basic Editor	31
CHAPTER 4: Introducing the Excel Object Model	51
CHAPTER 5: VBA Sub and Function Procedures	67
CHAPTER 6: Using the Excel Macro Recorder	83
Part 3: Programming Concepts	97
CHAPTER 7: Essential VBA Language Elements	99
CHAPTER 8: Working with Range Objects	119
CHAPTER 9: Using VBA and Worksheet Functions	135
CHAPTER 10: Controlling Program Flow and Making Decisions	151
CHAPTER 11: Automatic Procedures and Events	171
CHAPTER 12: Error-Handling Techniques	193
CHAPTER 13: Bug Extermination Techniques	205
CHAPTER 14: VBA Programming Examples	219
Part 4: Communicating with Your Users	243
CHAPTER 15: Simple Dialog Boxes	245
CHAPTER 16: UserForm Basics	263
CHAPTER 17: Using UserForm Controls	281
CHAPTER 18: UserForm Techniques and Tricks	301
CHAPTER 19: Accessing Your Macros through the User Interface	329
Part 5: Putting It All Together	343
CHAPTER 20: Creating Worksheet Functions	345
CHAPTER 21: Creating Excel Add-Ins	365
Part 6: The Part of Tens	377
CHAPTER 22: Ten Handy Visual Basic Editor Tips	379
CHAPTER 23: Resources for VBA Help	389
CHAPTER 24: Ten VBA Do's and Don'ts	395
Index	401

Table of Contents

INTRODUCTION	1
About This Book	1
Typographical conventions	2
Macro security	3
Foolish Assumptions	5
Icons Used in This Book	5
Beyond the Book	6
Where to Go from Here	6
PART 1: STARTING EXCEL VBA PROGRAMMING	7
CHAPTER 1: Getting to Know VBA	9
Understanding VBA Basics	9
Knowing What VBA Can Do	10
Inserting a bunch of text	11
Automating a task you perform frequently	11
Automating repetitive operations	11
Creating a custom command	11
Creating a custom button	12
Developing new worksheet functions	12
Creating custom add-ins for Excel	12
Getting the Most from VBA	12
Knowing what VBA does best	12
Recognizing the disadvantages of using VBA	13
Understanding VBA Concepts	14
Ensuring Excel Compatibility	16
CHAPTER 2: Building Simple Macros	17
Displaying the Developer Tab	17
Creating a Macro	18
Preparing the Environment	18
Recording a Macro	19
Running the Macro	21
Viewing a Macro in the Visual Basic Editor	22
Modifying the Macro	24
Saving Workbooks That Contain Macros	25
Understanding Macro Security	25

PART 2: EMPLOYING VBA WITH EXCEL	29
CHAPTER 3: Working in the Visual Basic Editor	31
Getting to Know the Visual Basic Editor.....	31
Activating the VBE.....	32
Exploring VBE components.....	32
Working with the Project Explorer.....	34
Adding a new VBA module.....	35
Working with a Code Pane.....	36
Minimizing and maximizing windows.....	36
Looking at the parts of a module.....	37
Getting VBA code into a module.....	38
Entering code directly.....	38
Using the macro recorder.....	41
Copying VBA code.....	44
Customizing the VBE.....	44
Using the Editor tab.....	44
Using the Editor Format tab.....	47
Using the General tab.....	48
Using the Docking tab.....	48
CHAPTER 4: Introducing the Excel Object Model	51
Working with the Excel Object Model.....	51
Understanding the object hierarchy.....	52
Referring to objects.....	53
Diving into Object Properties and Methods.....	57
Setting object properties.....	58
Taking action with object methods.....	60
Triggering actions with object events.....	61
Finding Out More from VBA Resources.....	62
Using VBA's Help system.....	62
Using the Object Browser.....	63
Automatically listing properties and methods.....	64
CHAPTER 5: VBA Sub and Function Procedures	67
Understanding Subs versus Functions.....	67
Looking at Sub procedures.....	68
Looking at Function procedures.....	68
Naming Subs and Functions.....	69
Executing Sub procedures.....	70
Executing the Sub procedure directly.....	72
Executing the procedure from the Macro dialog box.....	73
Executing a macro by using a shortcut key.....	74
Executing the procedure from a button or shape.....	75
Executing the procedure from another procedure.....	77
Executing the procedure from the Immediate window.....	77

	Executing Function Procedures	78
	Calling the function from a Sub procedure	78
	Calling a function from the Immediate window	79
	Calling a function from a worksheet formula	80
CHAPTER 6:	Using the Excel Macro Recorder	83
	Recording Basics	84
	Preparing to Record	85
	Choosing Between Relative and Absolute Mode	86
	Recording in absolute mode	86
	Recording in relative mode	87
	Watching the Macro Recorder in Action	89
	Specifying Recording Options for Your Macro	91
	Streamlining Code Generated by the Macro Recorder	92
	PART 3: PROGRAMMING CONCEPTS	97
CHAPTER 7:	Essential VBA Language Elements	99
	Using Comments in Your VBA Code	99
	Using Variables, Constants, and Data Types	101
	Understanding variables	101
	What are VBA's data types?	103
	Declaring and scoping variables	103
	Working with constants	110
	Using premade constants	110
	Working with strings	111
	Working with dates	112
	Using Assignment Statements	113
	Assignment statement examples	113
	About that equal sign	114
	Smooth operators	114
	Working with Arrays	116
	Declaring arrays	116
	Multidimensional arrays	117
	Dynamic arrays	117
	Using Labels	118
CHAPTER 8:	Working with Range Objects	119
	Referring to Range Objects	119
	Referring to a Range Using Properties	121
	The Cells property	122
	The Offset property	122
	The Resize property	123

Working with Range Object Properties	124
The Value property	124
The Text property	125
The Count property	126
The Column and Row properties	126
The Address property	126
The HasFormula property	127
The Font property	128
The Interior property	128
The Formula property	130
The NumberFormat property	131
Taking Action with Range Object Methods	131
The Select method	132
The Copy and Paste methods	132
The Clear method	133
The Delete method	133
CHAPTER 9: Using VBA and Worksheet Functions	135
Understanding Functions	135
Using Built-In VBA Functions	136
Working with dates and times	136
Manipulating strings	138
Identifying objects and data	139
VBA functions that do more than return a value	140
Discovering VBA functions	141
Using Worksheet Functions in VBA	144
Worksheet function examples	144
Entering worksheet functions	147
More about using worksheet functions	148
Using Custom Functions	148
CHAPTER 10: Controlling Program Flow and Making Decisions	151
Going with the Flow, Dude	151
The GoTo Statement	152
Decisions, Decisions	154
The If-Then structure	154
The Select Case structure	158
Knocking Your Code for a Loop	162
For-Next loops	162
Do-While loop	167
Do-Until loop	168
Using For Each-Next Loops with Collections	168

CHAPTER 11: Automatic Procedures and Events	171
Preparing for the Big Event	171
Learning when to use event procedures	173
Programming event-handler procedures	174
Knowing Where to Put the Event Code	174
Writing an Event-Handler Procedure	175
Triggering Workbook Events	177
The Open event for a workbook	177
The BeforeClose event for a workbook	179
The BeforeSave event for a workbook	180
Using Activation Events	181
Activate and deactivate events in a sheet	181
Activate and deactivate events in a workbook	182
Workbook activation events	184
Programming Worksheet-Related Events	185
The BeforeDoubleClick event	185
The BeforeRightClick event	185
The Change event	186
Understanding Events Not Associated with Objects	188
The OnTime event	188
Keypress events	190
CHAPTER 12: Error-Handling Techniques	193
Types of Errors	193
An Erroneous Macro Example	194
Not-quite-perfect macros	195
Perfecting the macro	196
Giving up on perfection	198
Alternate Ways of Handling Errors	198
Revisiting the EnterSquareRoot procedure	198
Trapping errors with the On Error statement	200
Handling Errors: The Details	200
Resuming after an error	200
Error handling in a nutshell	202
An Intentional Error	203
CHAPTER 13: Bug Extermination Techniques	205
Species of Bugs	205
Identifying Bugs	207
Debugging Techniques	208
Examining your code	208
Using the MsgBox function	208
Inserting Debug.Print statements	210
Using the VBA debugger	210

Using the Debugger's Tools	211
Setting breakpoints in your code	211
Using the Watches window	214
Using the Locals window	216
Bug Reduction Tips	217
CHAPTER 14: VBA Programming Examples	219
Working with Ranges	220
Copying a range	220
Copying a variable-size range	221
Selecting to the end of a row or column	223
Selecting a row or column	224
Moving a range	224
Looping through a range efficiently	225
Looping through a range efficiently (Part II)	227
Prompting for a cell value	227
Determining the selection type	228
Identifying a multiple selection	229
Changing Excel Settings	230
Changing Boolean settings	230
Changing non-Boolean settings	231
Working with Charts	231
AddChart versus AddChart2	232
Modifying the chart type	234
Looping through the ChartObjects collection	234
Modifying chart properties	235
Applying chart formatting	235
VBA Speed Tips	237
Turning off screen updating	237
Turning off automatic calculation	238
Eliminating those pesky alert messages	239
Simplifying object references	240
Declaring variable types	241
Using the With-End With structure	242
PART 4: COMMUNICATING WITH YOUR USERS	243
CHAPTER 15: Simple Dialog Boxes	245
Interacting with the User in VBA	246
Displaying Messages with the MsgBox Function	247
Displaying a simple message box	247
Getting a response from a message box	248
Customizing message boxes	250
Getting Data with an Input Box	252

Understanding the InputBox syntax	253
Using the InputBox function	253
Using the InputBox method	255
Allowing the User to Select a File or Folder	256
Constructing a GetOpenFilename statement	256
Selecting a file with GetOpenFilename	256
Picking a file with GetSaveAsFilename	259
Getting a folder name	259
Displaying Excel's Built-In Dialog Boxes	260
CHAPTER 16: UserForm Basics	263
Knowing When to Use a UserForm	263
Creating UserForms: An Overview	265
Working with UserForms	266
Inserting a new UserForm	266
Adding controls to a UserForm	267
Changing properties for a UserForm control	268
Viewing the UserForm Code pane	269
Displaying a UserForm	269
Using information from a UserForm	270
A UserForm Example	271
Creating the UserForm	271
Adding the CommandButtons	272
Adding the OptionButtons	272
Adding event-handler procedures	275
Creating a macro to display the dialog box	277
Making the macro available	277
Testing the macro	278
CHAPTER 17: Using UserForm Controls	281
Getting Started with Dialog Box Controls	281
Adding controls	282
Introducing control properties	283
Learning Dialog Box Controls Details	285
CheckBox control	285
ComboBox control	286
CommandButton control	287
Frame control	288
Image control	288
Label control	289
ListBox control	289
MultiPage control	291
OptionButton control	292
RefEdit control	292

ScrollBar control	293
SpinButton control	294
TabStrip control	295
TextBox control	295
ToggleButton control	296
Working with Dialog Box Controls	296
Moving and resizing controls	297
Aligning and spacing controls	297
Accommodating keyboard users	297
Testing a UserForm	300
Dialog Box Aesthetics	300
CHAPTER 18: UserForm Techniques and Tricks	301
Using Dialog Boxes	302
A UserForm Example	302
Creating the dialog box	302
Writing code to display the dialog box	305
Making the macro available	305
Trying out your dialog box	306
Adding event-handler procedures	307
Validating the data	309
Now the dialog box works	309
A ListBox Control Example	309
Filling a ListBox Control	310
Determining the selected item	312
Determining multiple selections	313
Selecting a Range	314
Using Multiple Sets of Option Buttons	316
Using a Spin Button and a Text Box	317
Using a UserForm as a Progress Indicator	319
Creating the progress-indicator dialog box	320
The procedures	321
How this example works	322
Creating a Modeless Tabbed Dialog Box	323
Displaying a Chart in a UserForm	325
A Dialog Box Checklist	326
CHAPTER 19: Accessing Your Macros through the User Interface	329
Customizing the Ribbon	329
Customizing the Ribbon manually	330
Adding a macro to the Ribbon	332
Customizing the Ribbon with XML	333
Customizing the Excel UI with VBA	337

Adding commands to the Add-ins Ribbon tab	338
Adding a new item to the Cell shortcut menu.	339
Adding customizations automatically.	340
Understanding shortcut menus and the single document interface.	341
PART 5: PUTTING IT ALL TOGETHER	343
CHAPTER 20: Creating Worksheet Functions	345
Create Custom Functions to Simplify Your Work	345
Understanding VBA Function Basics.	347
Writing Functions.	347
Working with Function Arguments	348
A function with no argument.	349
A function with one argument.	349
A function with two arguments	351
A function with a range argument	352
A function with an optional argument	354
Introducing Wrapper Functions	356
The NumberFormat function.	356
The ExtractElement function	357
The SayIt function	358
The IsLike function	358
Working with Functions That Return an Array	359
Returning an array of month names	359
Returning a sorted list.	360
Using the Insert Function Dialog Box	362
Displaying the function's description	362
Adding argument descriptions	364
CHAPTER 21: Creating Excel Add-Ins	365
Add-Ins Defined	365
Reasons to Create Add-Ins.	366
Working with Add-Ins	367
Understanding Add-In Basics	368
Looking at an Add-In Example.	369
Setting up the workbook	369
Testing the workbook	372
Adding descriptive information.	372
Protecting the VBA code.	373
Creating the add-in	374
Opening the add-in	374
Distributing the add-in	375
Modifying the add-in.	375

PART 6: THE PART OF TENS	377
CHAPTER 22: Ten Handy Visual Basic Editor Tips	379
Applying Block Comments	380
Copying Multiple Lines of Code at Once	381
Jumping between Modules and Procedures	382
Teleporting to Your Functions	382
Staying in the Right Procedure	383
Stepping through Your Code	383
Stepping to a Specific Line in Your Code	384
Stopping Your Code at a Predefined Point	385
Seeing the Beginning and End of Variable Values	386
Turning Off Auto Syntax Check	387
CHAPTER 23: Resources for VBA Help	389
Letting Excel Write Code for You	390
Referencing the Help System	390
Pilfering Code from the Internet	390
Leveraging User Forums	391
Visiting Expert Blogs	392
Mining YouTube for Video Training	393
Attending Live and Online Training Classes	393
Learning from the Microsoft Office Dev Center	393
Dissecting the Other Excel Files in Your Organization	394
Asking Your Local Excel Guru	394
CHAPTER 24: Ten VBA Do's and Don'ts	395
Do Declare All Variables	395
Don't Confuse Passwords with Security	396
Do Clean Up Your Code	396
Don't Put Everything in One Procedure	397
Do Consider Other Software	397
Don't Assume That Everyone Enables Macros	397
Do Get in the Habit of Experimenting	398
Don't Assume That Your Code Will Work with Other Excel Versions	398
Do Keep Your Users in Mind	399
Don't Forget about Backups	399
INDEX	401

Introduction

Greetings, prospective Excel programmer. . .

You no doubt have your reasons for picking up a book on VBA programming. Maybe you got a new job (congratulations). Maybe you're trying to automate some of the repetitive data crunching tasks you have to do. Maybe you're just a nerd at heart. Whatever the reason, thank you for choosing this book.

Inside, you find everything you need to get up and running with VBA fast. Even if you don't have the foggiest idea of what programming is all about, this book can help. Unlike most programming books, this one is filled with information designed to include just what you need to know to quickly ramp your VBA programming skillset.

About This Book

Go to any large bookstore (in person or online), and you'll find many Excel books. A quick overview can help you decide whether this book is really right for you. This book

- » Is designed for intermediate to advanced Excel users who want to get up to speed with Visual Basic for Applications (VBA) programming.
- » Requires no previous programming experience.
- » Covers the most commonly used commands.
- » Is appropriate for recent versions of Excel.
- » Just might make you crack a smile occasionally.

If you're using an older version of Excel, this book *might* be okay, but some things have changed. You'd probably be better off with the preceding edition.

Oh, yeah — this is *not* an introductory Excel book. If you're looking for a general-purpose Excel book, check out either of the following books, which are both published by Wiley:

- »» *Excel 2019 For Dummies*, by Greg Harvey
- »» *Excel Bible*, by Michael Alexander and Dick Kusleika

These books are also available in editions for earlier versions of Excel.

Notice that the title of this book isn't *The Complete Guide to Excel VBA Programming For Dummies*. This book doesn't cover all aspects of Excel programming — but then again, you probably don't want to know *everything* about this topic.

If you consume this book and find that you're hungry for a more comprehensive Excel programming book, you might try *Microsoft Excel 2019 Power Programming with VBA*, also published by Wiley. And yes, editions for older versions of Excel are also available.

To make the content more accessible, I divided this book into six parts:

- »» **Part 1, Starting with Excel VBA Programming**
- »» **Part 2, Employing VBA with Excel**
- »» **Part 3, Programming Concepts**
- »» **Part 4, Communicating with Your Users**
- »» **Part 5, Putting It All Together**
- »» **Part 6, The Part of Tens**

Typographical conventions

Sometimes, I refer to key combinations — which means you hold down one key while you press another. For example, Ctrl+Z means you hold down the Ctrl key while you press Z.

For menu commands, I use a distinctive character to separate items on the Ribbon or menu. For example, you use the following command to create a named range in a worksheet:

Formulas ⇨ Defined Names ⇨ Define Name

Formulas is the tab at the top of the Ribbon, Defined Names is the Ribbon group, and Define Name is the Ribbon tool you click.

The Visual Basic Editor still uses old-fashioned menus and toolbars. So Tools⇨ Options means choose the Tools menu and then choose the Options menu item.

Excel programming involves developing *code* — that is, the instructions VBA follows. All code in this book appears in a monospace font, like this:

```
Range("A1:A12").Select
```

Some long lines of code don't fit between the margins in this book. In such cases, I use the standard VBA line-continuation character sequence: a space followed by an underscore character. Here's an example:

```
Selection.PasteSpecial Paste:=xlValues, _  
    Operation:=xlNone, SkipBlanks:=False, _  
    Transpose:=False
```

When you enter this code, you can type it as written or place it on a single line (omitting the space and underscore combination).

Macro security

It's a cruel world out there. It seems that some scam artist is always trying to take advantage of you or cause some type of problem. The world of computing is equally cruel. You probably know about computer viruses, which can cause some nasty things to happen to your system. But did you know that computer viruses can also reside in an Excel file? It's true. In fact, it's relatively easy to write a computer virus by using VBA. An unknowing user can open an Excel file and spread the virus to other Excel workbooks and to other systems.

Over the years, Microsoft has become increasingly concerned about security issues. This is a good thing, but it also means that Excel users need to understand how things work. You can check Excel's security settings by choosing File⇨ Options⇨ Trust Center⇨ Trust Center Settings. There is a plethora of options in there, and people have been known to open that dialog box and never be heard from again.

If you click the Macro Settings tab (on the left side of the Trust Center dialog box), your options are as follows:

- » **Disable VBA macros without notification.** Macros will not work, regardless of what you do.
- » **Disable VBA macros with notification.** When you open a workbook with macros, you see the Message Bar open with an option you can click to enable macros, or (if the Visual Basic Editor window is open) you get a message asking if you want to enable macros.
- » **Disable VBA macros except digitally signed macros.** Only macros with a digital signature are allowed to run (but even for those signatures you haven't marked as trusted, you still get the security warning).
- » **Enable VBA macros.** All macros run with no warnings. This option is not recommended because potentially dangerous code can be executed.

Consider this scenario: You spend a week writing a killer VBA program that will revolutionize your company. You test it thoroughly and then send it to your boss. They call you into their office and claim that your macro doesn't do anything at all. What's going on? Chances are, your boss's security setting doesn't allow macros to run. Or maybe they chose to go along with Microsoft's default suggestion and disable the macros when they opened the file.

Bottom line? Just because an Excel workbook contains a macro does not guarantee that the macro will ever be executed. It all depends on the security setting and whether the user chooses to enable or disable macros for that file.

To work with this book, you need to enable macros for the files you work with. My advice is to use the second security level. Then, when you open a file that you've created, you can simply enable the macros. If you open a file from someone you don't know, you should disable the macros and check the VBA code to ensure that it doesn't contain anything destructive or malicious. Usually, it's pretty easy to identify suspicious VBA code.

Another option is to designate a trusted folder. Choose File ⇨ Options ⇨ Trust Center ⇨ Trust Center Settings. Select the Trusted Locations option and then designate a particular folder as a trusted location. Store your trusted workbooks there, and Excel won't bug you about enabling macros. For example, if you download the sample files for this book, you can put them in a trusted location.

Foolish Assumptions

People who write books usually have a target reader in mind. The following points more or less describe the hypothetical target reader for this book:

- » You have access to a PC at work — and probably at home. And those computers are connected to the internet.
- » You're running a fairly recent version of Excel.
- » You've been using computers for several years.
- » You use Excel frequently in your work, and you consider yourself to be more knowledgeable about Excel than the average bear.
- » You need to make Excel do some things that you currently can't make it do.
- » You have little or no programming experience.
- » You understand that the Help system in Excel can actually be useful. Face it — this book doesn't cover everything. If you get on good speaking terms with the Help system, you'll be able to fill in some of the missing pieces.
- » You need to accomplish some work, and you have a low tolerance for thick, boring computer books.

Icons Used in This Book

Throughout this book, icons in the margins highlight certain types of valuable information that call out for your attention. Here are the icons you'll encounter and a brief description of each.



TIP

The Tip icon marks tips and shortcuts that can save you a great deal of time (and maybe even allow you to leave the office at a reasonable hour).



REMEMBER

Remember icons mark the information that's especially important to know. To siphon off the most important information in each chapter, just skim through these icons.



TECHNICAL
STUFF

The Technical Stuff icon marks information of a highly technical nature that you can normally skip over.



WARNING

The Warning icon tells you to watch out! It marks important information that may save you from losing data and ruining your whole day.

Beyond the Book

This book has its very own website where you can download the sample files. To get these files, point your web browser to

<https://www.dummies.com/go/excelvbaprogrammingfd6e>

Having the sample files will save you a lot of typing. Better yet, you can play around with them and experiment with various changes. In fact, experimentation is the best way to master VBA.

In addition, this book comes with a free access-anywhere Cheat Sheet that includes keyboard shortcuts related to Excel VBA programming. To get this Cheat Sheet, simply go to www.dummies.com and type **VBA Excel Programming For Dummies Cheat Sheet** in the Search box and click on the Cheat Sheets tab.

Where to Go from Here

This book contains everything you need to learn VBA programming at a mid-advanced level. The book starts off with the basics of recording macros and builds, chapter by chapter.

If you're completely new to Excel macros, start with Part 1 to get a refresher on the fundamentals of recording macros. If you have experience recording macros, but want to better understand the VBA behind them, read to Parts 2 and 3. There, you gain a concise understanding of how VBA works, along with the basic foundation you need to implement your own code.

Finally, if you're familiar with programming concepts and just want to get a quick run-through of some of the more advanced techniques like creating your custom functions and add-ins, feel free to jump to Part 4.

1

**Starting
Excel VBA
Programming**

IN THIS PART . . .

Get to know Visual Basic for Applications.

Work through a real-live Excel programming session.

- » Getting a conceptual overview of VBA
- » Finding out what you can do with VBA
- » Discovering the advantages and disadvantages of using VBA
- » Getting the lowdown on what VBA is
- » Staying Excel compatible

Chapter 1

Getting to Know VBA

If you're eager to jump into VBA programming, hold your horses. This chapter is completely devoid of any hands-on training material. It does, however, contain some essential background information that assists you in becoming an Excel programmer. Just like a great heart surgeon has to take freshman biology, you must learn some basic concepts and terminology so that the more practical aspects you do later make sense.

Understanding VBA Basics

VBA, which stands for *Visual Basic for Applications*, is a programming language developed by Microsoft — you know, the company that tries to get you to buy a new version of Windows every few years. Excel, along with the other members of Microsoft Office, includes the VBA language (at no extra charge). In a nutshell, VBA is the tool that people use to write programs that automate Excel, such as a program to format a spreadsheet into a monthly report. In the next section, I discuss in more detail the types of tasks you can automate with VBA.

Imagine a robot that knows all about Excel. This robot can read instructions, and it can also operate Excel quickly and accurately. When you want the robot to do something in Excel, you write a set of robot instructions by using special codes. Then you tell the robot to follow your instructions while you sit back and drink a glass of lemonade. With VBA, you don't need the extra chair at your desk for an actual robot. Just feed the special codes into VBA and it does the work.



TECHNICAL
STUFF

A FEW WORDS ABOUT TERMINOLOGY

Excel programming terminology can be a bit confusing. For example, VBA is a programming language, but it also serves as a macro language. In this context, a *macro* is a set of instructions Excel performs to imitate keystrokes and mouse actions. What do you call something written in VBA and executed in Excel? Is it a *macro*, or is it a *program*? Excel's Help system often refers to VBA procedures as *macros*, so that terminology is used in this book. But you can also call this stuff a *program*.

You'll see the term *automate* throughout this book. This term means that a series of steps are completed automatically. For example, if you write a macro that adds color to some cells, prints the worksheet, and then removes the color, you have *automated* those three steps.

By the way, *macro* doesn't stand for **M**essy **A**nd **C**onfusing **R**epeated **O**peration. Rather, it comes from the Greek *makros*, which means large — which also describes your paycheck after you become an expert macro programmer.

Knowing What VBA Can Do

You're probably aware that people use Excel for thousands of different tasks. Here are just a few examples:

- » Analyzing scientific data
- » Budgeting and forecasting
- » Creating invoices and other forms
- » Building charts from data
- » Keeping lists of things such as customers' names, students' grades, or holiday gift ideas (a nice fruitcake would be lovely)

The list could go on and on, but you get the idea. The point is simply that Excel is used for a wide variety of tasks, and everyone reading this book has different needs and expectations regarding Excel. One thing virtually every reader has in common is the *need to automate some aspect of Excel*. That, dear reader, is what VBA is all about.

For example, you might create a VBA program to import some numbers and then format and print your month-end sales report. After writing and testing the program, you can execute the macro with a single command, causing Excel to

automatically perform many time-consuming procedures. Rather than struggle through a tedious sequence of commands, you can simply click a button and then hop on over to TikTok and kill some time while your macro does the work.

The following sections briefly describe some common uses for VBA macros. One or two of these may push your button.

Inserting a bunch of text

If you often need to enter your company name, address, and phone number in your worksheets, you can create a macro to do the typing for you. You can extend this concept as far as you like. For example, you might develop a macro that automatically enters a list of all salespeople who work for your company.

Automating a task you perform frequently

Assume you're a sales manager and you need to prepare a month-end sales report to keep your boss happy. If the task is straightforward, you can develop a VBA program to do it for you. Your boss will be impressed by the consistently high quality of your reports, and you'll be promoted to a new job for which you are highly unqualified.

Automating repetitive operations

If you need to perform the same action on, say, 12 different Excel workbooks, you can record a macro while you perform the task on the first workbook, and then let the macro repeat your action on the other workbooks. The nice thing about this is that Excel never complains about being bored. Excel's macro recorder is similar to recording live action on a video recorder. However, it doesn't require a camera, and the battery never needs to be recharged.

Creating a custom command

Do you often issue the same sequence of Excel commands? If so, save yourself a few seconds by developing a macro that combines these commands into a single custom command, which you can execute with a single keystroke or button click. You probably won't save *that* much time, but you'll probably be more accurate. And the guy sitting in the next cubicle will be really impressed.

Creating a custom button

You can customize your Quick Access toolbar with your own buttons that execute the macros you write. Office workers tend to be very impressed by buttons that perform magic. And if you *really* want to impress your fellow employees, you can even add new buttons to the Ribbon.

Developing new worksheet functions

Although Excel includes hundreds of built-in functions (such as SUM and AVERAGE), you can create *custom* worksheet functions that can greatly simplify your formulas. You'll be surprised by how easy this is. (You can explore how to do this in Chapter 20.) Even better, the Insert Function dialog box displays your custom functions, making them appear built-in. Very snazzy stuff.

Creating custom add-ins for Excel

You might be familiar with some of the add-ins that ship with Excel. For example, the Analysis ToolPak is a popular add-in. You can use VBA to develop your own special-purpose add-ins. Add-ins are just like regular Excel workbooks except they don't have any worksheets the users can see. They're all VBA and they usually automate tasks on other workbooks.

Getting the Most from VBA

VBA provides a ton of benefits that are tempered with a few disadvantages you'll want to keep in mind. One advantage of VBA, for example, is that you can use it to automate almost anything you do in Excel. All you have to do is write instructions in VBA, and Excel carries out those instructions when instructed to do so. The previous section, "Knowing What VBA Can Do," describes some specific tasks you can accomplish by using VBA. The following sections help you decide whether VBA is the best tool to achieve the results you want.

Knowing what VBA does best

Here are some benefits of automating a task by using VBA:

- » Excel always executes the task in exactly the same way. (In most cases, consistency is a good thing.)

- » Excel performs the task much faster than you can do it manually. (Unless, of course, you're Clark Kent.)
- » If you're a good macro programmer, Excel always performs the task without errors (which probably can't be said about you, no matter how careful you are).
- » If you set up things properly, someone who doesn't know anything about Excel can perform the task by running the macro.
- » You can do things in Excel that are otherwise impossible — which can make you a very popular person around the office.
- » For long, time-consuming tasks, you don't have to sit in front of your computer and get bored. Excel does the work while you hang out at the water cooler.

Recognizing the disadvantages of using VBA

Using VBA can present some disadvantages (or *potential* disadvantages). Understanding these limitations upfront helps you avoid running down rabbit trails to nowhere. Most people use VBA to save time, not waste it!

Keep the following points in mind when deciding whether to use VBA:

- » Other people who need to use your VBA programs must have their own copies of Excel. It would be nice if you could press a button that transforms your Excel/VBA application into a stand-alone program, but that isn't possible. (And probably never will be.)
- » Sometimes, things go wrong. In other words, you can't blindly assume that your VBA program will always work correctly under all circumstances. Welcome to the world of *debugging* (fixing errors) and, if others are using your macros, providing technical support.
- » VBA is a moving target. As you know, Microsoft is continually upgrading Excel. Even though Microsoft puts great effort into compatibility between versions, you might discover that the VBA code you've written doesn't work properly with older versions or with a future version of Excel. For more information on the importance of Excel compatibility, see the section "Ensuring Excel Compatibility," later in this chapter.

Understanding VBA Concepts

Just to let you know what you're in for, here's a quick-and-dirty summary of what VBA is all about.

»» **You perform actions in VBA by writing (or recording) code in a VBA module.** You view and edit VBA modules by using the Visual Basic Editor (VBE).

»» **A VBA module consists of Sub procedures.** A Sub procedure has nothing to do with underwater vessels or tasty sandwiches. Rather, it's a chunk of computer code that performs some action on or with objects (discussed in a moment). The following example shows a simple Sub procedure called AddEmUp. This amazing program, when executed, displays the result of 1 plus 1:

```
Sub AddEmUp( )
    Sum = 1 + 1
    MsgBox "The answer is " & Sum
End Sub
```

A Sub procedure that doesn't perform properly is said to be *substandard*.

»» **A VBA module can also have Function procedures.** A Function procedure returns a single value. You can call it from another VBA procedure or even use it as a function in a worksheet formula. An example of a Function procedure (named AddTwo) follows. This Function accepts two numbers (called arguments) and returns the sum of those values:

```
Function AddTwo(arg1, arg2)
    AddTwo = arg1 + arg2
End Function
```

A Function procedure that doesn't work correctly is said to be *dysfunctional*.

»» **VBA manipulates objects.** Excel provides dozens and dozens of objects that you can manipulate. Examples of objects include a workbook, a worksheet, a cell range, a chart, and a shape. You have many more objects at your disposal, and you can manipulate them by using VBA code.

»» **Objects are arranged in a hierarchy.** Objects can act as *containers* for other objects. At the top of the object hierarchy is Excel. Excel itself is an object called *Application*. The Application object contains other objects, such as Workbook objects and Add-In objects. The Workbook object can contain other objects, such as Worksheet objects and Chart objects. A Worksheet object can contain objects such as Range objects and PivotTable objects. The term *object model* refers to the arrangement of these objects. (Object-model mavens can find out more in Chapter 4.)

» **Collection Objects hold other objects of the same type.** For example, the Worksheets collection consists of all the worksheets in a particular workbook. The Charts collection consists of all Chart objects in a workbook. Collections are themselves objects.

» **You refer to an object by specifying its position in the object hierarchy, using a dot (entered as a period) as a separator.** For example, you can refer to the workbook Book1.xlsx as

```
Application.Workbooks("Book1.xlsx")
```

This refers to the workbook Book1.xlsx in the Workbooks collection. The Workbooks collection is contained in the Application object (that is, Excel). Extending this to another level, you can refer to Sheet1 in Book1.xlsx as

```
Application.Workbooks("Book1.xlsx").Worksheets("Sheet1")
```

You can take this to still another level and refer to a specific cell (in this case, cell A1):

```
Application.Workbooks("Book1.xlsx").Worksheets("Sheet1").Range("A1")
```

» **If you omit specific references, Excel uses the *active* objects.** If Book1.xlsx is the active workbook, you can simplify the preceding reference as follows:

```
Worksheets("Sheet1").Range("A1")
```

If you know that Sheet1 is the active sheet, you can simplify the reference even more:

```
Range("A1")
```

» **Objects have properties.** You can think of a property as a *characteristic* of an object. For example, a Range object has such properties as Value and Address. A Chart object has such properties as HasTitle and Type. You can use VBA to read object properties and also to change properties.

» **You refer to a property of an object by combining the object name with the property name, separated by a dot.** For example, you can refer to the Value property in cell A1 on Sheet1 as follows:

```
Worksheets("Sheet1").Range("A1").Value
```

» **You can assign values to variables.** A *variable* is a named element that stores information. You can use variables in your VBA code to store such things as numbers, text, and properties. To assign the value in cell A1 on Sheet1 to a variable called *Interest*, use the following VBA statement:

```
Interest = Worksheets("Sheet1").Range("A1").Value
```

- » **Objects have methods.** A *method* is an action Excel performs with an object. For example, one of the methods for a Range object is ClearContents. This aptly named method clears the contents of the range.
- » **You specify a method by combining the object with the method, separated by a dot.** For example, the following statement deletes the value in cell A1 using the ClearContents method:

```
Worksheets("Sheet1").Range("A1").ClearContents
```
- » **VBA includes all the constructs of modern programming languages, including variables, arrays, and looping.** In other words, if you're willing to spend a little time learning the ropes, you can write code that does some incredible things.

Believe it or not, the preceding list pretty much describes VBA. Now you just have to discover the details by reading the rest of the book.

Ensuring Excel Compatibility



REMEMBER

This book is written for the desktop versions of Excel 2019 and Excel 2021. If you don't have one of those versions, there's a slight risk you'll get confused in a few places, but mostly it will just work.

If you plan to distribute your Excel/VBA files to other users, it's vitally important that you understand which versions of Excel they use. People using older versions won't be able to take advantage of features introduced in later versions. For example, if you write VBA code that references cell XFD1048576 (the last cell in a workbook), those who use a version prior to Excel 2007 will receive an error because those pre-Excel 2007 worksheets had only 65,536 rows and 255 columns (the last cell is IV65536).

Excel 2010 and later also have some new objects, methods, and properties. If you use these in your code, users with an older version of Excel will receive an error when they run your macro — and you'll get the blame.

IN THIS CHAPTER

- » Developing a useful VBA macro: A hands-on, step-by-step example
- » Recording your actions by using Excel's macro recorder
- » Examining and running recorded code
- » Changing a recorded macro
- » Dealing with macro security issues

Chapter 2

Building Simple Macros

The best way to get into a cold body of water is to jump right in — no sense prolonging the agony. By wading through this chapter, you can get your feet wet immediately but avoid getting in over your head.

By the time you reach the end of this chapter, you'll start feeling better about this Excel programming business, and you'll be glad you took the plunge. This chapter provides a step-by-step demonstration of how to develop a simple but useful VBA macro.

Displaying the Developer Tab

Before you can call yourself an Excel programmer, you need to learn the secret handshake. That means you need to make a small change so that Excel will display a new tab at the top of the screen: Developer. Getting Excel to display the Developer tab is easy (and you only have to do it once). Just follow these steps:

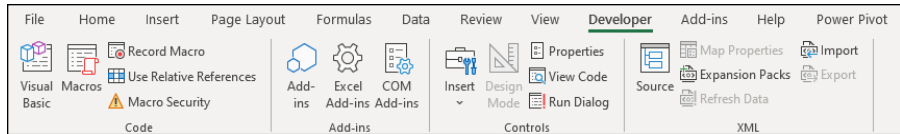
1. **Right-click any part of the Ribbon and choose Customize the Ribbon from the shortcut menu.**
2. **In the Customize Ribbon tab of the Excel Options dialog box, locate Developer in the box on the right.**

3. Put a check mark next to Developer.
4. Click OK.

You're back to Excel with a brand-new tab: Developer.

When you click the Developer tab, the Ribbon displays information that is of interest to programmers (that's you!). Figure 2-1 shows how the Ribbon looks when the Developer tab is selected.

FIGURE 2-1:
The Developer tab is normally hidden, but it's easy to unhide.



Creating a Macro

In this chapter, you create your first macro. The macro that you create does the following:

- » Types your name in a cell
- » Enters the current date and time in the cell below
- » Formats both cells to display bold
- » Changes the font size of both cells to 16 point

This macro won't be winning any prizes for Most Complicated Macro of the Year, but everyone must start somewhere. (And here's a secret: The macros you use the most are the simplest ones.) This macro accomplishes all these steps in a single action. As I describe in the following sections, you start by recording your actions as you go through these steps. Then you test the macro to see whether it works. Finally, you edit the macro to add some finishing touches.

Preparing the Environment

This section describes the steps you take prior to recording the macro. In other words, you need to make a few preparations before the fun begins:

1. **Start Excel, if it's not already running.**
2. **If necessary, create a new, empty workbook.**
Pressing Ctrl+N is a quick way to do that.
3. **Click the Developer tab, and then take a look at the Use Relative References button in the Code group.**

If the color of that button is different from the other buttons, you're in good shape. If the Use Relative References button is the same color as the other buttons, you need to click it to enable this option.

You explore the Relative References button in Chapter 6. For now, just make sure that the option is turned on. When it's turned on, the Use Relative References button is a different color from the other buttons in the group.

Recording a Macro

Here comes the hands-on part. Follow these instructions carefully:

1. **Select a cell.**
Any cell will do.
2. **Choose Developer ⇨ Code ⇨ Record Macro, or click the Macro Recording button on the status bar.**

The Record Macro dialog box appears, as shown in Figure 2-2.

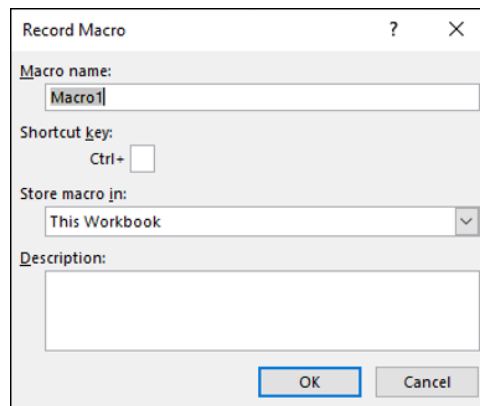


FIGURE 2-2:
The Record Macro dialog box appears when you're about to record a macro.

3. Enter a name for the macro.

Excel provides a default name (something like *Macro1*), but it's better to use a more descriptive name. *NameAndTime* (with no spaces) is a good name for this macro.

4. Click the Shortcut Key box, and enter Shift+N (for an uppercase N) as the shortcut key.



WARNING

Specifying a shortcut key is optional. If you do specify one, you can execute the macro by pressing a key combination — in this case, Ctrl+Shift+N. Be aware that if you assign a common shortcut key (for instance, Ctrl+C), you lose the normal functionality for that shortcut key; Excel will trigger your macro instead.

5. Verify that the Store Macro In setting is This Workbook.

6. (Optional) Enter some text in the Description box.

Some people like to describe what the macro does (or is *supposed* to do).

Figure 2-3 shows the Record Macro dialog box filled in with a name, optional shortcut, and optional description.

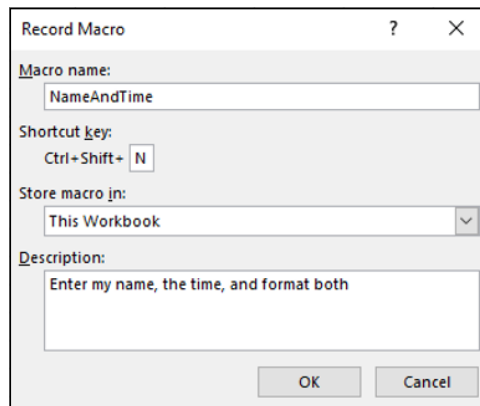


FIGURE 2-3:
The completed Record Macro dialog box.

7. Click OK.

The Record Macro dialog box closes, Excel's macro recorder is turned on, and the Record Macro button's caption is changed to Stop Recording. From this point, Excel monitors everything you do and converts it to VBA code.

8. Type your name in the active cell.

9. Select the cell below and enter this formula:

```
=NOW()
```

The formula displays the current date and time.

10. Select the formula cell, and press Ctrl+C to copy that cell to the Clipboard.

11. Choose Home ⇨ Clipboard ⇨ Paste ⇨ Values (V).

This command converts the formula to its value.

12. Select both the cell with your name and the one with the date and time.

13. Use the controls in the Home ⇨ Font group to change the formatting to Bold and make the font size 16 point.

14. Choose Developer ⇨ Code ⇨ Stop Recording.

The macro recorder is turned off.

Congratulations! You just recorded your first Excel VBA macro. You might want to phone your mother and tell her the good news.

Running the Macro

Once you've finished writing your macro, it's time to see if it actually works. The following are some of the ways to run a macro:

- » Press the shortcut key. If you created a shortcut key sequence for your macro, you can run it by press those keys. For example, in the previous section you assigned Ctrl+Shift+N in the Macro Options dialog. If you hold down Ctrl and Shift, and press N, your macro will insert your name and the date and format them.
- » Choose Developer ⇨ Code ⇨ Macros. This shows the Macro dialog where you can select your macro and click Run.
- » Run it from the VBE. Open the VBE, place the cursor anywhere within your macro, and choose Run ⇨ Run Sub/UserForm from the menu (or press F5).
- » Assign the macro to the Quick Access toolbar. Right-click on the Quick Access toolbar and choose Customize Quick Access Toolbar to show the Excel Options dialog. Choose Macros from the Choose commands from the drop-down dialog box and add your macro. Click OK to close the dialog. Now you can click the tool on the Quick Access toolbar to run the macro.



REMEMBER

For your macro to run, the workbook that contains it must be open. If it's closed, the macro won't show up in the dialog box or in the VBE. The workbook doesn't have to be active, however. You can activate a workbook and run code that's contained in a different workbook. You can also store your macro in the Personal Macro Workbook (see Chapter 6) or in an add-in (see Chapter 21). Those are both types of files that are open in the background.



WARNING

The NameAndTime macro you recorded in the previous section does not warn you if there is already data in the cells you are about to write data to. It's not what you would call production-quality code.

Whatever way you choose to run your macro, run it and make sure it does what you expect it to. If it doesn't, read on to see how to view and edit it.

Viewing a Macro in the Visual Basic Editor

After you record and run a macro, you may be curious to see what the macro looks like. You might even wonder where it's stored.

Excel stores macros in the workbook you indicate when creating the macro. So for the example used in this chapter, the macro is stored in This Workbook. To view macros, however, you need to activate the Visual Basic Editor (VBE, for short).

Follow these steps to see the macro used as an example throughout this chapter:

1. Choose Developer ⇄ Code ⇄ Visual Basic (or press Alt+F11).

The Visual Basic Editor program window appears, as shown in Figure 2-4. This window is highly customizable, so your VBE window may look a bit different. The VBE window contains several other windows, which can be intimidating. Don't fret; you'll get used to it.

2. In the VBE window, locate the Project Explorer.

The Project Explorer contains a list of all workbooks and add-ins that are currently open. Each project is arranged as a *tree* and can be expanded (to show more information) or contracted (to show less information).



TIP

The VBE uses quite a few different windows, any of which can be open or closed. If a window isn't immediately visible in the VBE, you can choose an option from the View menu to display the window. For instance, if the Project Explorer is not visible, you can choose View ⇄ Project Explorer (or press Ctrl+R) to display it. You can display any other VBE window in a similar manner. Chapter 3 covers the components of the VBE.

3. If necessary, expand the project that corresponds to the workbook in which you recorded the macro by clicking the plus sign next to it.

If you haven't saved the workbook, the project is probably called VBAProject (Book1).

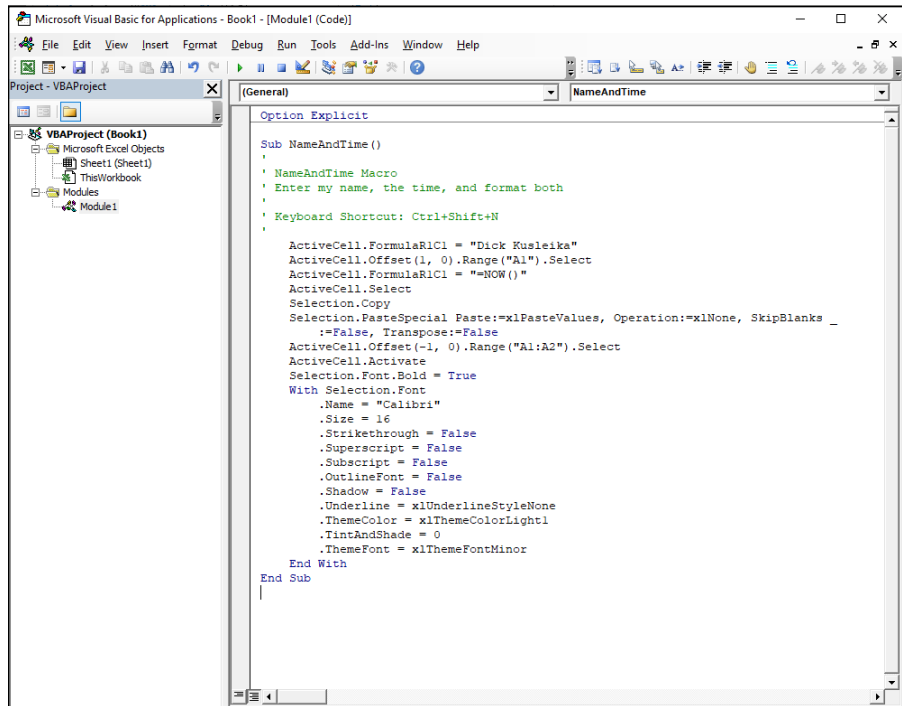


FIGURE 2-4:
The VBE displays
the VBA code in
Module1 of
Book1.

4. Click the plus sign (+) to the left of the folder named Modules.

The tree expands to show Module1, which is the only module in the project.

5. Double-click Module1.

The VBA code in that module is displayed in a Code pane (refer to Figure 2-4).

Your screen may not look exactly the same as Figure 2-4. The code that's recorded depends on the specific actions you made while recording the macro.

At this point, the macro probably might look a bit mysterious. Don't worry. Travel a few chapters down the road, and all will be crystal clear.

The NameAndTime macro consists of several statements. Excel executes the statements one by one, from top to bottom. A statement that's preceded by an apostrophe (') is a comment. Comments are included only for your information and are ignored by Excel. In other words, Excel skips right over comments.

The first VBA statement (which begins with the word *Sub*) identifies the macro as a Sub procedure and gives its name; you provided this name before you started recording the macro. If you read through the code, you might be able to make sense of some of it. You see your name, the formula you entered, and lots of additional code that changes the font. The Sub procedure ends with the End Sub statement.

HEY, I DIDN'T RECORD THAT!

Reviewing the actions you recorded with the macro recorder has the same effect as listening to a voice memo you recorded on your phone. When you play back the voice memo and listen to your own voice, you probably say, “I don’t sound like that.” And when you look at your recorded macro, you might see some actions that you didn’t think you recorded.

For example, if you change only one aspect of the font, such as the font size, the recorded code will show all sorts of font-changing statements (Strikethrough, Superscript, Shadow, and so on). Don’t worry; it happens all the time. Excel often records lots of seemingly useless code. In later chapters, you find out how to remove the extra stuff from a recorded macro.

Modifying the Macro

As you might expect, you not only can view your macro in the VBE, you can change it. You can edit a macro directly in the Code pane like the one you opened in the previous section by double-clicking `Module1`.

You modify a macro by typing new statements or modifying existing statements between the `Sub` and `End Sub` statements. For example, in the `NameAndTime` macro you recorded earlier in this chapter, you could change it to make the font size 18 instead of 16. Find the line `.Size = 16` and change it to:

```
.Size = 18
```

When you use the macro recorder, you don’t have to know a lot of VBA language to be able to find the line you want to change and change it. However, if it’s not as straightforward as the font size example and you’re not sure what to change, you can record a new macro to see what the recorder will generate when you do what you want. Then compare the new macro to the old one, manually edit the old one to look like the new one, and delete what you just recorded.



TIP

Working in a VBA code module is much like working in a word-processing document (except there’s no word wrap, and you can’t format the text). On second thought, it’s more like working in Windows Notepad. You can press `Enter` to start a new line, and the familiar editing keys work as expected.

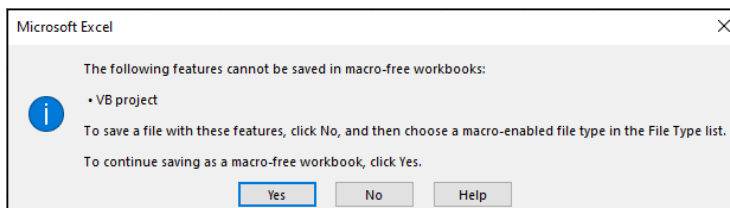
After you make your changes, jump back to Excel and try the revised macro to see how it works. Just as you can press Alt+F11 in Excel to display the VBE, you can press Alt+F11 in the VBE to switch back to Excel.

Saving Workbooks That Contain Macros

If you store one or more macros in a workbook, the file must be saved as a *macro-enabled* file type. In other words, the file must be saved with an XLSM extension rather than the normal XLSX extension.

When you save a workbook that contains a macro, the Excel might try to save it as Excel Workbook (*.xlsx), a format that cannot contain macros. Unless you change the file format to Excel Macro-Enabled Workbook (*.xlsm), Excel displays the warning shown in Figure 2-5. You need to click No and change the file type to Excel Macro-Enabled Workbook (*.xlsm).

FIGURE 2-5: If your workbook contains macros, and you attempt to save it in a macro-free file format, Excel warns you.

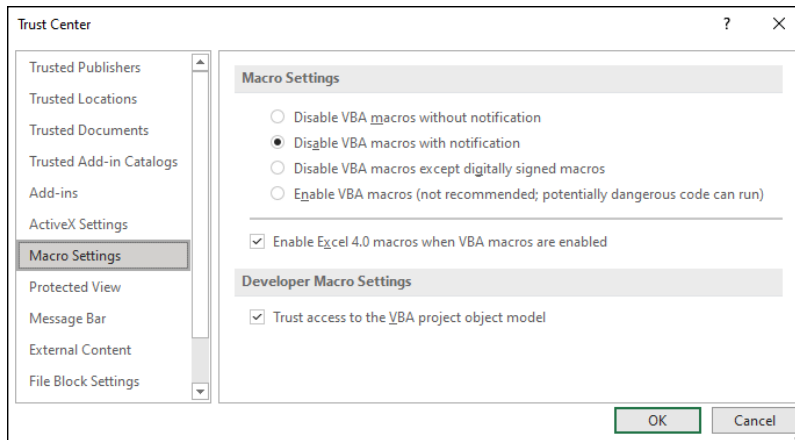


Understanding Macro Security

Macro security is a key feature in Excel. The reason is that VBA is a powerful language — so powerful that it's possible to create a macro that can do serious damage to your computer. A macro can delete files, send information to other computers, and even destroy Windows so that you can't start your system.

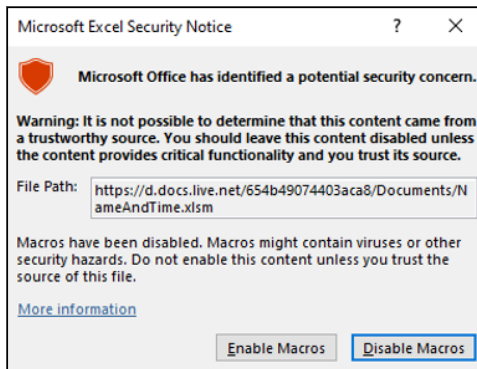
Figure 2-6 shows the Macro Settings section of the Trust Center dialog box. To display this dialog box, choose Developer ⇨ Code ⇨ Macro Security.

FIGURE 2-6:
The Macro
Settings section
of the Trust
Center
dialog box.



By default, Excel uses the Disable All Macros with Notification option. With this setting in effect, if you open a workbook that contains macros (and the file is not digitally “signed” or stored in a trusted location), Excel displays a warning like the one shown in Figure 2-7. If you are certain that the workbook comes from a trusted source, click Enable Macros, and Excel enables the macros.

FIGURE 2-7:
Excel’s warning
that the file to be
opened contains
macros.

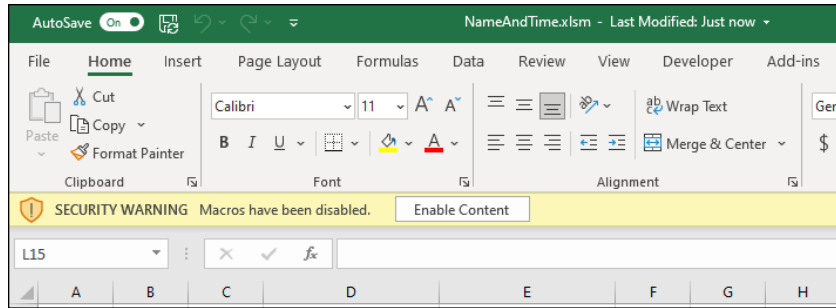


REMEMBER

You see the pop-up box in Figure 2-7 only when the VBE is open. Otherwise, Excel displays an eye-catching Security Warning above the Formula bar, as shown in Figure 2-8. If you know the workbook is safe, click the Enable Content button to enable the macros. To use the workbook without macros, click the X to dismiss the warning.

Excel remembers when you designate a workbook to be safe. So the next time you open the workbook, you won’t see the Security Warning.

FIGURE 2-8: Excel's warning that the workbook just opened contains macros. You see this warning when the VBE isn't open.



Perhaps the best way to handle macro security is to designate one or more folders as *trusted locations*. All the workbooks in a trusted location are opened without a macro warning. You designate trusted folders in the Trusted Locations section of the Trust Center dialog box.

If you want to find out what the other macro security settings mean, press F1 while the Macro Settings section of the Trust Center dialog box is in view and review the Help screen that appears.

2

Employing VBA with Excel

IN THIS PART . . .

See how to access the important parts of the Visual Basic Editor.

Discover VBA code modules (where you store your VBA code).

Obtain an overview of the Excel object model.

Get a crash course in using the Excel macro recorder.

- » Accessing the Visual Basic Editor
- » Discovering the Visual Basic Editor parts
- » Knowing what goes into a VBA module
- » Getting VBA code into a module
- » Customizing the VBA environment

Chapter 3

Working in the Visual Basic Editor

The Visual Basic Editor (VBE) is the main tool for programming in VBA. It's where you view and edit recorded code and write code from scratch. In this chapter, you find out how to work with the VBE, and you get down to the nitty-gritty of writing some VBA code.

Getting to Know the Visual Basic Editor

The *Visual Basic Editor* (often referred to as the *VBE*) is a separate application where you write and edit your VBA macros. Beginning with Excel 2013, when you open multiple workbooks, each opens in a separate window. However, the VBE only ever has one window, and from this window you can write, edit, and view macros for any open workbook.



REMEMBER

You can't run the VBE separately; Excel must be running for the VBE to run.

Activating the VBE

The quickest way to activate the VBE is to press Alt+F11 from an Excel window. To return to Excel, press Alt+F11 again. Or you can simply click the Close button on the VBE's title bar. When the VBE window closes, Excel becomes the active window.

You can also activate the VBE by choosing Developer ⇨ Code ⇨ Visual Basic. If you don't have a Developer tab at the top of your Excel window, refer to Chapter 2, which shows how to get that handy Developer tab to show up.

Exploring VBE components

The VBE contains several windows and is highly customizable. You can hide windows, rearrange windows, dock windows, and more. Figure 3-1 shows the VBE program, with some key parts identified. Your VBE program window probably won't look exactly like what is shown in Figure 3-1, but from the figure, you can at least get a feel for the basic appearance of the VBE.

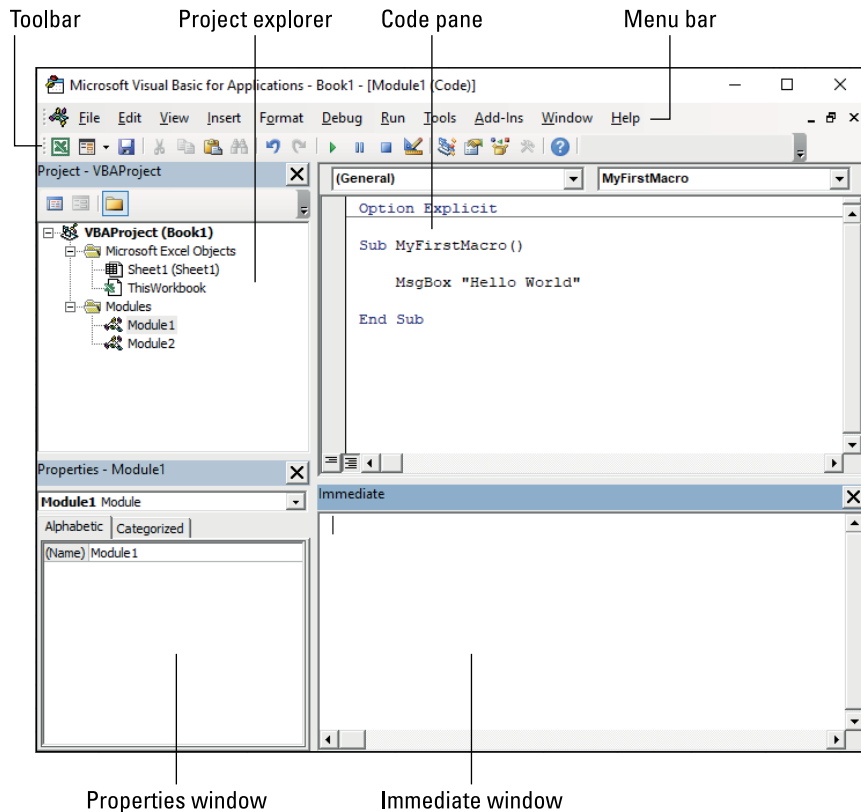


FIGURE 3-1:
The VBE is your customizable friend.

Menu bar

The VBE menu bar contains commands you can use to do things with the various components in the VBE. Many of the menu commands have shortcut keys associated with them.



TIP

The VBE also features shortcut menus. You can right-click virtually anything in the VBE and get a shortcut menu of common commands.

Toolbar

The Standard toolbar, which is directly below the menu bar by default (refer to Figure 3-1), is one of the four VBE toolbars. You can customize the toolbars, move them around, display other toolbars, and more. To do so, choose View⇨ Toolbars, and customize as you see fit. Most people just leave them as they are.

Project Explorer

The Project Explorer displays a tree diagram that shows every workbook currently open in Excel (including add-ins and hidden workbooks). Double-click items to expand or contract them within the outline. See the upcoming “Working with the Project Explorer” section for more detail.

If the Project Explorer is not visible, press Ctrl+R or choose View⇨ Project Explorer. To hide the Project Explorer, click the Close button on its title bar. Or right-click anywhere in the Project Explorer and choose Hide from the shortcut menu.

Code pane

A Code pane is where you put your VBA code. Every object in a project has an associated Code pane. To view an object’s Code pane, double-click the object in the Project Explorer. For example, to view the Code pane for the Sheet1 object in Book1, double-click Sheet1 in the VBAProject for Book1. Unless you’ve added some VBA code, the Code pane is empty.

You find out more about Code panes later in this chapter’s “Working with a Code Pane” section.

Immediate window

The Immediate window may or may not be visible. If it isn’t visible, press Ctrl+G or choose View⇨ Immediate Window. To close the Immediate window, click the Close button on its title bar (or right-click anywhere in the Immediate window and choose Hide from the shortcut menu).

GETTING HELP IN THE VBE

Beginning with Excel 2013, all VBA help information is on the internet and is displayed in your web browser. In other words, you must be connected to the internet to access the Help system. You can, however, download your very own copy of the Help system from Microsoft's site. Do a web search for *download excel VBA documentation*, and you'll find it. Pick the link at microsoft.com and don't worry if the version they have is a few versions older than yours — they don't update it all that often.

The Immediate window is most useful for executing VBA statements directly and for debugging your code. If you're just starting out with VBA, this window won't be all that useful, so feel free to hide it and free up some screen space for other things.

Chapter 13 covers the Immediate window in detail. It may just become your good friend!

Working with the Project Explorer

In the VBE, workbooks are called *projects*. Every workbook contains exactly one project, and every project is associated with exactly one workbook. A project holds all the modules and keeps them neatly in folders that tell you what kind of module it is. There are four kinds of modules, each kind in its own folder:

- » **Microsoft Excel Objects:** These are modules that are linked to user interface elements like workbooks and worksheets. See Chapter 11 for more about these types of modules.
- » **Modules:** Excel calls these simply modules, but everyone else refers to them as standard modules or VBA modules. These contain the code that doesn't go in any of the other three module types.
- » **Forms:** These are modules that have a form user-interface. Chapter 16 provides an introduction to UserForms.
- » **Class Modules:** These are modules where you create your own objects. Class modules are beyond the scope of this book.

You can expand a project by clicking the plus sign (+) at the left of the project's name in the Project Explorer. Collapse a project by clicking the minus sign (–) to the left of a project's name. Or you can double-click a project's name to expand and collapse it.



REMEMBER

If a project is password-protected, the VBE prompts for its password when you double-click the project's name. If you don't know the password, you can't expand the project — which means that you can't view or modify any part of the project.

Figure 3-2 shows a Project Explorer with four projects listed: an add-in named UIHelpers.xlam, a workbook named Book1, a workbook named NumbersToWords.xlsm, and the Personal Macro Workbook (which is always named PERSONAL.XLSB). Of the four, only the NumbersToWords.xlsm project is expanded to show all of its modules.

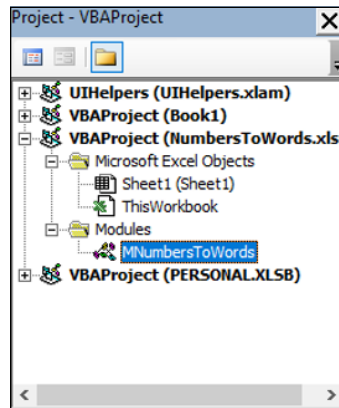


FIGURE 3-2:
This Project Explorer lists projects that can be expanded to show modules.

Every project expands to show at least one folder called *Microsoft Excel Objects*. This folder expands to show an item for each sheet in the workbook (each sheet is considered an object) and another object called *ThisWorkbook* (which represents the Workbook the module lives in). If the project has any VBA modules, the project listing also shows a *Modules* folder. And as you'll find out in Part 4, a project may also contain a folder called *Forms*, which contains UserForm objects (that hold custom dialog boxes).

The concept of objects may be a bit fuzzy for you, but don't worry. Things become much clearer in subsequent chapters. Don't be too concerned if you don't understand what's going on at this point.

Adding a new VBA module

Follow these steps to add a new VBA module to a project:

1. In the VBE, select the project's name in the Project window.
2. Choose **Insert** ⇨ **Module**.

Or

1. **Right-click the project's name.**
2. **Choose Insert ⇨ Module from the shortcut menu.**



TIP

When you record a macro, Excel automatically inserts a VBA module to hold the recorded code. Which workbook holds the module for the recorded macro depends on where you chose to store the recorded macro, just before you started recording.

3. **Choose File ⇨ Import File or press Ctrl+M.**

A dialog box appears that asks for a file.

4. **Locate the file, and click Open.**



REMEMBER

You should import modules only if you know the person who exported them. Otherwise, you risk introducing macros that perform malicious actions. If you're not sure, open it in a text editor to review it first.

Working with a Code Pane

A *code pane* is where you write and edit the code that lives in the module. As you become proficient with VBA, you spend an increasing amount of time working in code panes. To open a code pane and view what's in a module, double-click the module's name in the Project Explorer.

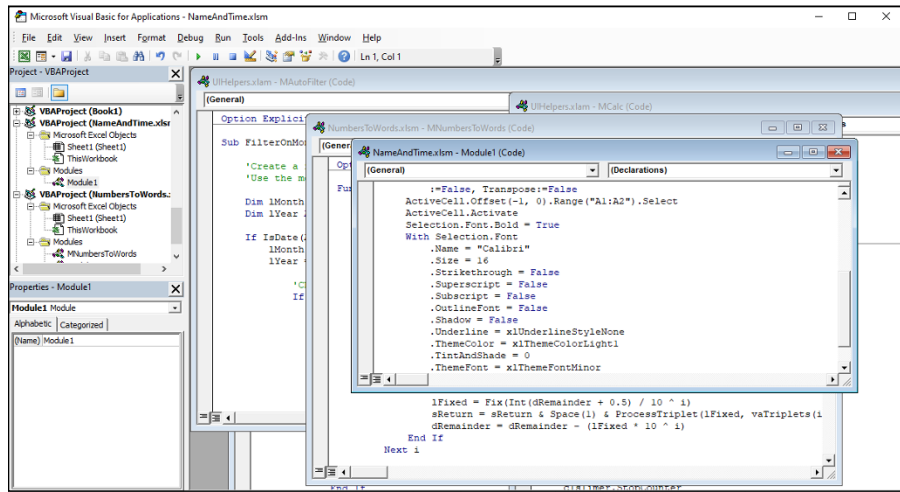
Minimizing and maximizing windows

If you have several projects open, the VBE may have lots of code panes showing at any given time. Figure 3-3 shows an example of the VBE overloaded with code panes.

Code panes are much like workbook windows in Excel. You can minimize them, maximize them, resize them, hide them, rearrange them, and more. Most people find it much easiest to maximize the code pane that they're working on. Doing so lets you see more code and keeps you from getting distracted.

For some tasks, you might want to have two or more code panes visible. For example, you might want to compare the code in two modules, or copy code from one module to another. You can arrange the panes manually, or choose Window ⇨ Tile Horizontally or Window ⇨ Tile Vertically to arrange them automatically.

FIGURE 3-3:
Code pane
overload isn't a
pretty sight.



You can quickly switch among code panes by pressing **Ctrl+Tab**. If you repeat that key combination, you keep cycling through all the open code panes. Pressing **Ctrl+Shift+Tab** cycles through the panes in reverse order.



TIP

Minimizing a code pane gets it out of the way. You can also click the window's Close button (which displays **X**) on a code pane's title bar to close its window. (Closing a window just hides it; you won't lose anything.) To reopen the code pane, double-click the appropriate module in the Project Explorer. By the way, working with these code panes sounds more difficult than it really is.

Looking at the parts of a module

In general, a VBA module can hold three types of code:

- » **Declarations:** One or more information statements that you provide to VBA. For example, you can declare the data type for variables you plan to use or set some other module-wide options. Declarations are basically housekeeping statements. They aren't actually executed.
- » **Sub procedures:** A set of programming instructions that, when executed, performs some action.
- » **Function procedures:** A set of programming instructions that returns a single value (similar in concept to a worksheet function, such as **SUM**).

A single VBA module can store any number of Sub procedures, Function procedures, and declarations. Well, there is a limit — about 64,000 characters per module. It's unlikely you'll even get close to reaching the 64,000-character limit. But if you did, the solution is simple: Just insert a new module.

How you organize a VBA module is completely up to you. Some people prefer to keep all their VBA code for an application in a single VBA module; others like to split the code into several modules. The best practice is to store related procedures in their own modules. For example, you might keep all the procedures that deal with importing and exporting data in a module called ImportExport, all the procedures that deal with formatting cells in a module called Formatting, and all the procedures that deal with printing in a module called Printing. Organizing your code in this manner makes it easier for you and others to understand and, if necessary, modify the code.

Getting VBA code into a module

An empty VBA module is like the fake food you see in the windows of some restaurants; it looks good, but it doesn't really do much for you. Before you can do anything meaningful, you must have some VBA code in the VBA module. You can get VBA code into a VBA module in three ways:

- » Enter the code directly.
- » Use the Excel macro recorder to record your actions and convert those actions to VBA code (see Chapter 6).
- » Copy the code from one module and paste it into another.

Entering code directly

Sometimes, the best route is the most direct one. Entering code directly involves . . . well, typing the code using your keyboard. Entering and editing text in a VBA module works as you might expect. You can select, copy, cut, paste, and drag-and-drop.



TECHNICAL
STUFF

PAUSE FOR A TERMINOLOGY BREAK

Throughout this book, you'll see the terms *Sub procedure*, *routine*, *program*, *procedure*, and *macro*. These terms can be a bit confusing. Programming folks usually use the word *procedure* to describe an automated task. Technically, a procedure can be a Sub procedure or a Function procedure — both of which are sometimes called *routines* — or even *programs*. All these terms can be used interchangeably. As detailed in later chapters, however, an important distinction exists between Sub and Function procedures. For now, don't worry about the programming terminology. Just try to understand the concepts.

Use the Tab key to indent some of the lines to make your code easier to read. Indenting isn't necessary, but it's a good habit to acquire. As you study the code in this book, you'll understand why indenting code lines is helpful.



REMEMBER

A single line of VBA code can be as long as you need it to be. However, you might want to use the line-continuation characters to break up lengthy lines of code. To continue a single line of code (also known as a *statement*) from one line to the next, end the first line with a space followed by an underscore (_). Then continue the statement on the next line. And don't forget the space. An underscore character that's not preceded by a space won't do the job.

Here's an example of a single statement split into three lines:

```
Selection.Sort Key1:=Range("A1"), _  
    Order1:=xlAscending, Header:=xlGuess, _  
    Orientation:=xlTopToBottom
```

This statement would perform exactly the same way if it were entered in a single line (with no line-continuation characters). Notice that the second and third lines of this statement are indented. Indenting is optional, but it helps you see that these lines are not separate statements.



TIP

The white-coated engineers who designed the VBE anticipated that people like us would make mistakes. Therefore, the VBE has multiple levels of undo and redo buttons. If you deleted a statement that you shouldn't have, click the Undo button on the toolbar (or press Ctrl+Z) until the statement shows up again. After undoing, you can click the Redo button to perform the changes you've undone. Are you ready to enter some real-live code? Try the following steps:

1. **Create a new workbook in Excel.**
2. **Press Alt+F11 to activate the VBE.**
3. **Click the new workbook's name in the Project Explorer.**
4. **Choose Insert ⇨ Module to insert a VBA module into the project.**
5. **Type the following code in the module:**

```
Sub GuessName()  
    Msg = "Is your name " & Application.UserName & "?"  
    Ans = MsgBox(Msg, vbYesNo)  
    If Ans = vbNo Then MsgBox "Oh, never mind."  
    If Ans = vbYes Then MsgBox "I must be psychic!"  
End Sub
```

6. Position the cursor anywhere within the text you typed and press F5 to execute the procedure.

F5 is a shortcut for Run → Run Sub/UserForm. If you entered the code correctly, Excel executes the procedure, and you can respond to the simple dialog box shown in Figure 3-4. The text in the dialog box that appears on your screen will differ, of course, from the text shown in the figure.

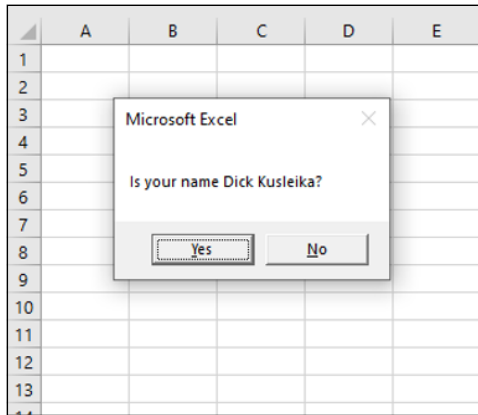


FIGURE 3-4: The GuessName procedure displays this dialog box.

When you enter the code listed in Step 5, you might notice that the VBE makes some adjustments to the text you enter. For example, after you type the Sub statement, the VBE automatically inserts the End Sub statement. And if you omit the space before or after an equal sign, the VBE inserts the space for you. Also, the VBE changes the color and capitalization of some text. This is all perfectly normal. It's just the VBE's way of keeping things neat and readable.

COMPILE ERROR?

There's a chance that the GuessName macro won't work. When you try to run it, Excel may complain and pop up an error message: `Compile Error: Variable Not Defined`. Don't worry; there's an easy fix for that.

If you receive that error, look at the top of your module, and you'll see this text: `Option Explicit`. Just delete that line, and the macro should work. That line, when present at the top of a module, means that you must "declare" all your variables. (See Chapter 7 for more about variables.) If that line was added, it means that your VBE is set up to add the line automatically. For now, don't worry about it. Delete the line, and forget about the rude interruption.

If you followed the previous steps, you just wrote a VBA Sub procedure, also known as a *macro*. When you press F5, Excel executes the code and follows the instructions. In other words, Excel evaluates each statement and does what you told it to do. (Don't let this newfound power go to your head.) You can execute this macro any number of times — although it tends to lose its appeal after a few dozen times.

For the record, the following concepts were used to create this simple macro, all of which are covered later in this book:

- » Defining a Sub procedure (the first line)
- » Assigning values to variables (Msg and Ans)
- » *Concatenating* (joining) a string (using the & operator)
- » Using a built-in VBA function (MsgBox)
- » Using built-in VBA constants (vbYesNo, vbNo, and vbYes)
- » Using an If-Then construct (twice)
- » Ending a Sub procedure (the last line)

Not bad for a beginner, eh?

Using the macro recorder

Another way you can get code into a VBA module is by recording your actions, using the Excel macro recorder. If you worked through the hands-on exercise in Chapter 2, you already have some experience with this technique.



REMEMBER

By the way, there is absolutely no way you can record the `GuessName` procedure shown in the preceding section. You can record only things that you can do directly in Excel. Displaying a message box is not in Excel's normal repertoire. (It's a VBA thing.) The macro recorder is useful, but in many cases, you'll probably need to enter at least some code manually.

Here's a step-by-step example that shows how to record a macro that inserts a new worksheet and hides all but the first 10 rows and all but the first 10 columns. If you want to try this example, follow these steps:

- 1. Open a new, blank workbook.**
- 2. Click the Developer tab, and make sure that Use Relative References is *not* highlighted.**

This macro is recorded using Absolute References.

3. Choose Developer ⇨ Code ⇨ Record Macro, or click the icon next to the Ready indicator on the left end of the status bar.

Excel displays its Record Macro dialog box.

4. In the Record Macro dialog box, name the macro TenByTen, specify that you want the macro stored in This Workbook, and press Shift+T for the shortcut key.

The macro can be executed when you press Ctrl+Shift+T.

5. Click OK to start recording.

Excel automatically inserts a new VBA module into the project that corresponds to the active workbook. From this point on, Excel converts your actions to VBA code. While you're recording, the icon in the status bar turns into a small square, which is a reminder that the macro recorder is running. You can also click that icon to stop the macro recorder.

6. Click the New Sheet icon to the right of the last sheet tab.

Excel inserts a new worksheet.

7. Select the entire Column K (the 11th column) and press Ctrl+Shift+right arrow; then right-click any selected column and choose Hide from the shortcut menu.

Excel hides all the selected columns.

8. Select the entire Row 11 and press Ctrl+Shift+down arrow; then right-click any selected row and choose Hide from the shortcut menu.

Excel hides all the selected rows.

9. Select cell A1.

10. Choose Developer ⇨ Code ⇨ Stop Recording, or click the Stop Recording button on the status bar (the small square).

Excel stops recording your actions.

To view this newly recorded macro, press Alt+F11 to activate the VBE. Locate the workbook's name in the Project Explorer. You see that the project has a new module listed. The name of the module depends on whether you had any other modules in the workbook when you started recording the macro. If you didn't, the module is named Module1. You can double-click the module to view the code.

Here's the code generated by your actions:

```
Sub TenByTen()  
'  
' TenByTen Macro  
'  
' Keyboard Shortcut: Ctrl+Shift+T  
'  
  
    Sheets.Add After:=ActiveSheet  
    Columns("K:K").Select  
    Range(Selection, Selection.End(xlToRight)).Select  
    Selection.EntireColumn.Hidden = True  
    Rows("11:11").Select  
    Range(Selection, Selection.End(xlDown)).Select  
    Selection.EntireRow.Hidden = True  
    Range("A1").Select  
End Sub
```

To try this macro, activate any worksheet and press the shortcut key that you assigned in Step 4: Ctrl+Shift+T.

If you didn't assign a shortcut key to the macro, don't worry. Here's how to display a list of all macros available and run the one you want:

1. Choose Developer ⇨ Code ⇨ Macros.

Keyboard fans can press Alt+F8. Either of these methods displays a dialog box that lists all the available macros.

2. Select the macro in the list (in this case, TenByTen).

3. Click the Run button.

Excel executes the macro, and you get a new worksheet with 10 visible rows and 10 visible columns.

You can execute any number of commands and perform any number of actions while the macro recorder is running. Excel dutifully translates your mouse actions and keystrokes to VBA code.

And, of course, you can also edit the macro after you record it. To test your new skills, try editing the macro so that it inserts a worksheet with nine visible rows and columns — perfect for a Sudoku puzzle.

Copying VBA code

The final method for getting code into a VBA module is to copy it from another module or from some other place (such as a website). For example, a Sub or Function procedure that you write for one project might also be useful in another project. Instead of wasting time reentering the code, you can activate the module and use the normal Clipboard copy-and-paste procedures. (You can use the keyboard shortcuts Ctrl+C to copy and Ctrl+V to paste.) After pasting the code into a VBA module, you can modify the code if necessary.



TIP

By the way, you can find lots of VBA code examples on the web. If you want to try them, select the code in your browser and press Ctrl+C to copy it. Then activate a module and press Ctrl+V to paste it.

When you copy code from a website, it sometimes requires some fixing. For example, quote characters may be “smart quotes” and they must be converted to simple quote characters. And sometimes, long lines wrap around. Erroneous statements are easy to spot in the VBE because they appear in red.

Customizing the VBE

If you're serious about becoming an Excel programmer, you'll spend a lot of time with VBA modules on your screen. To help make things as comfortable as possible (no, please keep your shoes on), the VBE provides quite a few customization options.

When the VBE is active, choose Tools ⇨ Options. You'll see a dialog box with four tabs: Editor, Editor Format, General, and Docking. The sections that follow discuss the most useful options of those contained in each tab.

Using the Editor tab

Figure 3-5 shows the options you can access by clicking the Editor tab of the Options dialog box. Use the following options in the Editor tab to control how certain things work in the VBE.

- » **Auto Syntax Check option:** The Auto Syntax Check setting determines whether the VBE pops up a dialog box if it discovers a syntax error while you're entering your VBA code. The dialog box tells roughly what the problem is. If you don't choose this setting, the VBE flags syntax errors by displaying them in a different color from the rest of the code, and you don't have to deal with any dialog boxes popping up on your screen.

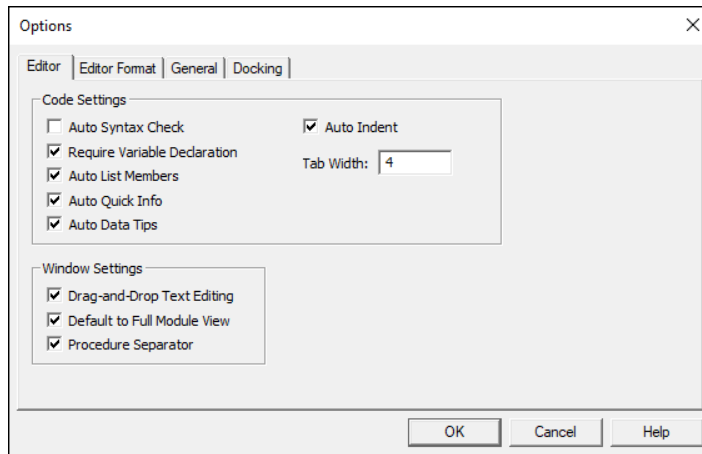


FIGURE 3-5:
The Editor tab of
the Options
dialog box.

- » **Require Variable Declaration option:** If the Require Variable Declaration option is set, VBE inserts the following statement at the beginning of each new VBA module you insert:

```
Option Explicit
```

Changing this setting affects only new modules, not existing modules. If this statement appears in your module, you must explicitly define each variable you use. Chapter 7 goes into the details why you should develop this habit.

- » **Auto List Members option:** If the Auto List Members option is set, the VBE provides some help when you're entering your VBA code. It displays a list that would logically complete the statement you're typing. This bit of magic is sometimes called *IntelliSense*. It helps you write code more quickly and accurately, making it one of the best features of the VBE. Figure 3-6 shows an example (which will make lots more sense when you start writing VBA code).

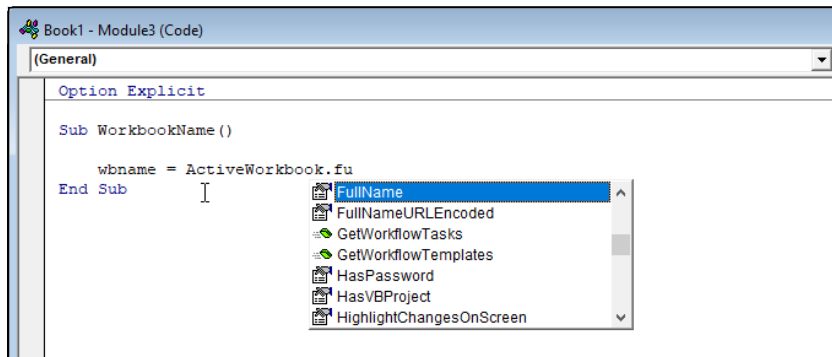


FIGURE 3-6:
An example of
Auto List
Members.

- » **Auto Quick Info option:** If the Auto Quick Info option is set, the VBE displays information about functions and their arguments as you type, which can be very helpful. Figure 3-7 shows this feature in action, telling you about the arguments for the MsgBox function.

The screenshot shows the VBA Editor window titled 'Book1 - Module3 (Code)'. The 'General' tab is selected. The code in the editor is as follows:

```
Option Explicit

Sub WorkbookName ()

    wfname = ActiveWorkbook.FullName
    msgbox
End Sub
```

A yellow tooltip is displayed over the `Msgbox` function call, showing its arguments: `Msgbox(Prompt, [Buttons As VbMsgBoxStyle = vbOKOnly], [Title], [HelpFile], [Context]) As VbMsgBoxResult`.

FIGURE 3-7: Auto Quick Info offers help about the MsgBox function.

- » **Auto Data Tips option:** If the Auto Data Tips option is set, the VBE displays the value of the variable over which your cursor is placed when you're debugging code. When you enter the wonderful world of debugging, as described in Chapter 13, you'll appreciate this option.
- » **Auto Indent setting:** The Auto Indent setting determines whether the VBE automatically indents each new line of code the same as the previous line.



TIP

Use the Tab key to indent your code, not the spacebar. Also, you can press Shift+Tab to “unindent” a line of code. If you want to indent more than just one line, select all the lines you want to indent. Then press the Tab key.



TIP

The VBE's Edit toolbar (which is hidden by default) contains two useful buttons: Indent and Outdent. These buttons let you quickly indent or “unindent” a block of code. Select the code and click one of these buttons to change the block's indenting.

- » **Tab Width:** Determines how wide your tab characters are in the equivalent number of spaces.
- » **Drag-and-Drop Text Editing option:** The Drag-and-Drop Text Editing option, when enabled, lets you move or copy and paste text by dragging and dropping with your mouse.
- » **Default to Full Module View option:** The Default to Full Module View option sets the default state for new modules. (It doesn't affect existing modules.) If this option is set, procedures in the code pane appear as a single scrollable list. If this option is turned off, you can see only one procedure at a time.

» **Procedure Separator option:** When the Procedure Separator option is turned on, separator bars appear between procedures in a code pane.

Using the Editor Format tab

Figure 3-8 shows the Editor Format tab of the Options dialog box. With this tab, you can customize the way the VBE looks.

» **Code Colors option:** The Code Colors option lets you set the text color and background color displayed for various elements of VBA code. This is largely a matter of personal preference.

» **Font option:** The Font option lets you select the font that's used in your VBA modules. For best results, stick with a fixed-width font such as Courier New. In a *fixed-width font*, all characters are exactly the same width. This makes your code more readable because the characters are nicely aligned vertically, and you can easily distinguish multiple spaces (which is sometimes useful).

» **Size setting:** The Size setting specifies the point size of the font in the VBA modules. This setting is a matter of personal preference determined by your video display resolution and how many carrots you've been eating.

» **Margin Indicator Bar option:** This option controls the display of the vertical margin indicator bar in your modules. You should keep this turned on; otherwise, you won't be able to see the helpful graphical indicators when you're debugging your code.

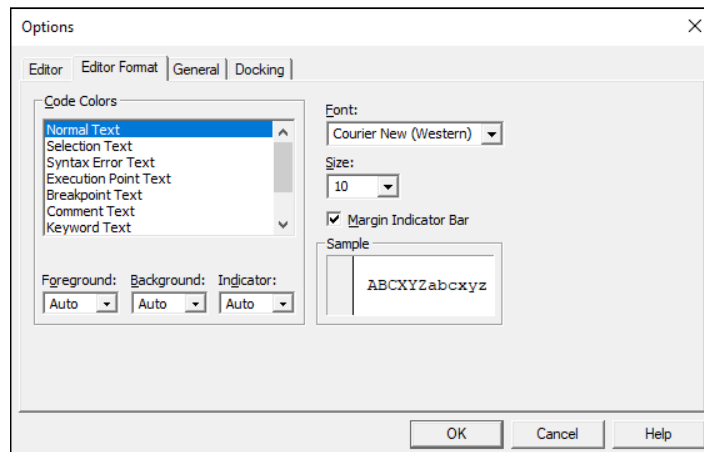


FIGURE 3-8: Change how the VBE looks with the Editor Format tab.

Using the General tab

Figure 3-9 shows the options available on the General tab of the Options dialog box. In almost every case, the default settings are just fine.

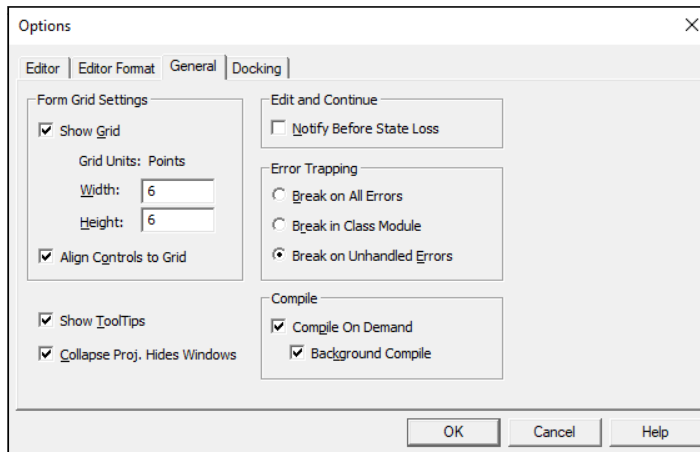


FIGURE 3-9:
The General tab
of the Options
dialog box.

The most important setting is Error Trapping. It's considered a best practice not to use the Break on All Errors setting. If you use this setting, your error-handling code won't work. You can read more about this in Chapter 12.

If you're really interested in these options, click the Help button for details.

Using the Docking tab

Figure 3-10 shows the Docking tab. These options determine how the various windows in the VBE behave. When a window is *docked*, it's fixed in place along one of the edges of the VBE program window. This makes it much easier to identify and locate a particular window. If you turn off all docking, you have a big, confusing mess of windows. Generally, the default settings work fine.



REMEMBER

Sometimes, the VBE seems to have a mind of its own when you're trying to dock a window. If docking doesn't seem to work correctly, try double-clicking the title bar of the window.

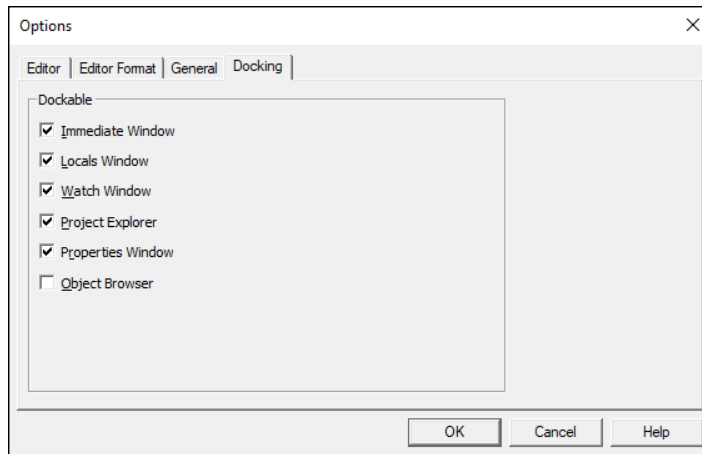


FIGURE 3-10:
The Docking tab
of the Options
dialog box.

- » Learning the Excel Object Model and its hierarchy
- » Understanding how to access properties and methods
- » Discovering resources to help you code

Chapter 4

Introducing the Excel Object Model

The purpose of Excel VBA is to manipulate Excel. Some of the code you write will be VBA language constructs — aspects of the language that are common to all programming languages. The rest of the code you write will be specific to Excel. In this chapter, you learn about the Excel Object Model. The object model is the gateway into all the objects that make up Excel. Manipulating these objects is what Excel VBA programming is all about.

Working with the Excel Object Model

The Excel Object Model is computer code that Microsoft wrote that defines how VBA interacts with Excel. In it, Microsoft has defined hundreds of objects whose names you would recognize as elements of the Excel user interface, like Workbook, Worksheet, or PivotTable. An object is nothing more than computer code that defines properties, methods, and events. It is the unique combination of properties, methods, and events that defines an object. Properties and methods are discussed later in this chapter and events are discussed in Chapter 11.

A car is an object. It has properties like color and number of pistons. If you change the color or the number of pistons, you have a different car, but it's still a car. Cars have methods like accelerate and brake. Excel objects are a little more abstract. For example, a Worksheet is an object. It has properties like Name and Visible that you can change to rename or hide the worksheet. It has methods like Activate that you can invoke to make it the active worksheet. You can change the properties of a Worksheet object to make it the Worksheet you want, but it's still a Worksheet because it has that unique set of properties and methods.

Excel's object model is arranged as a hierarchy. That is, every object is organizationally a parent or a child of another object, like a family tree. There's no magic to the hierarchy; it's just how Microsoft designed it. But you won't be surprised to learn that it mostly mirrors what you see in the user interface. Worksheet objects are children of a Workbook object just like how workbooks hold worksheets in Excel. A Worksheet object is the parent of a PivotTable object because PivotTables exist on sheets in Excel.

Understanding the object hierarchy

The Application object is at the very top of the hierarchy in the object model. It represents Excel itself and every other object is a child or grandchild of the Application object. The following are some of the more useful objects contained just below Application in the hierarchy:

- » Addin
- » Window
- » Workbook
- » WorksheetFunction

Each object contained in the Application object can contain other objects. For example, the following are some objects that can be contained in a Workbook object:

- » Chart (which is a chart sheet)
- » Name
- » VBProject
- » Window
- » Worksheet

In turn, each of these objects can contain still other objects. Consider a Worksheet object, which is contained in a Workbook object, that is contained in the Application object. Some of the objects that can be contained in a Worksheet object are

- » Comment
- » Hyperlink
- » Name
- » PageSetup
- » PivotTable
- » Range



TIP

If you want to do something with a range on a particular worksheet, you might find it helpful to visualize that range in the following manner:

Range ⇄ contained in Worksheet ⇄ contained in Workbook ⇄ contained in Excel



TIP

Excel has more objects than you can shake a stick at. Even power users would get overwhelmed if they tried to learn every object in the object model. The good news is that you don't have to do anything with most of these objects. You could go your whole VBA programming life and never need to use the `Excel4MacroSheet` object. You only need to know the objects for the problem your working on and most of the time the macro recorder tells you everything you need.

Referring to objects

Referring to an object is important because you must identify the object with which you want to work. After all, VBA can't read your mind — yet. The Application object, being the top dog, is easy. Just type `Application` and a period (called a dot operator) to get to its properties and methods. For example, if you wanted to change Excel's behavior so that the cursor doesn't move when you press Enter, you could write the following code:

```
Application.MoveAfterReturn = False
```

Some of the Application object's properties return other objects. Just like the `MoveAfterReturn` property return a value (either `True` or `False`), a property can also return an object. `AutoCorrect` is an object in the object model that's just below the Application object. The way you refer to the `AutoCorrect` object is by using the `AutoCorrect` property. Yes, the property and the object it returns have the same

name. If you want to tell Excel to fix your typing when you leave Caps Lock on, you would do so with the following code:

```
Application.AutoCorrect.CorrectCapsLock = True
```

In this case, `CorrectCapsLock` is a property of the `AutoCorrect` object and you are able to address that object via the `AutoCorrect` property of the `Application` object.

In the previous section, I wrote that cars are similar to Excel objects because they have properties like color and number of pistons. Cars also have steering wheels and steering wheels are objects, too. They're just one rung down the car object hierarchy. If a car were a computer program, it would have a property called `SteeringWheel` that you would use to access the `SteeringWheel` object.



Workbook names also have a dot to separate the filename from the extension (for example, `Book1.xlsx`). That's just a coincidence. The dot in a filename has nothing at all to do with the dot operator referred to a few paragraphs ago.

Using Collection objects

Now you can work with the `Application` object and any object that's just below it via one of its properties. To get another level below that you need collection objects.

Collection objects are objects that give you access to single objects contained inside them. In many cases, the collection object's name is the plural of the single object's name. For example, if you want to work with a specific `Workbook` object, you need to go through the `Workbooks` collection object to get there.

Here are a few examples of commonly used collections:

- » **Workbooks:** A collection of all currently open `Workbook` objects
- » **Worksheets:** A collection of all `Worksheet` objects contained in a particular `Workbook` object
- » **Charts:** A collection of all `Chart` objects (chart sheets) contained in a particular `Workbook` object
- » **Sheets:** A collection of all sheets (regardless of their type) contained in a particular `Workbook` object. To get to a `Workbook` object, you can start with the `Application` object like in the following code:

```
Application.Workbooks.Item("Book1").Path
```

Just like `Application` had an `AutoCorrect` property to get to the `AutoCorrect` object, it has a `Workbooks` property to get to the `Workbooks` collection object. All collection objects have an `Item` property to get to a singular instance of an object they collect. In this example, the `Item` property returns a `Workbook` object because that's the type of object in the `Workbook` collection.

A collection's `Item` property takes one argument. That argument can be a string (enclosed in double quotes) or an integer. If you provide a string argument, `Item` returns an object whose name matches the string. In the example above, `Book1` is the name of the workbook returned. If you provide an integer argument, `Item` returns the object whose position in the collection matches that number. The following code returns the first worksheet of the second workbook:

```
Application.Workbooks.Item(2).Worksheets.Item(1)
```

You might not always know how the objects are ordered in the collection. With worksheets, they are ordered the same way as in Excel. The left-most worksheet is the first worksheet in the collection. But workbooks aren't so straightforward. There are hidden workbooks like Add-Ins and the Personal Macro Workbook that are in the collection but not visible in Excel.

Considering generic collection objects

The `Workbooks` object contains `Workbook` objects and the `Worksheets` object contains `Worksheet` objects. It all seems very clean and simple. But there also collection objects that contain objects that are similar but not exactly the same. The example of this type of object that you'll see most often is the `Sheets` collection object. The `Sheets` object contains both `Worksheet` objects and `Chart` objects. Sometimes you want to work with every sheet in a workbook regardless of its type. In that case, you would use the `Sheets` object to get at both types of sheets. The following example demonstrates how to access a worksheet named `Sheet1` using either the `Worksheets` object or the `Sheets` object:

```
Application.Workbooks.Item(1).Worksheets.Item("Sheet1")  
Application.Workbooks.Item(1).Sheets.Item("Sheet1")
```

Simplifying object references

All the examples in this section so far have been fully qualified references. A fully qualified reference starts with the `Application` object and traverses the hierarchy all the way down to the object you want. They are unambiguous, but if you were required to fully qualify every object reference you make, your code would be quite long, more difficult to read, and your keyboard would wear out too fast. Fortunately, Excel provides some shortcuts that can improve the readability and save you some typing.

For starters, objects have default properties. If you want to use the default property, you don't have to type and VBA will know what you mean. The star of the default property show is the Item property. Item is the default property for every collection object making the following code equivalent:

```
Application.Workbooks.Item("Book1.xlsx").Worksheets.Item(2).Range("A1").Value  
Application.Workbooks("Book1.xlsx").Worksheets(2).Range("A1").Value
```

While it's important to understand the object hierarchy and how the Item property works, you almost never see Item used in code.

The next shortcut is that the Application object is always assumed. There are only a few cases when it makes sense to type it. Omitting the Application object reference shortens the example from the previous section to

```
Workbooks("Book1.xlsx").Worksheets(2).Range("A1").Value
```

That's a pretty good improvement. But wait, there's more. If you're sure that Book1.xlsx is the active workbook, you can omit that reference, too. Now you're down to

```
Worksheets(2).Range("A1").Value
```

Finally, you're getting somewhere. Have you guessed the next shortcut? That's right. If you know the second worksheet is the currently active worksheet, Excel assumes that reference and allows you to just type

```
Range("A1").Value
```



REMEMBER

Contrary to what some people may think, Excel does not have a Cell object. A *cell* is simply a Range object that consists of just one element.

The shortcuts described here are great, but they can be dangerous. What if you only *think* Book1.xlsx is the active workbook? You could get an error, or worse, you could get the wrong value and not even realize it's wrong. For that reason, it's often best to qualify your object references enough to be safe. You almost never need the Application object in your reference, but you may need the Workbook object.

Chapter 14 discusses the With-End With structure, which helps you fully qualify your references but also helps to make the code more readable and cuts down on the typing. The best of both worlds!

Diving into Object Properties and Methods

Although knowing how to refer to objects is important, you can't do anything useful by simply referring to an object (as in the examples in the preceding sections). To accomplish anything meaningful, you must do one of two things:

- » Read or modify an object's *properties*.
- » Call a *method* of action to be used with an object.



TECHNICAL
STUFF

A FAST-FOOD TAKE ON OBJECTS, PROPERTIES, AND METHODS

Here's an analogy comparing Excel to a fast-food chain that may help you understand the relationships among objects, properties, and methods in VBA.

The basic unit of Excel is a Workbook object. In a fast-food chain, the basic unit is an individual restaurant. With Excel, you can add a workbook and close a workbook, and all the open workbooks are known as Workbooks (a collection of Workbook objects). Similarly, the management of a fast-food chain can add a restaurant and close a restaurant, and all the restaurants in the chain can be viewed as the Restaurants collection (a collection of Restaurant objects).

An Excel workbook is an object, but it also contains other objects such as worksheets, chart sheets, VBA modules, and so on. Furthermore, each object in a workbook can contain its own objects. For example, a Worksheet object can contain Range objects, PivotTable objects, Shape objects, and so on.

Continuing with the analogy, a fast-food restaurant (like a workbook) contains objects such as the Kitchen, DiningArea, and Tables (a collection). Furthermore, management can add or remove objects from the Restaurant object. For example, management may add more tables to the Tables collection. Each of these objects can contain other objects. For example, the Kitchen object has a Stove object, VentilationFan object, Chef object, Sink object, and so on.

So far, so good. This analogy seems to work.

Excel's objects have properties. For example, a Range object has properties such as Value and Address, and a Shape object has properties such as Width, Height, and so on. Not surprisingly, objects in a fast-food restaurant also have properties. The Stove object,

(continued)

(continued)

for example, has properties such as Temperature and NumberofBurners. The VentilationFan has its own set of properties (TurnedOn, RPM, and so on).

Besides properties, Excel's objects also have methods, which perform an operation on an object. For example, the ClearContents method erases the contents of a Range object. An object in a fast-food restaurant also has methods. You can easily envision a ChangeThermostat method for a Stove object or a SwitchOn method for a VentilationFan object.

In Excel, methods sometimes change an object's properties. The ClearContents method for a Range changes the Range's Value property. Similarly, the ChangeThermostat method on a Stove object affects its Temperature property. With VBA, you can write procedures to manipulate Excel's objects. In a fast-food restaurant, the management can give orders to manipulate the objects in the restaurants ("Turn the stove on and switch the ventilation fan to high").

The next time you visit your favorite fast-food joint, just say, "Use the Grill method on a Burger object with the Onion property set to False."

Setting object properties

Every object has properties. You can think of *properties* as characteristics that describe the object. An object's properties determine how it looks, how it behaves, and even whether it's visible. Using VBA, you can do two things with an object's properties:

- » Examine the current setting for a property.
- » Change the property's setting.

For example, a single-cell Range object has a property called Value. The Value property stores the value contained in the cell. You can write VBA code to display the Value property, or you can write VBA code to set the Value property to a specific value. The following macro uses the VBA built-in MsgBox function to bring up a box that displays the value in cell A1 on Sheet1 of the active workbook (see Figure 4-1):

```

Sub ShowValue()
    Contents = Worksheets("Sheet1").Range("A1").Value
    MsgBox Contents
End Sub

```

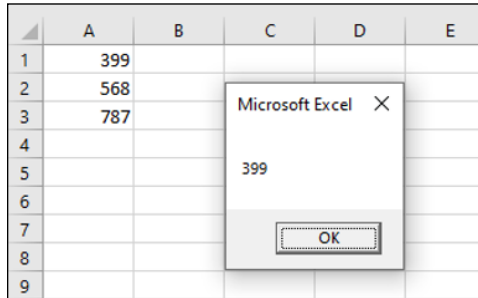


FIGURE 4-1:
This message box displays a Range object's Value property.



TIP

MsgBox is a very useful function. You can use the MsgBox function, for example, to display results while Excel executes your VBA code. You find out more about this function in Chapter 15, so be patient (or flip ahead and read all about it).

The code in the preceding example displays the current setting of a cell's Value property. What if you want to change the setting for that property? The following macro changes the value in cell A1 by changing the cell's Value property:

```

Sub ChangeValue()
    Worksheets("Sheet1").Range("A1").Value = 994.92
End Sub

```

After Excel executes this procedure, cell A1 on Sheet1 of the active workbook contains the value 994.92. If the active workbook doesn't have a sheet named Sheet1, the result of executing that macro is an error message. VBA just follows instructions, and it can't work with a sheet that doesn't exist.

Each object has its own set of properties, although some properties are common to many objects. For example, many (but not all) objects have a Visible property. Most objects also have a Name property.

Some object properties are read-only properties, which means that your code can get the property's value, but it can't change it. For example, a Workbook object has a Name property that returns the workbook's name. You can't change the Name property directly because it's read-only. To change a workbook's name, you must use the Save or SaveAs methods.



REMEMBER

A collection is also an object. This means that a collection also has properties. For example, you can determine how many workbooks are open by accessing the Count property of the Workbooks collection. The following VBA procedure displays a message box that tells you how many workbooks are open:

```
Sub CountBooks()  
    MsgBox Workbooks.Count  
End Sub
```

For more about collections, see the previous section, “Referring to objects.”

Taking action with object methods

In addition to properties, objects have methods. A *method* is an action you perform with an object. A method can change an object’s properties or make the object do something.

This simple example uses the ClearContents method on a Range object to erase the contents of 12 cells on the active sheet:

```
Sub ClearRange()  
    Range("A1:A12").ClearContents  
End Sub
```

Some methods take one or more arguments. An *argument* is a value that further specifies the action to perform. You place the arguments for a method after the method, separated by a space. Multiple arguments are separated by a comma.

The following example activates Sheet1 (in the active workbook) and then copies the contents of cell A1 to cell B1 by using the Range object’s Copy method. In this example, the Copy method has one argument, which is the destination range for the copy operation:

```
Sub CopyOne()  
    Worksheets("Sheet1").Activate  
    Range("A1").Copy Range("B1")  
End Sub
```

Notice that the worksheet reference is omitted when referring to the Range objects. You can do this safely due to the statement to activate Sheet1 (using the Activate method).

Another way to specify an argument for a method is to use the official name of the argument followed by a colon and an equal sign. Using named arguments is optional, but doing so can often make your code easier to understand, particularly if the method takes many parameters. The second statement in the CopyOne procedure could be written like this:

```
Range("A1").Copy Destination:=Range("B1")
```

Figure 4-2 shows the little prompt that appears as I type a statement. That prompt indicates the official name of the argument.

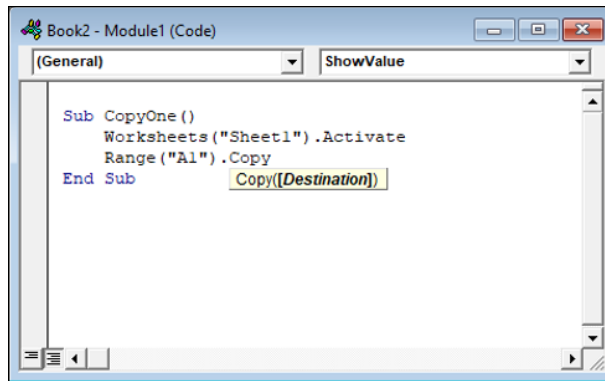


FIGURE 4-2:
The VBE displays a list of arguments while you type.

Because a collection is also an object, collections have methods. The following macro uses the Add method for the Workbooks collection:

```
Sub AddAWorkbook()  
    Workbooks.Add  
End Sub
```

As you might expect, this statement creates a new workbook. In other words, it adds a new workbook to the Workbooks collection. After you execute this macro, a fresh workbook is the active workbook.

Triggering actions with object events

This section briefly touches on one more topic that you need to know about: events. *Events* are specific things that you do inside Excel that Excel is constantly listening for (such as switching sheets or changing cells). For example, when you type a value into a cell, a Worksheet Change event occurs. You could, for example, have a VBA macro that is designed to execute whenever someone changes the value of a particular cell.

A lot of objects have events, but not all objects do. Some objects have a ton of events to listen for, while others have just a few. The only events you can use are those made available by the programmers of Microsoft Excel. Events are a very cool feature of the Excel object model, and I dig into them in Chapter 11 and also in Part 4.

Finding Out More from VBA Resources

This chapter introduces the wonderful world of objects, properties, methods, and events. You find out more about these concepts in the chapters that follow. If you just can't get enough, you might also be interested in these three excellent tools:

- » VBA's Help system
- » The Object Browser
- » Auto List Members

Using VBA's Help system

The VBA Help system describes every object, property, and method available to you, and also provides sample code. This is an excellent resource for finding out about VBA, and it's more comprehensive than any book on the market. But it's also very boring to read.




REMEMBER

If you're using Excel 2013 or later, you must be connected to the internet to use the VBA Help system (previous versions don't have this requirement). You can, however, download the VBA Help system from Microsoft's website. Do a web search for *download excel VBA documentation*, and you'll find it.

If you're working in a VBA module and want information about a particular object, method, or property, move the cursor to the word you're interested in and press F1. In a few seconds, you'll see the appropriate Help topic displayed in your web browser, complete with cross-references, and perhaps even an example or two.

Figure 4-3 shows part of a screen from the VBA Help system — in this case, for the Copy method of the Range object.

Range.Copy method (Excel)

08/14/2019 • 2 minutes to read •  -3

Copies the range to the specified range or to the Clipboard.

Note

Interested in developing solutions that extend the Office experience across multiple platforms? Check out the new Office Add-ins model. Office Add-ins have a small footprint compared to VSTO Add-ins and solutions, and you can build them by using almost any web programming technology, such as HTML5, JavaScript, CSS3, and XML.

Syntax

expression.Copy (*Destination*)

expression A variable that represents a [Range](#) object.

Parameters

Name	Required/Optional	Data type	Description
<i>Destination</i>	Optional	Variant	Specifies the new range to which the specified range will be copied. If this argument is omitted, Microsoft Excel copies the range to the Clipboard.

FIGURE 4-3:
An example
from VBA's
Help system.

Using the Object Browser

The VBE includes another tool known as the Object Browser. As the name implies, this tool lets you browse through the objects available to you. To access the Object Browser, press F2 when the VBE is active (or choose View ⇄ Object Browser). You see a window like the one shown in Figure 4-4.

The drop-down list at the top contains a list of all currently available object libraries. Figure 4-4 shows All Libraries. If you want to browse through Excel's objects, select Excel from the drop-down list.

The second drop-down list is where you enter a search string. For example, if you want to look at all Excel objects that deal with borders, type **border** in the second field and click the Search button. (It has a pair of binoculars on it.) The Search Results window displays everything in the object library that contains the text border. If you see something that looks like it might be of interest, select it and press F1 for more information online.

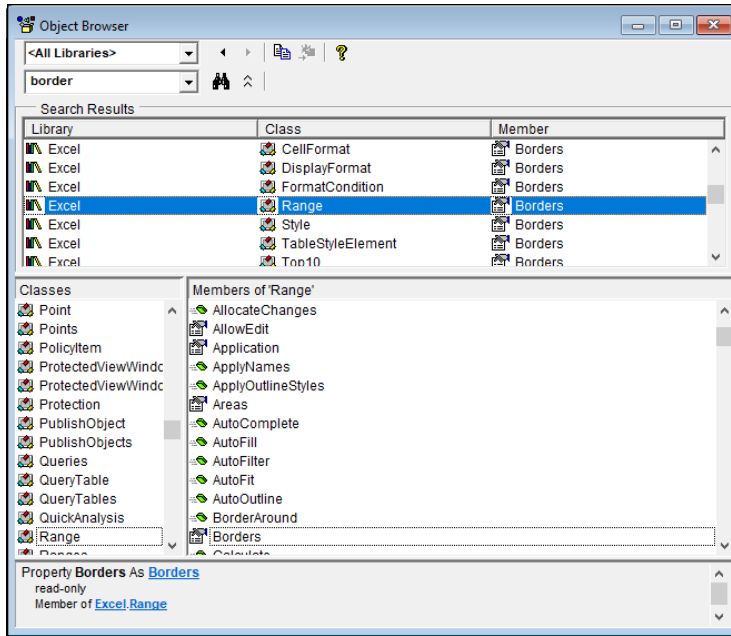


FIGURE 4-4: Browsing for objects with the Object Browser.

Automatically listing properties and methods

Chapter 3 introduces you to a handy feature called Auto List Members. This feature provides a list of properties and methods as you type. Figure 4-5 shows an example for the Workbooks collection.

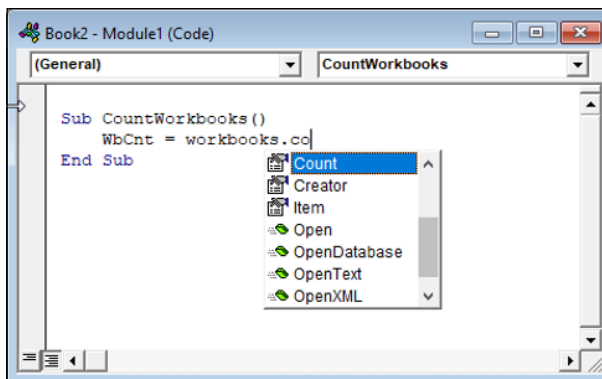


FIGURE 4-5: The Auto List Members feature helps you identify properties and methods for an object.

After typing the dot after *workbooks*, the VBE volunteers to help by displaying a list of properties and methods for that collection. Typing the letter (like the letter *c*) narrows the list to items that begin with that letter. With each letter you type, the VBE further narrows the list of choices. Highlight the item you need, press Tab, and voilà! You've eliminated some typing — and also ensured that the property or method was spelled correctly.

- » Understanding the difference between Sub procedures and Function procedures
- » Executing Sub procedures (many ways)
- » Executing Function procedures (three ways)

Chapter 5

VBA Sub and Function Procedures

In previous chapters, I use the terms *Sub procedures* and *Function procedures* without going into much explanation about what these procedures do or how to use them. This chapter fills in those gaps. It explains the differences between Sub and Function procedures, and shows the various ways to execute each type of procedure.

Understanding Subs versus Functions

The VBA code that you write in the VBE is known as a *procedure*. The two most common types of procedures are Sub procedures and Function procedures.

- » A *Sub procedure* is a group of VBA statements that performs an action (or a sequence of actions) with Excel.
- » A *Function procedure* is a group of VBA statements that performs a calculation and returns a single value (or, sometimes, something slightly more complicated like a single object).

Most of the macros you write in VBA are Sub procedures. You can think of a Sub procedure as being like a command: Execute the Sub procedure, and something happens. (Of course, exactly *what* happens depends on the Sub procedure's VBA code.)

A Function is also a procedure, but it's quite different from a Sub. You're already familiar with the concept of a function. Excel includes many worksheet functions that you use every day (well, at least every weekday). Examples include SUM, PMT, and VLOOKUP. You use these worksheet functions in formulas. Each function takes one or more arguments (although a few functions don't use any arguments). The function does some behind-the-scenes calculations using those arguments and then returns a single value. Function procedures that you develop with VBA work the same way.

Looking at Sub procedures

Every Sub procedure starts with the keyword *Sub* and ends with an *End Sub* statement. Here's an example:

```
Sub ShowMessage()  
    MsgBox "That's all folks!"  
End Sub
```

This example shows a procedure named ShowMessage. A set of parentheses follows the procedure's name. In most cases, these parentheses are empty. However, you can pass arguments to Sub procedures from other procedures. If your Sub uses arguments, list them between the parentheses, as in the following example:

```
Sub ShowMessage(MyMessage)  
    MsgBox MyMessage  
End Sub
```



REMEMBER

When you record a macro with the Excel macro recorder, the result is always a Sub procedure that takes no arguments.

As you see in “Naming Subs and Functions” later in this chapter, Excel provides quite a few ways to execute a VBA Sub procedure.

Looking at Function procedures

Every Function procedure starts with the keyword *Function* and ends with an *End Function* statement. Here's a simple example:

```
Function CubeRoot(number)
    CubeRoot = number ^ (1 / 3)
End Function
```

This function, named `CubeRoot`, takes one argument (a variable named *number*), which is enclosed in parentheses. Functions can have as many as 255 arguments or none at all. When you execute this function, it returns a single value — the cube root of the argument passed to the function.



TIP

VBA allows you to specify what type of information (also known as *data type*) is returned by a Function procedure. For example, a value can be a number, a date, or a text string. Chapter 7 contains more information on specifying data types.

You can execute a Function procedure in three ways: You can call it from another procedure (a Sub or another Function procedure), use it in a worksheet formula, or execute it in the Immediate window by typing a question mark followed by the function name and any arguments.



REMEMBER

No matter how hard you try, you can't use the Excel macro recorder to record a Function procedure. You must manually enter every Function procedure that you create.

Naming Subs and Functions

Like humans, pets, and hurricanes, every Sub and Function procedure must have a name. Although it's perfectly acceptable to name your dog Hairball Harris, it's usually not a good idea to use such a freewheeling attitude when naming procedures. When naming procedures, you must follow a few rules:

- » You can use letters, numbers, and some punctuation characters, but the first character must be a letter.
- » You can't use spaces or periods in the name.
- » VBA does not distinguish between uppercase and lowercase letters.
- » You can't use any of the following characters in a procedure name: #, \$, %, &, @, ^, *, or !. In other words, your procedure name can't look like comic-strip curse words.
- » If you write a Function procedure for use in a formula, avoid using a name that looks like a cell address (for example, A1 or B52). Actually, Excel allows such function names, but why make things more confusing than they are already?

- » Procedure names can't be VBA keywords like Open, Dim, or Input. You can, however, name them the same as object names in the object model, but you probably shouldn't as it would be confusing to anyone maintaining your code.
- » Procedure names can be no longer than 255 characters. (Of course, you would never make a procedure name this long.)

Ideally, a procedure's name describes the routine's purpose. A good practice is to create a name by combining a verb and a noun — for example, ProcessData, PrintReport, Sort_Array, or CheckFilename.

Some programmers prefer using sentence-like names that provide a complete description of the procedure. Some examples include WriteReportToTextFile and Get_Print_Options_and_Print_Report. The use of such lengthy names has pros and cons. On the one hand, such names are descriptive and usually unambiguous. On the other hand, they take longer to type.



REMEMBER

Everyone develops a naming style, but if your macro isn't just a quick-and-dirty temporary macro, it's a good idea to be descriptive and to avoid meaningless names such as DoIt, Update, Fix, and the ever-popular Macro1.

Executing Sub procedures

Although you might not know much about developing Sub procedures at this point, it's important to know how to execute these procedures. A Sub procedure is worthless unless you know how to execute it, like having the best omelet recipe in the world and no stove.



TIP

Executing a Sub procedure means the same thing as *running* or *calling* a Sub procedure. You can use whatever terminology you like.

You can execute a VBA Sub in many ways; that's one reason you can do so many useful things with Sub procedures. Here's an exhaustive list of the ways to execute a Sub procedure:

- » Choose Run ⇨ Run Sub/UserForm (in the VBE). Excel executes the Sub procedure in which the cursor is located. This menu command has two alternatives: the F5 key and the Run Sub/UserForm button on the Standard toolbar in the VBE. These methods don't work if the procedure requires one or more arguments.

- » Use Excel's Macro dialog box. You open this box by choosing Developer ⇨ Code ⇨ Macros or by choosing View ⇨ Macros ⇨ Macros. Or you can bypass the Ribbon and just press Alt+F8. When the Macro dialog box appears, select the Sub procedure you want and click Run. This dialog box lists only the procedures that don't require an argument.
- » Press Ctrl+key (or Ctrl+Shift+key) assigned to the Sub procedure (assuming you assigned one).
- » Click a button or a shape on a worksheet. The button or shape must have a Sub procedure assigned to it — which is very easy to do.
- » From another Sub procedure that you write.
- » Click a button that you've added to the Quick Access toolbar. (See Chapter 19.)
- » From a custom item you've added to the Ribbon. (See Chapter 19.)
- » When an event occurs. As I explain in Chapter 11, these events include opening the workbook, closing the workbook, saving the workbook, making a change to a cell, activating a sheet, and other things.
- » From the Immediate window in the VBE. Just type the name of the Sub procedure and press Enter.

Some of these techniques are covered in the following sections. To follow along, you need to enter a Sub procedure in a VBA module:

1. **Start with a new workbook.**
2. **Press Alt+F11 to activate the VBE.**
3. **Select the workbook in the Project Explorer.**
4. **Choose Insert ⇨ Module to insert a new module.**
5. **Enter the following in the module:**

```
Sub ShowCubeRoot()  
    Num = InputBox("Enter a positive number")  
    MsgBox Num ^ (1/3) & " is the cube root."  
End Sub
```

This procedure asks the user for a number and then displays that number's cube root in a message box. Figures 5-1 and 5-2 show what happens when you execute this procedure.

FIGURE 5-1: Using the built-in VBA InputBox function to get a number.

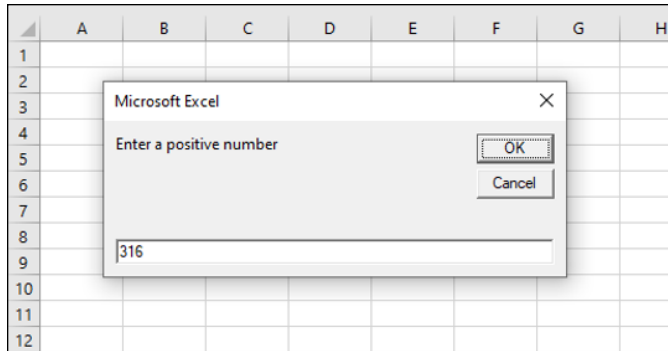
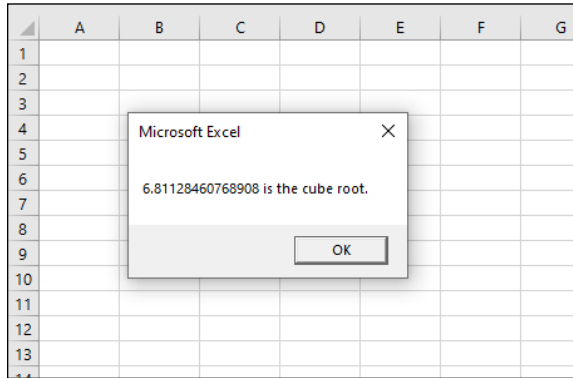


FIGURE 5-2: Displaying the cube root of a number via the MsgBox function.



By the way, ShowCubeRoot is not an example of a *good* macro. It doesn't check for errors, so it fails easily. Try clicking the Cancel button in the input box or entering a negative number. Either action results in an error message. Chapter 12 describes how to deal with these types of errors.

Executing the Sub procedure directly

One way to execute this procedure is by doing so directly from the VBA module in which you defined it. Follow these steps:

1. **Activate the VBE, and select the VBA module that contains the procedure.**
2. **Move the cursor anywhere in the procedure's code.**
3. **Press F5 (or choose Run ⇨ Run Sub/UserForm).**
4. **Respond to the input box, and click OK.**

The procedure displays the cube root of the number you entered.



REMEMBER

You can't use Run ⇨ Run Sub/UserForm to execute a Sub procedure that uses arguments, because you have no way to pass the arguments to the procedure. If the procedure contains one or more arguments, the only way to execute it is to call it from another procedure or from the Immediate window — both of which must supply the argument(s).

Executing the procedure from the Macro dialog box

Most of the time, you execute Sub procedures from Excel, not from the VBE. The following steps describe how to execute a macro by using Excel's Macro dialog box:

- 1. If you're working in the VBE, activate Excel.**
Pressing Alt+F11 is the express route.
- 2. Choose Developer ⇨ Code ⇨ Macros (or press Alt+F8).**
Excel displays the dialog box shown in Figure 5-3.
- 3. Select the macro.**
- 4. Click Run (or double-click the macro's name in the list box).**

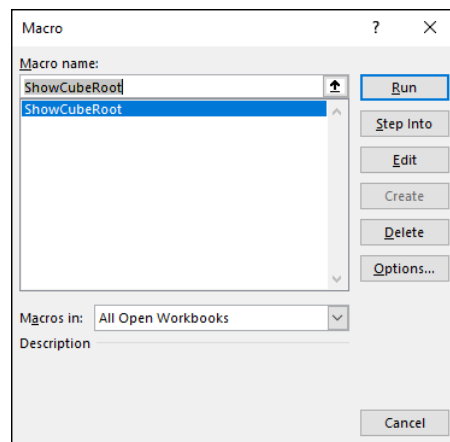


FIGURE 5-3: The Macro dialog box lists all available Sub procedures.



REMEMBER

The Macro dialog box doesn't display Sub procedures that use arguments. That's because there is no way for you to specify the arguments.

Executing a macro by using a shortcut key

Another way to execute a macro is to press its shortcut key. But before you can use this method, you must assign a shortcut key to the macro.

You have the opportunity to assign a shortcut key in the Record Macro dialog box when you begin recording a macro. If you create the procedure without using the macro recorder, you can assign a shortcut key (or change an existing shortcut key) by using the following steps:

1. **Choose Developer ⇨ Code ⇨ Macros.**
2. **Select the Sub procedure name from the list box.**

In this example, the procedure is named ShowCubeRoot.

3. **Click the Options button.**

Excel displays the Macro Options dialog box shown in Figure 5-4.

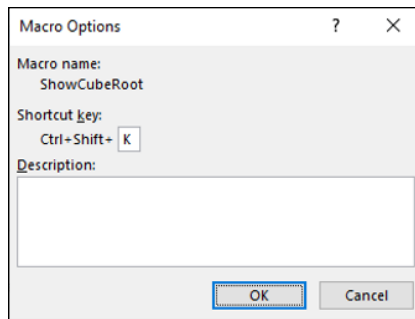


FIGURE 5-4:
The Macro Options dialog box lets you set options for your macros.

4. **Click the Shortcut Key option and enter a letter in the box labeled Ctrl.**

The letter you enter corresponds to the key combination you want to use for executing the macro. For example, if you enter the lowercase letter *k*, you can execute the macro by pressing Ctrl+K. If you enter an uppercase letter, you need to add the Shift key to the key combination. For example, if you enter *K*, you can execute the macro by pressing Ctrl+Shift+K.

5. **Click OK to close the Macro Options dialog box and then click Cancel to close the Macro dialog box.**

After you assign a shortcut key, you can press that key combination to execute the macro. A shortcut key doesn't work if it's assigned to a macro that uses an argument.



WARNING

The shortcut keys you assign to macros override Excel's built-in shortcut keys. For example, Ctrl+C is the standard shortcut key to copy data. If you assign Ctrl+C to a macro, you can't use Ctrl+C to copy. Try to avoid overriding the common shortcut keys.

Executing the procedure from a button or shape

Sometimes, you might like the idea of assigning the macro to a button (or any other shape) on a worksheet. To assign the macro to a button, follow these steps:

1. **Activate a worksheet.**
2. **Add a button from the Form Controls group.**

To display the Form Controls group, choose Developer ⇨ Controls ⇨ Insert (see Figure 5-5).

3. **Click the Button tool in the Form Controls group.**

It's the first button in the first row of controls.

4. **Drag in the worksheet to create the button.**

After you add the button to your worksheet, Excel reads your mind and displays the Assign Macro dialog box shown in Figure 5-6.

5. **Select the macro you want to assign to the button.**
6. **Click OK.**

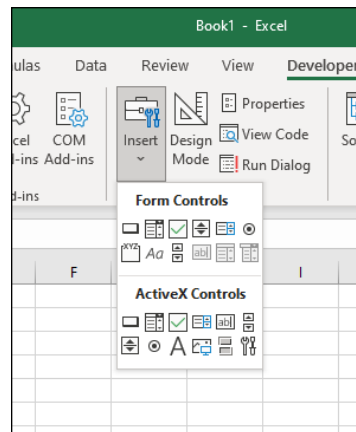
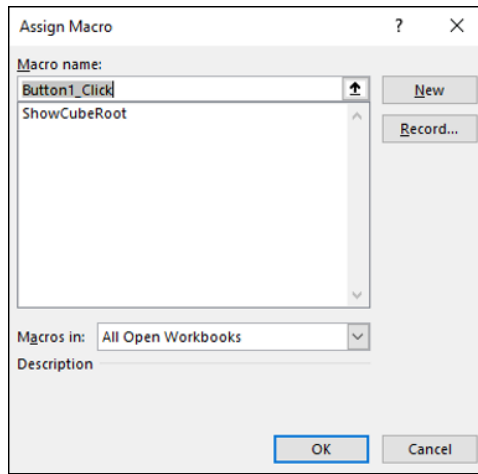


FIGURE 5-5:
The Ribbon, showing the controls available when you click Insert on the Developer tab.

FIGURE 5-6:
When you add a button to a worksheet, Excel automatically displays the Assign Macro dialog box.



After you make the assignment, click anywhere else in the spreadsheet to deselect the button, then you can click the button to execute the macro — just like magic.



REMEMBER

When you add a button, the drop-down box shows two sets of controls: Form Controls and ActiveX Controls. These two groups of controls look similar, but they are actually very different. In practice, the Form Controls are easier to use.

You can also assign a macro to any other shape or object. For example, assume you'd like to execute a macro when the user clicks a Rectangle object. Follow these steps:

- 1. Add the rectangle to the worksheet.**
Insert a rectangle by choosing Insert ⇨ Illustrations ⇨ Shapes.
- 2. Right-click the rectangle.**
- 3. Choose Assign Macro from its shortcut menu.**
- 4. Select the macro in the Assign Macro dialog box.**
- 5. Click OK.**

After you've performed these steps, clicking the rectangle executes the assigned macro.

Executing the procedure from another procedure

You can execute a procedure from another procedure. Follow these steps if you want to give this a try:

1. **Activate the VBA module that holds the ShowCubeRoot routine.**
2. **Enter this new procedure (either above or below ShowCubeRoot code — it makes no difference):**

```
Sub NewSub()  
    ShowCubeRoot  
End Sub
```

3. **Execute the NewSub macro.**

The easiest way to do this is to move the cursor anywhere within the NewSub code and press F5. Notice that this NewSub procedure simply executes the ShowCubeRoot procedure.

Typing the name of your procedure in another procedure is all you have to do to execute it from that procedure. Executing one procedure from another is known as “calling” the procedure. That term comes from the fact that you could also use the Call keyword as shown:

```
Call ShowCubeRoot
```

The Call keyword is kind of old-fashioned and not many people use it anymore.

Executing the procedure from the Immediate window

Executing a procedure from the Immediate window is just like calling it from another procedure. Simply type the name of the procedure in the Immediate window and press Enter. If the procedure takes arguments, type a space after the procedure name and separate arguments with a comma. The following example is how you would execute a procedure called AddTwo that accepts two numeric arguments:

```
AddTwo 10, 20
```

Executing Function Procedures

Functions, unlike Sub procedures, can be executed in only three ways:

- » By calling the function from another Sub procedure or Function procedure
- » By calling it from the Immediate Window in the VBE
- » By using the function in a worksheet formula

Try this simple function. Enter it in a VBA module:

```
Function CubeRoot(number)
    CubeRoot = number ^ (1 / 3)
End Function
```

This function is pretty wimpy; it merely calculates the cube root of the number passed to it as its argument. It does, however, provide a starting point for understanding functions. It also illustrates an important concept about functions: how to return the value. (You do remember that a function returns a value, right?)

Notice that the single line of code that makes up this Function procedure performs a calculation. The result of the math (number to the power of $1/3$) is assigned to the variable `CubeRoot`. Not coincidentally, `CubeRoot` is also the name of the function. To tell the function what value to return, you assign that value to the name of the function.

Calling the function from a Sub procedure

Because you can't execute a function directly, you must call it from another procedure. Enter the following simple procedure in the same VBA module that contains the `CubeRoot` function:

```
Sub CallerSub()
    Ans = CubeRoot(125)
    MsgBox Ans
End Sub
```

When you execute the `CallerSub` procedure (using any of the methods described earlier in this chapter), Excel displays a message box that contains the value of the `Ans` variable, which is 5.

Here's what's going on: The CubeRoot function is executed, and it receives an argument of 125. The calculation is performed by the function's code (using the value passed as an argument), and the function's returned value is assigned to the Ans variable. The MsgBox function then displays the value of the Ans variable.

Try changing the argument that's passed to the CubeRoot function and run the CallerSub macro again. It works just like it should — assuming that you give the function a valid argument (non-negative number).

By the way, the CallerSub procedure could be simplified a bit. The Ans variable is not really required unless your code will use that variable later. You could use this single statement to obtain the same result:

```
MsgBox CubeRoot(125)
```

Calling a function from the Immediate window

The Immediate window is a place where you can execute Sub and Function procedures to make sure they work right. As its name suggests, whatever you type in the Immediate window is executed immediately (well, immediately after you press Enter).

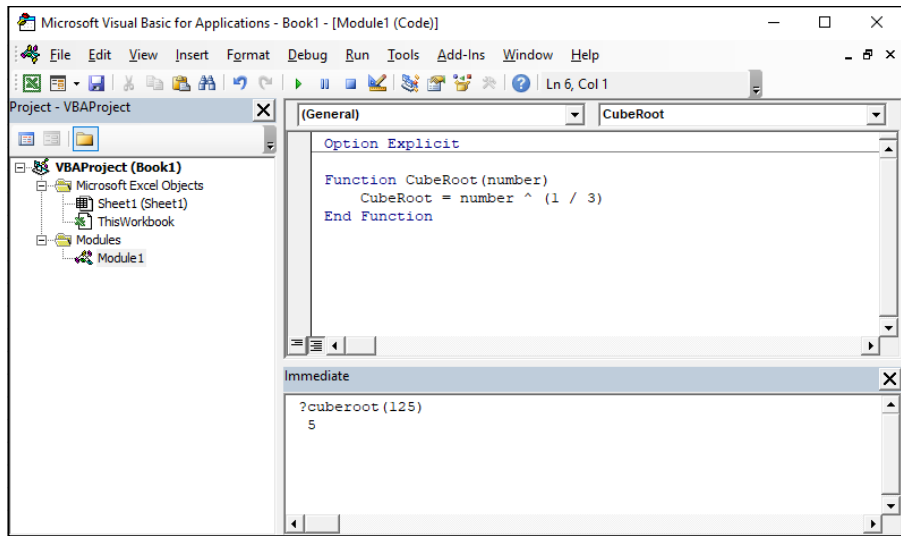
Open the VBE, and if the Immediate window isn't visible, choose View ⇄ Immediate Window or press Ctrl+G. In the Immediate window, the question mark is the shortcut for *print*. Type the following:

```
?cuberoot(125)
```

When you press Enter, the answer appears in the line below the code you typed (see Figure 5-7).

After you press Enter to get the result, your cursor appears on the line below the answer, ready for another command. Notice that the capitalization in the example isn't the same as the function name. VBA doesn't care about upper- or lowercase, so you don't have to either.

FIGURE 5-7:
Executing a
Function in the
Immediate
window returns
the answer
immediately.



Calling a function from a worksheet formula

Now it's time to call this VBA Function procedure from a worksheet formula. Activate a worksheet in the same workbook that holds the CubeRoot function definition. Then enter the following formula in any cell:

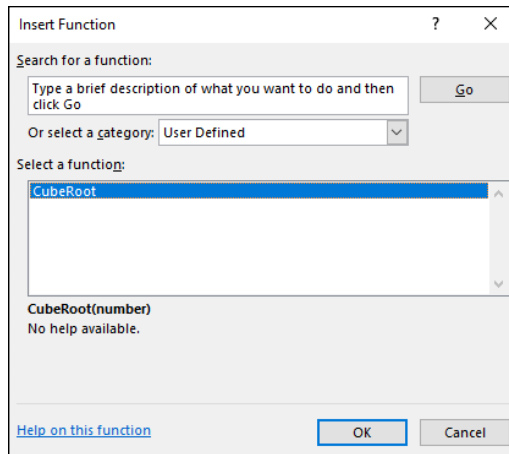
```
=CubeRoot(1728)
```

The cell displays 12, which is indeed the cube root of 1,728.

As you might expect, you can use a cell reference as the argument for the CubeRoot function. For example, if cell A1 contains a value, you can enter **=CubeRoot(A1)**. In this case, the function returns the number obtained by calculating the cube root of the value in A1.

You can use this function any number of times in the worksheet. Like Excel's built-in functions, your custom functions appear in the Insert Function dialog box. Click the Insert Function toolbar button, and choose the User Defined category. As shown in Figure 5-8, the Insert Function dialog box lists your very own function.

FIGURE 5-8:
The CubeRoot function appears in the User Defined category of the Insert Function dialog box.



TIP

If you want the Insert Function dialog box to display a description of the function, follow these steps:

1. **Choose Developer ⇨ Code ⇨ Macros.**
2. **Type the word CubeRoot in the Macro Name box.**
3. **Click the Options button.**
4. **Enter a description of the function in the Description box.**
5. **Click OK to close the Macro Options dialog box.**
6. **Close the Macro dialog box by clicking the Cancel button.**

This descriptive text now appears in the Insert Function dialog box.

Figure 5-9 shows the CubeRoot function being used in worksheet formulas.

	A	B	C	D	E	F
1	100	4.641589				
2	350	7.047299				
3	750	9.085603				
4	1000	10				
5	1728	12				
6						
7						

FIGURE 5-9:
Using the CubeRoot function in formulas.

IN THIS CHAPTER

- » Recording your actions by using the Excel built-in macro recorder
- » Understanding the types of macros you can record
- » Setting the appropriate options for macro recording
- » Evaluating the efficiency of recorded macros

Chapter 6

Using the Excel Macro Recorder

You can use two methods to create an Excel macro:

- » Record it by using the Excel macro recorder.
- » Write it manually.

This chapter deals specifically with the ins and outs of using the Excel macro recorder. Recording a macro isn't always the best approach, and some macros simply can't be recorded, no matter how hard you try. You'll see, however, that the Excel macro recorder is very useful. Even if your recorded macro isn't quite what you want, the macro recorder can almost always lead you in the right direction.

Recording Basics

You take the following basic steps when recording a macro.

- 1. Determine what you want the macro to do.**
- 2. Get things set up properly.**

This step determines how well your macro works.
- 3. Determine whether you want cell references in your macro to be relative or absolute.**
- 4. Click the Record Macro button on the left side of the status bar (or choose Developer ⇄ Code ⇄ Record Macro).**

Excel displays its Record Macro dialog box.
- 5. Enter a name, shortcut key, macro location, and description.**

Each of these items — with the exception of the name — is optional.
- 6. Click OK in the Record Macro dialog box.**

Excel automatically inserts a VBA module in the workbook specified in the Store Macro In box. From this point, Excel converts your actions to VBA code. It also displays a square Stop Recording button on your status bar.
- 7. Perform the actions you want to record by using the mouse or the keyboard.**
- 8. When you finish, click the Stop Recording button on the status bar (or choose Developer ⇄ Code ⇄ Stop Recording).**

Excel stops recording your actions.
- 9. Test the macro to make sure it works correctly.**
- 10. (Optional) Clean up the code by removing extraneous statements or adding some comments to your code to explain what it does.**

The macro recorder is best suited for simple, straightforward macros. For example, you might want a macro that applies formatting to a selected range of cells or that sets up row and column headings for a new worksheet.



REMEMBER

The macro recorder is for Sub procedures only. You can't use the macro recorder to create Function procedures.

You might also find the macro recorder helpful for developing more complex macros. That is to say, you can record some actions and then copy the recorded code into another, more complex macro. In most cases, you need to edit the recorded code and add some new VBA statements.

The macro recorder *cannot* generate code for any of the following tasks, which are described later in the book:

- » Performing any type of repetitive looping
- » Performing any type of conditional actions (using an If-Then statement)
- » Assigning values to variables
- » Specifying data types
- » Displaying pop-up messages
- » Displaying custom dialog boxes



REMEMBER

The macro recorder's limited capability certainly doesn't diminish its importance. Recording your actions is perhaps the best way to master VBA. When in doubt, try recording. Although the result may not be exactly what you want, viewing the recorded code may reveal some objects, properties, and methods that you weren't aware of and steer you in the right direction.

Preparing to Record

Before you take the big step and turn on the macro recorder, spend a minute or two thinking about what you're going to do. You record a macro so that Excel can automatically repeat the actions you record, so you'll want those actions to be accurate.



REMEMBER

Ultimately, the success of a recorded macro depends on five factors:

- » How the workbook is set up while you record the macro
- » What is selected when you start recording
- » Whether you use absolute or relative recording mode
- » The accuracy of your recorded actions
- » The context in which you play back the recorded macro

The importance of these factors becomes more clear as you go through the recording process.

Choosing Between Relative and Absolute Mode

When recording your actions, Excel, by default, records absolute references to cells. That is, if you enter a value in cell B10, Excel will record that you entered a cell in B10. When you execute the macro, the value will be entered in B10 regardless of which cell is active. The reference to B10 is unchanging. If you use relative recording, Excel records *your actions starting in the active cell*. If B10 is the active cell and you record entering a value in relative mode, Excel records that you entered value in the active cell. When you execute that macro and the active cell is, say, C15, then the value is entered in C15.

Whether you record in absolute or relative mode depends on what you're trying to accomplish with your code. One mode is not better than the other, just more appropriate for the situation. For example, if you want to record a macro that bolds, underlines, italicizes whatever cell you're on, you have to use relative mode. If you use absolute mode in the case, you would always be formatting the same cell.

Recording in absolute mode

Open a new workbook and follow these steps to record a simple macro in absolute mode. This macro simply enters three month names in a worksheet:

- 1. Make sure that the Developer ⇨ Code ⇨ Use Relative References button is *not* highlighted and then choose Developer ⇨ Code ⇨ Record Macro.**
- 2. Enter Absolute as the name for this macro.**
- 3. Click OK to begin recording.**
- 4. Select cell B1, and type Jan in that cell.**
- 5. Move to cell C1, and type Feb.**
- 6. Move to cell D1, and type Mar.**
- 7. Click cell B1 to activate it again.**
- 8. Stop the macro recorder.**
- 9. Press Alt+F11 to activate the VBE.**
- 10. Examine the Module1 module.**

Excel generates the following code:

```
Sub Absolute()  
,  
,  
' Absolute Macro  
,  
  
    Range("B1").Select  
    ActiveCell.FormulaR1C1 = "Jan"  
    Range("C1").Select  
    ActiveCell.FormulaR1C1 = "Feb"  
    Range("D1").Select  
    ActiveCell.FormulaR1C1 = "Mar"  
    Range("B1").Select  
  
End Sub
```

When executed, this macro selects cell B1 and inserts the three month names into the range B1:D1. Then the macro reactivates cell B1.

These same actions occur regardless of which cell is active when you execute the macro. A macro recorded by using absolute references always produces the same results when it's executed. In this case, the macro always enters the names of the first three months in the range B1:D1 on the active worksheet.

Absolute mode is appropriate when you want the same actions to happen to the same cells every time. For example, if you create a monthly sales report and you want to record a macro to apply the same formatting to the report every month, you would choose absolute mode. A monthly report is likely to occupy the same cells each time it's created.



REMEMBER

When you first open Excel, absolute mode is selected. If you change it to relative mode, it will remain in that mode until you change it back or close Excel.

Recording in relative mode

Recording macros in relative mode is useful when you want a macro to perform an action beginning in the active cell (as opposed to an “absolute” cell that you specified when recording the macro). For example, you might want the macro to enter month names in the cell that is active when you're designing an annual summary report.

When designing such a report, you know you'll need a list of month names, but until you've established what the header will look like, you won't know where you want the month names to start. Once you know, you can select the cell where you

want them to start and execute the macro. And the next annual report you design may have month names starting in a completely different cell.

You can change the manner in which Excel records your actions by clicking the Use Relative References button in the Code group of the Developer tab. This button is a toggle button. When the button appears highlighted in a different color, the recording mode is relative. When the button appears normally, you're recording in absolute mode.



REMEMBER

You can change the recording method at any time, even in the middle of recording.

To see how relative mode recording works, delete the contents of range B1:D1 and then perform the following steps:

- 1. Activate cell B1.**
- 2. Choose Developer ⇄ Code ⇄ Record Macro.**
- 3. Enter Relative as the name for this macro.**
- 4. Click OK to begin recording.**
- 5. Click the Use Relative References button to change the recording mode to relative.**
When you click this button, it changes to a different color from the rest of the ribbon.
- 6. Type Jan in cell B1.**
- 7. Move to cell C1, and type Feb.**
- 8. Move to cell D1, and type Mar.**
- 9. Select cell B1.**
- 10. Stop the macro recorder.**

Notice that this procedure differs slightly from the previous example. In this example, you activate the beginning cell *before* you start recording. This is an important step when you record macros that use the active cell as a base.

This macro always starts entering text in the active cell. Try it. Move the cell pointer to any cell and then execute the Relative macro. The month names are always entered beginning at the active cell.

With the recording mode set to relative, the code that Excel generates is quite different from the code generated in absolute mode:

```
Sub Relative()  
'  
' Relative Macro  
'  
    ActiveCell.FormulaR1C1 = "Jan"  
    ActiveCell.Offset(0, 1).Range("A1").Select  
    ActiveCell.FormulaR1C1 = "Feb"  
    ActiveCell.Offset(0, 1).Range("A1").Select  
    ActiveCell.FormulaR1C1 = "Mar"  
    ActiveCell.Offset(0, -2).Range("A1").Select  
End Sub
```

To test this macro, select any cell except B1 and run the macro. The month names are entered in three cells, beginning with the cell that you selected.



TIP

Did you notice that you clicked Use Relative References *after* you started recording? That's right, you can record parts of your macro using relative and parts using absolute.



TECHNICAL
STUFF

Notice that the code generated by the macro recorder refers to cell A1. This may seem strange because you never used cell A1 during the recording of the macro. This is simply a byproduct of the way the macro recorder works. (Chapter 8 discusses this aspect of using the macro recorder in more detail, in the section that explores the Offset property.)

Watching the Macro Recorder in Action

When you turn on the macro recorder, Excel converts your mouse and keyboard actions to valid VBA code. The best way to understand the process is to watch the macro recorder in action. Figure 6-1 shows both Excel and the VBE halfway through recording the Relative Sub procedure.

Follow these steps:

1. **Start with a blank workbook.**
2. **Make sure that the Excel window is not maximized.**
3. **Press Alt+F11 to activate the VBE (and make sure that *this* program window is not maximized).**

4. Resize and arrange the Excel window and the VBE window so that both are visible.

For best results, position the Excel window above the VBE window and minimize any other applications that are running.

5. Activate Excel, and choose Developer ⇨ Code ⇨ Record Macro.

6. Click OK to start the macro recorder.

Excel inserts a new module (named Module1) and starts recording in that module.

7. Activate the VBE program window.

8. In the Project Explorer, double-click Module1 to display that module in the Code window.

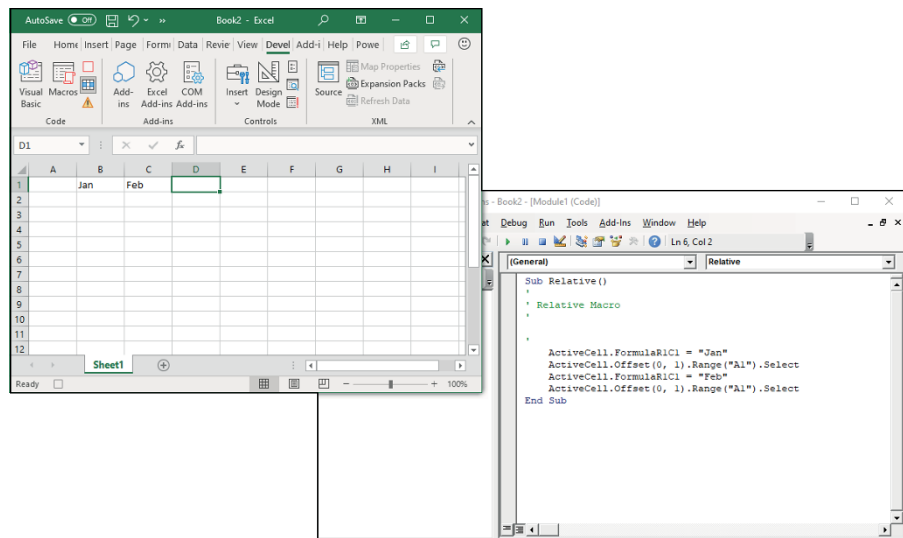


FIGURE 6-1:
A convenient window arrangement for watching the macro recorder do its thing.

Jump back to Excel and play around for a while. Choose various Excel commands and watch the code being generated in the VBE. Select cells, enter data, format cells, use the Ribbon commands, create a chart, change column widths, manipulate graphics objects, and more — go crazy! You'll be enlightened as you watch Excel spit out the VBA code before your eyes.



If you have a system with dual monitors, you might find it helpful to keep Excel on one monitor and the VBE window on the other one.

TIP

Specifying Recording Options for Your Macro

When click the Record Macro Ribbon control, you can use the options in the Record Macro dialog box to specify various aspects of the macro you're about to record, including what the macro is called and how it works.

Recall that Developer ⇨ Code ⇨ Record Macro displays the Record Macro dialog box before recording begins, as shown in Figure 6-2.

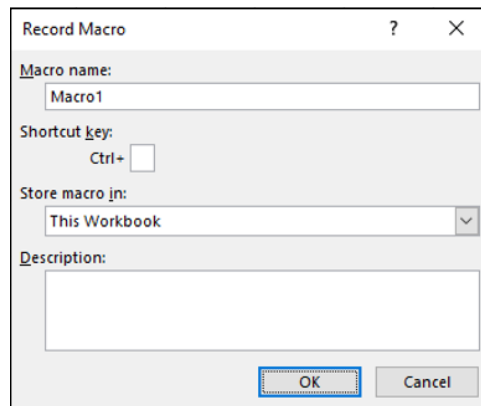


FIGURE 6-2:
The Record Macro dialog box provides several options.

Here are the options the Record Macro dialog box provides:

- » **Macro name:** You can enter a name for the Sub procedure that you're recording. By default, Excel uses the names Macro1, Macro2, and so on for each macro you record. Don't worry if you don't give your macro a friendly name in Record Macro dialog box. You can always give it a more descriptive name later by editing the recorded code in the VBE.



REMEMBER

» **Shortcut key:** The Shortcut key option allows you to execute the macro by pressing a shortcut key combination. For example, if you enter **w** (lowercase), you can execute the macro by pressing Ctrl+W. If you enter **W** (uppercase), the macro comes alive when you press Ctrl+Shift+W.

You can add or change a shortcut key at any time, so there's no real reason to set this option when recording a macro. For instructions on assigning a shortcut key to an existing macro, see Chapter 5.

» **Store Macro In:** The Store Macro In option tells Excel where to store the macro that it's recording. By default, Excel puts the recorded macro in a module in the active workbook. If you prefer, you can record it in a new workbook (Excel opens a blank workbook), or in your Personal Macro Workbook.

Your Personal Macro Workbook is a hidden workbook that opens automatically when Excel starts. This is a good place to store macros that you'll use with multiple workbooks. The Personal Macro Workbook is named PERSONAL.XLSB. This file doesn't exist until you specify it as the location for a recorded macro. If you've made any changes to this file, Excel prompts you to save it when you exit.

» **Description:** You can add descriptive comments for your macro in the Description box. You can put anything you like here, or nothing at all.

Streamlining Code Generated by the Macro Recorder

You might think that recording a macro would generate some award-winning VBA code — better than you could ever write manually. Think again. Because the macro recorder has to be generic enough to record virtually every combination of actions, it often generates extra code that works, but is less than efficient.

To demonstrate just how inefficient the macro recorder's code can be, try this:

1. **Turn on the macro recorder.**
2. **Choose Page Layout ⇄ Page Setup ⇄ Orientation ⇄ Landscape.**
3. **Turn off the macro recorder.**

To take a look at the macro, activate the Module1 sheet. This single (very simple) command generates the following code:

```
Sub Macro1()  
'  
' Macro1 Macro  
'  
'  
  
Application.PrintCommunication = False  
With ActiveSheet.PageSetup  
    .PrintTitleRows = ""  
    .PrintTitleColumns = ""  
End With  
Application.PrintCommunication = True  
ActiveSheet.PageSetup.PrintArea = ""  
Application.PrintCommunication = False  
With ActiveSheet.PageSetup  
    .LeftHeader = ""  
    .CenterHeader = ""  
    .RightHeader = ""  
    .LeftFooter = ""  
    .CenterFooter = ""  
    .RightFooter = ""  
    .LeftMargin = Application.InchesToPoints(0.7)  
    .RightMargin = Application.InchesToPoints(0.7)  
    .TopMargin = Application.InchesToPoints(0.75)  
    .BottomMargin = Application.InchesToPoints(0.75)  
    .HeaderMargin = Application.InchesToPoints(0.3)  
    .FooterMargin = Application.InchesToPoints(0.3)  
    .PrintHeadings = False  
    .PrintGridlines = False  
    .PrintComments = xlPrintNoComments  
    .PrintQuality = 600  
    .CenterHorizontally = False  
    .CenterVertically = False  
    .Orientation = xlLandscape  
    .Draft = False  
    .PaperSize = xlPaperLetter  
    .FirstPageNumber = xlAutomatic  
    .Order = xlDownThenOver  
    .BlackAndWhite = False  
    .Zoom = 100  
    .PrintErrors = xlPrintErrorsDisplayed
```

```

.OddAndEvenPagesHeaderFooter = False
.DifferentFirstPageHeaderFooter = False
.ScaleWithDocHeaderFooter = True
.AlignMarginsHeaderFooter = True
.EvenPage.LeftHeader.Text = ""
.EvenPage.CenterHeader.Text = ""
.EvenPage.RightHeader.Text = ""
.EvenPage.LeftFooter.Text = ""
.EvenPage.CenterFooter.Text = ""
.EvenPage.RightFooter.Text = ""
.FirstPage.LeftHeader.Text = ""
.FirstPage.CenterHeader.Text = ""
.FirstPage.RightHeader.Text = ""
.FirstPage.LeftFooter.Text = ""
.FirstPage.CenterFooter.Text = ""
.FirstPage.RightFooter.Text = ""
End With
Application.PrintCommunication = TrueEnd Sub

```

You might be surprised by the amount of code generated by this single command. Although you changed only one print setting, Excel generated code that set many other print-related properties.

This is a good example of macro-recording overkill. If you want a macro that just switches the page setup to landscape mode, you can simplify this macro considerably by deleting the unneeded code. This makes the macro a bit faster and a lot easier to read. Here's how the macro looks after deleting the irrelevant lines:

```

Sub Macro1()
    With ActiveSheet.PageSetup
        .Orientation = xlLandscape
    End With
End Sub

```

The only line necessary is the one that sets the Orientation property. Actually, you can simplify this macro even more because you don't really need the With-End With construct (you find out more about this construct in Chapter 14):

```

Sub Macro1()
    ActiveSheet.PageSetup.Orientation = xlLandscape
End Sub

```

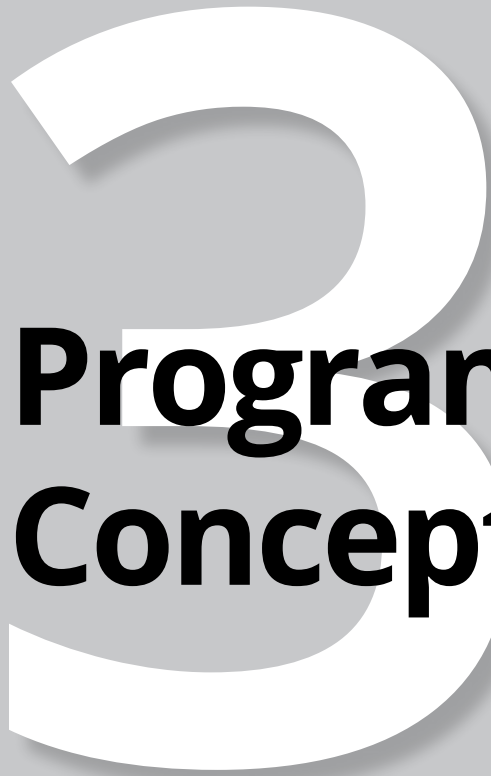
In this case, the macro changes the Orientation property of the PageSetup object on the active sheet. All other properties are unchanged. By the way, xlLandscape is a built-in constant that makes your code easier to read. This constant has a value of 2, so the following statement works exactly the same (but isn't as easy to read):

```
ActiveSheet.PageSetup.Orientation = 2
```

Stay tuned for the built-in constants explanations in Chapter 7.

Rather than record this macro, you can enter it directly in a VBA module. To do so, you have to know which objects, properties, and methods to use. Although the recorded macro isn't all that great, by recording it, you realize that the PageSetup object is contained in a Worksheet object and that the PageSetup object has an Orientation property. Armed with this knowledge and a quick trip to the Help system (and probably some experimentation), you can write the macro manually.

This chapter nearly sums it up when it comes to using the macro recorder. The only thing missing is experience. Eventually, you discover which recorded statements you can safely delete. Better yet, you discover how to modify a recorded macro to make it more useful.



Programming Concepts

IN THIS PART . . .

Discover the essential elements of Excel programming: variables, constants, data types, operators, arrays, and so on.

Get acquainted with Range objects; you'll be glad you did.

Find out why VBA functions (and also Excel worksheet functions) are important.

Discover the essence of programming: decision-making and looping.

See how to run code automatically when certain things occur.

Find out about the different types of errors and why error handling is important.

Know what to do when good code does bad things: Get initiated into the bug extermination club.

IN THIS CHAPTER

- » Knowing when, why, and how to use comments in your code
- » Using variables and constants
- » Telling VBA what type of data you're using
- » Getting familiar with arrays
- » Knowing why you might need to use labels in your procedures

Chapter 7

Essential VBA Language Elements

Because VBA is a real, live programming language, it uses many elements common to all programming languages. In this chapter, you're introduced to several of these elements: comments, variables, constants, data types, arrays, and a few other goodies. If you've programmed with other languages, some of this material will be familiar. If you're a programming newbie, it's time to roll up your sleeves and get busy.

Using Comments in Your VBA Code

A *comment* is the simplest type of VBA statement. Because VBA ignores these statements, they can consist of anything you want. You can insert a comment to remind yourself why you did something or to clarify some particularly elegant code you wrote.



TIP

Use comments liberally and extensively to describe what the code does (which isn't always obvious from reading the code itself). Often, code that makes perfect sense today mystifies you tomorrow. Been there. Done that.

You begin a comment with an apostrophe ('). VBA ignores any text that follows an apostrophe in a line of code. You can use a complete line for your comment or insert your comment at the end of a line of code. The following example shows a VBA procedure with four comments:

```
Sub FormatCells()  
    ' Exit if a range is not selected  
    If TypeName(Selection) <> "Range" Then  
        MsgBox "Select a range."  
        Exit Sub  
    End If  
    ' Format the cells  
    With Selection  
        .HorizontalAlignment = xlRight  
        .WrapText = False ' wrapped text ruins the layout  
        .MergeCells = False ' merged cells break other code  
    End With  
End Sub
```



REMEMBER

The “apostrophe indicates a comment” rule has one exception: VBA doesn’t interpret an apostrophe inside a set of quotation marks as a comment indicator. For example, the following statement doesn’t contain a comment, even though it has an apostrophe:

```
Msg = "Can't continue"
```

When you’re writing code, you might want to test a procedure by *excluding* a particular statement or group of statements. You *could* delete the statements and then retype them later. But that’s a waste of time. A better solution is to simply turn those statements into comments by inserting apostrophes. VBA ignores statements beginning with apostrophes when executing a routine. To reactivate those “commented” statements, just remove the apostrophes.



TIP

Here’s a quick way to convert a block of statements to comments. In the VBE, choose View ⇨ Toolbars ⇨ Edit to display the Edit toolbar. To convert a block of statements to comments, select the statements and click the Comment Block button. To remove the apostrophes, select the statements and click the Uncomment Block button.

Everyone develops their own style of commenting. To be useful, however, comments should convey information that’s not immediately obvious from reading the code.



TIP

The following tips can help you make effective use of comments:

- » Identify yourself as the author. This can be useful when you get promoted and the person who takes over your job has questions.
- » Briefly describe the purpose of each Sub or Function procedure you write.
- » Use comments to keep track of changes you make to a procedure.
- » Use a comment to indicate that you're using a function or a construct in an unusual or nonstandard manner.
- » Use comments to describe the variables you use, especially if your variable names would be too long if they were completely self-explanatory.
- » Use a comment to describe any workarounds you develop to overcome bugs in Excel.
- » Write comments as you develop code instead of saving the task for a final step.
- » Depending on your work environment, consider adding a joke or two as a comment. The person who takes over your job when you get promoted might appreciate the humor.

Using Variables, Constants, and Data Types

VBA's main purpose is to manipulate data. VBA stores the data in your computer's memory, and the data may or may not end up on disk. Some data, such as worksheet ranges, resides in objects. Other data is stored in variables that you create.

Understanding variables

A *variable* is simply a named storage location in your computer's memory that's used by a program. You have lots of flexibility in naming your variables, so make the variable names as descriptive as possible. You assign a value to a variable by using the equal-sign operator. (You can find out more about assigning values to variables in the "Using Assignment Statements" section.)

Here are some examples of variables being assigned values. Note that the last example uses two variables.

```
x = 1
InterestRate = 0.075
LoanPayoffAmount = 243089
DataEntered = False
x = x + 1
UserName = "Bob Johnson"
Date_Started = #3/14/2019#
MyNum = YourNum * 1.25
```

VBA enforces a few rules regarding variable names:

- » You can use letters, numbers, and some punctuation characters, but the first character must be a letter.
- » VBA doesn't distinguish between uppercase and lowercase letters.
- » You can't use spaces, periods, or mathematical operators in a variable name.
- » You can't use the following characters in a variable name: #, \$, %, &, or !.
- » Variable names can be no longer than 255 characters. However, nobody even gets close to that limit.

To make variable names more readable, programmers often use mixed case (for example, `InterestRate`) or the underscore character (`interest_rate`).

VBA has many reserved words that you can't use for variable or procedure names. These include words such as `Sub`, `Dim`, `With`, `End`, `Next`, and `For`. If you attempt to use one of these words as a variable, you might get a compile error (which means your code won't run). So if an assignment statement produces an error message, double-check to make sure that the variable name isn't a reserved word. An easy way to do that is to select the variable name and press F1. If your variable name is a reserved word, it will have an entry in the Help system.

VBA does allow you to create variables with names that match names in Excel's object model, such as `Workbook` and `Range`. But obviously, using names like that just increases the possibility of getting confused. Here's a perfectly valid (but very confusing) macro that declares `Range` as a variable name and works with a cell named `Range` in a worksheet named `Range`:

```
Sub RangeConfusion()
    Dim Range As Double
    Range = Sheets("Range").Range("Range").Value
    MsgBox Range
End Sub
```

Resist the urge to use a variable named `Workbook` or `Range`, and use something like `SourceWorkbook` or `InputRange` instead.

What are VBA's data types?

When discussing programming languages, the term *data type* refers to the manner in which a program stores data in memory — for example, as integers, real numbers, or strings. Although VBA can take care of these details automatically, it does so at a cost. (There's no free lunch.) Letting VBA handle your data typing results in slower execution and inefficient memory use, but for most applications, the speed difference isn't noticeable. The real benefit to data types is finding errors in your code. If you think something is supposed to be a number and you get a string, you'll get an error that's much easier to find if you use data types.

VBA can automatically handle all the data details, which makes writing code easier for programmers. Not all programming languages provide this luxury. For example, some languages are *strictly typed*, which means the programmer must explicitly define the data type for every variable used.

VBA doesn't require that you declare the variables that you use, but it's definitely a good practice. You see why later in this chapter.

VBA has a variety of built-in data types. Table 7-1 lists the most common types of data that VBA can handle.

In general, choose the data type that uses the smallest number of bytes but can still handle all the data you want to store in the variable.



An exception to the “smallest number of bytes” rule is `Long`. Most VBA programmers use `Long` instead of `Integer` because doing so offers a slight performance increase. But for small procedures, you would never notice any difference between `Integer` and `Long` data types.

Declaring and scoping variables

If you read the preceding sections, you know a bit about variables and data types. In this section, you discover how to declare a variable as a certain data type.

If you don't declare the data type for a variable you use in a VBA routine, VBA uses the default data type: `Variant`. Data stored as a variant acts like a chameleon; it changes type depending on what you do with it. For example, if a variable is a `Variant` data type and contains a text string that looks like a number (such as “143”), you can use this variable for string manipulations as well as numeric calculations.

VBA automatically handles the conversion. Letting VBA handle data types may seem like an easy way out — but remember that you make it harder to find errors.

TABLE 7-1

VBA's Built-In Data Types

Data Type	Bytes Used	Range of Values
Byte	1	0 to 255
Boolean	2	True or False
Integer	2	-32,768 to 32,767
Long	4	-2,147,483,648 to 2,147,483,647
LongLong	8	-9,223,372,036,854,775,808 to 9,223,372,036,854,775,807
Single	4	-3.40E38 to -1.40E-45 for negative values; 1.40E-45 to 3.40E38 for positive values
Double	8	-1.79E308 to -4.94E-324 for negative values; 4.94E-324 to 1.79E308 for positive values
Currency	8	-922,337,203,685,477 to 922,337,203,685,477
Date	8	1/1/0100 to 12/31/9999
Object	4	Any object reference
String	1 per character	Varies
Variant	Varies	Varies

Before you use variables in a procedure, it's an excellent practice to *declare* your variables — that is, tell VBA each variable's data type. Declaring your variables makes your macro run faster and use memory more efficiently. The default data type, Variant, causes VBA to repeatedly perform time-consuming checks and reserve more memory than necessary. If VBA knows a variable's data type, it doesn't have to investigate and can reserve just enough memory to store the data.

To force yourself to declare all the variables you use, include these two words as the first statement in your VBA module:

```
Option Explicit
```


When this statement is present, you won't be able to run your code if it contains any undeclared variables.



REMEMBER

You need to use `Option Explicit` only once: at the beginning of your module, above any procedures in the module. Keep in mind that the `Option Explicit` statement applies only to the module in which it resides. If you have more than one VBA module in a project, you need an `Option Explicit` statement for each module.

Suppose that you use an undeclared variable (that is, a `Variant`) named `CurrentRate`. At some point in your routine, you insert the following statement:

```
CurentRate = .075
```

The variable name is misspelled (missing an `r`) and can be very difficult to spot. If you don't notice it, Excel interprets it as a *different* variable, and it will probably cause your routine to give incorrect results. If you use `Option Explicit` at the beginning of your module (forcing you to declare the `CurrentRate` variable), Excel generates an error if it encounters a misspelled variation of that variable.



TIP

To ensure that the `Option Explicit` statement is inserted automatically whenever you insert a new VBA module, turn on the `Require Variable Definition` option. You find it on the `Editor` tab of the `Options` dialog box (in the `VBE`, choose `Tools` ⇄ `Options`).



TIP

Declaring your variables also allows you to take advantage of a shortcut that can save you some typing. Just type the first two or three characters of the variable name, then press `Ctrl+spacebar`. The `VBE` either completes the entry for you or — if the choice is ambiguous — shows you a list of matching words to choose among. In fact, this slick trick works with reserved words and functions, too. Figure 7-1 shows an example of how this works.

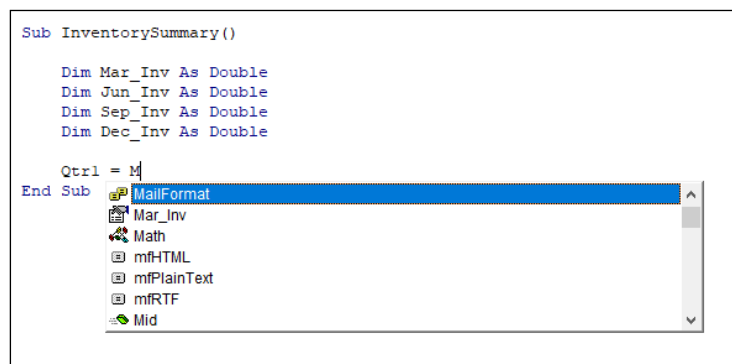


FIGURE 7-1: Pressing `Ctrl+spacebar` displays a list of variable names, reserved words, and functions.

You now know the advantages of declaring variables, but *how* do you do it? The most common way is to use a Dim statement. Here are some examples of variables being declared:

```
Dim YourName As String
Dim Mar_Inv As Double
Dim AmountDue As Double
Dim RowNumber As Long
Dim X
```

The first four variables are declared as a specific data type. The last variable, X, is not declared as a specific data type, so it's treated as a Variant (it can be anything).

Besides Dim, VBA has three keywords that are used to declare variables:

- » Static
- » Public
- » Private

The Dim, Static, Public, and Private keywords are discussed later, but first, two other topics are relevant here: a variable's scope and life.

A workbook can have any number of VBA modules, and a VBA module can have any number of Sub and Function procedures. A variable's *scope* determines which modules and procedures can use the variable. Table 7-2 has the details.

TABLE 7-2

Variable's Scope

Scope	How the Variable Is Declared
Procedure only	By using Dim or Static inside the procedure that uses the variable
Module only	By using Dim or Private before the first Sub or Function statement in the module
All procedures in all modules	By using Public before the first Sub or Function statement in any module

Confused? Keep turning the pages; some examples make this stuff crystal clear.

Procedure-only variables

The smallest scope for a variable is at the procedure level. (A *procedure* is either a Sub or a Function procedure.) Variables declared with this scope can be used only in the procedure in which they're declared. When the procedure ends, the variable

no longer exists, and Excel frees up its memory. If you execute the procedure again, the variable comes back to life, but its previous value is lost.

The most common way to declare a procedure-only variable is with a Dim statement. Dim doesn't refer to the mental capacity of the VBA designers. Rather, it's an old programming term that's short for *dimension*, which simply means you're setting aside memory for a particular variable. You usually place Dim statements immediately after the Sub or Function statement and before the procedure's code.

The following example shows some procedure-only variables declared by using Dim statements:

```
Sub MySub()  
    Dim x As Double  
    Dim First As Long  
    Dim InterestRate As Single  
    Dim TodaysDate As Date  
    Dim UserName As String  
    Dim MyValue  
    ' ...      [The procedure's code goes here] ...  
End Sub
```

Notice that the last Dim statement in the preceding example doesn't declare a data type for the MyValue variable; it declares only the variable itself. The effect is that the variable MyValue is a Variant data type.



WARNING

Unlike some languages, VBA doesn't allow you to declare a group of variables to be a particular data type by separating the variables with commas. For example, though valid, the following statement does *not* declare all the variables as Longs:

```
Dim i, j, k As Long
```

In this example, only k is declared to be a Long; the other variables default to the Variant data type.

If you declare a variable with procedure-only scope, other procedures in the same module can use the same variable name, but each variable instance is unique to its own procedure. In general, variables declared at the procedure level are the most efficient because VBA frees up the memory they use when the procedure ends.

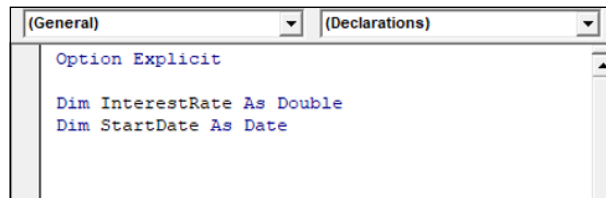
Module-only variables

Sometimes, you want a variable to be available to all procedures in a module. If so, just declare the variable (using Dim or Private) *before* the module's first Sub or Function statement — outside any procedures. You do this in the Declarations

section, at the beginning of your module. (This is also where the Option Explicit statement is located.)

Figure 7-2 shows how you know when you're working with the Declarations section. Use the drop-down menu on the right, and go directly to the Declarations section. Do not pass Go, and do not collect \$200.

FIGURE 7-2:
Each VBA module has a Declarations section, which appears before any Sub or Function procedures.



Suppose that you want to declare the CurrentValue variable so that it's available to all the procedures in your module. All you need to do is use the Dim statement in the Declarations section:

```
Dim CurrentValue As Double
```

With this declaration in place — and in the proper place — the CurrentValue variable can be used from any other procedure within the module, and it retains its value from one procedure to another.

Public variables

If you need to make a variable available to all the procedures in all your VBA modules in a workbook, declare the variable at the module level (in the Declarations section) by using the Public keyword. Here's an example:

```
Public CurrentRate As Double
```

The Public keyword makes the CurrentRate variable available to any procedure in the workbook — even those in other VBA modules. You must insert this statement before the first Sub or Function statement in a module.

Static variables

Normally, when a procedure ends, all the procedure's variables are reset. *Static variables* are special cases because they retain their value even after the procedure ends. You declare a static variable at the procedure level. A static variable may be useful if you need to track the number of times you execute a procedure. You can declare a static variable and increment it each time you run the procedure.

As shown in the following example, you declare static variables by using the `Static` keyword:

```
Sub MySub()  
    Static Counter As Long  
    Dim Msg As String  
    Counter = Counter + 1  
    Msg = "Number of executions: " & Counter  
    MsgBox Msg  
End Sub
```

The code keeps track of the number of times the procedure was executed and displays the number in a message box. The value of the `Counter` variable isn't reset when the procedure ends, but it's reset when you close and reopen the workbook.



WARNING

Even though the value of a variable declared as `Static` is retained after a variable ends, that variable is unavailable to other procedures. In the preceding `MySub` procedure example, the `Counter` variable and its value are available only within the `MySub` procedure. In other words, it's a procedure-level variable.

Life of variables

Nothing lives forever, including variables. The scope of a variable not only determines where that variable may be used, but also affects the circumstances under which the variable is removed from memory.

You can purge all variables from memory by using three methods:

- » Click the Reset toolbar button (the little blue square button on the Standard toolbar in the VBE).
- » Click End when a runtime error message dialog box shows up.
- » Include an End statement anywhere in your code. This is not the same as an End Sub or End Function statement.

Otherwise, only procedure-level variables will be removed from memory when the macro code has completed running. Static variables, module-level variables, and global (public) variables all retain their values in between runs of your code.



WARNING

If you use module-level or global-level variables, make sure they have the values you expect them to have. You never know whether one of the situations just mentioned may have caused your variables to lose their content!

Working with constants

A variable's value may (and usually does) change while your procedure is executing. That's why they call it a *variable*. Sometimes, you need to refer to a value or string that never changes. In such a case, you need a *constant* — a named element whose value doesn't change.

As shown in the following examples, you declare constants by using the Const statement. The declaration statement also gives the constant its value:

```
Const NumQuarters As Long = 4
Const Rate = .0725, Period = 12
Const ModName As String = "Budget Macros"
Public Const AppName As String = "Budget Application"
```



TIP

Using constants in place of hard-coded values or strings is an excellent programming practice. For example, if your procedure needs to refer to a specific value (such as an interest rate) several times, it's better to declare the value as a constant and refer to its name rather than the value. This makes your code more readable and easier to change. And if the interest rate changes, you have to change only one statement rather than several.



REMEMBER

Like variables, constants have a scope. Keep these points in mind:

- » To make a constant available within only a single procedure, declare the constant after the procedure's Sub or Function statement.
- » To make a constant available to all procedures in a module, declare the constant in the Declarations section for the module.
- » To make a constant available to all modules in the workbook, use the Public keyword and declare the constant in the Declarations section of any module.

Unlike a variable, the value of a constant doesn't vary. If you attempt to change the value of a constant in a VBA routine, you get an error. This isn't too surprising because the value of a constant must remain constant. If you need to change the value of a constant while your code is running, what you really need is a variable.

Using premade constants

Excel and VBA contain many predefined constants, which you can use without the need to declare them yourself. The macro recorder usually uses constants rather than actual values. In general, you don't need to know the value of these constants to use them. The following simple procedure uses a built-in constant (xlCalculationManual) to change the Calculation property of the Application object (in other words, to change the Excel recalculation mode to manual):

```
Sub CalcManual()  
    Application.Calculation = xlCalculationManual  
End Sub
```

If you look in Excel's Help system for calculation modes, you'll find this:

Name	Value	Description
xlCalculationAutomatic	-4105	Excel controls recalculation.
xlCalculationManual	-4135	Calculation is done when the user requests it.
xlCalculationSemiauto- matic	2	Excel controls recalculation but ignores changes in tables.

So the actual value of the built-in `xlCalculationManual` constant is `-4135`. Obviously, it's easier to use the constant's name than try to remember such an odd value. As you can see, many of the built-in constants are just arbitrary numbers that have special meaning to VBA.



TIP

To find the actual value of a built-in constant, use the Immediate window in the VBE and execute a VBA statement such as the following:

```
? xlCalculationAutomatic
```

If the Immediate window isn't visible, press `Ctrl+G`. The question mark is a shortcut for typing **Print**.

Working with strings

Excel can work with both numbers and text, so it should come as no surprise that VBA has this same power. Text is often referred to as a *string*. You can work with two types of strings in VBA:

- » **Fixed-length strings** are declared with a specified number of characters. The maximum length is 65,526 characters, which is a lot of characters! As a point of reference, this chapter contains about half that many characters.
- » **Variable-length strings** theoretically can hold as many as 2 billion characters. If you type 5 characters per second, it would take you about 760 days to bang out 2 billion characters — assuming you don't take any breaks to eat or sleep.

When declaring a string variable with a `Dim` statement, you can specify the maximum length if you know it (it's a fixed-length string) or let VBA handle it

dynamically (it's a variable-length string). The following example declares the MyString variable as a string with a maximum length of 50 characters. (Use an asterisk to specify the number of characters, up to the 65,526-character limit.) YourString is also declared as a string, but its length is unspecified:

```
Dim MyString As String * 50
Dim YourString As String
```

You won't see a lot of fixed-length string variables in the wild. Back when computer memory was scarce and valuable, they made programs take up less space. Today, they're generally not necessary.



WARNING

When declaring a fixed-length string that exceeds 999, don't use a comma in the number that specifies the string size. In fact, never use commas when entering a numeric value in VBA. VBA doesn't like that.

Working with dates

Another data type you might find useful is Date. You can use a string variable to store dates, but then you can't perform date calculations. Using the Date data type gives your routines greater flexibility. For example, you might need to calculate the number of days between two dates. This would be impossible (or at least extremely challenging) if you used strings to hold your dates.

A variable defined as a Date can hold dates ranging from January 1, 0100, to December 31, 9999. That's a span of nearly 10,000 years and more than enough for even the most aggressive financial forecast. You can also use the Date data type to work with time data. (VBA lacks a Time data type.)

These examples declare variables and constants as a Date data type:

```
Dim Today As Date
Dim StartTime As Date
Const FirstDay As Date = #1/1/2019#
Const Noon = #12:00:00#
```

In VBA, place dates and times between two hash marks, as shown in the preceding examples.



REMEMBER

Date variables display dates according to your system's short date format, and they display times according to your system's time format (either 12- or 24-hour formatting). The Windows Registry stores these settings, and you can modify them via the Regional Settings in the Windows Control Panel. Therefore, the VBA-displayed date or time format may vary, depending on the settings for the system on which the application is running.

When writing VBA code, however, you must use one of the US date formats (such as mm/dd/yyyy). So, the following statement assigns a day in October (not November) to the MyDate variable (even if your system is set to use dd/mm/yyyy for dates):

```
MyDate = #10/11/2019#
```

When you display the variable (with the MsgBox function, for example), VBA shows MyDate using your system settings. So if your system uses the dd/mm/yyyy date format, MyDate is displayed as 11/10/2019.

Using Assignment Statements

An *assignment statement* is a VBA statement that assigns the result of an expression to a variable or an object. Excel's Help system defines the term expression as

... a combination of keywords, operators, variables, and constants that yields a string, number, or object. An expression can be used to perform a calculation, manipulate characters, or test data.

Much of your work in VBA involves developing (and debugging) expressions. If you know how to create formulas in Excel, you'll have no trouble creating expressions. With a worksheet formula, Excel displays the result in a cell. A VBA expression, on the other hand, can be assigned to a variable.

Assignment statement examples

In the assignment statement examples that follow, the expressions are to the right of the equal sign:

```
x = 1  
x = x + 1  
x = (y * 2) / (z * 2)  
HouseCost = 375000  
FileOpen = True  
Range("TheYear").Value = 2019
```



TIP

Expressions can be as complex as you need them to be; use the line continuation character (a space followed by an underscore) to make lengthy expressions easier to read.

Often, expressions use functions: VBA's built-in functions, Excel's worksheet functions, or functions that you develop with VBA. Functions are discussed in Chapter 9.

About that equal sign

As you can see in the preceding example, VBA uses the equal sign as its assignment operator. You're probably accustomed to using an equal sign as a mathematical symbol for equality. Therefore, an assignment statement like the following may cause you to raise your eyebrows:

```
z = z + 1
```

In what crazy universe is z equal to itself plus 1? Answer: No known universe. In this case, the assignment statement (when executed) increases the value of z by 1. So if z is 12, executing the statement makes z equal to 13. Just remember that an assignment uses the equal sign as an operator, not a symbol of equality.

Smooth operators

Operators play major roles in VBA. Besides the equal-sign operator (discussed in the previous section), VBA provides several operators. Table 7-3 lists these operators. These should be familiar to you because they're the same operators used in worksheet formulas (except for the Mod operator).

TABLE 7-3

VBA's Operators

Function	Operator Symbol
Addition	+
Multiplication	*
Division	/
Subtraction	-
Exponentiation	^
String concatenation	&
Integer division (the result is always an integer)	\
Modulo arithmetic (returns the remainder of a division operation)	Mod

When you're writing an Excel formula, you do modulo arithmetic by using the MOD function. For example, the following formula returns 2 (the remainder when you divide 12 by 5):

```
=MOD(12,5)
```

In VBA, the Mod operator is used like this (and z has a value of 2):

```
z = 12 Mod 5
```



TECHNICAL
STUFF

The term *concatenation* is programmer speak for “join together.” Thus, if you concatenate strings, you're combining strings to make a new and improved string.

As shown in Table 7-4, VBA also provides a full set of logical operators.

TABLE 7-4

VBA's Logical Operators

Operator	What It Does
Not	Turns TRUE or FALSE into its opposite
And	Returns TRUE only if both expressions return TRUE
Or	Returns TRUE if either expression returns TRUE
Xor	Short for exclusive or, returns TRUE if one expression is TRUE and the other FALSE

The precedence order for operators in VBA is exactly the same as in Excel formulas. Exponentiation has the highest precedence. Multiplication and division come next, followed by addition and subtraction. You can use parentheses to change the natural precedence order, making whatever's sandwiched in parentheses come before any operator. Take a look at this code:

```
x = 3  
y = 2  
z = x + 5 * y
```

When the preceding code is executed, what's the value of z? If you answered 13, you get a gold star that proves you understand the concept of operator precedence. If you answered 16, read this: The multiplication operation (5 * y) is performed first, and that result is added to x.

If you have trouble remembering the correct operator precedence, add parentheses around the parts that get calculated first. For example, the previous assignment statement looks like this with parentheses:

```
z = x + (5 * y)
```



TIP

Don't be shy about using parentheses even when they aren't required — especially if doing so makes your code easier to understand. VBA doesn't care if you use extra parentheses.

Working with Arrays

Like most programming languages, VBA supports arrays. An *array* is a group of variables that share a name. You refer to a specific variable in the array by using the array name and an index number in parentheses. For example, you can define an array of 12 string variables to hold the names of the months of the year. If you name the array *MonthNames*, you can refer to the first element of the array as *MonthNames (1)*, the second element as *MonthNames (2)*, and so on.

Declaring arrays

Before you can use an array, you *must* declare it. No exceptions. Unlike with normal variables, VBA is very strict about this rule. You declare an array with a *Dim* statement, just as you declare a regular variable. However, you also need to specify the number of elements in the array. You do this by specifying the first index number, the keyword *To*, and the last index number — all inside parentheses. The following example shows how to declare an array of 100 integers:

```
Dim MyArray(1 To 100) As Integer
```

When you declare an array, you can choose to specify only the upper index. If you omit the lower index, VBA assumes that it's 0. Therefore, both of the following statements declare the same 101-element array:

```
Dim MyArray (0 To 100) As Integer  
Dim MyArray (100) As Integer
```



TIP

If you want VBA to assume that 1 (rather than 0) is the lower index for your arrays, include the following statement in the Declarations section at the top of your module:

```
Option Base 1
```

This statement forces VBA to use 1 as the first index number for arrays that declare only the upper index. If this statement is present, the following statements are identical, both declaring a 100-element array:

```
Dim MyArray (1 To 100) As Integer  
Dim MyArray (100) As Integer
```

Multidimensional arrays

The arrays created in the previous examples are all one-dimensional arrays. Think of one-dimensional arrays as a single line of values. Arrays you create in VBA can have as many as 60 dimensions — although you rarely need more than two or three dimensions in an array. The following example declares an 81-number array with two dimensions:

```
Dim MyArray (1 To 9, 1 To 9) As Long
```

You can think of this array as occupying a 9×9 matrix — perfect for storing all numbers in a Sudoku puzzle.

To refer to a specific element in this array, you need to specify two index numbers (similar to its “row” and its “column” in the matrix). The following example shows how you can assign a value to an element in this array:

```
MyArray(3, 4) = 125
```

This statement assigns a value to a single element in the array. If you’re thinking of the array in terms of a 9×9 matrix, this assigns 125 to the element located in the third row and fourth column of the matrix.

Here’s how to declare a three-dimensional array, with 1,000 elements:

```
Dim My3DArray(1 To 10, 1 To 10, 1 To 10) As Long
```

You can think of a three-dimensional array as a cube. Visualizing an array of more than three dimensions is more difficult.

Dynamic arrays

You can also create *dynamic* arrays. A dynamic array doesn’t have a preset number of elements. Declare a dynamic array with an empty set of parentheses:

```
Dim MyArray() As String
```

Before you can use this array, you must use the ReDim statement to tell VBA how many elements the array has (for example, to redimension the array). Usually, the number of elements in the array is determined while your code is running. You can use the ReDim statement any number of times, changing the array's size as often as needed. The following example demonstrates how to change the number of elements in a dynamic array. It assumes that the NumElements variable contains a value, which your code calculated.

```
ReDim MyArray(1 To NumElements)
```



WARNING

When you redimension an array by using ReDim, you wipe out any values currently stored in the array elements. You can avoid destroying the old values by using the Preserve keyword. The following example shows how you can preserve an array's values when you redimension the array:

```
ReDim Preserve MyArray(1 To NumElements)
```

If MyArray currently has ten elements, and you execute the preceding statement with NumElements equaling 12, the first ten elements remain intact, and the array has room for two additional elements (up to the number contained in the variable NumElements). If NumElements equals 7, however, the first seven elements are retained, but the remaining three elements meet their demise.

The topic of arrays comes up again in Chapter 10, when you explore the concept of looping.

Using Labels

In early versions of BASIC, every line of code required a line number. For example, if you had written a BASIC program in the '70s (dressed, of course, in your bell bottoms), it may have looked something like this:

```
010: LET X=5  
020: LET Y=3  
030: LET Z=X*Y  
040: PRINT Z  
050: END
```



REMEMBER

VBA permits the use of such line numbers, and it even permits text labels. You don't typically use a label for each line, but you may occasionally need to use a label. For example, insert a label if you use a GoTo statement (discussed in Chapter 10). A label must begin with the first nonblank character in a line and end with a colon.

IN THIS CHAPTER

- » Finding out why Range objects are so important
- » Understanding the various ways of referring to ranges
- » Discovering some of the most useful Range object properties
- » Uncovering some of the most useful Range object methods

Chapter 8

Working with Range Objects

This chapter digs a bit deeper into Excel's dungeons and takes a closer look at Range objects. Excel is all about cells, and the Range object is a container for cells. Much of the programming work you do in Excel focuses on Range objects, such as assigning values to cells, putting formulas in cells, and formatting cells.

Referring to Range Objects

A *Range object* represents a range contained in a Worksheet object. Range objects, like all other objects, have properties (which you can examine and sometimes change) and methods (which perform actions on the object).

A Range object can be as small as a single cell (for example, B4) or as large as every one of the 17,179,869,184 cells in a worksheet (A1:XFD1048576).

When you refer to a Range object, the address is always surrounded by double quotes, like this:

```
Range("A1:C5")
```

If the range consists of one cell, you still need the quotes:

```
Range("K9")
```

If the range happens to have a name (created with Formulas ⇔ Defined Names ⇔ Define Name), you can refer to the range by its name (which is also in quotes):

```
Range("PriceList")
```



WARNING

Unless you tell Excel otherwise by qualifying the range reference, it assumes that you're referring to a range on the active worksheet. If anything other than a worksheet is active (such as a chart sheet), the range reference fails, and your macro displays an error message and grinds to a screeching halt.

As shown in the following example, you can refer to a range outside the active sheet by qualifying the range reference with a worksheet name from the active workbook:

```
Worksheets("Sheet1").Range("A1:C5")
```

If you need to refer to a range in a different workbook (that is, any workbook other than the active workbook), you can use a statement like this:

```
Workbooks("Budget.xlsx").Worksheets("Sheet1").Range("A1:C5")
```

A Range object can consist of one or more entire rows or columns. You can refer to an entire row (in this case, row 3) by using syntax like this:

```
Range("3:3")
```

You can refer to an entire column (the fourth column in this example) like this:

```
Range("D:D")
```

In Excel, you select noncontiguous ranges by holding down Ctrl while selecting various ranges with your mouse. Figure 8-1 shows a noncontiguous range selection. You shouldn't be surprised that VBA also allows you to work with

noncontiguous ranges. To refer to the range in Figure 8-1, use the following expression. Notice that a comma separates the two areas.

```
Range("B2:D8,C11:G12")
```

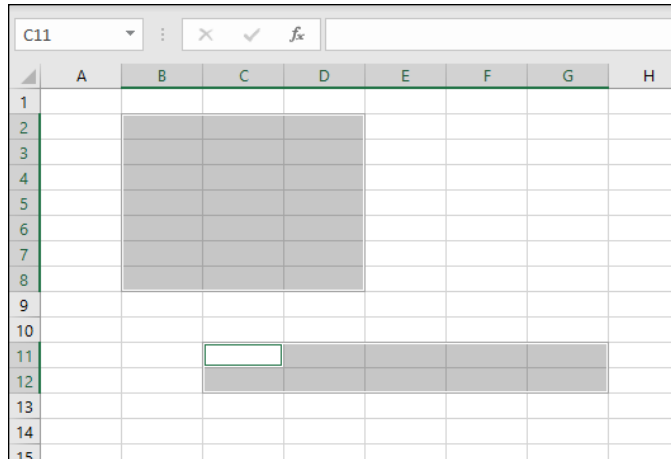


FIGURE 8-1:
A noncontiguous
range selection.



WARNING

Be aware that some methods and properties cause havoc with noncontiguous ranges. Copy-and-paste won't work with noncontiguous ranges unless all the cells are in the same rows and columns. And when it does work, it ignores the empty cells in between and pastes a contiguous range. If it doesn't do what you want, you might have to process each area separately by using a loop.

Referring to a Range Using Properties

The more you work with VBA, the more you realize that it's a fairly well-conceived language and is usually quite logical (despite what you might be thinking right now). Often, VBA provides multiple ways to perform an action. You can choose the most appropriate solution for your problem. This section discusses some of the other ways to refer to a range.



REMEMBER

This chapter barely scratches the surface for the Range object's properties and methods. As you work with VBA, you'll probably need to access other properties and methods. The Help system is the best place to find out about them, but it's also a good idea to record your actions and examine the code Excel generates. You're probably getting tired of hearing that advice by now, but it really is good advice.

The Cells property

Rather than use the VBA Range keyword, you can refer to a range via the Cells property.



Although Cells may seem like an object (or a collection), it's really not. Rather, Cells is a property that VBA evaluates. VBA then returns an object (more specifically, a Range object). If this seems strange, don't worry. Even Microsoft appears to be confused about this issue. In some earlier versions of Excel, the Cells property was known as the Cells method. Regardless of what it is, just understand that Cells is a handy way to refer to a range.

The Cells property takes two arguments: a row number and a column number. Both of these arguments are numbers, even though you usually refer to columns by using letters. For example, the following expression refers to cell C2 on Sheet2:

```
Worksheets("Sheet2").Cells(2, 3)
```

You can also use the Cells property to refer to a multicell range. The following example demonstrates the syntax you use:

```
Range(Cells(1, 1), Cells(10, 8))
```

This expression refers to an 80-cell range that extends from cell A1 (row 1, column 1) to cell H10 (row 10, column 8).

The following statements both produce the same result; they enter a value of 99 into a 10-by-8 range of cells. More specifically, these statements set the Value property of the Range object:

```
Range("A1:H10").Value = 99  
Range(Cells(1, 1), Cells(10, 8)).Value = 99
```



The advantage of using the Cells property to refer to ranges becomes apparent when you use variables rather than actual numbers as the Cells arguments. Things also really start to click when you understand looping, which is in Chapter 10.

The Offset property

The Offset property provides another handy means for referring to ranges. This property, which operates on a Range object and returns another Range object, allows you to refer to a cell that is a particular number of rows and columns away from another cell.

Like the Cells property, the Offset property takes two arguments. The first argument represents the number of rows to offset; the second represents the number of columns to offset.

The following expression refers to a cell one row below cell A1 and two columns to the right of cell A1. In other words, this refers to the cell commonly known as C2:

```
Range("A1").Offset(1, 2)
```

The Offset property can also use negative arguments. A *negative* row offset refers to a row above the range. A negative column offset refers to a column to the left of the range. The following example refers to cell A1:

```
Range("C2").Offset(-1, -2)
```

And as you may expect, you can use 0 as one or both of the arguments for Offset. The following expression refers to cell A1:

```
Range("A1").Offset(0, 0)
```

Here's a statement that inserts the time of day into the cell to the right of the active cell:

```
ActiveCell.Offset(0,1) = Time
```

When you record a macro in relative mode, Excel uses the Offset property quite a bit. Refer to Chapter 6 for an example.

The Resize property

When you want to refer to a bigger or smaller range, look no further than the Resize property. This property extends or shrinks whatever range you start with by a certain number of rows and columns. The first of Resize's arguments is how many rows you want the new range to be. The second argument is how many columns.

The following expression selects a 10 × 12 range of cells with C10 as the top-left cell:

```
Range("C10").Resize(10,12).Select
```

Resize's arguments have to be greater than zero, or you'll create a black hole (or maybe just get an error). You can also shrink a range as shown in this example:

```
RowCnt = 20  
Range("A1:A1000").Resize(RowCnt,1)
```

In that expression, a variable named RowCnt is used to shrink a 1,000-cell range down to 20 cells.

Working with Range Object Properties

A Range object has dozens of properties. You can write VBA programs nonstop for the next 12 months and never use them all. This section briefly describes some of the most commonly used Range properties. For complete details, consult the Help system in the VBE.



REMEMBER

Some Range properties are *read-only* properties, which means that your code can look at their values but can't change them ("Look, but don't touch"). For example, every Range object has an Address property, which holds the range's address. You can access this read-only property, but you can't change it — which makes perfect sense when you think about it.

By the way, the examples that follow are typically statements rather than complete procedures. If you'd like to try any of these (and you should), create a Sub procedure to do so. Also, many of these statements work properly only if a worksheet is the active sheet.

The Value property

The Value property represents the value contained in a cell. It's a read-write property, so your VBA code can either read or change the value.

The following statement displays a message box that shows the value in cell A1 on Sheet1:

```
MsgBox Worksheets("Sheet1").Range("A1").Value
```

It stands to reason that you can read the Value property only for a single-cell Range object. For example, the following statement generates an error:

```
MsgBox Worksheets("Sheet1").Range("A1:C3").Value
```



ASSIGNING THE VALUES IN A MULTICELL RANGE TO A VARIABLE

Even though you can read the Value property only for a single-cell Range object, you can assign the values in a multicell range to a variable, as long as the variable is a variant. That's because a variant can act like an array. Here's an example:

```
Dim x As Variant
x = Range("A1:C3").Value
```

Then you can treat the x variable as though it were an array. This statement, for example, returns the value in cell B1:

```
MsgBox x(1, 2)
```

You can, however, change the Value property for a range of any size. The following statement enters the number 123 into each cell in a range:

```
Worksheets("Sheet1").Range("A1:C3").Value = 123
```



TIP

Value is the default property for a Range object. In other words, if you omit a property for a Range, Excel uses its Value property. The following statements both enter a value of 75 into cell A1 of the active worksheet:

```
Range("A1").Value = 75
Range("A1") = 75
```

The Text property

The Text property returns a string that represents the text as it's displayed in a cell — the formatted value. The Text property is read-only — to change it you have to change other properties, such as Value or NumberFormat. Suppose that cell A1 contains the value 12.3 and is formatted to display two decimals and a dollar sign (\$12.30). The following statement displays a message box containing \$12.30:

```
MsgBox Worksheets("Sheet1").Range("A1").Text
```

But the next statement displays a message box containing 12.3:

```
MsgBox Worksheets("Sheet1").Range("A1").Value
```

If the cell contains a formula, the Text property returns the result of the formula. If a cell contains text, the Text property and the Value property always return the same thing, because text (unlike a number) can't be formatted to display differently.

The Count property

The Count property returns the number of cells in a range. It counts all cells, not just the nonblank cells. Count is a read-only property, just as you would expect. The following statement accesses a range's Count property and displays the result (9) in a message box:

```
MsgBox Range("A1:C3").Count
```

The Column and Row properties

The Column property returns the column number of a single-cell range. Its sidekick, the Row property, returns the row number of a single-cell range. Both are read-only properties. For example, the following statement displays 6 because cell F3 is in the sixth column:

```
MsgBox Sheets("Sheet1").Range("F3").Column
```

The next expression displays 3 because cell F3 is in the third row:

```
MsgBox Sheets("Sheet1").Range("F3").Row
```



REMEMBER

If the Range object consists of more than one cell, the Column property returns the column number of the first column in the range, and the Row property returns the row number of the first row in the range.

The Address property

Address, a read-only property, displays the cell address for a Range object as an absolute reference (a dollar sign before the column letter and before the row number). The following statement displays the message box shown in Figure 8-2:

```
MsgBox Range(Cells(1, 1), Cells(5, 5)).Address
```

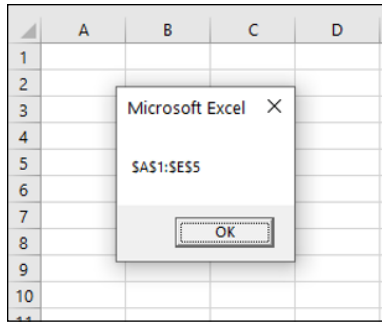


FIGURE 8-2:
This message box displays the Address property of a 5 × 5 range.

The HasFormula property

The HasFormula property (which is read-only) returns True if the single-cell range contains a formula. It returns False if the cell contains something other than a formula (or is empty). If the range consists of more than one cell, VBA returns True only if all cells in the range contain a formula or False if all cells in the range don't have a formula. The property returns Null if the range contains a mixture of formulas and nonformulas. Null is kind of a no-man's land: The answer is neither True nor False, and any cell in the range may or may not have a formula.



WARNING

You need to be careful when you work with properties that can return Null. More specifically, the only data type that can deal with Null is Variant.

For example, assume that cell A1 contains a value and cell A2 contains a formula. The following statements generate an error because the range doesn't consist of all formulas or all nonformulas:

```
Dim FormulaTest As Boolean
FormulaTest = Range("A1:A2").HasFormula
```

The Boolean data type can handle only True or False. Null causes Excel to complain and display an error message. To fix this type of situation, the best thing to do is make sure that the FormulaTest variable is declared as a Variant rather than as a Boolean. The following example uses VBA's handy TypeName function (along with an If-Then-Else construct) to determine the data type of the FormulaTest variable. If the range has a mixture of formulas and nonformulas, the message box displays Mixed! Otherwise, it displays True or False.

```
Sub CheckForFormulas()
    Dim FormulaTest As Variant
    FormulaTest = Range("A1:A2").HasFormula
```

```
If TypeName(FormulaTest) = "Null" Then
    MsgBox "Mixed!"
Else
    MsgBox FormulaTest
End If
End Sub
```

See Chapter 10 for more about using the If-Then-Else construct.

The Font property

As noted earlier in this chapter (see the “The Cells property” section), a property can return an object. The Font property of a Range object is another example of that concept at work. The Font property returns a Font object.

A Font object, as you may expect, has many accessible properties. To change some aspect of a range’s font, you must first access the range’s Font object and then manipulate the properties of that object. This may be confusing, but perhaps this example will help.

The following statement uses the Font property of the Range object to return a Font object. Then the Bold property of the Font object is set to True. In plain English, this statement makes the cell display in boldface:

```
Range("A1").Font.Bold = True
```

Truth is, you don’t really need to know that you’re working with a special Font object that’s contained in a Range object. As long as you use the proper syntax, it works just fine. Often, recording your actions with the macro recorder tells you everything you need to know about the proper syntax.

See Chapter 6 for more information about recording macros.

The Interior property

Here’s yet another example of a property that returns an object. A Range object’s Interior property returns an Interior object (strange name, but that’s what it’s called). This type of object referencing works the same way as the Font property (described in the preceding section).

For example, the following statement changes the Color property of the Interior object contained in the Range object:

```
Range("A1").Interior.Color = 8421504
```


A QUICK-AND-DIRTY COLOR PRIMER

Before Excel 2007, Microsoft tried to convince us that 56 colors were good enough for a spreadsheet. But things have changed, and we can use more than 16 million colors in a workbook — 16,777,216 colors, to be exact.

Many objects have a Color property, and that property accepts color values that range from 0 to 16777215. Nobody can remember that many color values, so (fortunately) there's an easier way to specify colors: VBA's RGB function. This function takes advantage of the fact that any of these 16 million colors can be represented by various levels of red, green, and blue. The three arguments in the RGB function correspond to the color's red, green, and blue components, and each of these arguments can range from 0 to 255.

Note that $256 \times 256 \times 256 = 16,777,216$ — which happens to be the number of colors. Don't you just love it when the math works out?

Here's a statement that changes a cell's background color to a random color:

```
Range("A1").Interior.Color = Int(16777216 * Rnd)
```

Following are a few examples that use the RGB function to change a cell's background color:

```
Range("A1").Interior.Color = RGB(0, 0, 0) 'black
Range("A1").Interior.Color = RGB(255, 0, 0) ' pure red
Range("A1").Interior.Color = RGB(0, 0, 255) ' pure blue
Range("A1").Interior.Color = RGB(198, 212, 60) ' ugly green
Range("A1").Interior.Color = RGB(128, 128, 128) ' middle gray
```

What's the exact value of RGB(128, 128, 128)? This statement tells you that it's 8421504:

```
MsgBox RGB(128, 128, 128)
```

If you need to use standard colors, you might prefer to use one of the built-in color constants: vbBlack, vbRed, vbGreen, vbYellow, vbBlue, vbMagenta, vbCyan, or vbWhite. For example, the following statement makes cell A1 yellow:

```
Range("A1").Interior.Color = vbYellow
```

(continued)

(continued)

Excel 2007 also introduced *theme colors*. These colors appear when you use color control such as the Fill Color control in the Font group of the Home tab. Try recording a macro while you change colors, and you'll get something like this:

```
Range("A1").Interior.ThemeColor = xlThemeColorAccent4  
Range("A1").Interior.TintAndShade = 0.399975585192419
```

Yep, two more color-related properties to deal with. Here, you have a theme color (the basic color, specified as a built-in constant), plus a “tint and shade” value that represents how dark or light the color is. TintAndShade values range from -1.0 to +1.0. Positive values of the TintAndShade property make the color lighter, and negative values make the color darker. When you set a color by using the ThemeColor property, the color changes if you apply a different document theme (by choosing Page Layout ⇨ Themes ⇨ Themes).

In other words, this statement changes the cell's background to middle gray. What's that? You didn't know that 8421504 is middle gray? For some insights into Excel's wonderful world of color, see the sidebar, “A Quick-and-Dirty Color Primer.”

The Formula property

The Formula property represents the formula in a cell. This is a read-write property, so you can access it to either view the formula in a cell, or to insert a formula into a cell. For example, the following statement enters a SUM formula into cell A13:

```
Range("A13").Formula = "=SUM(A1:A12)"
```

Notice that the formula is a text string and is enclosed in quotation marks. Also notice that the formula begins with an equal sign, as all formulas do.

If the formula itself contains quotation marks, things get a bit tricky. Say that you want to insert this formula by using VBA:

```
=SUM(A1:A12)&" Stores"
```

This formula displays a value followed by the word *Stores*. To make this formula acceptable, you need to replace every quotation mark in the formula with two quotation marks. Otherwise, VBA gets confused and claims that there's a syntax error (because there is!). So, here's a statement that enters a formula that contains quotes:

```
Range("A13").Formula = "=SUM(A1:A12)&"" Stores"""
```

By the way, you can access a cell's Formula property even if the cell doesn't have a formula. If a cell has no formula, the Formula property returns the same as its Value property.

If you need to know whether a cell has a formula, use the HasFormula property (discussed earlier in this chapter, in the aptly named section, "The HasFormula property").



REMEMBER

Be aware that VBA "speaks" US English. This means that to put a formula in a cell, you must use the US syntax. If you use a non-English version of Excel, read up on the FormulaLocal property in the Help system.

The NumberFormat property

The NumberFormat property represents the number format (expressed as a text string) of the Range object. This is a read-write property, so your VBA code can either examine the number format or change it. The following statement changes the number format of column A to a percentage with two decimal places:

```
Columns("A:A").NumberFormat = "0.00%"
```

Follow these steps to see a list of other number formats (better yet, turn on the macro recorder while you do this):

1. **Activate a worksheet.**
2. **Press Ctrl+1 to access the Format Cells dialog box.**
3. **Click the Number tab.**
4. **Select the Custom category to view and apply some additional number format strings.**

Taking Action with Range Object Methods

As you know, a VBA method performs an action. A Range object has dozens of methods but, again, you won't need most of these. In this section, you explore some of the most commonly used Range object methods.

The Select method

Use the Select method to select a range of cells. The following statement selects a range in the active worksheet:

```
Range("A1:C12").Select
```



WARNING

Before selecting a range, it's often a good idea to use one additional statement to ensure that the correct worksheet is active. For example, if Sheet1 contains the range you want to select, use the following statements to select the range:

```
Sheets("Sheet1").Activate  
Range("A1:C12").Select
```

Contrary to what you might expect, the following statement generates an error if Sheet1 is not already the active sheet. In other words, you must use two statements rather than just one: one to activate the sheet and another to select the range.

```
Sheets("Sheet1").Range("A1:C12").Select
```



TIP

If you use the GoTo method of the Application object to select a range, you can forget about selecting the correct worksheet first. This statement activates Sheet1 and then selects the range:

```
Application.Goto Sheets("Sheet1").Range("A1:C12")
```

The GoTo method is the VBA equivalent of pressing F5 in Excel, which displays the GoTo dialog box.

The Copy and Paste methods

You can perform copy and paste operations in VBA by using the Copy and Paste methods. Note that two objects come into play. The Copy method is applicable to the Range object, and the Paste method applies to the Worksheet object. It actually makes sense: You copy a range and paste it into a worksheet.

This short macro (courtesy of the macro recorder) copies range A1:A12 and pastes it into the same worksheet, beginning at cell C1:

```
Sub CopyRange()  
    Range("A1:A12").Select  
    Selection.Copy
```

```
Range("C1").Select
ActiveSheet.Paste
End Sub
```



TIP

Notice that in the preceding example, the `ActiveSheet` object is used with the `Paste` method. This is a special version of the `Worksheet` object that refers to the currently active worksheet. Also notice that the macro selects the range before copying it. However, you don't have to select a range before doing something with it. In fact, the following procedure accomplishes the same task as the preceding example by using a single statement:

```
Sub CopyRange2()
    Range("A1:A12").Copy Range("C1")
End Sub
```

This procedure takes advantage of the fact that the `Copy` method can use an argument that corresponds to the destination range for the copy operation. That's something that you can find out by checking with the Help system.

The Clear method

The `Clear` method deletes the contents of a range, plus all the cell formatting. For example, if you want to zap everything in column D, the following statement does the trick:

```
Columns("D:D").Clear
```

You should be aware of two related methods. The `ClearContents` method deletes the contents of the range but leaves the formatting intact. The `ClearFormats` method deletes the formatting in the range but not the cell contents.

The Delete method

Clearing a range differs from deleting a range. When you *delete* a range, Excel shifts the remaining cells around to fill up the range you deleted.

The following example uses the `Delete` method to delete row 6:

```
Rows("6:6").Delete
```

When you delete a range that's not a complete row or column, Excel needs to know how to shift the cells. (To see how this works, experiment with `Home ⇨ Cells ⇨ Delete ⇨ Delete Cells in Excel`.)

The following statement deletes a range and then fills the resulting gap by shifting the other cells to the left:

```
Range("C6:C10").Delete xlToLeft
```

The Delete method uses an argument that indicates how Excel should shift the remaining cells. In this case, the built-in constant (xlToLeft) is used for the argument.

- » Using functions to make your VBA expressions more powerful
- » Utilizing the VBA built-in functions
- » Applying Excel worksheet functions in your VBA code
- » Writing custom functions

Chapter 9

Using VBA and Worksheet Functions

There are three function types: those built into VBA, those built into Excel, and other functions written in VBA. Previous chapters mention how you can use functions in your VBA expressions, and this chapter provides a full explanation. Functions can make your VBA code perform some powerful feats, with little or no programming effort required. If you like that idea, this chapter's for you.

Understanding Functions

Except for a few people who think Excel is a word processor, all Excel users incorporate worksheet functions in their formulas. The most common worksheet function is the SUM function, and you have more than 500 others at your disposal.

A *function* essentially performs a calculation and returns a single value. The SUM function, of course, returns the sum of a range of values. The same holds true for functions used in your VBA expressions: Each function does its thing and returns a single value.

The functions you use in VBA can come from three sources:

- » Built-in functions provided by VBA
- » Worksheet functions provided by Excel
- » Custom functions that you (or someone else) write, using VBA

The rest of this chapter clarifies the differences between functions that come from these three sources.

Using Built-In VBA Functions

VBA provides numerous built-in functions. Some take arguments, and some do not. The following sections present a few examples of using VBA functions in code. In many of these examples, the `MsgBox` function displays a value in a message box. Yes, `MsgBox` is a VBA function — a rather unusual one, but a function nonetheless. This useful function displays a message in a dialog box and also returns a value. For more details about the `MsgBox` function, see Chapter 15.



TIP

A workbook that contains all the examples is available at this book's website (<https://www.dummies.com/go/excelvbaprogrammingfd6e>).

Working with dates and times

Dates are an interesting data type because they are stored as numbers but most often displayed as strings (see Chapter 7 for more on the `Date` data type). For example, October 5, 2022 is stored as the number 44839. That number bears very little resemblance the way it is written out. You can't tell just by looking at it that it's in October or that it's the fifth day. VBA provides several date related functions that makes working with dates much easier.

Displaying the system date or time

The first example uses VBA's `Date` function to display the current system date in a message box:

```
Sub ShowDate()  
    MsgBox "Today is: " & Date  
End Sub
```


Notice that the Date function doesn't use an argument. Unlike worksheet functions, a VBA function with no argument doesn't require an empty set of parentheses. In fact, if you type an empty set of parentheses, the VBE promptly removes them.

To get the system time, use the Time function. And if you want it all, use the Now function to return both the date and the time. Like the Date function, neither Time nor Now takes an argument.

Getting a part of a date or time

VBA provides the Year, Month, Day, Hour, Minute, and Second functions for when you need only one part of a date or time. Each of these functions takes a date or time and returns the part that is the function's name. The Day function returns the day of the month. To return the day of the week, there is a Weekday function. This example shows how to use WeekDay and Hour:

```
Sub DayAndHour()  
    Dim DayName As String  
    Dim TimeName As String  
    DayName = Weekday(Date)  
    TimeName = Hour(Time)  
    MsgBox "It's day " & DayName & " after " & TimeName & "  
    hundred"  
End Sub
```

Displaying the name of a month

The following procedure uses the MonthName function, which returns the name of a month. MonthName uses one argument: an integer between 1 and 12.

```
Sub ShowMonthName()  
    Dim ThisMonth As Long  
    ThisMonth = Month(Date)  
    MsgBox MonthName(ThisMonth)  
End Sub
```

This procedure uses the Month function to get the current month (as a value), and this value is assigned to the ThisMonth variable. The MonthName function then converts the value to text. So if you run this procedure in April, the message box displays the text April.

Actually, the `ThisMonth` variable isn't required. You can get the same effect with this expression, which uses three VBA functions:

```
MonthName(Month(Date))
```

Here, the current date is passed as an argument to the `Month` function, which returns a value that's passed as an argument to the `MonthName` function. VBA also has a `WeekDayName` function for converting a `WeekDay` into a text. For example, `WeekDayName(5)` returns `Thursday`.

Manipulating strings

If you have a variable that's not a date and you don't want to do math with it, then you probably have a string. Strings are arrays of letters in memory. If you could see them in memory, it would look like a bunch of characters strung together, which is why we call them strings. VBA has many built-in functions for working with strings.

Finding a string length

The following procedure uses the VBA `Len` function, which returns the length of a text string. The `Len` function takes one argument: the string. When you execute this procedure, the message box displays your name, and the number of characters in your name (see Figure 9-1).

```
Sub GetLength()  
    Dim MyName As String  
    Dim StringLength As Long  
    MyName = Application.UserName  
    StringLength = Len(MyName)  
    MsgBox MyName & " has " & StringLength & " characters."  
End Sub
```

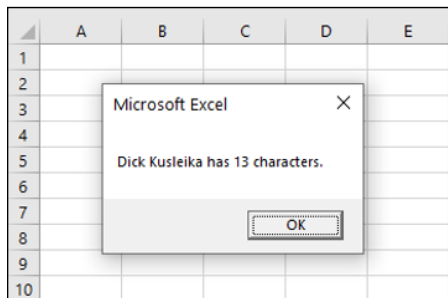


FIGURE 9-1:
Calculating the
length of your
name.



REMEMBER

Excel also has a LEN function, which you can use in your worksheet formulas. The Excel version and the VBA function work the same.

Getting a part of a string

The Left, Right, and Mid function are used to return only a part of a string. The Left and Right functions take two arguments: a string and the number of characters you want. The Mid function takes three: a string, the starting point, and the number of characters you want. This procedure returns four characters of the active sheet's name, starting with the second character:

```
Sub MiddleOfSheetName()  
    MsgBox Mid(ActiveSheet.Name, 2, 4)  
End Sub
```



REMEMBER

If the last argument of Mid is longer than the rest of the string, you just get the rest of the string.

Replacing part of a string

The Replace function works like the SUBSTITUTE function in Excel. It replaces one text string with another. The Replace function has three required arguments: the string, the part you want to find, and the part you want to replace it with. For example, this procedure shows you what your workbook name would look like if it were a CSV file by replacing the .xlsm file extension with .csv:

```
Sub ThisWorkbookAsACSV()  
    MsgBox Replace(ThisWorkbook.Name, ".xlsm", ".csv")  
End Sub
```

Identifying objects and data

There's data and there's metadata. Metadata is not the content itself, but some other aspect that describes or identifies the data. For example, a date is the month, day, and year that comprise the date. That's the content. The fact that it is a date (and not a string or another kind of number) is metadata that describes the data. VBA provides functions for determining what kind of object or data you're working with.

Identifying the type of a selected object

The following procedure uses the `TypeName` function, which returns the type of the selection on the worksheet (as a string):

```
Sub ShowSelectionType()  
    Dim SelType As String  
    SelType = TypeName(Selection)  
    MsgBox SelType  
End Sub
```

The selection could be a Range, a Picture, a Rectangle, a ChartArea, or any other type of object that can be selected.



TIP

The `TypeName` function is very versatile. You can also use this function to determine the data type of a variable.

Validating data

VBA has several functions that start with `Is`, like `IsDate`, `IsError`, and `IsNumeric`. They all take on argument, an expression, and return `True` or `False`. If you want to make sure you're working with a date before you do something, you can check it with the `IsDate` function, like in this procedure:

```
Sub ShowTheYear()  
    Dim MyValue As Variant  
    MyValue = Range("A1").Value  
    If IsDate(MyValue) Then  
        MsgBox Year(MyValue)  
    Else  
        MsgBox "Not a date"  
    End If  
End Sub
```



TIP

Chapter 10 has more information on the `If` statement.

VBA functions that do more than return a value

A few VBA functions go above and beyond the call of duty. Rather than simply return a value, these functions have some useful side effects. Table 9-1 lists them.

TABLE 9-1 VBA Functions with Useful Side Benefits

Function	What It Does
MsgBox	Displays a handy dialog box containing a message and buttons. The function returns a code that identifies which button the user clicks. See Chapter 15 for details.
InputBox	Displays a simple dialog box that asks the user for some input. The function returns whatever the user enters in the dialog box. Chapter 15 explores the InputBox function.
Shell	Executes another program. The function returns the <i>task ID</i> (a unique identifier) of the other program (or an error if the function can't start the other program).

Discovering VBA functions

How do you find out which functions VBA provides? Good question. The best source is the Excel VBA system. Another way is to type **VBA**, followed by a period. You get a list of items, as shown in Figure 9-2. Those with a green icon are functions. If this feature isn't working, choose VBE's Tools⇨Options, click the Editor tab, and place a check next to Auto List Members.

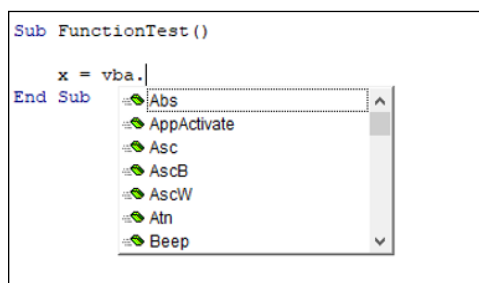


FIGURE 9-2: A way to display a list of VBA functions.

Over 140 different functions are available in VBA. Some are so specialized and obscure that you'll never need them. Others, however, are quite useful for many applications. Table 9-2 lists some of the more useful functions.



TIP

For complete details on a particular function, type the function name in a VBA module, move the cursor anywhere in the text, and press F1.

TABLE 9-2**VBA's Most Useful Built-In Functions**

Function	What It Does
Abs	Returns a number's absolute value
Array	Returns a variant containing an array
Choose	Returns a value from a list of items
Chr	Converts an ANSI value to a string
CurDir	Returns the current path
Date	Returns the current system date
DateAdd	Returns a date to which a specified time interval has been added — for example, one month from a particular date
DateDiff	Returns an integer showing the number of specified time intervals between two dates — for example, the number of months between now and your birthday
DatePart	Returns an integer containing the specified part of a given date — for example, a date's day of the year
DateSerial	Converts a date to a serial number
DateValue	Converts a string to a date
Day	Returns the day of the month from a date value
Dir	Returns the name of a file or directory that matches a pattern
Err	Returns the error number of an error condition
Error	Returns the error message that corresponds to an error number
Exp	Returns the base of the natural logarithm (e) raised to a power
FileLen	Returns the number of bytes in a file
Fix	Returns a number's integer portion
Format	Displays an expression in a particular format
GetSetting	Returns a value from the Windows registry
Hour	Returns the hour portion of a time
InputBox	Displays a box to prompt a user for input
InStr	Returns the position of a string within another string (counting from the start)
InStrRev	Returns the position of a string within another string (counting from the end)
Int	Returns the integer portion of a number
IsArray	Returns True if a variable is an array
IsDate	Returns True if an expression is a date

Function	What It Does
IsEmpty	Returns True if a variable has not been initialized
IsError	Returns True if an expression is an error value
IsMissing	Returns True if an optional argument was not passed to a procedure
IsNull	Returns True if an expression contains no valid data
IsNumeric	Returns True if an expression can be evaluated as a number
LBound	Returns the smallest subscript for a dimension of an array
LCase	Returns a string converted to lowercase
Left	Returns a specified number of characters from the left of a string
Len	Returns the number of characters in a string
Mid	Returns a specified number of characters from a string
Minute	Returns the minutes portion of a time value
Month	Returns the month from a date value
MsgBox	Displays a message box and (optionally) returns a value
Now	Returns the current system date and time
Replace	Replaces a substring in a string with another substring
RGB	Returns a numeric RGB value representing a color
Right	Returns a specified number of characters from the right of a string
Rnd	Returns a random number between 0 and 1
Second	Returns the seconds portion of a time value
Shell	Runs an executable program
Space	Returns a string with a specified number of spaces
Split	Splits a string into parts, using a delimiting character
Sqr	Returns a number's square root
String	Returns a repeating character or string
Time	Returns the current system time
Timer	Returns the number of seconds since midnight
TimeSerial	Returns the time for a specified hour, minute, and second
TimeValue	Converts a string to a time serial number

(continued)

TABLE 9-2 (continued)

Function	What It Does
Trim	Returns a string without leading or trailing spaces
TypeName	Returns a string that describes a variable's data type
UBound	Returns the largest available subscript for an array's dimension
UCase	Converts a string to uppercase
Val	Returns the numbers contained in a string
Weekday	Returns a number representing a day of the week
Year	Returns the year from a date value

Using Worksheet Functions in VBA

Although VBA offers a decent assortment of built-in functions, you might not always find exactly what you need. Fortunately, you can also use most of Excel's worksheet functions in your VBA procedures. The only worksheet functions that you can't use are those that have an equivalent VBA function. For example, you can't use Excel's RAND function (which generates a random number) because VBA has an equivalent function: Rnd.

VBA makes Excel's worksheet functions available through the WorksheetFunction object, which is contained in the Application object. Here's an example of how you can use Excel's SUM function in a VBA statement:

```
Total = Application.WorksheetFunction.Sum(Range("A1:A12"))
```



TIP

You can omit either the Application part or the WorksheetFunction part of the expression. In either case, VBA figures out what you're doing. In other words, these three expressions all work exactly the same:

```
Total = Application.WorksheetFunction.Sum(Range("A1:A12"))
Total = WorksheetFunction.Sum(Range("A1:A12"))
Total = Application.Sum(Range("A1:A12"))
```

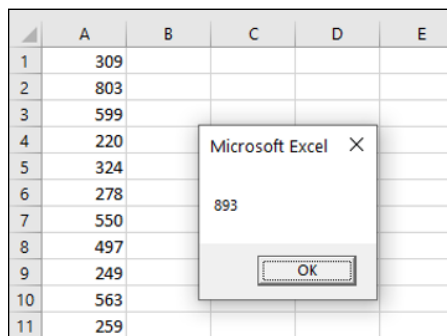
Worksheet function examples

Many of Excel's worksheet functions can be used in your VBA expressions. Think of worksheet functions as plug-ins you can use to extend the utility of your own procedures. In this section, you discover how to incorporate Excel worksheet functions into your VBA code.

Finding the maximum value in a range

Here's an example that shows how to use Excel's MAX worksheet function in a VBA procedure. This procedure displays the maximum value in column A of the active worksheet (see Figure 9-3):

```
Sub ShowMax()  
    Dim TheMax As Double  
    TheMax = WorksheetFunction.Max(Range("A:A"))  
    MsgBox TheMax  
End Sub
```



	A	B	C	D	E
1	309				
2	803				
3	599				
4	220				
5	324				
6	278				
7	550				
8	497				
9	249				
10	563				
11	259				

FIGURE 9-3:
Using a worksheet function in your VBA code.

You can use the MIN function to get the smallest value in a range. And as you might expect, you can use other worksheet functions in a similar manner. For example, you can use the LARGE function to determine the *k*th-largest value in a range. The following expression demonstrates this:

```
SecondHighest = WorksheetFunction.Large(Range("A:A"),2)
```

Notice that the LARGE function uses two arguments. The second argument represents the *k*th part — 2, in this case (the second-largest value).

Calculating a mortgage payment

The next example uses the PMT worksheet function to calculate a mortgage payment. This procedure uses three variables to store the data that's passed to the PMT function as arguments. A message box displays the calculated payment.

```
Sub PmtCalc()  
    Dim IntRate As Double  
    Dim LoanAmt As Double  
    Dim Periods As Long
```

```

IntRate = 0.0625 / 12
Periods = 30 * 12
LoanAmt = 150000
MsgBox WorksheetFunction.Pmt(IntRate, Periods, -LoanAmt)
End Sub

```

As the following statement shows, you can also insert the values directly as the function arguments:

```
MsgBox WorksheetFunction.PMT(0.0625 /12, 360, -150000)
```

However, using variables to store the parameters makes the code easier to read and modify, if necessary.

Using a lookup function

The following example uses VBA's InputBox and MsgBox functions, plus Excel's VLOOKUP function. It prompts for a part number and then gets the price from a lookup table. In Figure 9-4, range A1:B13 is named PriceList.

```

Sub GetPrice()
    Dim PartNum As Variant
    Dim Price As Double
    PartNum = InputBox("Enter the Part Number")
    Sheets("Prices").Activate
    Price = WorksheetFunction.VLookup(PartNum, Range("PriceList"), 2, False)
    MsgBox PartNum & " costs " & Price
End Sub

```

	A	B	C	D	E	F	G	H	I
1	Part	Price							
2	A-132	39.95							
3	A-183	12.95							
4	B-942	16.49							
5	C-832	3.99							
6	C-999	17.59							
7	D-873	19.99							
8	F-143	39.95							
9	G-771	49.95							
10	K-873	129.95							
11	M-732	89.95							
12	P-101	3.95							
13	R-932	13.95							
14									
15									

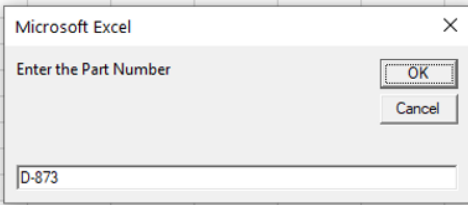


FIGURE 9-4:
The range, named PriceList, contains prices for parts.



TIP

You can download this workbook from the book's website (<https://www.dummies.com/go/excelvbaprogrammingfd6e>).

Here's how the GetPrice procedure works:

1. VBA's InputBox function asks the user for a part number.
2. The part number the user enters is assigned to the PartNum variable.
3. The next statement activates the Prices worksheet, just in case it's not already the active sheet.
4. The code uses the VLOOKUP function to find the part number in the table.
Notice that the arguments you use in this statement are the same as those you would use with the function in a worksheet formula. This statement assigns the result of the function to the Price variable.
5. The code displays the price for the part via the MsgBox function.

This procedure doesn't have any error handling, and it fails miserably if you enter a nonexistent part number. (Try it.) If this were an actual application that's used in an actual business, you would want to add some statements that deal with errors more gracefully. Chapter 12 discusses error handling.

Entering worksheet functions

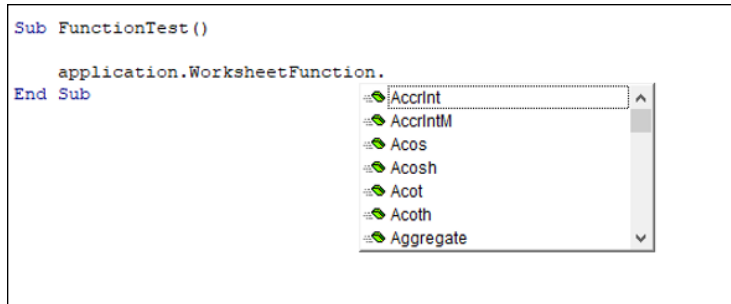
You can't use the Excel Paste Function dialog box to insert a worksheet function into a VBA module. Instead, enter such functions the old-fashioned way: by hand. However, you *can* use the Paste Function dialog box to identify the function you want to use and find out about its arguments.



TIP

You can also take advantage of the VBE's Auto List Members option, which displays a drop-down list of all worksheet functions. Just type **Application.WorksheetFunction**, followed by a period. Then you see a list of the functions you can use, as shown in Figure 9-5. If this feature isn't working, choose the VBE's Tools ⇨ Options, click the Editor tab, and place a check next to Auto List Members.

FIGURE 9-5: Getting a list of worksheet functions that you can use in your VBA code.



More about using worksheet functions

Newcomers to VBA often confuse VBA's built-in functions and Excel's workbook functions. A good rule to remember is that VBA doesn't try to reinvent the wheel. For the most part, VBA doesn't duplicate Excel worksheet functions.

For most worksheet functions that are unavailable as methods of the WorksheetFunction object, you can use an equivalent VBA built-in operator or function. For example, the MOD worksheet function is not available in the WorksheetFunction object because VBA has an equivalent: its built-in Mod operator.



TIP

Bottom line? If you need to use a function, first determine whether VBA has something that meets your needs. If not, check out the worksheet functions. If all else fails, you may be able to write a custom function by using VBA.

Using Custom Functions

After you know how to handle VBA functions and Excel worksheet functions, you can dive into the third category of functions you can use in your VBA procedures: custom functions. A *custom function* (also known as a User Defined Function, or UDF) is one you develop yourself by using (what else?) VBA. To use a custom function, you must define it in the workbook in which you use it — or else define the functions in an add-in (see Chapter 21).

Here's an example of defining a simple Function procedure (MultiplyTwo) and then using it in a VBA Sub procedure (ShowResult):

```

Function MultiplyTwo(num1, num2) As Double
    MultiplyTwo = num1 * num2
End Function

Sub ShowResult()
    Dim n1 As Double, n2 As Double
    Dim Result As Double
    n1 = 123
    n2 = 544
    Result = MultiplyTwo(n1, n2)
    MsgBox Result
End Sub

```

The custom function `MultiplyTwo` has two arguments. The `ShowResult` Sub procedure uses this Function procedure by passing two arguments to it (in parentheses). The `ShowResult` procedure then displays a message box showing the value returned by the `MultiplyTwo` function.

Of course, most custom functions aren't as trivial as the `MultiplyTwo` function. But this example should give you an idea of how a Sub procedure can make use of a custom function.

You can also use custom functions in your worksheet formulas. For example, if `MultiplyTwo` is defined in your workbook, you can write a formula such as this one:

```
=MultiplyTwo(A1,A2)
```

This formula returns the product of the values in cells `A1` and `A2`.

Creating custom worksheet functions is an important (and very useful) topic. So important (and useful) that Chapter 20 includes many examples of customer worksheet functions.

IN THIS CHAPTER

- » Discovering methods for controlling the flow of your VBA procedures
- » Finding out about the dreaded GoTo statement
- » Using If-Then and Select Case structures
- » Performing looping in your procedures

Chapter **10**

Controlling Program Flow and Making Decisions

Some VBA procedures start at the code's beginning and progress line by line to the end, never deviating from this top-to-bottom program flow. Macros that you record always work like this. In many cases, however, you need to control the flow of your code by skipping some statements, executing some statements multiple times, and testing conditions to determine what the procedure does next. Hang on to your hat and enjoy the ride, because you're about to discover the essence of programming.

Going with the Flow, Dude

Some programming newbies can't understand how a dumb computer can make intelligent decisions. The secret is in several programming constructs that most programming languages support. Table 10-1 provides a sneak preview of these constructs. (These are explained later in this chapter.)

TABLE 10-1

Programming Constructs for Making Decisions

Construct	How It Works
GoTo statement	Jumps to a particular statement
If-Then structure	Does something if something else is true
Select Case	Does any of several things, depending on something's value
For-Next loop	Executes a series of statements a specified number of times
Do-While loop	Does something as long as something else remains true
Do-Until loop	Does something until something else becomes true

The GoTo Statement

A GoTo statement offers the most straightforward means for changing a program's flow. The GoTo statement simply transfers program execution to a new statement, which is preceded by a label.

Your VBA procedures can contain as many labels as you like. A *label* is just a text string followed by a colon.

The following procedure shows how a GoTo statement works:

```
Sub CheckUser()  
    UserName = InputBox("Enter Your Name: ")  
    If UserName <> "Satya Nadella" Then GoTo WrongName  
    MsgBox ("Welcome Satya...")  
    ' ...[More code here] ...  
    Exit Sub  
WrongName:  
    MsgBox "Sorry. Only Satya Nadella can run this."  
End Sub
```

The procedure uses the InputBox function to get the user's name. Then a decision is made: If the user enters a name other than Satya Nadella, the program flow jumps to the WrongName label, displays an apologetic message, and the procedure ends. On the other hand, if Mr. Nadella runs this macro and uses his real name, the procedure displays a welcome message and then executes some additional code (not shown in the example).

Notice that the Exit Sub statement ends the procedure before the second MsgBox function has a chance to work. Without that Exit Sub statement, both MsgBox statements would be executed.

This simple procedure works, but VBA provides several better (and more structured) alternatives than GoTo. In general, you should use GoTo only when you have no other way to perform an action. In real life, the only time you *must* use a GoTo statement is for trapping errors. (You can find a detailed review of error handling in Chapter 12.)

By the way, the CheckUser procedure simply demonstrates the GoTo statement. It's not intended to demonstrate an effective security technique!



WARNING

Many hard-core programmers have a deep-seated hatred for GoTo statements because using them tends to result in difficult-to-read (and difficult-to-maintain) “spaghetti code,” so called because you can’t tell where a path starts and ends in a code like you can’t tell where a noodle starts and ends in a bowl of spaghetti. Therefore, you should never admit that you use GoTo statements when talking with other programmers.



TECHNICAL
STUFF

USING STRUCTURED PROGRAMMING TO WRITE BETTER CODE

If you hang around with programmers, sooner or later you'll hear the term *structured programming*. This term has been around for decades, and programmers generally agree that structured programs are superior to unstructured programs.

The basic premise of structured programming is that a procedure or code segment should have only one entry point and one exit point. In other words, a block of code should be a stand-alone unit. A program cannot jump into the middle of this unit; neither can it exit at any point except at the single exit point. When you write structured code, your program progresses in an orderly manner and is easy to follow — unlike a program that jumps around in a haphazard fashion. This pretty much rules out using the GoTo statement.

In general, a structured program is easier to read and understand. More important, it's also easier to modify when the need arises.

VBA is indeed a structured language. It offers standard structured constructs, such as If-Then-Else, For-Next loops, Do-Until loops, Do-While loops, and Select Case structures. Furthermore, it fully supports module code constructions. If you're new to programming, you should try to develop good structure-programming habits early on.

Decisions, Decisions

As in many other aspects of life, effective decision-making is the key to success in writing Excel macros. This section reviews two programming structures that can empower your VBA procedures with some impressive decision-making capabilities: the If-Then and Select Case structures.

The If-Then structure

The If-Then structure is VBA's most important control structure. You'll probably use this command on a daily basis.

Use the If-Then structure when you want to execute one or more statements conditionally. The optional Else clause, if included, lets you execute one or more statements if the condition you're testing is *not* true. Here's the simple CheckUser procedure presented earlier in this chapter, recoded to use the If-Then-Else structure:

```
Sub CheckUser2()  
    UserName = InputBox("Enter Your Name: ")  
    If UserName = "Satya Nadella" Then  
        MsgBox ("Welcome Satya...")  
        ' ...[More code here] ...  
    Else  
        MsgBox "Sorry. Only Satya Nadella can run this."  
    End If  
End Sub
```

You would probably agree that this version is much easier to follow.



TIP

A workbook that contains this section's examples can be downloaded from this book's website (<https://www.dummies.com/go/excelvbaprogrammingfd6e>).

If-Then examples

The following procedure demonstrates the If-Then structure without the optional Else clause:

```
Sub GreetMe()  
    If Time < 0.5 Then MsgBox "Good Morning"  
End Sub
```

The GreetMe procedure uses VBA's Time function to get the system time. If the current time is less than .5 (in other words, before noon), the procedure displays a friendly greeting. If Time is greater than or equal to .5, the procedure ends, and nothing happens.

To display a different greeting if Time is greater than or equal to .5, you can add another If-Then statement after the first one:

```
Sub GreetMe2()  
    If Time < 0.5 Then MsgBox "Good Morning"  
    If Time >= 0.5 Then MsgBox "Good Afternoon"  
End Sub
```

Notice that the second If-Then statement uses >= (greater than or equal to). This ensures that the entire day is covered. Had it used > (greater than), no message would appear if this procedure were executed at precisely 12:00 noon. That's pretty unlikely, but with an important program like this, you don't want to take any chances.

An If-Then-Else example

Another approach to the preceding problem uses the Else clause. Here's the same procedure recoded to use the If-Then-Else structure:

```
Sub GreetMe3()  
    If Time < 0.5 Then MsgBox "Good Morning" Else _  
        MsgBox "Good Afternoon"  
End Sub
```

Notice the line continuation character (underscore) in the preceding example. The If-Then-Else statement is actually a single statement. VBA provides a slightly different way of coding If-Then-Else constructs that use an End If statement. Therefore, the GreetMe procedure can be rewritten as

```
Sub GreetMe4()  
    If Time < 0.5 Then  
        MsgBox "Good Morning"  
    Else  
        MsgBox "Good Afternoon"  
    End If  
End Sub
```

In fact, you can insert any number of statements under the If part and any number of statements under the Else part. This syntax is easier to read and makes the statements shorter.



REMEMBER

When If-Then or If-Then-Else is on one line, it's called a *single-line If*, and when it takes multiple lines, it's called a *block If*.

What if you need to expand the GreetMe procedure to handle three conditions: morning, afternoon, and evening? You have two options: Use three If-Then statements or use a *nested If-Then-Else* structure. *Nesting* means placing an If-Then-Else structure within another If-Then-Else structure. The first approach, using three If-Then statements, is simpler:

```
Sub GreetMe5()  
    Dim Msg As String  
    If Time < 0.5 Then Msg = "Morning"  
    If Time >= 0.5 And Time < 0.75 Then Msg = "Afternoon"  
    If Time >= 0.75 Then Msg = "Evening"  
    MsgBox "Good " & Msg  
End Sub
```

Now, you can get fancy by using a variable. The Msg variable gets a different text value, depending on the time of day. The MsgBox statement displays the greeting: Good Morning, Good Afternoon, or Good Evening.

The following procedure performs the same action, but uses a nested If-Then-Else structure:

```
Sub GreetMe6()  
    Dim Msg As String  
    If Time < 0.5 Then  
        Msg = "Morning"  
    Else  
        If Time >= 0.5 And Time < 0.75 Then  
            Msg = "Afternoon"  
        Else  
            Msg = "Evening"  
        End If  
    End If  
    MsgBox "Good " & Msg  
End Sub
```

The indenting in the code gives away the structure. You can see that the If block for afternoon and evening is completely contained in the Else part of the If block for morning. One advantage of nesting If statements is that the program doesn't waste time evaluating a bunch of statements that it doesn't need to. For example, if it's before noon, once the program hits the Else line, it jumps down to the End If and ignores everything in between. For a program this small, it doesn't make much difference. But for larger programs, nesting can make the code run faster.

Using Elseif

Another twist to the If block is Elseif. Elseif lets you evaluate a bunch of statements all in one If block, and it's a little easier to read than nested If blocks. But just like nested If blocks, once it hits a line that's true, it jumps to the end.

Here's how you can rewrite the GreetMe procedure by using this syntax:

```
Sub GreetMe7()  
    Dim Msg As String  
    If Time < 0.5 Then  
        Msg = "Morning"  
    ElseIf Time >= 0.5 And Time < 0.75 Then  
        Msg = "Afternoon"  
    Else  
        Msg = "Evening"  
    End If  
    MsgBox "Good " & Msg  
End Sub
```

You can have as many Elseif lines as you need. Note, you can't use Elseif in a single-line If statement, though.

Another If-Then example

Here's another example that uses the simple form of the If-Then structure. This procedure prompts the user for a quantity and then displays the appropriate discount, based on the quantity the user enters:

```
Sub ShowDiscount()  
    Dim Quantity As Long  
    Dim Discount As Double  
    Quantity = InputBox("Enter Quantity:")  
    If Quantity > 0 Then Discount = 0.1  
    If Quantity >= 25 Then Discount = 0.15  
    If Quantity >= 50 Then Discount = 0.2  
    If Quantity >= 75 Then Discount = 0.25  
    MsgBox "Discount: " & Discount  
End Sub
```

Notice that each If-Then statement in this procedure is executed, and the value for Discount can change as the statements are executed. However, the procedure ultimately displays the correct value for Discount because the If-Then statements are set in order of ascending Discount values.

The following procedure performs the same tasks by using the alternative ElseIf syntax. In this case, the procedure ends immediately after executing the statements for a true condition:

```
Sub ShowDiscount2()  
    Dim Quantity As Long  
    Dim Discount As Double  
    Quantity = InputBox("Enter Quantity: ")  
    If Quantity > 0 And Quantity < 25 Then  
        Discount = 0.1  
    ElseIf Quantity >= 25 And Quantity < 50 Then  
        Discount = 0.15  
    ElseIf Quantity >= 50 And Quantity < 75 Then  
        Discount = 0.2  
    ElseIf Quantity >= 75 Then  
        Discount = 0.25  
    End If  
    MsgBox "Discount: " & Discount  
End Sub
```

As important as the If-Then structure is to VBA, they become cumbersome when a decision involves three or more choices. Fortunately, the Select Case structure, discussed in the next section, offers a simpler and more efficient approach.

The Select Case structure

The Select Case structure is useful for decisions involving three or more options (although it also works with two options, providing an alternative to the If-Then-Else structure).



TIP

The examples in this section are available at this book's website (<https://www.dummies.com/go/excelvbaprogrammingfd6e>).

A Select Case example

The following example shows how to use the Select Case structure. This also shows another way to code the examples presented in the previous section:

```
Sub ShowDiscount3()  
    Dim Quantity As Long  
    Dim Discount As Double  
    Quantity = InputBox("Enter Quantity: ")
```

```

Select Case Quantity
    Case 0 To 24
        Discount = 0.1
    Case 25 To 49
        Discount = 0.15
    Case 50 To 74
        Discount = 0.2
    Case Is >= 75
        Discount = 0.25
End Select
MsgBox "Discount: " & Discount
End Sub

```

In this example, the Quantity variable is being evaluated. The procedure checks for four different cases (0–24, 25–49, 50–74, and 75 or greater).

Any number of statements can follow each Case statement, and they all are executed if the case is true. If you use only one statement, as in this example, you can put the statement on the same line as the Case keyword, preceded by a colon — the VBA statement separator character. This tends to make your code more compact and you might find it more readable. Here’s how the procedure looks in this format:

```

Sub ShowDiscount4 ()
    Dim Quantity As Long
    Dim Discount As Double
    Quantity = InputBox("Enter Quantity: ")
    Select Case Quantity
        Case 0 To 24: Discount = 0.1
        Case 25 To 49: Discount = 0.15
        Case 50 To 74: Discount = 0.2
        Case Is >= 75: Discount = 0.25
    End Select
    MsgBox "Discount: " & Discount
End Sub

```

When VBA executes a Select Case structure, the structure is exited as soon as VBA finds a true case and executes the statements for that case.

A nested Select Case example

As demonstrated in the following example, you can nest Select Case structures. This procedure examines the active cell and displays a message describing the

cell's contents. Notice that the procedure has three Select Case structures, and each has its own End Select statement:

```
Sub CheckCell()  
    Dim Msg As String  
    Select Case IsEmpty(ActiveCell)  
        Case True  
            Msg = "is blank."  
        Case Else  
            Select Case ActiveCell.HasFormula  
                Case True  
                    Msg = "has a formula"  
                Case Else  
                    Select Case IsNumeric(ActiveCell)  
                        Case True  
                            Msg = "has a number"  
                        Case Else  
                            Msg = "has text"  
                    End Select  
                End Select  
            End Select  
        End Select  
    MsgBox "Cell " & ActiveCell.Address & " " & Msg  
End Sub
```

The logic goes something like this:

1. Find out whether the cell is empty.
2. If it's not empty, see whether it contains a formula.
3. If there's no formula, find out whether it contains a numeric value or text.

When the procedure ends, the Msg variable contains a string that describes the cell's contents. As shown in Figure 10-1, the MsgBox function displays that message.

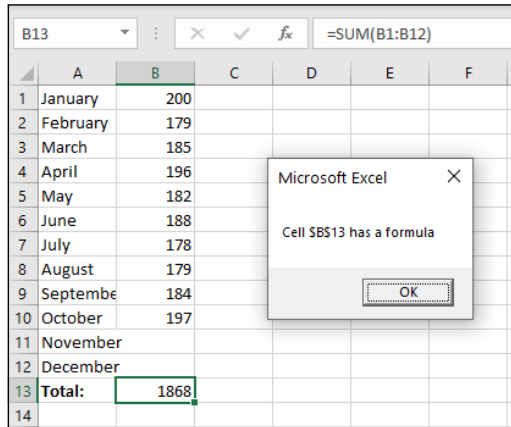
You can nest Select Case structures as deeply as you need to, but make sure that each Select Case statement has a corresponding End Select statement.



TIP

If you're still not convinced that indenting code is worth the effort, the previous listing serves as a good example. The indentations really make the nesting levels clear. Take a look at the same procedure without any indentation:

FIGURE 10-1:
A message
displayed by the
CheckCell
procedure.



```

Sub CheckCell()
    Dim Msg As String
    Select Case IsEmpty(ActiveCell)
    Case True
        Msg = "is blank."
    Case Else
        Select Case ActiveCell.HasFormula
        Case True
            Msg = "has a formula"
        Case Else
            Select Case IsNumeric(ActiveCell)
            Case True
                Msg = "has a number"
            Case Else
                Msg = "has text"
            End Select
        End Select
    End Select
    MsgBox "Cell " & ActiveCell.Address & " " & Msg
End Sub

```

Fairly incomprehensible, eh?

Knocking Your Code for a Loop

The term *looping* refers to repeating a block of VBA statements numerous times. With loops, your code can

- » Loop through a range of cells, working with each cell individually.
- » Loop through all open workbooks (the Workbooks collection) and do something with each one.
- » Loop through all worksheets in a workbook (the Worksheets collection) and do something with each one.
- » Loop through all the elements in an array.
- » Loop through all characters in a cell.
- » Loop through all charts on a worksheet (the ChartObjects collection) and do something with each chart.

VBA supports several types of loops, and the examples that follow demonstrate a few ways that you can use them.

For-Next loops



TIP

The examples in this section are all available at this book's website (<https://www.dummies.com/go/excelvbaprogrammingfd6e>).

The simplest type of loop is a For-Next loop. The looping is controlled by a counter variable, which starts at one value and stops at another value. The statements between the For statement and the Next statement are the statements that get repeated in the loop. To see how this works, keep reading.

A For-Next example

The following example uses a For-Next loop to sum the first 1,000 positive numbers. The Total variable starts out as zero. Then the looping occurs. The variable Cnt is the loop counter. It starts out as 1 and is incremented by 1 each time it passes through the loop. The loop ends when Cnt is 1,000.

This example has only one statement inside the loop. This statement adds the value of Cnt to the Total variable. When the loop finishes, a MsgBox displays the sum of the numbers.

```

Sub AddNumbers()
    Dim Total As Long
    Dim Cnt As Long
    Total = 0
    For Cnt = 1 To 1000
        Total = Total + Cnt
    Next Cnt
    MsgBox Total
End Sub

```



WARNING

Because the loop counter is a normal variable, you can write code to change its value within the block of code between the For and the Next statements. This, however, is a *very bad* practice. Changing the counter within the loop can have unpredictable results. Take special precautions to ensure that your code doesn't change the value of the loop counter.

For-Next examples with a Step

You can use a Step value to skip some counter values in a For-Next loop. Here's the previous example, rewritten to sum only the odd numbers between 1 and 1,000:

```

Sub AddOddNumbers()
    Dim Total As Long
    Dim Cnt As Long
    Total = 0
    For Cnt = 1 To 1000 Step 2
        Total = Total + Cnt
    Next Cnt
    MsgBox Total
End Sub

```

This time, Cnt starts out as 1 and then takes on values of 3, 5, 7, and so on. The Step value determines how the counter is incremented. Notice that the upper loop value (1000) is not actually used because the highest value of Cnt will be 999.

Here's another example that uses a Step value of 3. This procedure works with the active sheet and applies light gray shading to every third row, from row 1 to row 100.

```

Sub ShadeEveryThirdRow()
    Dim i As Long
    For i = 1 To 100 Step 3
        Rows(i).Interior.Color = RGB(200, 200, 200)
    Next i
End Sub

```

Figure 10-2 shows the result of running this macro.

	A	B	C	D	E	F	G
1	862	185	289	804	193	731	85
2	129	544	992	168	701	487	584
3	736	186	217	753	530	544	937
4	457	524	666	914	670	785	984
5	978	80	743	823	570	971	413
6	858	367	991	256	613	88	562
7	594	184	436	742	664	581	52
8	154	74	596	97	508	288	449
9	623	197	829	204	799	397	184
10	407	120	717	264	464	274	626
11	297	446	150	791	279	141	734
12	540	222	149	353	666	840	238
13	218	881	733	861	194	395	565
14	989	814	149	291	744	510	211

FIGURE 10-2:
Using a loop to
apply background
shading to rows.



It's a good practice to give all your variables descriptive, meaningful names. Loop counter variables are the exception. It's a common convention to use the single letters *i*, *j*, and *k* for For Next loop counter variables.

A For-Next example with an Exit For statement

A For-Next loop can also include one or more Exit For statements within the loop. When VBA encounters this statement, the loop terminates immediately.

The following example, available on this book's website (<https://www.dummies.com/go/excelvbaprogrammingfd6e>), demonstrates the Exit For statement. This procedure is a Function procedure, intended to be used in a worksheet formula. The function accepts one argument (a variable named *Str*) and returns the characters to the left of the first numeric digit. For example, if the argument is "KBR98Z," the function returns "KBR."

```
Function TextPart(Str)
    Dim i As Long
    TextPart = ""
    For i = 1 To Len(Str)
        If IsNumeric(Mid(Str, i, 1)) Then
            Exit For
        Else
            TextPart = TextPart & Mid(Str, i, 1)
        End If
    Next i
End Function
```

The For-Next loop starts with 1 and ends with the number that represents the number of characters in the string. The code uses VBA's Mid function to extract a single character within the loop. If a numeric character is found, the Exit For statement is executed, and the loop ends prematurely. If the character is not numeric, it's appended to the returned value (which is the same as the function's name). The only time the loop will examine every character is if the string passed as the argument contains no numeric characters.

Now, you might shout, "Hey, but you said something about always using a single point of exit!" Well, you're right, and obviously, you're getting the hang of this structured programming business. But in some cases, ignoring that rule is a wise decision. In this example, it greatly speeds up your code because there's no reason to continue the loop after the first numeric digit is found.

A nested For-Next example

So far, all this chapter's examples use relatively simple loops. However, you can have any number of statements in the loop and nest For-Next loops inside other For-Next loops.

The following example uses a nested For-Next loop to insert random numbers into a 12-row-by-5-column range of cells, as shown in Figure 10-3. Notice that the procedure executes the *inner loop* (the loop with the Row counter) once for each iteration of the *outer loop* (the loop with the Col counter). In other words, the procedure executes the Cells(Row, Col) = Rnd statement 60 times.

```
Sub FillRange()  
    Dim Col As Long  
    Dim Row As Long  
    For Col = 1 To 5  
        For Row = 1 To 12  
            Cells(Row, Col) = Rnd  
        Next Row  
    Next Col  
End Sub
```

The next example uses nested For-Next loops to initialize a three-dimensional array with the value 100. This procedure executes the statement in the middle of all the loops (the assignment statement) 1,000 times (10 * 10 * 10), each time with a different combination of values for i, j, and k:

```
Sub NestedLoops()  
    Dim MyArray(10, 10, 10)  
    Dim i As Long
```

```

Dim j As Long
Dim k As Long
For i = 1 To 10
    For j = 1 To 10
        For k = 1 To 10
            MyArray(i, j, k) = 100
        Next k
    Next j
Next i
' Other statements go here
End Sub

```

	A	B	C	D	E	F
1	0.705548	0.862619	0.4687	0.695116	0.28448	
2	0.533424	0.79048	0.298165	0.980003	0.045649	
3	0.579519	0.373536	0.622697	0.243931	0.295773	
4	0.289562	0.961953	0.647821	0.533873	0.382011	
5	0.301948	0.871446	0.263793	0.10637	0.30097	
6	0.77474	0.056237	0.279342	0.999415	0.948571	
7	0.014018	0.949557	0.829802	0.676176	0.979829	
8	0.760724	0.364019	0.824602	0.015704	0.401374	
9	0.81449	0.524868	0.589163	0.575184	0.27828	
10	0.709038	0.767112	0.986093	0.100052	0.160442	
11	0.045353	0.053505	0.910964	0.103023	0.162822	
12	0.414033	0.592458	0.226866	0.798884	0.646587	
13						
14						

FIGURE 10-3:
These cells were filled using a nested For-Next loop.

Refer to Chapter 7 for information about arrays.

Here's a final example that uses nested For-Next loops, with a Step value. This procedure creates a checkerboard (or chessboard, if you prefer) by changing the background color of alternating cells (see Figure 10-4).

The Row counter loops from 1 to 8. An If-Then construct determines which nested For-Next structure to use. For odd-numbered rows, the Col counter begins with 2. For even-numbered rows, the Col counter begins with 1. Both loops use a Step value of 2, so alternate cells are affected. Two additional statements make the cells square (just like a real checkerboard).

```

Sub MakeCheckerboard()
    Dim R As Long, C As Long
    For R = 1 To 8
        If WorksheetFunction.IsOdd(R) Then
            For C = 2 To 8 Step 2
                Cells(R, C).Interior.Color = 255
            Next C
        End If
    Next R
End Sub

```

```

        Next C
    Else
        For C = 1 To 8 Step 2
            Cells(R, C).Interior.Color = 255
        Next C
    End If
Next R
Rows("1:8").RowHeight = 35
Columns("A:H").ColumnWidth = 6.5
End Sub

```

	A	B	C	D	E	F	G	H	I
1									
2									
3									
4									
5									
6									
7									
8									

FIGURE 10-4: Using loops to create a checkerboard pattern.

Do-While loop

VBA supports another type of looping structure known as a Do-While loop. A For-Next loop executes a specified number of times. A Do-While loop executes an unspecified number of times. That is, it keeps going until a condition is met.

The following example uses a Do-While loop. This procedure uses the active cell as a starting point and then travels down the column, multiplying each cell's value by 2. The loop continues until the procedure encounters an empty cell.

```

Sub DoWhileDemo()
    Do While ActiveCell.Value <> Empty
        ActiveCell.Value = ActiveCell.Value * 2
        ActiveCell.Offset(1, 0).Select
    Loop
End Sub

```

When the loop starts, the program doesn't know how many times it will loop. It just keeps moving to the next cell and evaluating the Do While statement. Once it's false, it exits the loop.

Do-Until loop

The Do-Until loop structure is similar to the Do-While structure. The two structures differ in their handling of the tested condition. A program continues to execute a Do-While loop *while* the condition remains true. In a Do-Until loop, the program executes the loop *until* the condition is true.

The following example is the same one presented for the Do-While loop but recoded to use a Do-Until loop:

```
Sub DoUntilDemo()  
    Do Until IsEmpty(ActiveCell.Value)  
        ActiveCell.Value = ActiveCell.Value * 2  
        ActiveCell.Offset(1, 0).Select  
    Loop  
End Sub
```

Using For Each-Next Loops with Collections

VBA supports yet another type of looping: looping through each object in a collection of objects. A collection, as you might know, consists of a number of objects of the same type. For example, Excel has a collection of all open workbooks (the Workbooks collection), and each workbook has a collection of worksheets (the Worksheets collection).

When you need to loop through each object in a collection, use the For Each-Next structure. The following example loops through each worksheet in the active workbook and deletes the worksheet if it's empty:


```

Sub DeleteEmptySheets()
    Dim WkSht As Worksheet
    Application.DisplayAlerts = False
    For Each WkSht In ActiveWorkbook.Worksheets
        If WorksheetFunction.CountA(WkSht.Cells) = 0 Then
            WkSht.Delete
        End If
    Next WkSht
    Application.DisplayAlerts = True
End Sub

```

In this example, the variable `WkSht` is an object variable that represents each worksheet in the workbook. Nothing is special about the variable name `WkSht`; you can use any variable name that you like.

The code loops through each worksheet and determines an empty sheet by counting the nonblank cells. If that count is zero, the sheet is empty, and it's deleted. Notice that the `DisplayAlerts` setting is turned off while the loop is doing its thing. Without that statement, Excel displays a warning every time a sheet is about to be deleted.

If all the worksheets in the workbook are empty, you get an error when Excel attempts to delete the only sheet. Normally, you would write code to handle that situation.

Here's another `For Each-Next` example. This procedure uses a loop to hide all worksheets in the active workbook except the active sheet.

```

Sub HideSheets()
    Dim Sht As Worksheet
    For Each Sht In ActiveWorkbook.Worksheets
        If Sht.Name <> ActiveSheet.Name Then
            Sht.Visible = xlSheetHidden
        End If
    Next Sht
End Sub

```

The `HideSheets` procedure checks the sheet name. If it's not the same as the active sheet's name, the sheet is hidden. Notice that the `Visible` property isn't Boolean. This property can actually take on any of *three* values, and Excel provides three built-in constants. If you're curious about the third possibility (`xlVeryHidden`), check the Help system.

What gets hidden must eventually get unhidden, so here's a macro that unhides all worksheets in the active workbook:

```
Sub UnhideSheets()  
    Dim Sht As Worksheet  
    For Each Sht In ActiveWorkbook.Worksheets  
        Sht.Visible = xlSheetVisible  
    Next Sht  
End Sub
```

Not surprisingly, you can create nested For Each-Next loops. The CountBold procedure loops through every cell in the used range on each worksheet in every open workbook and displays a count of the number of cells that are formatted as bold:

```
Sub CountBold()  
    Dim WBook As Workbook  
    Dim WSheet As Worksheet  
    Dim Cell As Range  
    Dim Cnt As Long  
    For Each WBook In Workbooks  
        For Each WSheet In WBook.Worksheets  
            For Each Cell In WSheet.UsedRange  
                If Cell.Font.Bold = True Then Cnt = Cnt + 1  
            Next Cell  
        Next WSheet  
    Next WBook  
    MsgBox Cnt & " bold cells found"  
End Sub
```

IN THIS CHAPTER

- » Knowing the event types that can trigger an execution
- » Finding out where to place your event-handler VBA code
- » Executing a macro when a workbook is opened or closed
- » Executing a macro when a workbook or worksheet is activated

Chapter **11**

Automatic Procedures and Events

You have a number of ways to execute a VBA Sub procedure. One way is to arrange for the Sub to be executed automatically. In this chapter, you explore the ins and outs of this potentially useful feature, learning how to set things up so that a macro is executed automatically when a particular event occurs.

Preparing for the Big Event

An *event* is basically something that happens in Excel. Following are a few examples of the types of events that Excel can recognize:

- » A workbook is opened or closed.
- » A window is activated or deactivated.
- » A worksheet is activated or deactivated.
- » Data in a cell is entered or changed.

- »» A workbook is saved.
- »» An object, such as a button, is clicked.
- »» A particular key or key combination is pressed.
- »» A particular time of day occurs.
- »» An error occurs.

Dozens of different types of events are associated with all kinds of Excel objects, such as workbooks, worksheets, pivotTables, and even charts. To simplify things, you can use two other more common types of events: workbook events and worksheet events.

Table 11-1 lists some useful workbook-related events. If, for some reason, you need to see the complete list of workbook-related events, check out the Help system.

TABLE 11-1

Workbook Events

Event	When It's Triggered
Activate	The workbook is activated.
BeforeClose	The command to close the workbook is given.
BeforePrint	The command to print is given.
BeforeSave	The command to save the workbook is given.
Deactivate	The workbook is deactivated.
NewSheet	A new sheet is added to the workbook.
Open	The workbook is opened.
SheetActivate	A sheet in the workbook is activated.
SheetBeforeDoubleClick	A cell in the workbook is double-clicked.
SheetBeforeRightClick	A cell in the workbook is right-clicked.
SheetChange	A change is made to a cell in the workbook.
SheetDeactivate	A sheet in the workbook is deactivated.
SheetSelectionChange	Cells are selected in the workbook.
WindowActivate	The workbook window is activated.
WindowDeactivate	The workbook window is deactivated.

Table 11-2 lists some useful worksheet-related events.

TABLE 11-2

Worksheet Events

Event	When It's Triggered
Activate	The worksheet is activated.
BeforeDoubleClick	A cell in the worksheet is double-clicked.
BeforeRightClick	A cell in the worksheet is right-clicked.
Change	A change is made to a cell in the worksheet.
Deactivate	The worksheet is deactivated.
SelectionChange	Cells are selected in the worksheet.

Learning when to use event procedures

At this point, you might be wondering how these events can be useful. Here's a quick example.

Suppose that you have a workbook in which you enter values in column A. Your boss, a very compulsive person, tells you that they need to know exactly when each number was entered. Entering data is an event: a `WorksheetChange` event. You can write a macro that responds to this event. That macro kicks in whenever the worksheet is changed. If the change was made in column A, the macro places the date and time in column B, next to the data point that was entered.

In case you're curious, here's what such a macro would look like. (Probably a lot simpler than you thought it would be, eh?)

```
Private Sub Worksheet_Change(ByVal Target As Range)
    If Target.Column = 1 Then
        Target.Offset(0, 1) = Now
    End If
End Sub
```

By the way, macros that respond to events are very picky about where they are stored. For example, this `Worksheet_Change` macro *must* be in the module for that worksheet. Put it somewhere else, and it won't work. More about this later (see the section titled "Knowing Where to Put the Event Code").



WARNING

Just because your workbook contains procedures that respond to events doesn't guarantee that those procedures will actually run. As you know, it's possible to open a workbook with macros disabled. In such a case, all macros (even procedures that respond to events) are turned off. Keep this fact in mind when you create workbooks that rely on event-handler procedures.

Programming event-handler procedures

A VBA procedure that executes in response to an event is called an *event-handler procedure*. These are always Sub procedures (as opposed to Function procedures). Writing these event-handlers is relatively straightforward after you understand how the process works.

Creating event-handler procedures boils down to a few steps:

- 1. Identify the event you want to trigger the procedure.**
- 2. Press Alt+F11 to activate the Visual Basic Editor.**
- 3. In the VBE Project window, double-click the appropriate object listed under Microsoft Excel Objects.**
- 4. In the code pane for the object, write the event-handler procedure that is executed when the event occurs.**

For workbook-related events, the object is ThisWorkbook. For a worksheet-related event, the object is a Worksheet object (such as Sheet1).

This procedure will have a special name that identifies it as an event-handler procedure.

These steps become clearer as you progress through the chapter.

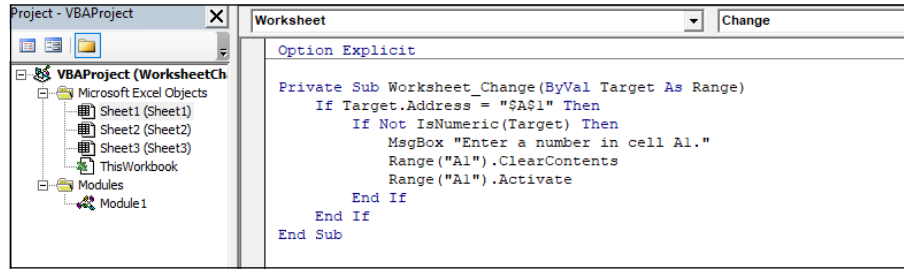
Knowing Where to Put the Event Code

It's very important to understand where your event-handler procedures go. They must reside in the module for their object. They do not go in a standard VBA module. If you put your event-handler procedure in the wrong place, it simply won't work, and you won't see any error messages indicating it, either.

Figure 11-1 shows the VBE window with one project displayed in the Project Explorer. (Refer to Chapter 3 for some background on the VBE.) Notice that the VBA project for Book1 is fully expanded and consists of several objects:

- »» One object for each worksheet in the workbook (in this case, three Sheet objects)
- »» An object labeled ThisWorkbook
- »» A VBA module inserted manually (choose Insert ⇨ Module)

FIGURE 11-1:
The Project window displays items for a single project.



Double-clicking any of these objects displays the code associated with the item, if any.

The event-handler procedures that you write go into the ThisWorkbook module (for workbook-related events) or one of the Sheet modules (for worksheet-related events).

In Figure 11-1, the code pane for the Sheet1 module is displayed, and it happens to have a single event-handler procedure defined. Notice the two drop-down controls at the top of the code pane? Keep reading to find out why those are useful.

Writing an Event-Handler Procedure

The VBE helps you out when you're ready to write an event-handler procedure; it displays a list of all events for the selected object.

At the top of each code pane, you find two drop-down lists:

- »» The Object drop-down list (the one on the left)
- »» The Procedure drop-down list (the one on the right)

By default, the Object drop-down list in the code pane displays General.

If you're writing an event-handler for the ThisWorkbook object, you need to click ThisWorkbook in the Project window and then choose Workbook from the Object drop-down (it's the only other choice).

If you're writing an event-handler for a Sheet object, you need to click the specific Sheet in the Project window and then choose Worksheet from the Object drop-down list (again, it's the only other choice).

After you've made your choice from the Object drop-down list, you can choose the event from the Procedure drop-down list. Figure 11-2 shows some of the choices for a workbook-related event.

FIGURE 11-2:
Choosing an event in the ThisWorkbook object's module.



When you select an event from the list, the VBE automatically starts creating an event-handler procedure for you. This is a very useful feature, because it tells you exactly what the proper arguments are.

Here's a little quirk. When you first select Workbook from the Object list, the VBE always assumes that you want to create an event-handler procedure for the Open event and creates it for you. If you're actually creating a Workbook_Open procedure, that's fine. But if you're creating a different event-procedure, you need to delete the empty Workbook_Open Sub that was created.

The VBE's help goes only so far, however. It writes the Sub statement and the End Sub statement. Writing the VBA code that goes between these two statements is your job.



REMEMBER

You don't really have to use those two drop-down lists, but doing so makes your job easier because the name of the event-handler procedure is critically important. If you don't get the name exactly right, the procedure won't work. Also, some event-handler procedures use one or more arguments in the Sub statement. There's no way you can remember what those arguments are. For example, if you select SheetActivate from the event list for a Workbook object, the VBE writes the following Sub statement:

```
Private Sub Workbook_SheetActivate(ByVal Sh As Object)
```


In this case, Sh is the argument passed to the procedure and is a variable that represents the sheet that was activated in the workbook. Examples found throughout the rest of this chapter clarify this point.

Triggering Workbook Events

In this section, you find a few examples so that you can get the hang of this event-handling business.

The Open event for a workbook

One of the most commonly used events is the Workbook Open event. Assume that you have a workbook that you use every day. The Workbook_Open procedure in this example is executed every time the workbook is opened. The procedure checks the day of the week; if it's Friday, the code displays a reminder message for you.

To create the procedure that is executed whenever the Workbook Open event occurs, follow these steps:

- 1. Open the workbook.**
Any workbook will do.
- 2. Press Alt+F11 to activate the VBE.**
- 3. Locate the workbook in the Project window.**
- 4. Double-click the project name to display its items, if necessary.**
- 5. Double-click the ThisWorkbook item.**
The VBE displays an empty code pane for the ThisWorkbook object.
- 6. In the code pane, select Workbook from the Object (left) drop-down list.**
The VBE enters the beginning and ending statements for a Workbook_Open procedure.
- 7. Enter the following statements, so the complete event-procedure looks like this:**

```
Private Sub Workbook_Open()  
    Dim Msg As String  
    If Weekday(Now) = 6 Then
```

```

        Msg = "Today is Friday. Don't forget to "
        Msg = Msg & "submit the TPS Report!"
        MsgBox Msg
    End If
End Sub

```

The code pane should look like Figure 11-3.

FIGURE 11-3:
This event-
handler
procedure is
executed when
the workbook
is opened.

The screenshot shows a VBA code editor window titled 'Workbook' with an 'Open' button. The code is as follows:

```

Option Explicit

Private Sub Workbook_Open()
    Dim Msg As String
    If Weekday(Now) = 6 Then
        Msg = "Today is Friday. Don't forget to "
        Msg = Msg & "submit the TPS Report!"
        MsgBox Msg
    End If
End Sub

```

`Workbook_Open` is executed automatically whenever the workbook is opened. It uses VBA's `WeekDay` function to determine the day of the week. If it's Friday (day 6), a message box reminds the user to submit a report. If it's not Friday, nothing happens.

If today isn't Friday, you might have a hard time testing this procedure. You can just change the 6 to correspond to today's actual day number.

And of course, you can modify this procedure any way you like. For example, the following version displays a message every time the workbook is opened. This gets annoying after a while.

```

Private Sub Workbook_Open()
    Msg = "This is Frank's cool workbook!"
    MsgBox Msg
End Sub

```

A `Workbook_Open` procedure can do almost anything. These event-handlers are often used for the following:

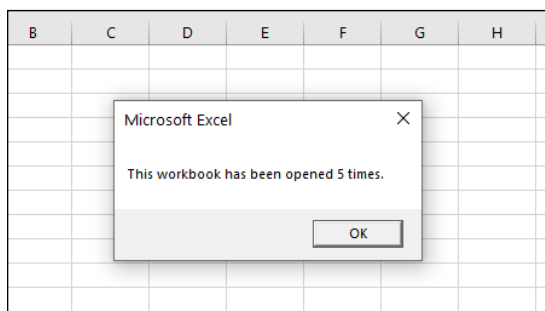
- »» Displaying welcome messages (such as in Frank's cool workbook)
- »» Opening other workbooks
- »» Activating a particular worksheet in the workbook
- »» Setting up custom shortcut menus

Here's a final example of a `Workbook_Open` procedure that uses the `GetSetting` and `SaveSetting` functions to keep track of how many times the workbook has been opened. The `SaveSetting` function writes a value to the Windows registry, and the `GetSetting` function retrieves that value (see the Help system for details).

The following example retrieves the count from the registry, increments it, and then saves it back to the registry. It also tells the user the value of `Cnt` that corresponds to the number of times the workbook has been opened (see Figure 11-4).

```
Private Sub Workbook_Open()  
    Dim Cnt As Long  
    Cnt = GetSetting("MyApp", "Settings", "Open", 0)  
    Cnt = Cnt + 1  
    SaveSetting "MyApp", "Settings", "Open", Cnt  
    MsgBox "This workbook has been opened " & Cnt & " times."  
End Sub
```

FIGURE 11-4:
Using a `Workbook_Open` event-handler to keep track of how many times a workbook has been opened.



The BeforeClose event for a workbook

Here's an example of the `Workbook_BeforeClose` event-handler procedure, which is executed automatically immediately before the workbook is closed. This procedure is located in the `ThisWorkbook` module:

```
Private Sub Workbook_BeforeClose(Cancel As Boolean)  
    Dim Msg As String  
    Dim Ans As Long  
    Dim FName As String  
    Msg = "Would you like to make a backup of this file?"  
    Ans = MsgBox(Msg, vbYesNo)
```

```

    If Ans = vbYes Then
        FName = "F:\BACKUP\" & ThisWorkbook.Name
        ThisWorkbook.SaveCopyAs FName
    End If
End Sub

```

This routine uses a message box to ask the user whether they would like to make a backup copy of the workbook. If the answer is yes, the code uses the `SaveCopyAs` method to save a backup copy of the file on drive F. If you adapt this procedure for your own use, you need to change the drive and path.

Excel programmers often use a `Workbook_BeforeClose` procedure to clean up after themselves. For example, if you use a `Workbook_Open` procedure to change some settings when you open a workbook (hiding the status bar, for example), it's only appropriate that you return the settings to their original state when you close the workbook. You can perform this electronic housekeeping with a `Workbook_BeforeClose` procedure.



WARNING

When using the `Workbook_BeforeClose` event, keep this in mind: If you close Excel and any open file has been changed since the last save, Excel shows its usual “Do you want to save your changes” message box. Clicking the Cancel button cancels the entire closing process. But the `Workbook_BeforeClose` event will have been executed by that point, anyway.

The BeforeSave event for a workbook

The `BeforeSave` event, as its name implies, is triggered before a workbook is saved. This event occurs when you choose `File ⇨ Save` or `File ⇨ Save As`.

The following procedure, which is in the `ThisWorkbook` module, demonstrates the `BeforeSave` event. The routine updates the value in a cell (cell A1 on Sheet1) every time the workbook is saved. In other words, cell A1 serves as a counter to keep track of the number of times the file was saved.

```

Private Sub Workbook_BeforeSave(ByVal SaveAsUI _
    As Boolean, Cancel As Boolean)
    Dim Counter As Range
    Set Counter = Sheets("Sheet1").Range("A1")
    Counter.Value = Counter.Value + 1
End Sub

```

Notice that the `Workbook_BeforeSave` procedure has two arguments: `SaveAsUI` and `Cancel`. To demonstrate how these arguments work, examine the following macro, which is executed before the workbook is saved. This procedure attempts to prevent the user from saving the workbook with a different name. If the user chooses `File` ⇨ `Save As`, the `SaveAsUI` argument is `True`.

When the code executes, it checks the `SaveAsUI` value. If this variable is `True`, the procedure displays a message and sets `Cancel` to `True`, which cancels the `Save` operation.

```
Private Sub Workbook_BeforeSave(ByVal SaveAsUI _  
    As Boolean, Cancel As Boolean)  
    If SaveAsUI Then  
        MsgBox "You cannot save a copy of this workbook!"  
        Cancel = True  
    End If  
End Sub
```

Note that this procedure won't really prevent anyone from saving a copy with a different name. If someone really wants to do it, they can just open the workbook with macros disabled. When macros are disabled, event-handler procedures are also disabled, which makes sense because they are, after all, macros.

Using Activation Events

Another category of events consists of activating and deactivating objects — specifically, sheets and workbooks.

Activate and deactivate events in a sheet

Excel can detect when a particular sheet is activated or deactivated and execute a macro when either of these events occurs. These event-handler procedures go in the sheet's module.



TIP

You can quickly access a sheet's module by right-clicking the sheet's tab and selecting `View Code`.

The following example shows a simple procedure that is executed whenever a particular sheet is activated. This code simply pops up an annoying message box that displays the name of the active sheet:

```
Private Sub Worksheet_Activate()  
    MsgBox "You just activated " & ActiveSheet.Name  
End Sub
```

Here's another example that activates cell A1 whenever the sheet is activated:

```
Private Sub Worksheet_Activate()  
    Range("A1").Activate  
End Sub
```

Although the code in these two procedures is about as simple as it gets, event-handler procedures can be as complex as you like.

The following procedure (which is stored in the Sheet1 module) uses the Deactivate event to prevent a user from activating any other sheet in the workbook. If Sheet1 is deactivated (that is, another sheet is activated), the user gets a message and Sheet1 is activated.

```
Private Sub Worksheet_Deactivate()  
    MsgBox "You must stay on Sheet1"  
    Sheets("Sheet1").Activate  
End Sub
```

By the way, it's not a great idea to use VBA procedures, such as this one, to attempt to take over Excel. These so-called "dictator" applications can be very frustrating and confusing for the user. And of course, they can be defeated easily by disabling macros.

Activate and deactivate events in a workbook

The previous examples use events associated with a specific worksheet. The ThisWorkbook object also handles events that deal with sheet activation and deactivation. The following procedure, which is stored in the ThisWorkbook module, is executed when *any* sheet in the workbook is activated. The code displays a message with the name of the activated sheet.

```
Private Sub Workbook_SheetActivate(ByVal Sh As Object)
    MsgBox Sh.Name
End Sub
```

The `Workbook_SheetActivate` procedure uses the `Sh` argument. `Sh` is a variable that represents the sheet that was activated. The message box displays the name of the sheet.

The next example is contained in the `ThisWorkbook` module. It consists of two event-handler procedures:

- » **Workbook_SheetDeactivate:** Executed when any sheet in the workbook is deactivated. It stores the sheet that is deactivated in an object variable — but only if the sheet is a worksheet. The `Set` keyword creates an object variable, which is available to all procedures in the module.
- » **Workbook_SheetActivate:** Executed when any sheet in the workbook is activated. It checks the type of sheet that is activated (using the `TypeName` function). If the sheet is a chart sheet, the user gets a message (see Figure 11-5). When the `OK` button in the message box is clicked, the *previous* worksheet (which is stored in the `OldSheet` variable) is reactivated.

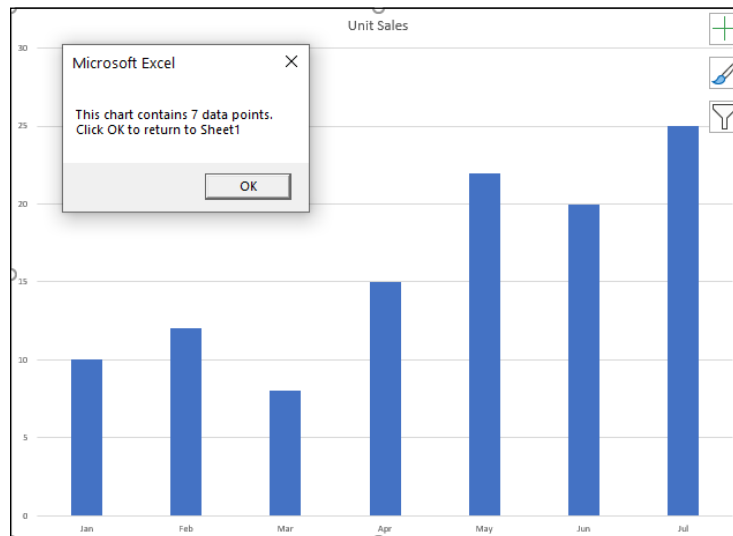


FIGURE 11-5: When a chart sheet is activated, the user sees a message like this.



TIP

A workbook that contains this code is available at this book's website (<https://www.dummies.com/go/excelvbaprogrammingfd6e>).

```
Dim OldSheet As Object

Private Sub Workbook_SheetDeactivate(ByVal Sh As Object)
    If TypeName(Sh) = "Worksheet" Then Set OldSheet = Sh
End Sub

Private Sub Workbook_SheetActivate(ByVal Sh As Object)
    Dim Msg As String
    If TypeName(Sh) = "Chart" Then
        Msg = "This chart contains "
        Msg = Msg & ActiveChart.SeriesCollection(1).Points.Count
        Msg = Msg & " data points." & vbNewLine
        Msg = Msg & "Click OK to return to " & OldSheet.Name
        MsgBox Msg
        OldSheet.Activate
    End If
End Sub
```

Workbook activation events

Excel also recognizes the event that occurs when you activate or deactivate a particular workbook. The following code, which is contained in the `ThisWorkbook` module, is executed whenever the workbook is activated. The procedure simply maximizes the workbook's window.

```
Private Sub Workbook_Activate()
    ActiveWindow.WindowState = xlMaximized
End Sub
```

An example of `Workbook_Deactivate` code appears next. This procedure is executed when a workbook is deactivated. This procedure copies the selected range whenever the workbook is deactivated. It might be useful if you're copying data from lots of areas and pasting them into a different workbook. When this event-procedure is in place, you can select the range to be copied, activate the other workbook, select the destination, and press `Ctrl+V` (or `Enter`) to paste the copied data.

```
Private Sub Workbook_Deactivate()
    ThisWorkbook.Windows(1).RangeSelection.Copy
End Sub
```


Programming Worksheet-Related Events

The preceding section illustrated examples for worksheet activation and deactivation events. In this section, you find additional events that occur in worksheets: double-clicking a cell, right-clicking a cell, and changing a cell.

The BeforeDoubleClick event

You can set up a VBA procedure to be executed when the user double-clicks a cell. In the following example (which is stored in a sheet's module), double-clicking a cell in that sheet makes the cell bold (if it's not bold) or not bold (if it is bold):

```
Private Sub Worksheet_BeforeDoubleClick _  
    (ByVal Target As Excel.Range, Cancel As Boolean)  
    Target.Font.Bold = Not Target.Font.Bold  
    Cancel = True  
End Sub
```

The `Worksheet_BeforeDoubleClick` procedure has two arguments: `Target` and `Cancel`. `Target` represents the cell (a `Range` object) that was double-clicked. If `Cancel` is set to `True`, the default double-click action doesn't occur.

The default action for double-clicking a cell is to put Excel in cell edit mode. In this case, you don't necessarily want to edit the cell when double-clicking the cells, so set `Cancel` to `True`.

The BeforeRightClick event

The `BeforeRightClick` event is similar to the `BeforeDoubleClick` event except that it consists of right-clicking a cell. The following procedure checks to see whether the cell that was right-clicked contains a numeric value. If so, the code displays the `Format Number` dialog box and sets the `Cancel` argument to `True` (avoiding the normal shortcut menu display). If the cell doesn't contain a numeric value, nothing special happens; the shortcut menu is displayed as usual.

```
Private Sub Worksheet_BeforeRightClick _  
    (ByVal Target As Excel.Range, Cancel As Boolean)  
    If IsNumeric(Target) And Not IsEmpty(Target) Then  
        Application.CommandBars.ExecuteMso ("NumberFormatsDialog")  
        Cancel = True  
    End If  
End Sub
```



TIP

Notice that the code, which is available on this book's website (<https://www.dummies.com/go/excelvbaprogrammingfd6e>), makes an additional check to see if the cell isn't empty. This is because VBA considers empty cells to be numeric.

The Change event

The Change event occurs whenever any cell in the worksheet is changed. In the following example, the `Worksheet_Change` procedure effectively prevents a user from entering a nonnumeric value in cell A1. This code is stored in a sheet's module.

```
Private Sub Worksheet_Change(ByVal Target As Range)
    If Target.Address = "$A$1" Then
        If Not IsNumeric(Target) Then
            MsgBox "Enter a number in cell A1."
            Range("A1").ClearContents
            Range("A1").Activate
        End If
    End If
End Sub
```

The single argument for the `Worksheet_Change` procedure (`Target`) represents the range that was changed. The first statement checks whether the cell's address is `A1`. If so, the code uses the `IsNumeric` function to determine whether the cell contains a numeric value. If not, a message appears, and the cell's value is erased. Cell A1 is then activated — useful if the cell pointer moved to a different cell after the entry was made. If the change occurs in any cell except A1, nothing happens.

Why not use data validation?

You might be familiar with `Data` ⇔ `Data Tools` ⇔ `Data Validation`. This handy feature makes it easy to ensure that only data of the proper type is entered into a particular cell or range. Although `Data` ⇔ `Data Tools` ⇔ `Data Validation` is useful, it's definitely not foolproof.

Try adding data validation to a cell. For example, you can set it up so the cell accepts only a numerical value. It works fine — until you copy another cell and paste it to the data validation cell. Pasting removes the data validation. It's as if it was never there. The severity of this flaw depends on your application.



TECHNICAL
STUFF

Pasting wipes out data validation because Excel considers validation to be a format for a cell. Therefore, it's in the same classification as font size, color, or other similar attributes. When you paste a cell, you're replacing the formats in the target cell with those of the source cell. Unfortunately, those formats also include your validation rules.

Preventing data validation from being destroyed

The procedure in this section demonstrates how to prevent users from copying data and wiping out data validation rules. This example assumes that the worksheet has a range named `InputArea`, and this input area contains data validation rules (set up by choosing `Data` ⇨ `Data Tools` ⇨ `Data Validation`). The range can have any validation rules you want.



TIP

A workbook that contains this code is available at this book's website (<https://www.dummies.com/go/excelvbaprogrammingfd6e>):

```
Private Sub Worksheet_Change(ByVal Target As Range)
    Dim VT As Long
    'Do all cells in the validation range
    'still have validation?
    On Error Resume Next
    VT = Range("InputRange").Validation.Type
    If Err.Number <> 0 Then
        Application.Undo
        MsgBox "Your last operation was canceled. " & _
            "It would have deleted data validation rules.", vbCritical
    End If
End Sub
```

The procedure is executed whenever a cell is changed. It checks the validation type of the range (named `InputRange`) that is *supposed* to contain the data validation rules. If the `VT` variable contains an error, one or more cells in the `InputRange` no longer have data validation. (The user probably copied some data over it.) If that's the case, the code executes the `Undo` method of the `Application` object and reverses the user's action. Then it displays a message box, as shown in Figure 11-6. See Chapter 12 for more information about using `On Error Resume Next`.

The net effect? It's impossible to wipe out the validation rules by copying data. When Excel is broken, sometimes you can use VBA to fix it.

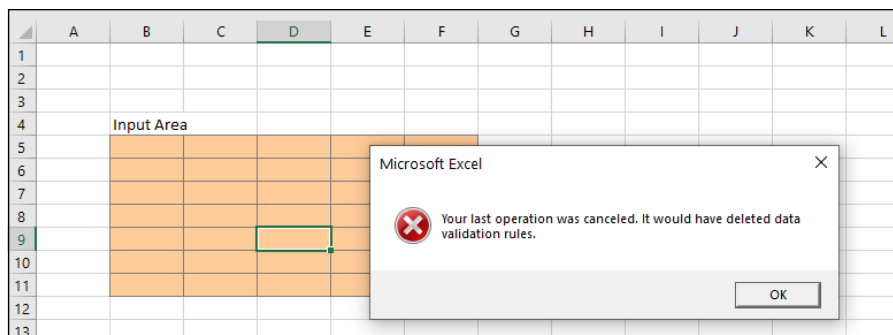


FIGURE 11-6: Performing data validation with an event procedure.

Understanding Events Not Associated with Objects

The events discussed previously in this chapter are associated with either a workbook object or a worksheet object. This section focuses on two types of events that aren't associated with objects: time and keypresses.



REMEMBER

Because time and keypresses aren't associated with a particular object such as a workbook or a worksheet, you program these events in a normal VBA module (unlike the other events discussed in this chapter).

The OnTime event

The OnTime event occurs when a particular time of day occurs. The following example demonstrates how to get Excel to execute a procedure at 3 p.m. In this case, a robot voice tells you to wake up, accompanied by a message box:

```
Sub SetAlarm()  
    Application.OnTime 0.625, "DisplayAlarm"  
End Sub  
Sub DisplayAlarm()  
    Application.Speech.Speak ("Hey, wake up")  
    MsgBox " It's time for your afternoon break!"  
End Sub
```

In this example, you use the OnTime method of the Application object. This method takes two arguments: the time (0.625, which is 3:00 p.m.) and the name of the Sub procedure to execute when the time event occurs (DisplayAlarm).

This procedure is quite useful if you tend to get so wrapped up in your work that you forget about meetings and appointments. Just set an OnTime event to remind yourself.



TIP

Most people find it difficult to think of time in terms of the Excel numbering system. Therefore, you might want to use the VBA TimeValue function to represent the time. TimeValue converts a string that looks like a time into a value that Excel can handle. The following statement shows an easier way to program an event for 3 p.m.:

```
Application.OnTime TimeValue("3:00:00 pm"), "DisplayAlarm"
```

If you want to schedule an event relative to the current time (for example, 20 minutes from now), you can use a statement like this:

```
Application.OnTime Now + TimeValue("00:20:00"), "DisplayAlarm"
```

You can also use the `OnTime` method to run a VBA procedure on a particular day. You must make sure that your computer keeps running and that the workbook with the procedure is kept open. The following statement runs the `DisplayAlarm` procedure at 5 p.m. on December 31, 2022:

```
Application.OnTime DateValue("12/31/2022 5:00 pm"), "DisplayAlarm"
```

This particular code line could come in handy to warn you that you need to go home and get ready for the New Year's Eve festivities.

Here's another example that uses the `OnTime` event. Executing the `UpdateClock` procedure writes the time to cell A1 and also programs another event 5 seconds later. This event reruns the `UpdateClock` procedure. The net effect is that cell A1 is updated with the current time every 5 seconds. To stop the events, execute the `StopClock` procedure (which cancels the event). Note that `NextTick` is a module-level variable that stores the time for the next event.

```
Dim NextTick As Date

Sub UpdateClock()
    ' Updates cell A1 with the current time
    ThisWorkbook.Sheets(1).Range("A1") = Time
    ' Set up the next event five seconds from now
    NextTick = Now + TimeValue("00:00:05")
    Application.OnTime NextTick, "UpdateClock"
End Sub

Sub StopClock()
    ' Cancels the OnTime event (stops the clock)
    On Error Resume Next
    Application.OnTime NextTick, "UpdateClock", , False
End Sub
```



WARNING

The `OnTime` event persists even after the workbook is closed. In other words, if you close the workbook without running the `StopClock` procedure, the workbook reopens itself in 5 seconds (assuming that Excel is still running). To prevent this, use the following `Workbook_BeforeClose` event procedure:

```
Private Sub Workbook_BeforeClose(Cancel As Boolean)
    StopClock
End Sub
```

The OnTime method has two additional arguments. If you plan to use this method, you should refer to the Help system for complete details.

Another use for OnTime is conducting a timed test or survey. In the following code, StartTest unprotects the worksheet allowing the user to enter values into cells and starts a timer. After 20 minutes, the user is informed the test is over and the worksheet is protected.

```
Sub StartTest()  
    MsgBox "You have 20 minutes to complete the test"  
    Sheet1.Unprotect  
    Application.OnTime Now + TimeSerial(0, 20, 0), "EndTest"  
End Sub  
  
Sub EndTest()  
    MsgBox "The test has ended"  
    Sheet1.Protect  
End Sub
```

This example uses the TimeSerial VBA function to add 20 minutes to the current time.

Keypress events

While you work, Excel constantly monitors what you type. Because of this, you can set up things so a keystroke or a key combination executes a procedure.

Here's an example that reassigns the PgDn and PgUp keys:

```
Sub Setup_OnKey()  
    Application.OnKey "{PgDn}", "PgDn_Sub"  
    Application.OnKey "{PgUp}", "PgUp_Sub"  
End Sub  
  
Sub PgDn_Sub()  
    On Error Resume Next  
    ActiveCell.Offset(1, 0).Activate  
End Sub  
  
Sub PgUp_Sub()  
    On Error Resume Next  
    ActiveCell.Offset(-1, 0).Activate  
End Sub
```

After setting up the OnKey events by executing the Setup_OnKey procedure, pressing PgDn moves you down one row. Pressing PgUp moves you up one row.

Notice that the key codes are enclosed in braces, not in parentheses. For a complete list of keyboard codes, consult the Help system. Search for *OnKey*.

In this example, On Error Resume Next ignores any errors that are generated. For example, if the active cell is in the first row, trying to move up one row causes an error that can safely be ignored. And if a chart sheet is active, there is no active cell.

By executing the following routine, you cancel the OnKey events:

```
Sub Cancel_OnKey()  
    Application.OnKey "{PgDn}"  
    Application.OnKey "{PgUp}"  
End Sub
```



WARNING

Using an empty string as the second argument for the OnKey method does *not* cancel the OnKey event. Rather, it causes Excel to simply ignore the keystroke. For example, the following statement tells Excel to ignore Alt+F4. The percent sign represents the Alt key:

```
Application.OnKey "%{F4}", ""
```

Although you can use the OnKey method to assign a shortcut key for executing a macro, you should use the Macro Options dialog box for this task. For more details, see Chapter 5.



REMEMBER

If you close the workbook that contains the code and leave Excel open, the OnKey method doesn't reset. As a consequence, pressing the shortcut key causes Excel to automatically open the file with the macro. To prevent this from happening, you should include code in your Workbook_BeforeClose event code (shown earlier in this chapter) to reset the OnKey event.

- » Understanding the difference between programming errors and runtime errors
- » Trapping and handling runtime errors
- » Using On Error and Resume statements
- » Finding out how you can use an error to your advantage

Chapter **12**

Error-Handling Techniques

To err is human. To anticipate errors is divine. When working with VBA, you must be aware of two broad classes of errors: programming errors and runtime errors. This chapter is all about runtime errors.

A well-written program handles errors the way Fred Astaire danced: gracefully. Fortunately, VBA includes several tools to help you identify errors and then handle them gracefully.

Types of Errors

If you've tried any of the examples in this book, you have probably encountered one or more error messages. Some were a result of bad VBA code. For example, you might have misspelled a keyword or typed a statement using the wrong syntax. If you make such an error, you won't even be able to execute the procedure until you correct it.

This chapter doesn't deal with those types of errors, however. Instead, it focuses on *runtime errors* — the errors that occur while Excel executes your VBA code. More specifically, this chapter covers the following fascinating topics:

- » Identifying errors
- » Correcting or ignoring the errors that occur
- » Recovering from errors
- » Creating intentional errors (Yes, sometimes an error can be a good thing.)

The ultimate goal of error handling is to write code that doesn't result in Excel's error messages as much as possible. In other words, you want to anticipate potential errors and deal with them *before* Excel has a chance to notify you with a (usually) less-than-informative error message.

An Erroneous Macro Example

To get things started, let's take a look at the following *macro*. A macro this simple shouldn't produce any errors, right?

Activate the VBE, insert a module, and enter the following code:

```
Sub EnterSquareRoot()  
    Dim Num As Double  
    ' Prompt for a value  
    Num = InputBox("Enter a value")  
    ' Insert the square root  
    ActiveCell.Value = Sqr(Num)  
End Sub
```

As shown in Figure 12-1, this procedure asks the user for a value. It then performs a magical calculation and enters the square root of that value into the active cell.

FIGURE 12-1:
The InputBox function displays a dialog box asking the user for a value.





TIP

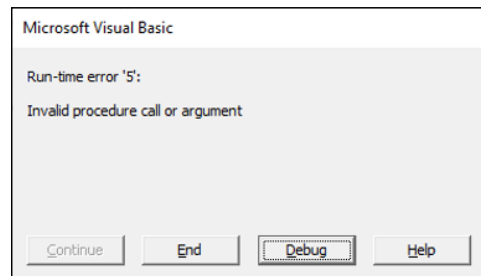
You can execute this procedure directly from the VBE by pressing F5. Alternatively, you might want to add a button to a worksheet (choose Developer ⇨ Controls ⇨ Insert and select the button in the Form Controls group to do this), and then assign the macro to the button. (Excel prompts you for the macro to assign.) Then you can run the procedure by simply clicking the button you assigned to the macro previously.

Not-quite-perfect macros

Try out the macro by executing the code a few times. It works pretty well, doesn't it? Now try entering a negative number when you're prompted for a value. Oops! Trying to calculate the square root of a negative number is illegal on this planet.

Excel responds to the request to calculate the square root of a negative number by displaying the runtime error message shown in Figure 12-2. For now, simply click the End button. If you click the Debug button, Excel suspends the macro so that you can use the debugging tools to help track down the error. (Note, debugging tools are covered in Chapter 13.)

FIGURE 12-2: Excel displays this error message when the procedure attempts to calculate the square root of a negative number.



Most Excel error messages (for example, *Invalid procedure call or argument*) aren't particularly helpful. To improve this procedure, you must anticipate this error and handle it more gracefully. In other words, you need to add some error-handling code.

Here's a modified version of EnterSquareRoot:

```
Sub EnterSquareRoot2()  
    Dim Num As Double  
    ' Prompt for a value  
    Num = InputBox("Enter a value")  
    ' Make sure the number is nonnegative
```

```

    If Num < 0 Then
        MsgBox "You must enter a positive number."
    Else
        ' Insert the square root
        ActiveCell.Value = Sqr(Num)
    End If
End Sub

```

In this code, an If-Then structure checks the value contained in the Num variable. If Num is less than 0, the procedure displays a message box containing information that can be actually understood. If not, the square root calculation is performed as in the previous version.

Perfecting the macro

If the modified EnterSquareRoot procedure still isn't perfect, try entering text rather than a value, or click the Cancel button in the input box. Both of these actions generate an error (*Type mismatch*), meaning this procedure needs still more error-handling code added.

The following modified code uses the IsNumeric function to ensure that Num contains a numeric value. If the user doesn't enter a number, the procedure displays a message and then stops. Also, notice that the Num variable is now declared as a Variant. If it were declared as a Double, the code would generate an unhandled error if the user entered a nonnumeric value into the input box.

```

Sub EnterSquareRoot3()
    Dim Num As String
    ' Prompt for a value
    Num = InputBox("Enter a value")

    ' Make sure Num is a number
    If Not IsNumeric(Num) Then
        MsgBox "You must enter a number."
        Exit Sub
    End If

    ' Make sure the number is nonnegative
    If Num < 0 Then
        MsgBox "You must enter a positive number."
        Exit Sub
    End If

```

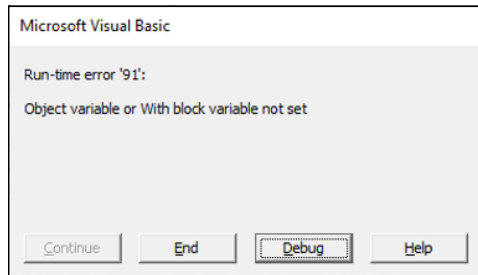
```

'   Insert the square root
    ActiveCell.Value = Sqr(Num)
End Sub

```

Now is this code absolutely perfect? Not quite. Try running the procedure while the active sheet is a chart sheet. Yikes — it results in another runtime error: This time the dreaded Number 91 (see Figure 12-3). This error occurs because there is no active cell when a chart sheet is active, or when something other than a range is selected.

FIGURE 12-3:
Running the procedure when a chart is selected generates this error.



The following procedure uses the TypeName function to ensure that the selection is a range. If anything other than a range is selected, this procedure displays a message and then exits:

```

Sub EnterSquareRoot4()
    Dim Num As String
    '   Make sure a worksheet is active
    If TypeName(Selection) <> "Range" Then
        MsgBox "Select a cell for the result."
        Exit Sub
    End If

    '   Prompt for a value
    Num = InputBox("Enter a value")
    '   Make sure Num is a number
    If Not IsNumeric(Num) Then
        MsgBox "You must enter a number."
        Exit Sub
    End If

    '   Make sure the number is nonnegative
    If Num < 0 Then
        MsgBox "You must enter a positive number."
        Exit Sub
    End If

```

```
End If
' Insert the square root
ActiveCell.Value = Sqr(Num)
End Sub
```

Giving up on perfection

By now, this procedure simply *must* be perfect. Think again, pal.

Protect the worksheet (choose Review ⇄ Changes ⇄ Protect Sheet) and then run the code. Yep, attempting to write to a protected worksheet generates yet another error. And, there are at least another half-dozen errors that are impossible to predict. Keep reading for another way to deal with errors — even those you can't anticipate.

Alternate Ways of Handling Errors

How can you identify and handle every possible error? Often, you can't. Fortunately, VBA provides another way to deal with errors.

Revisiting the EnterSquareRoot procedure

The following code is a modified version of the procedure from the previous section. Here, an all-purpose On Error statement traps all the errors and then checks to see whether the InputBox was canceled.

```
Sub EnterSquareRoot5()
    Dim Num As String
    Dim Msg As String

    ' Set up error handling
    On Error GoTo BadEntry
    ' Prompt for a value
    Num = InputBox("Enter a value")
    ' Exit if cancelled
    If Num = "" Then Exit Sub
```

```

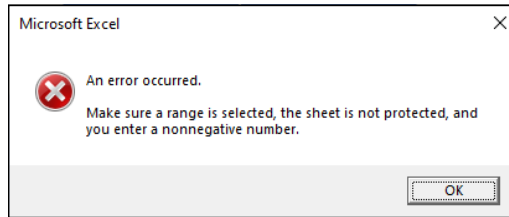
'   Insert the square root
   ActiveCell.Value = Sqr(Num)
   Exit Sub

BadEntry:
   Msg = "An error occurred." & vbNewLine & vbNewLine
   Msg = Msg & "Make sure a range is selected, "
   Msg = Msg & "the sheet is not protected, "
   Msg = Msg & "and you enter a nonnegative number."
   MsgBox Msg, vbCritical
End Sub

```

This routine traps *any* type of runtime error. After trapping a runtime error, the revised EnterSquareRoot procedure displays the message box shown in Figure 12-4. This message box describes the most likely causes of the error.

FIGURE 12-4: A runtime error in the procedure generates this semi-helpful error message.



TIP

ON ERROR NOT WORKING?

If an On Error statement isn't working as advertised, you need to change one of your settings:

1. **Activate the VBE.**
2. **Choose Tools ⇄ Options.**
3. **Click the General tab of the Options dialog box.**
4. **Make sure that the Break on All Errors setting is deselected.**

If this setting is selected, Excel essentially ignores any On Error statements. You normally want to keep the Error Trapping options set to Break on Unhandled Errors.

Trapping errors with the On Error statement

Using an On Error statement in your VBA code allows you to bypass Excel's built-in error handling and use your own error-handling code. In the EnterSquareRoot5 example from the previous section, a runtime error causes the macro execution to jump to the statement labeled BadEntry. As a result, you avoid Excel's unfriendly error messages and can display your own message to the user.



TIP

Notice that the example uses an Exit Sub statement right before the BadEntry label. This statement is necessary because you don't want to execute the error-handling code if an error does *not* occur.

Handling Errors: The Details

You can use the On Error statement in three ways, as shown in Table 12-1.

TABLE 12-1 Using the On Error Statement

Syntax	What It Does
On Error GoTo <i>label</i>	After executing this statement, VBA resumes execution at the statement following the specified label. You must include a colon after the label so that VBA recognizes it as a label.
On Error GoTo 0	After executing this statement, VBA resumes its normal error-checking behavior. Use this statement after using one of the other On Error statements to remove error handling in your procedure.
On Error Resume Next	After executing this statement, VBA simply ignores all errors and resumes execution with the next statement.

Resuming after an error

In some cases, you simply want the routine to end gracefully when an error occurs. For example, you might display a message describing the error and then exit the procedure. (The EnterSquareRoot5 example shown earlier uses this technique, for example.) In other cases, you want to recover from the error, if possible.

To recover from an error, you must use a Resume statement. This clears the error condition and allows you to continue execution at some location. You can use the Resume statement in three ways, as shown in Table 12-2.

TABLE 12-2

Using the Resume Statement

Syntax	What It Does
Resume	Execution resumes with the statement that caused the error. Use this if your error-handling code corrects the problem, and it's okay to continue.
Resume Next	Execution resumes with the statement immediately following the statement that caused the error. This essentially ignores the error.
Resume <i>label</i>	Execution resumes at the <i>label</i> you specify.

The following example uses a Resume statement after an error occurs:

```

Sub EnterSquareRoot6()
    Dim Num As String
    Dim Msg As String
    Dim Ans As Integer
TryAgain:
    ' Set up error handling
    On Error GoTo BadEntry

    ' Prompt for a value
    Num = InputBox("Enter a value")
    If Num = "" Then Exit Sub

    ' Insert the square root
    ActiveCell.Value = Sqr(Num)

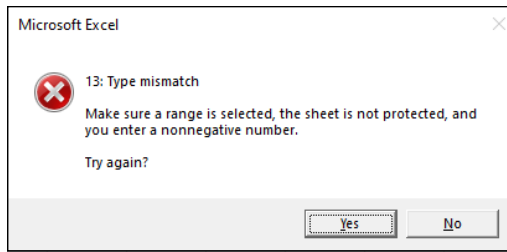
    Exit Sub

BadEntry:
    Msg = Err.Number & ": " & Error(Err.Number)
    Msg = Msg & vbNewLine & vbNewLine
    Msg = Msg & "Make sure a range is selected, "
    Msg = Msg & "the sheet is not protected, "
    Msg = Msg & "and you enter a nonnegative number."
    Msg = Msg & vbNewLine & vbNewLine & "Try again?"
    Ans = MsgBox(Msg, vbYesNo + vbCritical)
    If Ans = vbYes Then Resume TryAgain
End Sub

```

This procedure has another label: TryAgain. If an error occurs, execution continues at the BadEntry label, and the code displays the message shown in Figure 12-5. If the user responds by clicking Yes, the Resume statement kicks in, and execution jumps back to the TryAgain label. If the user clicks No, the procedure ends.

FIGURE 12-5:
If an error occurs, the user can decide whether to try again.



Notice that the error message also includes the error number, along with the “official” error description.

The Resume statement clears the error condition before continuing. To understand what this means, try substituting the following statement for the second-to-last statement in the preceding example:

```
If Ans = vbYes Then GoTo TryAgain
```

The code doesn’t work correctly if you use GoTo rather than Resume. To demonstrate, enter a negative number. You get the error prompt. Click Yes to try again and then enter *another* negative number. This second error is not trapped because the original error condition was not cleared.



TIP

This example is available on this book’s website.

Error handling in a nutshell

To help you keep all this error-handling business straight, here’s a quick-and-dirty summary. A block of error-handling code has the following characteristics:

- » It begins immediately after the label specified in the On Error statement.
- » It should be reached by your macro only if an error occurs. This means that you must use a statement such as Exit Sub or Exit Function immediately before the label.
- » It may require a Resume statement. If you choose not to abort the procedure when an error occurs, you must execute a Resume statement before returning to the main code.

When a runtime error occurs, execution jumps to the code beginning at the ErrorHandler label. The Select Case structure (discussed in Chapter 10) tests for three common error numbers. If the error number is 5, 13, or 1004, a custom error message is displayed and execution resumes at the next statement. (In other words, the error is ignored.) The last case, a catch-all for unanticipated errors, traps all other errors and displays the built-in error message.

An Intentional Error

Sometimes, you can use an error to your advantage. Suppose that you have a macro that works only if a particular workbook is open. How can you determine whether that workbook is open? One way is to write code that loops through the `Workbooks` collection, checking to determine whether the workbook you're interested in is contained in that collection.

Here's an easier way: using a general-purpose function that accepts one argument (a workbook name) and returns `True` if the workbook is open or `False` if it's not.

Here's the function:

```
Function WorkbookIsOpen(book As String) As Boolean
    Dim WBName As String
    On Error GoTo NotOpen
    WBName = Workbooks(book).Name
    WorkbookIsOpen = True
    Exit Function
NotOpen:
    WorkbookIsOpen = False
End Function
```

This function takes advantage of the fact that Excel generates an error if you refer to a workbook that isn't open. For example, the following statement generates an error if a workbook named `MyBook.xlsx` isn't open:

```
WBName = Workbooks("MyBook.xlsx").Name
```

In the `WorkbookIsOpen` function, the `On Error` statement tells VBA to continue the macro at the `NotOpen` statement if an error occurs. Therefore, an error means that the workbook isn't open, and the function returns `False`. If the workbook is open, no error occurs, and the function returns `True`.

Here's another variation on the `WorkbookIsOpen` function. This version uses `On Error Resume Next` to ignore the error. But the code checks `Err`'s `Number` property. If `Err.Number` is 0, no error occurred, and the workbook is open. If `Err.Number` is anything else, it means that an error occurred (and the workbook isn't open).

```

Function WorkbookIsOpen(book) As Boolean
    Dim WBName As String
    On Error Resume Next
    WBName = Workbooks(book).Name
    If Err.Number = 0 Then WorkbookIsOpen = True _
        Else WorkbookIsOpen = False
End Function

```

The following example demonstrates how to use this function in a Sub procedure:

```

Sub UpdatePrices()
    If WorkbookIsOpen("Prices.xlsx") Then
        ' [Other code that uses the workbook goes here]
    Else
        MsgBox "Please open the Prices workbook first!"
    End If
End Sub

```

The UpdatePrices procedure (which must be in the same workbook as WorkbookIsOpen) calls the WorkbookIsOpen function and passes the workbook name (Prices.xlsx) as an argument. The WorkbookIsOpen function returns either True or False. Therefore, if the workbook is not open, the procedure informs the user of that fact. If the workbook is open, the other code is executed.

Error handling can be a tricky proposition. After all, many errors can occur, and you can't anticipate all of them. In general, you should trap errors and correct the situation before Excel intervenes, if possible. Writing effective error-trapping code requires a thorough knowledge of Excel and a clear understanding of how VBA error handling works. Subsequent chapters contain more examples of error handling.

IN THIS CHAPTER

- » Defining a bug and knowing why you should squash it
- » Recognizing types of bugs you might encounter
- » Using techniques for debugging your code
- » Using the VBE's built-in debugging tools
- » Presenting a handy list of bug reduction tips

Chapter **13**

Bug Extermination Techniques

If the term *bugs* conjures up an image of a creepy crawly, this chapter can set you straight. Simply put, a bug is an error in your programming. This chapter details programming bugs — how to identify them and how to wipe them off your module.

Species of Bugs

In programming, the term *bug*, as you probably know, refers to a software problem. In other words, if software doesn't perform as expected, it has a bug. Fact is, all major software programs have bugs — lots of bugs. Excel itself has hundreds (if not thousands) of bugs. Fortunately, the vast majority of these bugs are relatively obscure and appear in only very specific circumstances.

When you write large enough VBA programs, your code probably will have bugs. Simply put, bugs are fact of life and not necessarily a reflection of your programming ability. These bugs may fall into any of the following categories:

- » **Logic flaws in your code:** You can often avoid these bugs by carefully thinking through the problem your program addresses and testing your code when it's written.
- » **Incorrect context bugs:** This bug type surfaces when you attempt to do something at the wrong time. For example, your code might try to write data to cells in the active sheet when the active sheet is actually a chart sheet (which has no cells).
- » **Extreme-case bugs:** These bugs rear their ugly heads when you encounter data you didn't anticipate, such as very large or very small numbers.
- » **Wrong data-type bugs:** This bug type occurs when you try to process data of the wrong type, such as attempting to take the square root of a text string.
- » **Wrong version bugs:** This bug type involves incompatibilities between different Excel versions. For example, you might develop a workbook with the latest version of Excel and then find out that the workbook doesn't work with Excel 2003. You can usually avoid such problems by not using version-specific features. Often, the easiest approach is to develop your program by using the lowest version number of Excel that users might have. In all cases, however, you should test your work on all versions of Excel you expect will be used to run your program.
- » **Beyond-your-control bugs:** These bugs are the most frustrating. An example of such a bug is when Microsoft upgrades Excel and makes a minor, undocumented change that causes your macro to bomb. Even security updates have been known to cause problems.

Debugging is the process of identifying and correcting bugs in your program. Developing debugging skills takes time, so don't be discouraged if this process is difficult at first.



REMEMBER

It's important to understand the distinction between *bugs* and *syntax errors*. A syntax error is a language error. For example, you might misspell a keyword, omit the Next statement in a For-Next loop, or have a mismatched parenthesis. Before you can even execute the procedure, you must correct these syntax errors. A program bug is a much subtler issue. You can execute the routine, but your program won't perform as expected due to the bug's inclusion.

Identifying Bugs

Before you can do any debugging, you must determine whether a bug actually exists. You can tell that your macro contains a bug if it doesn't work the way it should. For some types of bugs, this is easily discernable. For others, it can be tricky.

The easiest bugs to identify are the ones that cause Excel to display a runtime error message when you run the macro. Figure 13-1 shows such an example. Notice that this error message includes a button labeled Debug. More about can be found later in the “Debugging Techniques” section.

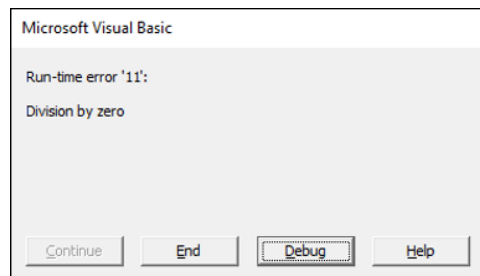


FIGURE 13-1: An error message like this often means that your VBA code contains a bug.

Bugs that don't result in a runtime error, but that simply produce incorrect results, are a little harder to find. The best way to find those bugs is to test your code thoroughly under a variety of real-life conditions.



TIP

Changes made by your VBA code can't be undone, so it's a good idea to use a backup copy of the workbook for testing.

Try to test your code with at least three types of data:

- » **Simplified data:** Start with simple data whose output you can predict. For a macro that creates an invoice, selling one unit at \$1 produces a predictable invoice total of \$1.
- » **Extreme data:** Create fake data at the extremes of what you macro should see. Try selling zero units, a million units, or even a negative number of units. Using extreme data shows you the limits of your macro.
- » **Real-life data:** After you test your code using simple and extreme data, find some real-life data to test with. Often real-life data is too complicated or just too big to precisely predict the output, but it still provides the best test of your macro.

Debugging Techniques

In this section, you explore the four most common methods for debugging Excel VBA code:

- » Examining the code
- » Inserting MsgBox functions at various locations in your code
- » Inserting Debug.Print statements
- » Using the Excel built-in debugging tools

Examining your code

Perhaps the most straightforward debugging technique is simply taking a closer look at your code to discern whether you can find the problem. This method, of course, requires knowledge and experience. In other words, you must know what you're doing. If you're lucky, the error jumps right out, and you slap your forehead and exclaim, "D'oh!" But oftentimes, you discover errors when you have been working on your program for eight hours straight — it's 2 a.m., and you're running on caffeine and willpower. During such times, you're lucky if you can even see your code, let alone find the bugs hiding in it. Don't be surprised if simply examining your code isn't enough to help you find and expunge all the bugs it contains.

Using the MsgBox function

One common problem in many programs involves one or more variables not taking on the values you expect. In such cases, monitoring the variable(s) while your code runs is a helpful debugging technique. One way to do this is by inserting temporary MsgBox functions into your routine. For example, if you have a variable named `CellCount`, you can insert the following statement:

```
MsgBox CellCount
```

When you execute the routine, the MsgBox function displays `CellCount`'s value.

It's often helpful to display the values of two or more variables in the message box. The following statement displays the current value of two variables: `LoopIndex` and `CellCount`, separated by a space.

```
MsgBox LoopIndex & " " & CellCount
```


Notice that the two variables are combined with the concatenation operator (&) and a space character inserted between them. Otherwise, the message box strings the two values together, making them look like a single value. You can also use the built-in constant, `vbNewLine`, in place of the space character. `vbNewLine` inserts a line-feed break, which displays the text on a new line. The following statement displays three variables, each on a separate line (see Figure 13-2):

```
MsgBox LoopIndex & vbNewLine & CellCount & vbNewLine & MyVal
```

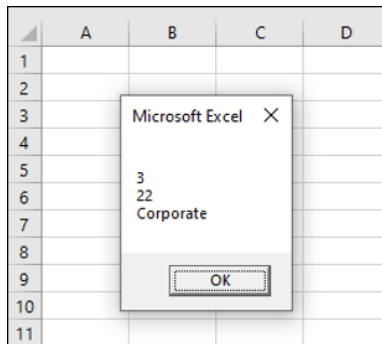


FIGURE 13-2:
Using a message box to display the value of three variables.

This technique isn't limited to monitoring variables. You can use a message box to display all sorts of useful information while your code is running. For example, if your code loops through a series of sheets, the following statement displays the name and type of the active sheet:

```
MsgBox ActiveSheet.Name & " " & TypeName(ActiveSheet)
```

If your message box shows something unexpected, press `Ctrl+Break`, and you should see a dialog box that tells you Code execution has been interrupted; as shown in Figure 13-3, you have four choices:

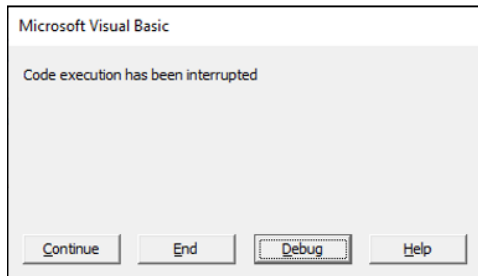
- » Click the Continue button. The code continues executing.
- » Click the End button. Execution stops.
- » Click the Debug button. The VBE goes into Debug mode (this is explained more later in the section "Using the Debugger's Tools").
- » Click the Help button. A help web page tells you that you pressed `Ctrl+Break`. In other words, it's not very helpful.



TIP

If your keyboard doesn't have a Break key, try pressing `Ctrl+ScrollLock`.

FIGURE 13-3:
Pressing
Ctrl+Break halts
execution of your
code and gives
you some
choices.



REMEMBER

Feel free to use MsgBox functions frequently when you debug your code. Just make sure that you remove them after you identify and correct the problem.

Inserting Debug.Print statements

As an alternative to using MsgBox functions in your code, you can insert one or more temporary Debug.Print statements. Use these statements to print the value of one or more variables in the Immediate window. Here's an example that displays the values of three variables:

```
Debug.Print LoopIndex, CellCount, MyVal
```

Notice that the variables are separated with commas. You can display as many variables as you like with a single Debug.Print statement.



REMEMBER

Debug.Print sends output to the Immediate window even if that window is hidden. If VBE's Immediate window is not visible, press Ctrl+G (or choose View ⇄ Immediate Window). Figure 13-4 shows some output in the Immediate window.

Unlike MsgBox, Debug.Print statements don't halt your code. So, you must keep an eye on the Immediate window to see what's going on.

After you debug your code, be sure to remove or comment out all the Debug.Print statements. Even big companies like Microsoft occasionally forget to remove their Debug.Print statements. In several previous Excel versions, every time the Analysis ToolPak add-in was opened, you'd see several strange messages in the Immediate window. That problem was finally fixed in Excel 2007.

Using the VBA debugger

The Excel designers are intimately familiar with the concept of bugs. Consequently, Excel includes a set of debugging tools that can help you correct problems in your VBA code. The VBA debugger is the topic of the next section.

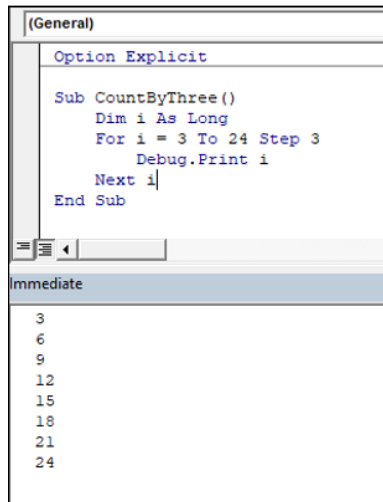


FIGURE 13-4:
A Debug.Print
statement sends
output to the
Immediate
window.

Using the Debugger's Tools

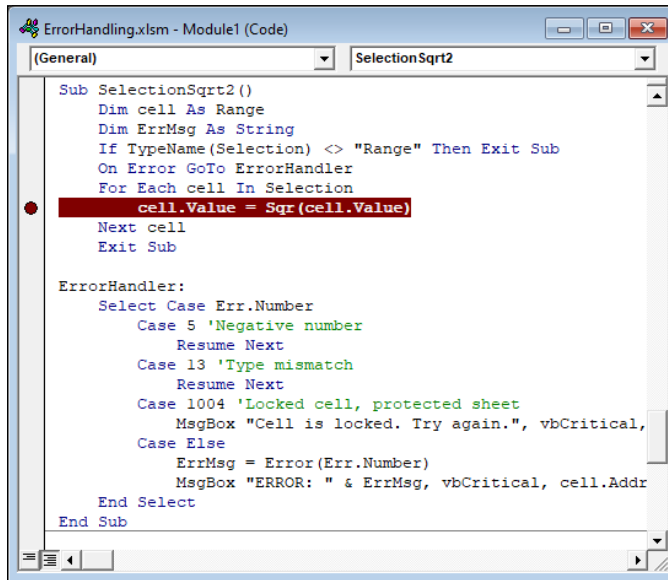
This section discusses the gory details of using the Excel debugging tools. These tools are much more powerful than the techniques discussed in the previous section. However, along with power comes responsibility. Using these debugging tools takes a bit of setup work on your part.

Setting breakpoints in your code

A *breakpoint* is a flag that you set on a line of code that tells VBA to stop. That is, to enter break mode when it reaches that line. Unlike using a MsgBox, you can examine any variable in break mode. You can set a breakpoint in your VBA code in several ways:

- » Move the cursor to the statement at which you want execution to stop; then press F9.
- » Click the gray margin to the left of the statement at which you want execution to stop.
- » Position the insertion point in the statement at which you want execution to stop. Then choose Debug ⇄ Toggle Breakpoint.
- » Right-click a statement and choose Toggle ⇄ Breakpoint from the shortcut menu.

The results of setting a breakpoint are shown in Figure 13-5. Excel highlights the line to remind you that you set a breakpoint there; it also inserts a large dot in the margin as an indicator.



```
Sub SelectionSqrt2()  
    Dim cell As Range  
    Dim ErrMsg As String  
    If TypeName(Selection) <> "Range" Then Exit Sub  
    On Error GoTo ErrorHandler  
    For Each cell In Selection  
        cell.Value = Sqr(cell.Value)  
    Next cell  
    Exit Sub  
  
ErrorHandler:  
    Select Case Err.Number  
        Case 5 'Negative number  
            Resume Next  
        Case 13 'Type mismatch  
            Resume Next  
        Case 1004 'Locked cell, protected sheet  
            MsgBox "Cell is locked. Try again.", vbCritical,  
                ErrMsg  
        Case Else  
            ErrMsg = Error(Err.Number)  
            MsgBox "ERROR: " & ErrMsg, vbCritical, cell.Addr  
    End Select  
End Sub
```

FIGURE 13-5: The highlighted statement marks a breakpoint in this procedure.

When you execute the procedure, Excel goes into *Break mode* before the line with the breakpoint is executed. Think of Break mode as a state of suspended animation. In this mode, your VBA code stops running, and the current statement is highlighted in bright yellow. In Break mode, you can

- » Type VBA statements in the Immediate window. (See the next section for details.)
- » Press F8 to step through your code one line at a time to check various things while the program is paused.
- » Move the mouse pointer over a variable to display its value in a small pop-up window.
- » Skip the next statement(s) and continue execution there (or even go back a couple of statements).
- » Edit a statement and then continue.

In Break mode, the word [break] is displayed in the VBE's title bar. To get out of Break mode and continue execution, press F5 or click the Run Sub/UserForm button on the VBE's toolbar. See the section "Stepping through your code," later in this chapter, to find out more.



TIP

To quickly remove a breakpoint, click the large dot in the gray margin or move the cursor to the highlighted line and press F9. To remove all breakpoints in the module, press Ctrl+Shift+F9.

VBA also has the following keyword, which you can insert as a statement, that forces Break mode:

```
Stop
```

When your code reaches this Stop keyword, VBA then enters Break mode.



TIP

Figure 13-6 shows some debugging action. A breakpoint is set (notice the big dot), and the F8 key is used to step through the code line by line (notice the arrow that points to the current statement).

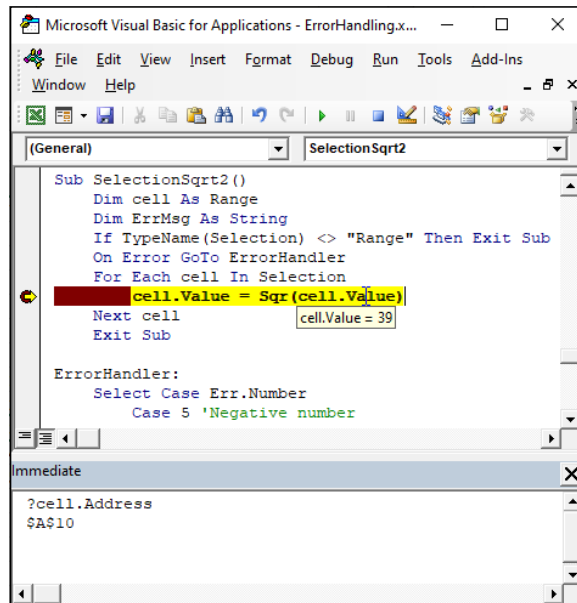


FIGURE 13-6:
A typical scene in Break mode.

Using the Immediate window

The Immediate window may not be visible in the VBE. You can display the VBE's Immediate window at any time by pressing Ctrl+G.

In Break mode, the Immediate window is particularly useful for finding the current value of any variable in your program. For example, if you want to know the current value of a variable named `CellCount`, enter the following in the Immediate window and press Enter:

```
Print CellCount
```

You can save a few milliseconds by using a question mark in place of the word `Print`, like this:

```
? CellCount
```

The Immediate window allows you to do other things besides check variable values. For example, you can change the value of a variable, activate a different sheet, or even open a new workbook. Just make sure that the command you enter is a valid VBA statement.



TIP

You can also use the Immediate window when Excel is not in Break mode. The Immediate window is a handy place to test small code snippets before incorporating them into your procedures.

Stepping through your code

While in Break mode, you can also step through your code line by line to review each coding part. One statement is executed each time you press F8. Throughout this line-by-line execution of your code, you can activate the Immediate window at any time to check the status of your variables.



TIP

You can use your mouse to change which statement VBA executes next. If you place your mouse pointer in the margin to the left of the currently highlighted statement (which is usually yellow), your pointer changes to a right-pointing arrow. Simply drag your mouse to the statement you want to execute next and watch that statement turn yellow. You can also right-click on the statement and choose Set Next Statement or press Ctrl+F9.

Using the Watches window

Sometimes, you need to know whether a certain variable or expression takes on a particular value. Suppose that a procedure loops through 1,000 cells. Along the

way, you notice that a problem occurs during the 900th iteration of the loop. Well, you could insert a breakpoint into the loop, but that would mean responding to 899 prompts before the code finally arrives at the iteration you want to see (and that gets boring real fast, trust me). A more efficient solution involves setting a *watch expression*.

For example, you can create a watch expression that places the procedure into Break mode whenever a certain variable takes on a specific value — for example, Counter=900. To create a watch expression, choose Debug ⇨ Add Watch to display the Add Watch dialog box (see Figure 13-7).

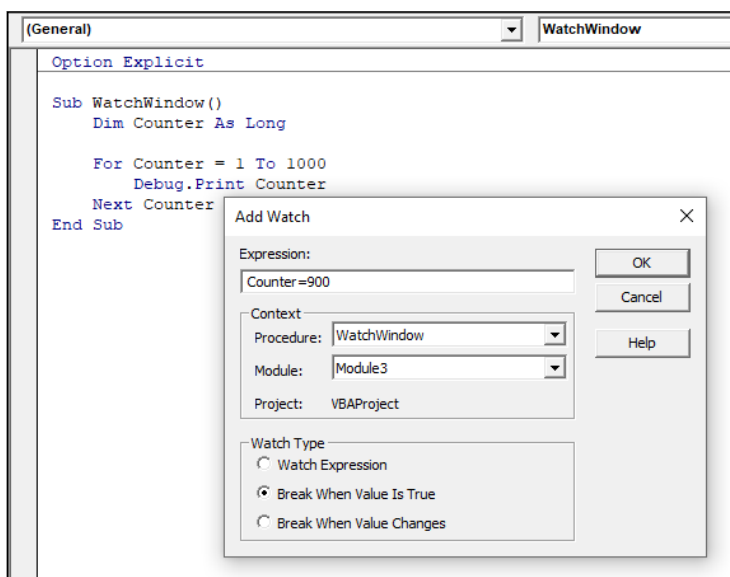


FIGURE 13-7: The Add Watch dialog box lets you specify a condition that causes a break.

The Add Watch dialog box has three parts:

- » **Expression:** Enter a valid VBA expression or a variable here — for example, Counter=900 or just Counter.
- » **Context:** Select the procedure and the module you want to watch. Note that you can select All Procedures and All Modules.
- » **Watch Type:** Select the type of watch by clicking an option button. Your choice here depends on the expression you enter. The first choice, Watch Expression, doesn't cause a break; it simply displays the expression's value when a break occurs.

Execute your procedure after setting up your watch expression(s). Things run normally until your watch expression is satisfied (based on the Watch Type you specified). When that happens, Excel enters Break mode (you did set the Watch Type to Break When Value Is True, didn't you?). From there, you can step through the code or use the Immediate window to debug your code.

When you create a watch, the VBE displays the Watches window, shown in Figure 13-8. This window displays the value of all watches that you've defined. In this figure, the value of the Counter variable hit 900, which caused Excel to enter Break mode.

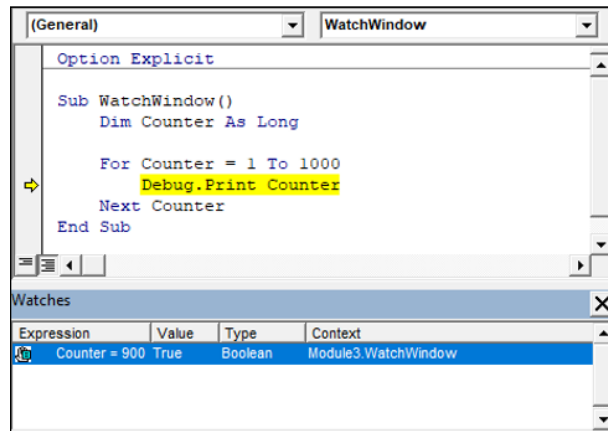


FIGURE 13-8: The Watches window displays all watches.

To remove a watch, right-click it in the Watches window, and choose Delete Watch from the shortcut menu.

The best way to understand how this Watch business works is to use it and try various options. Before long, you'll probably wonder how you ever got along without it.

Using the Locals window

Another useful debugging aid is the Locals window. You can show this window by choosing View ⇄ Locals Window in the VBE. When you are in Break mode, this window shows a list of all variables that are local to the current procedure (see Figure 13-9). The nice thing about this window is that you don't have to add a load of watches manually if you want to look at the content of many variables. The VBE does all the hard work for you.

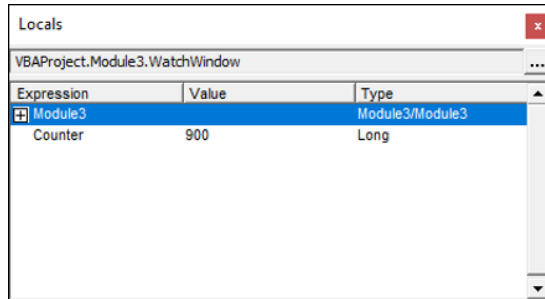


FIGURE 13-9:
The Locals window displays all local variables and their content.

Bug Reduction Tips



TIP

There is no surefire way to completely eliminate bugs in your VBA programs. But here are a few tips to help you keep those bugs to a minimum:

- » **Use an Option Explicit statement at the beginning of your modules.** This statement requires you to define the data type for every variable you use. It creates a bit more work for you, but you do avoid the common error of misspelling a variable name. Plus, it has a nice side benefit: Your routines run a bit faster.
- » **Format your code with indentation.** Using indentations helps delineate different code segments. If your program has several nested For-Next loops, for example, consistent indentation helps you keep track of them all.
- » **Be careful with the On Error Resume Next statement.** This statement causes Excel to ignore any errors and continue executing the routine. In some cases, using this statement causes Excel to ignore errors that it shouldn't ignore. Your code may have bugs, and you might not even realize it.
- » **Use comments.** Nothing is more frustrating than revisiting code you wrote six months ago and not having a clue as to how it works. By adding a few comments to describe your logic, you can save lots of time down the road.
- » **Keep your Sub and Function procedures simple.** By writing your code in small modules, each of which has a single, well-defined purpose, you simplify the debugging process.
- » **Use the macro recorder to help identify properties and methods.** When you can't remember the name or the syntax of a property or method, simply record a macro and look at the recorded code.
- » **Understand VBA's debugger.** Although it can be a bit daunting at first, the VBA debugger is a useful tool. Invest some time and get to know it.

IN THIS CHAPTER

- » Working with ranges in your VBA code
- » Changing Boolean and non-Boolean settings
- » Manipulating charts with VBA
- » Making your VBA code run as fast as possible

Chapter **14**

VBA Programming Examples

A good example often communicates a concept much better than a lengthy description of the underlying theory. In that spirit, this chapter presents several examples to demonstrate common VBA techniques.

These examples are organized into the following categories:

- » Working with ranges
- » Changing Excel settings
- » Working with charts
- » Speeding up your VBA code

Although you might be able to use some of the examples directly, in most cases you must adapt them to your own needs.

Working with Ranges

Most of your VBA programming probably involves worksheet ranges. (For some background on Range objects, refer to Chapter 8.) When working with Range objects, keep the following points in mind:

- » Your VBA doesn't need to *select* a range to work with it.
- » If your code does select a range, its worksheet must be active.
- » The macro recorder doesn't always generate the best code. Often, you can create your macro by using the recorder and then editing the code to make it better.
- » It's often a good idea to use named ranges in your VBA code. For example, using `Range("Total")` is better than using `Range("D45")`. In the latter case, if you add a row above row 45, you need to modify the macro so that it uses the correct range address (D46). Note that you name a range of cells by choosing Formulas ⇨ Defined Names ⇨ Define Name.
- » When running a macro that works on the current range selection, the user might select entire columns or rows. In most cases, you don't want to loop through every cell in the selection; that could take a long time. Your macro should create a subset of the selection consisting of only the nonblank cells.
- » Excel allows for multiple selections. For example, you can select a range, press Ctrl, and select another range with your mouse. Your code should test for a multiple selection and take appropriate actions.



TIP



REMEMBER

The examples in this section, which are available at this book's website (<https://www.dummies.com/go/excelvbaprogrammingfd6e>), demonstrate these points.

If you prefer to enter these examples yourself, press Alt+F11 to activate the VBE. Then insert a VBA module and type the code. Make sure that the workbook is set up properly. For example, if the example uses two sheets named Sheet1 and Sheet2, make sure that the workbook has sheets with those names.

Copying a range

Copying a range ranks right up there as one of the favorite Excel activities of all time. When you turn on the macro recorder and copy a range from A1:A5 to B1:B5, you get this VBA macro:

```
Sub CopyRange()  
    Range("A1:A5").Select  
    Selection.Copy  
    Range("B1").Select  
    ActiveSheet.Paste  
    Application.CutCopyMode = False  
End Sub
```

Notice the last statement. This statement was generated by pressing Esc, which cancels the dotted-line outline that appears in the worksheet when you copy a range.

Although this macro works fine, you can copy a range more efficiently. You can produce the same result with the following one-line macro, which doesn't select any cells (and also doesn't require setting CutCopyMode to False):

```
Sub CopyRange2()  
    Range("A1:A5").Copy Range("B1")  
End Sub
```

This procedure takes advantage that the Copy method can use an argument specifying the destination.

Alternatively, you also have the option of including the Destination argument by name to make your code easier to read. For example:

```
Sub CopyRange2()  
    Range("A1:A5").Copy Destination:=Range("B1")  
End Sub
```

Copying a variable-size range

In many cases, you need to copy a range of cells but don't know the exact row and column dimensions. For example, you might have a workbook that tracks weekly sales, and the number of rows changes as you add new data.

Figure 14-1 shows a range in a worksheet. This range consists of several rows, and the number of rows changes from day to day. Because you don't know the exact range address at any given time, you need a way to write code that doesn't use a range address.

	A	B	C	D
1	Date	Calls	Orders	
2	4/5/2022	452	89	
3	4/6/2022	546	102	
4	4/7/2022	587	132	
5	4/8/2022	443	65	
6	4/9/2022	609	156	
7	4/10/2022	592	92	
8	4/11/2022	487	95	
9	4/12/2022	601	105	
10	4/13/2022	515	133	
11	4/14/2022	540	122	
12				

FIGURE 14-1:
This range can consist of any number of rows.

The following macro demonstrates how to copy this range from the active worksheet to Sheet2 (beginning at cell A1). It uses the `CurrentRegion` property, which returns a `Range` object that corresponds to the block of cells around a particular cell. In this case, that cell is A1.

```
Sub CopyCurrentRegion()
    Dim sh As Worksheet

    Set sh = ActiveSheet
    Range("A1").CurrentRegion.Copy
    Sheets("Sheet2").Select
    Range("A1").Select
    ActiveSheet.Paste
    sh.Select
    Application.CutCopyMode = False
End Sub
```

Using the `CurrentRegion` property is equivalent to choosing `Home` ⇨ `Editing` ⇨ `Find & Select` ⇨ `GoTo Special` (which displays the `GoTo Special` dialog box) and choosing the `Current Region` option. To see how this works, record your actions while issuing that command. Generally, the `CurrentRegion` consists of a rectangular block of cells surrounded by one or more blank rows or columns.

You can make this macro even more efficient by not selecting the destination. The following macro takes advantage of the fact that the `Copy` method can use an argument for the destination range:

```
Sub CopyCurrentRegion2()
    Range("A1").CurrentRegion.Copy Sheets("Sheet2").Range("A1")
End Sub
```



TIP

It's even a bit easier if the data is in the form of a table (created in Excel; choose Insert ⇨ Tables ⇨ Table). The table has a name (such as Table1) and expands automatically when new data is added.

```
Sub CopyTable()  
    Range("Table1").Copy Sheets("Sheet2").Range("A1")  
End Sub
```

If you try this, you'll find that the header row in the table is not copied because the name Table1 doesn't include that row. If you need to include the header row, change the table reference to the following:

```
Range("Table1[#All]")
```

Tables are the one of the best features added to Excel in recent memory. In VBA, tables are called ListObjects. A ListObject has a few properties that point to ranges like Range, DataBodyRange, and HeaderRowRange. The CopyTable procedure could also use a ListObject to get to the range:

```
Sub CopyTable2()  
    ActiveSheet.ListObjects("Table1").Range.Copy Sheets("Sheet2").Range("A1")  
End Sub
```

Selecting to the end of a row or column

You're probably in the habit of using key combinations, such as Ctrl+Shift+right arrow and Ctrl+Shift+down arrow, to select a range that consists of everything from the active cell to the end of a row or a column. Not surprisingly, you can write macros that perform these types of selections.

You can use the CurrentRegion property to select an entire block of cells. But what if you want to select, say, one column from a block of cells? Fortunately, VBA can accommodate this type of action. The following VBA procedure selects the range beginning at the active cell and extending down to the cell just above the first blank cell in the column. After selecting the range, you can do whatever you want with it — copy it, move it, format it, and so on:

```
Sub SelectDown()  
    Range(ActiveCell, ActiveCell.End(xlDown)).Select  
End Sub
```

You can make this type of selection manually: Select the first cell, hold down the Shift key, press End, and then press the down-arrow key.

This example uses the `End` method of the `ActiveCell` object, which returns a `Range` object. The `End` method takes one argument, which can be any of the following constants:

- » `xlUp`
- » `xlDown`
- » `xlToLeft`
- » `xlToRight`

Keep in mind that it's not necessary to select a range before doing something with it. The following macro applies bold formatting to a variable-size (single-column) range without selecting the range:

```
Sub MakeBold()  
    Range(ActiveCell, ActiveCell.End(xlDown)).Font.Bold = True  
End Sub
```

Selecting a row or column

The following procedure demonstrates how to select the column that contains the active cell. It uses the `EntireColumn` property, which returns a `Range` object consisting of a full column:

```
Sub SelectColumn()  
    ActiveCell.EntireColumn.Select  
End Sub
```

As you might expect, VBA also offers an `EntireRow` property, which returns a `Range` object consisting of an entire row.

Moving a range

You move a range by cutting it to the Clipboard and then pasting it in another area. If you record your actions while performing a move operation, the macro recorder generates code like the following:

```
Sub MoveRange()  
    Range("A1:C6").Select  
    Selection.Cut
```



```
Range("A10").Select
ActiveSheet.Paste
End Sub
```

As with the copying example located earlier in this chapter, this is not the best way to move a range of cells. In fact, you can move a range with a single VBA statement, as follows:

```
Sub MoveRange2()
    Range("A1:C6").Cut Range("A10")
End Sub
```

This macro takes advantage of the fact that the Cut method can use an argument that specifies the destination. Notice also that the active cell didn't change. Using the Cut method's argument means the cell pointer remains in its original position.

Looping through a range efficiently

Many macros perform an operation on each cell in a range, or they perform selected actions based on each cell's content. These macros usually include a For-Next loop that processes each cell in the range.

The following example demonstrates how to loop through a range of cells. In this case, the range is the current selection. An object variable named Cell refers to the cell being processed. Within the For Each-Next loop, the single statement evaluates the cell and applies bold formatting if the cell contains a positive value.

```
Sub ProcessCells()
    Dim Cell As Range
    For Each Cell In Selection
        If Cell.Value > 0 Then Cell.Font.Bold = True
    Next Cell
End Sub
```

This example works, but what if the user's selection consists of an entire column or row? This is not uncommon because Excel lets you perform operations on entire columns or rows. In such a case, the macro seems to take forever because it loops through all cells (all 1,048,576 of them) in the column — even the blank cells. To make the macro more efficient, you need a way to process only the non-blank cells.

The following routine does just that by using the `SpecialCells` method. (Type `SpecialCells` in any code pane or in the Immediate window and press F1 for specific details about its arguments.) This routine uses the `Set` keyword to create two new `Range` objects: the selection's subset that consists of cells with constants, and the selection's subset that consists of cells with formulas. The routine processes each of these subsets, with the net effect of skipping all blank cells. Pretty slick, eh?

```
Sub SkipBlanks()  
    Dim ConstantCells As Range  
    Dim FormulaCells As Range  
    Dim cell As Range  
    ' Ignore errors  
    On Error Resume Next  
  
    ' Process the constants  
    Set ConstantCells = Selection.SpecialCells(xlConstants)  
    For Each cell In ConstantCells  
        If cell.Value > 0 Then  
            cell.Font.Bold = True  
        End If  
    Next cell  
  
    ' Process the formulas  
    Set FormulaCells = Selection.SpecialCells(xlFormulas)  
    For Each cell In FormulaCells  
        If cell.Value > 0 Then  
            cell.Font.Bold = True  
        End If  
    Next cell  
End Sub
```

The `SkipBlanks` procedure works equally fast, regardless of what you select. For example, you can select the range, all columns in the range, all rows in the range, or even the entire worksheet. It's a vast improvement over the `ProcessCells` procedure presented earlier in this section.

Notice the use of the following statement in this code:

```
On Error Resume Next
```

This statement tells Excel to ignore any errors that occur and simply process the next statement. (See Chapter 12 for a discussion of error handling.) This statement is necessary because the `SpecialCells` method produces an error if no cells qualify.

Using the `SpecialCells` method is equivalent to choosing Home ⇨ Editing ⇨ Find & Select ⇨ GoTo Special and selecting the Constants option or the Formulas option. To get a feel for how this works, record your actions while you issue that command and select various options.

Looping through a range efficiently (Part II)

And now, the sequel. This section demonstrates another way to process cells in an efficient manner. This method takes advantage of the `UsedRange` property — which returns a `Range` object that consists only of the used area of the worksheet. It also uses the `Intersect` method, which returns a `Range` object that consists of cells that two ranges have in common.

Here's a variation of the `SkipBlanks` procedure from the previous section:

```
Sub SkipBlanks2()  
    Dim WorkRange As Range  
    Dim cell As Range  
    Set WorkRange = Intersect(Selection, ActiveSheet.UsedRange)  
    For Each cell In WorkRange  
        If cell.Value > 0 Then  
            cell.Font.Bold = True  
        End If  
    Next cell  
End Sub
```

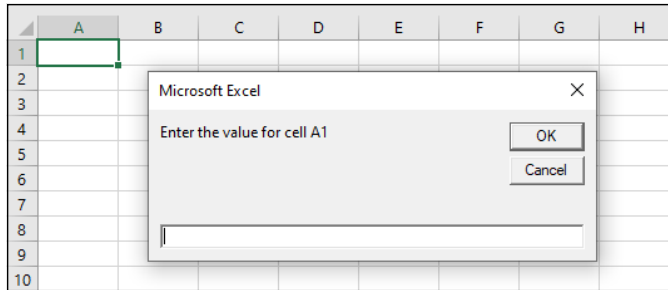
The `WorkRange` object variable consists of cells that are common to the user's selection and the worksheet's used range. Therefore, if an entire column is selected, `WorkRange` contains only the cells that are in that column and also within the used area of the worksheet. It's fast and efficient, with no time wasted on processing cells that are outside the worksheet's used area.

Prompting for a cell value

As shown in Figure 14-2, you can use VBA's `InputBox` function to get a value from the user. Then you can insert that value into a cell. The following procedure demonstrates how to ask the user for a value and place the value in cell A1 of the active worksheet, using only one statement:

```
Sub GetValue()  
    Range("A1").Value = InputBox( _  
        "Enter the value for cell A1")  
End Sub
```

FIGURE 14-2:
Use the VBA
InputBox function
to get a value
from the user.



If you try this example, you'll find that clicking the Cancel button in the InputBox erases the current value in cell A1. Erasing the user's data isn't very good programming practice. In fact, clicking Cancel should do nothing at all.

The following macro demonstrates a better approach: using a variable (x) to store the value entered by the user. If the value is not empty (that is, the user didn't click Cancel), the value of x is placed in cell A1. Otherwise, nothing happens.

```
Sub GetValue2()  
    Dim x as String  
    x = InputBox("Enter the value for cell A1")  
    If x <> "" Then Range("A1").Value = x  
End Sub
```

The variable x is defined as a String data type because InputBox always returns a string. If the user clicks Cancel, it returns an empty string.

Determining the selection type

If you design your macro to work with a range selection, the macro must be able to determine whether a range is actually selected. If something other than a range is selected (such as a chart or a shape), the macro will probably bomb. The following statement uses the VBA TypeName function to display the type of object that is currently selected:

```
MsgBox TypeName(Selection)
```

If a Range object is selected, the MsgBox displays Range. If your macro works only with ranges, you can use an If statement to ensure that a range is selected. This example displays a message and exits the procedure if the current selection is not a Range object:

```

Sub CheckSelection()
    If TypeName(Selection) <> "Range" Then
        MsgBox "Select a range."
        Exit Sub
    End If
    ' ... [Other statements go here]
End Sub

```

Identifying a multiple selection

As you know, Excel allows multiple selections by pressing Ctrl while choosing objects or ranges. This can cause problems with some macros. For example, you can't copy a multiple selection that doesn't have the same number of rows and columns. If you attempt to do so, Excel scolds you with the message shown in Figure 14-3.

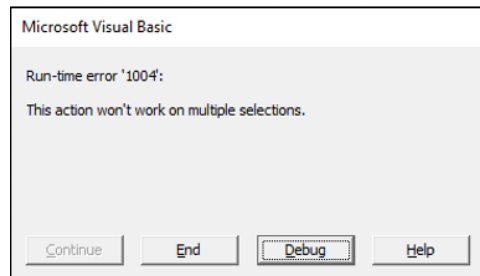


FIGURE 14-3:
Excel doesn't like it when you try to copy a multiple selection.

The following macro demonstrates how to determine whether the user made a multiple selection so your macro can take appropriate action:

```

Sub MultipleSelection()
    If Selection.Areas.Count > 1 Then
        MsgBox "Multiple selections not allowed."
        Exit Sub
    End If
    ' ... [Other statements go here]
End Sub

```

This example uses the `Areas` method, which returns a collection of all ranges in the selection. The `Count` property returns the number of objects in the `Areas` collection.

Changing Excel Settings

Some of the most useful macros are simple procedures that change one or more of Excel's settings. For example, if you find yourself making frequent trips to the Excel Options dialog box to change a setting, that's a good candidate for a simple time-saving macro.

This section presents two examples that show you how to change settings in Excel. You can apply the general principles demonstrated by these examples to other operations that change settings.

Changing Boolean settings

Like a light switch, a *Boolean* setting is either on or off. For example, you might want to create a macro that turns the worksheet page break display on and off. After you print or preview a worksheet, Excel displays dashed lines to indicate the page breaks. Some people find these dashed lines very annoying. Unfortunately, the only way to get rid of the page break display is to open the Excel Options dialog box, click the Advanced tab, and scroll down until you find the Show Page Breaks check box. If you turn on the macro recorder when you change that option, Excel generates the following code:

```
ActiveSheet.DisplayPageBreaks = False
```

On the other hand, if page breaks aren't visible when you record the macro, Excel generates the following code:

```
ActiveSheet.DisplayPageBreaks = True
```

This may lead you to conclude that you need two macros: one to turn on the page break display, and one to turn it off. Not true. The following procedure uses the Not operator, which turns True to False and False to True. Executing the TogglePageBreaks procedure is a simple way to toggle the page break display from True to False and from False to True:

```
Sub TogglePageBreaks()  
    On Error Resume Next  
    ActiveSheet.DisplayPageBreaks = Not _  
        ActiveSheet.DisplayPageBreaks  
End Sub
```

The first statement tells Excel to ignore any errors. For example, a chart sheet doesn't display page breaks, so if you execute the macro when a chart sheet is active, you won't see an error message.

You can use this technique to toggle any settings that have Boolean (True or False) values.

Changing non-Boolean settings

You can use a Select Case structure for non-Boolean settings. This example toggles the calculation mode between manual and automatic and displays a message indicating the current mode:

```
Sub ToggleCalcMode()  
    Select Case Application.Calculation  
        Case xlManual  
            Application.Calculation = xlCalculationAutomatic  
            MsgBox "Automatic Calculation Mode"  
        Case xlAutomatic  
            Application.Calculation = xlCalculationManual  
            MsgBox "Manual Calculation Mode"  
    End Select  
End Sub
```

You can adapt this technique for changing other non-Boolean settings.

Working with Charts

Charts are jam-packed with different objects, so manipulating charts with VBA can be a bit of a challenge due to some differences between versions of Excel.

For instance, imagine you were to record a macro in Excel 2013 or newer while you created a basic column chart. While still recording, you decide to delete the chart's gridlines and change the chart's title. Your recorded macro would look similar to this:

```
Sub Macro1()  
    ActiveSheet.Shapes.AddChart2(201, xlColumnClustered).Select  
    ActiveChart.SetSourceData Source:=Range("Sheet1!$A$1:$A$3")  
    ActiveChart.SetElement msoElementPrimaryValueGridLinesNone
```

```
ActiveChart.ChartTitle.Select
ActiveChart.ChartTitle.Text = "This is my chart"
End Sub
```

Note the use of the `AddChart2` method (in the first line of code). The `AddChart2` method was introduced in Excel 2013.

Now, if you were to record that same macro in Excel 2010, you get this code:

```
Sub Macro1()
    ActiveSheet.Shapes.AddChart.Select
    ActiveChart.ChartType = xlColumnClustered
    ActiveChart.SetSourceData Source:=Range("Sheet1!$A$1:$A$3")
    ActiveChart.Axes(xlValue).MajorGridlines.Select
    Selection.Delete
    ActiveChart.SetElement msoElementChartTitleAboveChart
    ActiveChart.ChartTitle.Text = "This is my chart"
End Sub
```

What does it all mean? It means that the macro recorded in Excel 2013 or later versions won't work in Excel 2010. But the macro recorded in Excel 2010 *will* work in Excel 2013 and later. In other words, the Excel 2010 macro exhibits forward compatibility. The Excel 2013 (and later) macro is not backward-compatible.



WARNING

A typical Excel user would probably know nothing about macro compatibility as it relates to chart creation. But if you share your macro with someone who uses an earlier version, you'll find out about it quickly. Bottom line? If you rely on the macro recorder for chart-related macros, make sure that you test the macros with all versions of Excel that will be running the macros.

AddChart versus AddChart2

Here's the official syntax of the `AddChart` method (which is compatible with Excel 2007 and later):

```
.AddChart(Type, Left, Top, Width, Height)
```

Here's the syntax of the `AddChart2` method (which is compatible only with Excel 2013 and later versions):

```
.AddChart2 (Style, XlChartType, Left, Top, Width, Height, NewLayout)
```

As you can see, the `AddChart2` method takes several additional arguments — arguments that specify the style, chart type, and layout. The `AddChart` method, on

the other hand, simply creates an empty chart. The specifics for the chart must be provided in additional statements.

Examining the recorded code does reveal a few things that may be helpful in writing your own chart-related macros. If you're curious, here's a handcrafted version of that macro that creates a chart from the selected range:

```
Sub CreateAChart()  
    Dim ChartData As Range  
    Dim ChartShape As Shape  
    Dim NewChart As Chart  
  
    ' Create object variables  
    Set ChartData = ActiveWindow.RangeSelection  
    Set ChartShape = ActiveSheet.Shapes.AddChart  
    Set NewChart = ChartShape.Chart  
    With NewChart  
        .ChartType = xlColumnClustered  
        .SetSourceData Source:=Range(ChartData.Address)  
        .SetElement msoElementLegendRight  
        .SetElement msoElementChartTitleAboveChart  
        .ChartTitle.Text = "This is my chart"  
    End With  
End Sub
```

This macro is compatible with Excel 2007 and later. The chart that's created is a clustered column chart with a legend and a title. This basic chart-creating macro can be customized easily. One way to do it is to record your actions while you modify the chart and then use the recorded code to guide you.



TIP

By the way, have a look at the With End-With construct later in this chapter. It's a handy way to save some typing and make your code easier to read.

If you need to write VBA macros that manipulate charts, you must understand some terminology. An *embedded chart* on a worksheet is an object called a ChartObject. You can activate a ChartObject much like you activate a sheet. The following statement activates the ChartObject named Chart 1:

```
ActiveSheet.ChartObjects("Chart 1").Activate
```

After you activate the chart, you can refer to it in your VBA code as the ActiveChart. If the chart is on a separate chart sheet, it becomes the active chart as soon as you activate that chart sheet.



TECHNICAL
STUFF

A `ChartObject` is also a `Shape`, which can be a bit confusing. In fact, when your VBA code creates a chart, it starts by adding a new `Shape`. You can also activate a chart by selecting the `Shape` object that holds the chart:

```
ActiveSheet.Shapes("Chart 1").Select
```



WARNING

When you click an embedded chart, Excel actually selects an object *inside* the `ChartObject` object. You can select the `ChartObject` itself by pressing `Ctrl` while clicking the embedded chart.

Modifying the chart type

Here's a confusing statement for you: A `ChartObject` object acts as a container for a `Chart` object. Read that a few times, and it might actually make sense.

To modify a chart with VBA, you don't have to activate the chart. Rather, the `Chart` method can return the chart contained in the `ChartObject`. Are you thoroughly confused yet? The following two procedures have the same effect: They change the chart named `Chart 1` to an area chart. The first procedure activates the chart first and then works with the active chart. The second procedure doesn't activate the chart. Rather, it uses the `Chart` property to return the `Chart` object contained in the `ChartObject` object.

```
Sub ModifyChart1()  
    ActiveSheet.ChartObjects("Chart 1").Activate  
    ActiveChart.Type = xlArea  
End Sub  
  
Sub ModifyChart2()  
    ActiveSheet.ChartObjects("Chart 1").Chart.Type = xlArea  
End Sub
```

Looping through the ChartObjects collection

This example changes the chart type of every embedded chart in the active sheet. The procedure uses a `For Each-Next` loop to cycle through each object in the `ChartObjects` collection, access the `Chart` object in each, and change its `Type` property.

```

Sub ChartType()
    Dim cht As ChartObject
    For Each cht In ActiveSheet.ChartObjects
        cht.Chart.Type = xlArea
    Next cht
End Sub

```

The following macro performs the same function but works on all the chart sheets in the active workbook:

```

Sub ChartType2()
    Dim cht As Chart
    For Each cht In ActiveWorkbook.Charts
        cht.Type = xlArea
    Next cht
End Sub

```

Modifying chart properties

The following example changes the Legend font for all charts on the active sheet. It uses a For-Next loop to process all ChartObject objects:

```

Sub LegendMod()
    Dim chtObj As ChartObject
    For Each chtObj In ActiveSheet.ChartObjects
        With chtObj.Chart.Legend.Font
            .Name = "Calibri"
            .FontStyle = "Bold"
            .Size = 12
        End With
    Next chtObj
End Sub

```

Note that the Font object is contained in the Legend object, which is contained in the Chart object, which is contained in the ChartObjects collection. Now do you understand why it's called an *object hierarchy*?

Applying chart formatting

This example applies several types of formatting to the active chart. Again, you don't have to magically know all the syntax to use. This particular procedure was

created by recording a macro, then cleaning the code to remove all the extraneous syntax put in by the macro recorder.

```
Sub ChartMods()  
    ActiveChart.Type = xlArea  
    ActiveChart.ChartArea.Font.Name = "Calibri"  
    ActiveChart.ChartArea.Font.FontStyle = "Regular"  
    ActiveChart.ChartArea.Font.Size = 9  
    ActiveChart.PlotArea.Interior.ColorIndex = xlNone  
    ActiveChart.Axes(xlValue).TickLabels.Font.Bold = True  
    ActiveChart.Axes(xlCategory).TickLabels.Font.Bold = True  
    ActiveChart.Legend.Position = xlBottom  
End Sub
```

You must activate a chart before executing the ChartMods macro. Activate an embedded chart by clicking it. To activate a chart in a chart sheet, activate the chart sheet.

To ensure that a chart is selected, you can add a statement to determine whether a chart is active. Here's the modified macro, which displays a message (and ends) if a chart isn't activated:

```
Sub ChartMods2()  
    If ActiveChart Is Nothing Then  
        MsgBox "Activate a chart."  
        Exit Sub  
    End If  
    ActiveChart.Type = xlArea  
    ActiveChart.ChartArea.Font.Name = "Calibri"  
    ActiveChart.ChartArea.Font.FontStyle = "Regular"  
    ActiveChart.ChartArea.Font.Size = 9  
    ActiveChart.PlotArea.Interior.ColorIndex = xlNone  
    ActiveChart.Axes(xlValue).TickLabels.Font.Bold = True  
    ActiveChart.Axes(xlCategory).TickLabels.Font.Bold = True  
    ActiveChart.Legend.Position = xlBottom  
End Sub
```

Here's another version that uses the With-End With construct to save some typing and make the code a bit clearer. Flip ahead a few pages to read about the With End-With structure. It also uses an error handler (see Chapter 12) instead of an If statement to determine if a chart is active.

```

Sub ChartMods3()
    On Error GoTo ErrorHandler
    With ActiveChart
        .Type = xlArea
        .ChartArea.Font.Name = "Calibri"
        .ChartArea.Font.FontStyle = "Regular"
        .ChartArea.Font.Size = 9
        .PlotArea.Interior.ColorIndex = xlNone
        .Axes(xlValue).TickLabels.Font.Bold = True
        .Axes(xlCategory).TickLabels.Font.Bold = True
        .Legend.Position = xlBottom
    End With
    Exit Sub
ErrorHandler:
    MsgBox "Activate a chart first."
End Sub

```

When it comes to using VBA to work with charts, this short section barely scratches the surface. There's a lot more to it, of course, but at least this basic introduction can get you headed in the right direction.

VBA Speed Tips

VBA is fast, but it's not always fast enough. (Computer programs are never fast enough.) This section presents some programming examples you can use to speed up your macros.

Turning off screen updating

When executing a macro, you can sit back and watch all the onscreen action that occurs in the macro. Although doing this can be instructive, after you get the macro working properly, it's often annoying and can slow the performance of your macro considerably. Fortunately, you can disable the screen updating that normally occurs when you execute a macro. To turn off screen updating, use the following statement:

```
Application.ScreenUpdating = False
```

If you want the user to see what's happening at any point during the macro, use the following statement to turn screen updating back on:

```
Application.ScreenUpdating = True
```

To demonstrate the difference in speed, execute this simple macro, which fills a range with numbers:

```
Sub FillRange()  
    Dim r as Long, c As Long  
    Dim Number as Long  
    Number = 0  
    For r = 1 To 50  
        For c = 1 To 50  
            Number = Number + 1  
            Cells(r, c).Select  
            Cells(r, c).Value = Number  
        Next c  
    Next r  
End Sub
```

You see each cell being selected and the value being entered in the cells. Now insert the following statement at the beginning of the procedure and execute it again:

```
Application.ScreenUpdating = False
```

The range fills much faster, and you don't see the result until the macro is finished running and screen updating is (automatically) set to True.



TIP

When you're debugging code, program execution sometimes ends somewhere in the middle without your having turned Screen updating back on. This sometimes causes Excel's application window to become totally unresponsive. The way out of this frozen state is simple: Go back to the VBE, and execute the following statement in the Immediate window:

```
Application.ScreenUpdating = True
```

Turning off automatic calculation

If you have a worksheet with many complex formulas, you might find that you can speed up things considerably by setting the calculation mode to manual while your macro is executing. When the macro finishes, set the calculation mode back to automatic.

The following statement sets the Excel calculation mode to manual:

```
Application.Calculation = xlCalculationManual
```

Execute the next statement to set the calculation mode to automatic:

```
Application.Calculation = xlCalculationAutomatic
```



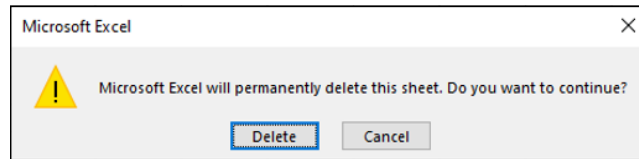
WARNING

If your code uses cells with formula results, turning off calculation means that the cells aren't recalculated unless you explicitly tell Excel to do so.

Eliminating those pesky alert messages

As you know, a macro can automatically perform a series of actions. In many cases, you can start a macro and then go hang out in the break room while Excel does its thing. Some Excel operations, however, display messages that require a human response. For example, if your macro deletes a nonempty sheet, your code comes to a screeching halt while Excel waits for your response to the message shown in Figure 14-4. These types of messages mean that you can't leave Excel unattended while it executes your macro — unless you know the secret trick.

FIGURE 14-4: You can instruct Excel to not display these types of alerts while running a macro.



The secret trick to avoiding these alert messages is inserting the following VBA statement into your macro:

```
Application.DisplayAlerts = False
```

Excel executes the default operation for these types of messages. In the case of deleting a sheet, the default operation is Delete (which is just what you want to happen). If you're not sure what the default operation is, perform a test to see what happens.

When the procedure ends, Excel automatically resets the DisplayAlerts property to True (its normal state). If you need to turn the alerts back on before the procedure ends, use this statement:

```
Application.DisplayAlerts = True
```



TIP

If you change application settings, be sure to change them back — even if you encounter an error. Fortunately, you can use error handling (see Chapter 12 to set them back to the default value in your error handling code. This example uses two labels: `ErrorExit` that sets all the properties back to their defaults, and `ErrorHandler` that displays the error and calls `ErrorExit`.

```
Sub ErrorHandlerResetValues()  
  
    On Error GoTo ErrorHandler  
  
    Application.Calculation = xlCalculationManual  
    Application.DisplayAlerts = False  
    Application.ScreenUpdating = False  
  
    'This code generates an error  
    Debug.Print 1 / 0  
  
    ErrorExit:  
    'turn off error handling and set the  
    'properties back to their default  
    On Error Resume Next  
    Application.Calculation = xlCalculationAutomatic  
    Application.DisplayAlerts = True  
    Application.ScreenUpdating = True  
    Exit Sub  
  
    ErrorHandler:  
    MsgBox Err.Description  
    'if there is an error, this calls  
    'the clean up part of the macro  
    Resume ErrorExit  
  
End Sub
```

Simplifying object references

As you probably already know, references to objects can become very lengthy. For example, a fully qualified reference to a `Range` object may look like this:

```
Workbooks("MyBook.xlsx").Worksheets("Sheet1").  
    .Range("InterestRate")
```


If your macro frequently uses this range, you might want to create an object variable by using the Set command. For example, the following statement assigns this Range object to an object variable named InterestRate:

```
Set Rate = Workbooks("MyBook.xlsx") _  
    .Worksheets("Sheet1").Range("InterestRate")
```

After defining this object variable, you can use the variable Rate rather than the lengthy reference. For example, you can change the value of the cell named InterestRate:

```
Rate.Value = 0.085
```

This is much easier to type (and understand) than the following statement:

```
Workbooks("MyBook.xlsx").Worksheets("Sheet1"). _  
    Range("InterestRate") = 0.085
```

In addition to simplifying your coding, using object variables speeds up your macros considerably; sometimes twice as fast.

Declaring variable types

You usually don't have to worry about the type of data you assign to a variable. Excel handles all the details for you behind the scenes. For example, if you have a variable named MyVar, you can assign a number of any type to that variable. You can even assign a text string to it later in the procedure.



REMEMBER

If you want your procedures to execute as fast as possible (and avoid some potentially nasty problems), tell Excel what type of data to assign to each of your variables. This is known as *declaring* a variable's type. (Refer to Chapter 7 for complete details.) Get into the habit of declaring all variables that you use.

In general, you should use the data type that requires the smallest number of bytes yet can still handle all the data assigned to it. When VBA works with data, execution speed depends on the number of bytes VBA has at its disposal. In other words, the fewer bytes data uses, the faster VBA can access and manipulate the data. An exception to this is the Integer data type. If speed is critical, use the Long data type instead.

If you use an object variable (as described in the preceding section), you can declare the variable as a particular object type. Here's an example:

```
Dim Rate as Range
Set Rate = Workbooks("MyBook.xlsx") _
    .Worksheets("Sheet1").Range("InterestRate")
```

Using the With-End With structure

Do you need to set a number of properties for an object? Your code runs faster if you use the With-End With structure. An additional benefit is that your code may be easier to read.

The following code doesn't use With-End With:

```
Selection.HorizontalAlignment = xlCenter
Selection.VerticalAlignment = xlCenter
Selection.WrapText = True
Selection.Orientation = 0
Selection.ShrinkToFit = False
Selection.MergeCells = False
```

Here's the same code, rewritten to use With-End With:

```
With Selection
    .HorizontalAlignment = xlCenter
    .VerticalAlignment = xlCenter
    .WrapText = True
    .Orientation = 0
    .ShrinkToFit = False
    .MergeCells = False
End With
```

As you can see, this code tells Excel that the next few statements apply to the Selection object. This is why all the statements inside the With-End With structure begin with a dot. You're simply avoiding the need to reference the same object over and over (in this case, the Selection object). This not only means less typing for you, but it means less processing for Excel.

4 Communicating with Your Users

IN THIS PART . . .

Save time in various ways by using built-in custom dialog box alternatives.

Discover how to develop custom dialog boxes (also known as UserForms).

Work with dialog box controls, such as command buttons, list boxes, and check boxes.

Find out lots of useful tips and tricks for creating custom dialog boxes.

Modify Excel's user interface to make running your macros easier.

- » Saving time by using any of several alternatives to UserForms
- » Using the InputBox and MsgBox functions to get information from the user
- » Getting a filename and path from the user
- » Getting a folder name from the user
- » Writing VBA code to execute Ribbon commands that display Excel built-in dialog boxes

Chapter **15**

Simple Dialog Boxes

You can't use Excel very long without being exposed to dialog boxes. They seem to pop up all the time. Like most Windows programs, Excel uses dialog boxes to obtain information, clarify commands, and display messages. If you develop VBA macros, you can create your own dialog boxes that work just like those built into Excel. Those custom dialog boxes are called UserForms in VBA.

This chapter doesn't tell you anything about creating UserForms. Rather, it describes some useful techniques you might be able to use in *place* of UserForms. If you can get the information you need without the trouble of designing and building a UserForm, you'll save time and have simpler code (which usually means fewer bugs). Sometimes you can't or you just want more control over the user interface. For those cases, see Chapters 16 through 18, which cover UserForms.

Interacting with the User in VBA

Some of the VBA macros you create behave the same every time you execute them. For example, you might develop a macro that enters a list of your employees into a worksheet range. This macro always produces the same result and requires no additional user input.

You might develop other macros, however, that require the user to supply a piece of information for the macro to work. If you write a macro that lists all the employees for a particular department, you might need to get the department name from the user first. Macros also might need to display a message to the user. Whether your macro asks the user for information or displays information to the user, a custom dialog box, known as a *UserForm*, gives you the most control of how you interact with your users.

Creating UserForms takes time and adds complexity to your code. Before delving into the topic of creating UserForms in the next chapter, you must know about some potentially time-saving alternatives.

VBA allows you to display several types of dialog boxes that you can sometimes use in place of a handcrafted UserForm. You can customize these built-in dialog boxes in some ways, but they certainly don't offer the all the options available in a UserForm. In some cases, however, they're just what the doctor ordered.

In this chapter, you read about

- »» The MsgBox function
- »» The InputBox function
- »» The GetOpenFilename method
- »» The GetSaveAsFilename method
- »» The FileDialog method

You also discover how to use VBA to display some of Excel's built-in dialog boxes, which are the dialog boxes that Excel uses to get information from you, such as cell formatting options or data validation settings.

Displaying Messages with the MsgBox Function

By now, you're probably familiar with the VBA MsgBox function; several of the examples in the preceding chapters made use of the MsgBox function. The MsgBox function, whose main arguments are shown in Table 15-1, is handy for displaying information and getting simple user input. It's able to accept user input because it's a function. A function, as you probably know, returns a value. In the case of the MsgBox function, it uses a dialog box to get the value that it returns. Keep reading to see exactly how it works.

TABLE 15-1

MsgBox Function Arguments

Argument	What It Affects
Prompt	The text Excel displays in the message box
Buttons	A number that specifies which buttons (along with what icon) appear in the message box (optional)
Title	The text that appears in the message box's title bar (optional)

Here's a simplified version of the syntax of the MsgBox function:

```
MsgBox(prompt[, buttons][, title])
```



REMEMBER

In syntax descriptions, arguments inside of square brackets are optional. For the MsgBox function, only the prompt argument is required.

Displaying a simple message box

You can use the MsgBox function in two ways:

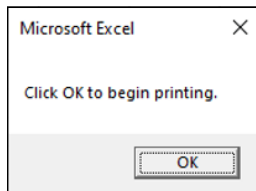
- » **To simply show a message to the user:** In this case, you don't care about the result returned by the function.
- » **To get a response from the user:** In this case, you do care about the result returned by the function. The result depends on the button that the user clicks.

If you use the `MsgBox` function by itself, don't include parentheses around the arguments. The following example simply displays a message and doesn't return a result. When the message is displayed, the code stops until the user clicks OK.

```
Sub MsgBoxDemo()  
    MsgBox "Click OK to begin printing."  
    Sheets("Results").PrintOut  
End Sub
```

Figure 15-1 shows how this message box looks. In this case, printing commences when the user clicks OK. Did you notice that there is no way to cancel the printing? The next section describes how to fix that.

FIGURE 15-1:
A simple
message box.



Getting a response from a message box

If you display a message box that has more than just an OK button, you'll probably want to know which button the user clicks. You're in luck. The `MsgBox` function returns a value that represents which button is clicked. You can then assign the result of the `MsgBox` function to a variable.

The following code uses some of the built-in constants (outlined in Table 15-2) that make it easy to work with the values returned by `MsgBox`:

```
Sub GetAnswer()  
    Dim Ans As Long  
    Ans = MsgBox("Start printing?", vbYesNo)  
    Select Case Ans  
        Case vbYes  
            ActiveSheet.PrintOut  
        Case vbNo  
            MsgBox "Printing canceled"  
    End Select  
End Sub
```


TABLE 15-2

Constants Used in the MsgBox Function

Constant	Value	What It Does
vbOKOnly	0	Displays OK button only.
vbOKCancel	1	Displays OK and Cancel buttons.
vbAbortRetryIgnore	2	Displays Abort, Retry, and Ignore buttons.
vbYesNoCancel	3	Displays Yes, No, and Cancel buttons.
vbYesNo	4	Displays Yes and No buttons.
vbRetryCancel	5	Displays Retry and Cancel buttons.
vbCritical	16	Displays Critical Message icon.
vbQuestion	32	Displays Warning Query icon.
vbExclamation	48	Displays Warning Message icon.
vbInformation	64	Displays Information Message icon.
vbDefaultButton1	0	First button is default.
vbDefaultButton2	256	Second button is default.
vbDefaultButton3	512	Third button is default.
vbDefaultButton4	768	Fourth button is default.

Figure 15-2 shows how the dialog box from the preceding example looks. When you execute this procedure, the Ans variable is assigned a value of either vbYes or vbNo, depending on which button the user clicks. The Select Case statement uses the Ans value to determine which action the code should perform.

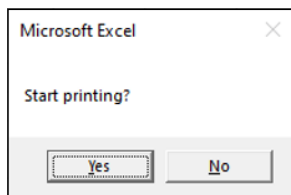


FIGURE 15-2:
A simple message
box, with two
buttons.

You can also use the MsgBox function result without using a variable, as the following example demonstrates:

```
Sub GetAnswer2()  
    If MsgBox("Start printing?", vbYesNo) = vbYes Then  
        ' ...[code if Yes is clicked]...  
    Else  
        ' ...[code if Yes is not clicked]...  
    End If  
End Sub
```

Customizing message boxes

The flexibility of the buttons argument makes it easy to customize your message boxes. You can choose which buttons to display, determine whether an icon appears, and decide which button is the default (the default button is “clicked” if the user presses Enter).

To use more than one of these constants as an argument, just connect them with a + operator. For example, to display a message box with Yes and No buttons and an exclamation icon, use the following expression as the second MsgBox argument:

```
vbYesNo + vbExclamation
```

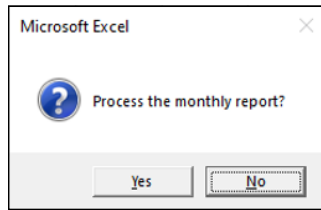
Or, if you prefer to make your code less understandable, use a value of 52 (that is, 4 + 48).

The following example uses a combination of constants to display a message box with a Yes button and a No button (vbYesNo), as well as a question-mark icon (vbQuestion). The constant vbDefaultButton2 designates the second button (No) as the default button — that is, the button that is clicked if the user presses Enter. For simplicity, you can assign these constants to the Config variable and then use Config as the second argument in the MsgBox function:

```
Sub GetAnswer3()  
    Dim Config As Long  
    Dim Ans As Integer  
    Config = vbYesNo + vbQuestion + vbDefaultButton2  
    Ans = MsgBox("Process the monthly report?", Config)  
    If Ans = vbYes Then RunReport  
End Sub
```

Figure 15-3 shows the message box Excel displays when you execute the GetAnswer3 procedure. If the user clicks the Yes button, the routine executes the procedure named RunReport (which is not shown). If the user clicks the No button (or presses Enter), the routine ends with no action. Because the procedure omits the title argument in the MsgBox function, Excel uses the default title, Microsoft Excel.

FIGURE 15-3:
The MsgBox function's buttons argument determines what appears in the message box.



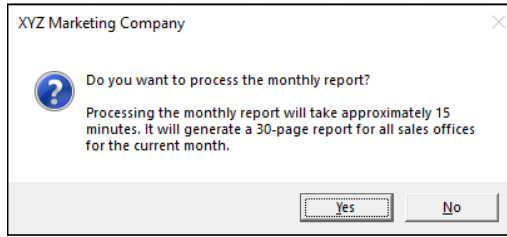
The following routine provides another example of using the MsgBox function:

```
Sub GetAnswer4()  
    Dim Msg As String, Title As String  
    Dim Config As Long, Ans As Long  
    Msg = "Do you want to process the monthly report?"  
    Msg = Msg & vbNewLine & vbNewLine  
    Msg = Msg & "Processing the monthly report will "  
    Msg = Msg & "take approximately 15 minutes. It "  
    Msg = Msg & "will generate a 30-page report for "  
    Msg = Msg & "all sales offices for the current "  
    Msg = Msg & "month."  
    Title = "XYZ Marketing Company"  
    Config = vbYesNo + vbQuestion  
    Ans = MsgBox(Msg, Config, Title)  
    If Ans = vbYes Then RunReport  
End Sub
```

This example demonstrates a way to specify a longer message in a message box. Here, the variable (Msg) and the concatenation operator (&) build the message in a series of statements. The vbNewLine constant inserts a line-break character that starts a new line (use it twice to insert a blank line). The Title argument replaces the message box's default title.

Figure 15-4 shows the message box Excel displays when you execute this procedure.

FIGURE 15-4:
This dialog box, displayed by the MsgBox function, displays a title, an icon, a message, and two buttons.



Previous examples use constants (such as vbYes and vbNo) for the return value of a MsgBox function. Table 15-3 lists a few other constants.

TABLE 15-3

Constants Used as Return Values for the MsgBox Function

Constant	Value	What It Means
vbOK	1	User clicked OK.
vbCancel	2	User clicked Cancel.
vbAbort	3	User clicked Abort.
vbRetry	4	User clicked Retry.
vbIgnore	5	User clicked Ignore.
vbYes	6	User clicked Yes.
vbNo	7	User clicked No.

And that's pretty much all you need to know about the MsgBox function. Use message boxes with caution, though. There's usually no reason to display message boxes that serve no purpose. For example, people tend to get annoyed when they see a message box every day that reads Good morning. Thanks for loading the Budget Projection workbook.

Getting Data with an Input Box

An *input box* is a dialog box useful for obtaining a single piece of information typed by the user. That information could be a number, a text string, or even a range address. This is a good alternative to developing a UserForm when you need to get only one value. In VBA, you can use the InputBox function to display an input box.

Understanding the InputBox syntax

Here's a simplified version of the syntax of the InputBox function:

```
InputBox(prompt[, title][, default])
```

Table 15-4 shows the key arguments for the InputBox function.

TABLE 15-4

InputBox Function Arguments

Argument	What It Affects
Prompt	The text displayed above the input area of the input box
Title	The text displayed in the input box's title bar (optional)
Default	The default value for the user's input (optional)

Using the InputBox function

Here's a statement that shows how you can use the InputBox function:

```
TheName = InputBox("What is your name?", "Greetings")
```

When you execute this VBA statement, Excel displays the dialog box shown in Figure 15-5. Notice that this example uses only the first two arguments and doesn't supply a default value. When the user enters a value and clicks OK, the code assigns the value to the variable TheName.

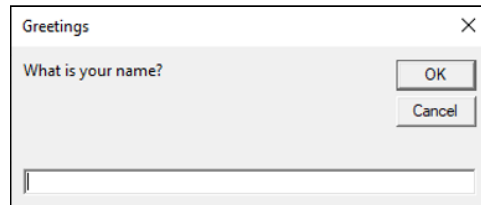


FIGURE 15-5:
The InputBox function displays this dialog box.

The following example uses the third argument and provides a default value. The default value is the username stored by Excel (the Application object's UserName property).

```

Sub GetName()
    Dim TheName As String
    TheName = InputBox("What is your name?", _
        "Greetings", Application.UserName)
End Sub

```

The input box always displays a Cancel button. If the user clicks Cancel, the InputBox function returns an empty string.



REMEMBER

The VBA InputBox function always returns a string, so if you need to get a number, your code needs to do some additional checking. The following example uses the InputBox function to get a number. It uses the IsNumeric function to check whether the string is a number. If the string does contain a number, all is fine. If the user's entry cannot be interpreted as a number, the code displays a message box.

```

Sub AddSheets()
    Dim Prompt As String
    Dim Caption As String
    Dim DefValue As Long
    Dim NumSheets As String
    Prompt = "How many sheets do you want to add?"
    Caption = "Tell me..."
    DefValue = 1
    NumSheets = InputBox(Prompt, Caption, DefValue)

    If NumSheets = "" Then Exit Sub 'Canceled
    If IsNumeric(NumSheets) Then
        If NumSheets > 0 Then Sheets.Add Count:=NumSheets
    Else
        MsgBox "Invalid number"
    End If
End Sub

```

Figure 15-6 shows the input box that this routine produces.

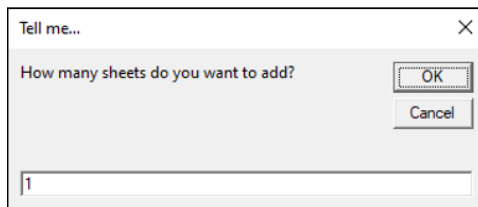


FIGURE 15-6: Another example of using the InputBox function.

Using the InputBox method

Microsoft seems to love confusion, so in addition to a function named InputBox you also have access to a *method* with the same name.

One big advantage of using the Application.InputBox method is that your code can prompt for a range selection. The user can then select the range in the worksheet by highlighting the cells. Here's a quick example that prompts the user to select a range:

```
Sub GetRange()  
    Dim Rng As Range  
    On Error Resume Next  
    Set Rng = Application.InputBox _  
        (prompt:="Specify a range:", Type:=8)  
    If Rng Is Nothing Then Exit Sub  
    MsgBox "You selected range " & Rng.Address  
End Sub
```

Figure 15-7 shows how it looks.

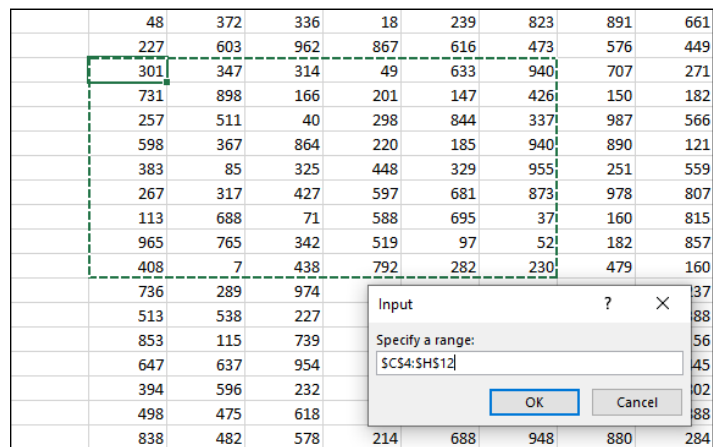


FIGURE 15-7:
Using the
Application.
InputBox method
to get a range.

In this simple example, the code tells the user the address of the range that was selected. In real life, your code would actually do something useful with the selected range. A nice thing about this example is that Excel takes care of the error handling. If you enter something that's not a range, Excel tells you about it and lets you try again.

The `Application.InputBox` method is similar to the VBA `InputBox` function, but it also has some differences. Check the Help system for complete details (see Chapter 23 for more information on the Help system).

Allowing the User to Select a File or Folder

If your VBA procedure needs to ask the user for a filename, you *could* use the `InputBox` function and have the user do some typing. An input box usually isn't the best tool for this job, however, because most users find it difficult to remember paths, backslashes, filenames, and file extensions. In other words, it's far too easy to mess up when typing a filename.

For a better solution to this problem, use the `GetOpenFilename` method of the `Application` object, which ensures that your code gets its hands on a valid filename, including its complete path. The `GetOpenFilename` method displays the familiar Open dialog box (a dead ringer for the dialog box Excel displays when you choose `File` ⇨ `Open` ⇨ `Browse`).



REMEMBER

The `GetOpenFilename` method doesn't actually open the specified file. This method simply returns the user-selected filename as a string. Then you can write code to do whatever you want with the filename.

Constructing a `GetOpenFilename` statement

The official syntax of the `GetOpenFilename` method is as follows:

```
object.GetOpenFilename ([fileFilter][, filterIndex]  
[, title][, buttonText][, multiSelect])
```

The `GetOpenFilename` method takes the optional arguments shown in Table 15-5.

Selecting a file with `GetOpenFilename`

The `FileFilter` argument determines what appears in the dialog box's Files of Type drop-down list. This argument consists of pairs of file filter strings followed by the wildcard file filter specification, with commas separating each part and pair. If omitted, this argument defaults to the following:

```
All Files (*.*) , *.*
```


TABLE 15-5

GetOpenFilename Method Arguments

Argument	What It Does
FileFilter	Determines the types of files that appear in the dialog box (for example, *.TXT). You can specify several filters for the user to choose from.
FilterIndex	Determines which of the file filters the dialog box displays by default.
Title	Specifies the caption for the dialog box's title bar.
ButtonText	Ignored (used only for the Macintosh version of Excel).
MultiSelect	If True, the user can select multiple files.

Notice that this string consists of two parts, separated by a comma:

```
All Files (*.*)
```

and

```
*.*
```

The first part of this string is the text displayed in the Files of Type drop-down list. The second part determines which files the dialog box displays. For example, *.* means *all files*.

The code in the following example opens a dialog box that asks the user for a filename. The procedure defines five file filters. Notice that the VBA line-continuation sequence sets up the FInfo variable; doing so helps simplify this rather complicated argument.

```
Sub GetImportFileName()
    Dim FInfo As String
    Dim FilterIndex As Long
    Dim Title As String
    Dim FileName As Variant

    ' Set up list of file filters
    FInfo = "Text Files (*.txt),*.txt," & _
           "Lotus Files (*.prn),*.prn," & _
           "Comma Separated Files (*.csv),*.csv," & _
           "ASCII Files (*.asc),*.asc," & _
           "All Files (*.*),*.*"

    ' Display *.* by default
    FilterIndex = 5
End Sub
```

```

' Set the dialog box caption
  Title = "Select a File to Import"

' Get the filename
  FileName = Application.GetOpenFilename (FInfo, _
    FilterIndex, Title)

' Handle return info from dialog box
  If FileName = False Then
    MsgBox "No file was selected."
  Else
    MsgBox "You selected " & FileName
  End If
End Sub

```

Figure 15-8 shows the dialog box Excel displays when you execute this procedure. The appearance may vary, depending on the version of Windows you use and the display options you've set.

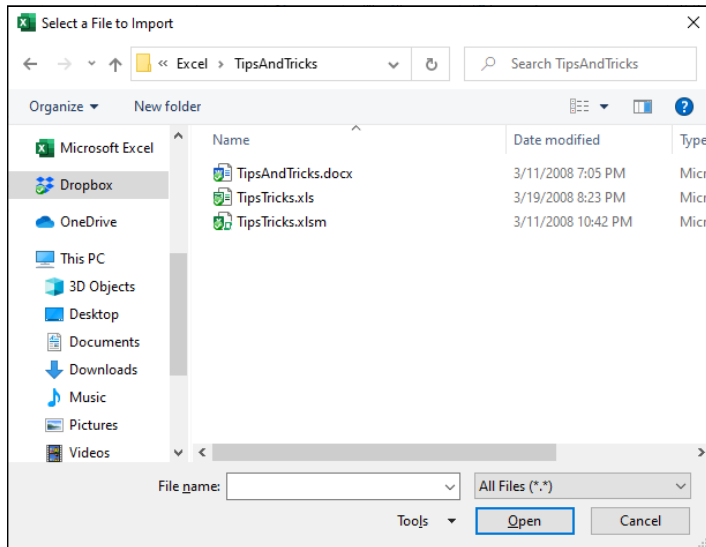


FIGURE 15-8: The `GetOpenFilename` method displays a customizable dialog box and returns the selected file's path and name.

In a real application, you would do something more meaningful with the filename. For example, you might want to open it by using a statement such as this:

```
Workbooks.Open FileName
```



Notice that the `FileName` variable is declared as a `Variant` data type. If the user clicks `Cancel`, that variable contains a `Boolean` value (`False`). Otherwise, `FileName` is a string. Therefore, using a `Variant` data type handles both possibilities.

Picking a file with `GetSaveAsFilename`

The Excel `GetSaveAsFilename` method works just like the `GetOpenFilename` method, but it displays the Excel `Save As` dialog box rather than its `Open` dialog box. The `GetSaveAsFilename` method gets a path and filename from the user but doesn't do anything with that information. It's up to you to write code that actually saves the file.

The syntax of this method follows:

```
object.GetSaveAsFilename ([InitialFilename][, FileFilter]  
[, FilterIndex][, Title][, ButtonText])
```

The `GetSaveAsFilename` method takes the arguments described in Table 15-6, all of which are optional.

TABLE 15-6 `GetSaveAsFilename` Method Arguments

Argument	What It Does
<code>InitialFileName</code>	Specifies a default filename that appears in the File Name box.
<code>FileFilter</code>	Determines the types of files Excel displays in the dialog box (for example, <code>*.TXT</code>). You can specify several filters for the user to choose among.
<code>FilterIndex</code>	Determines which of the file filters Excel displays by default.
<code>Title</code>	Defines a caption for the dialog box's title bar.

Getting a folder name

Sometimes you don't need to get a filename; you just need to get a folder name. If that's the case, the `FileDialog` object is just what the doctor ordered.

The following procedure displays a dialog box that allows the user to select a directory. The selected directory name (or "Canceled") is displayed by the `MsgBox` function.

```

Sub GetAFolder()
    With Application.FileDialog(msoFileDialogFolderPicker)
        .InitialFileName = Application.DefaultFilePath & "\"
        .Title = "Please select a location for the backup"
        .Show
        If .SelectedItems.Count = 0 Then
            MsgBox "Canceled"
        Else
            MsgBox .SelectedItems(1)
        End If
    End With
End Sub

```

The FileDialog object lets you specify the starting directory by specifying a value for the InitialFileName property. In this case, the code uses Excel's default file path as the starting directory.

Displaying Excel's Built-In Dialog Boxes

One way to look at VBA is that it's a tool that lets you mimic Excel commands. For example, consider this VBA statement:

```
Range("A1:A12").Name = "MonthNames"
```

Executing this VBA statement has the same effect as choosing Formulas ⇨ Defined Names ⇨ Define Name to display the New Name dialog box, typing MonthNames in the Name box and A1:A12 in the Refers to box, and clicking OK.

When you execute the VBA statement, the New Name dialog box doesn't appear. This is almost always what you want to happen; you don't want dialog boxes flashing across the screen while your macro executes.

In some cases, however, you might want your code to display one of Excel's many built-in dialog boxes and let the user make the choices in the dialog box. You can do this by using VBA to execute a Ribbon command. Here's an example that displays the New Name dialog box. The address in the Refers To box represents the range that's selected when the command is executed (see Figure 15-9).

```
Application.CommandBars.ExecuteMso "NameDefine"
```

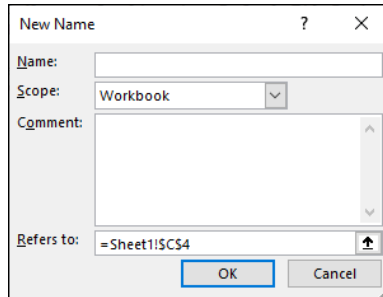


FIGURE 15-9: Displaying one of Excel's dialog boxes by using VBA.



REMEMBER

Your VBA code can't get any information from the dialog box. For example, if you execute the code to display the New Name dialog box, your code can't get the name entered by the user or the range that's being named.

ExecuteMso is a method of the CommandBars object and accepts one argument: an idMso parameter that represents a Ribbon control. Unfortunately, these parameters aren't listed in the Help system.

Here's another example of using the ExecuteMso method. This statement, when executed, displays the Font tab of the Format Cells dialog box:

```
Application.CommandBars.ExecuteMso "FormatCellsFontDialog"
```

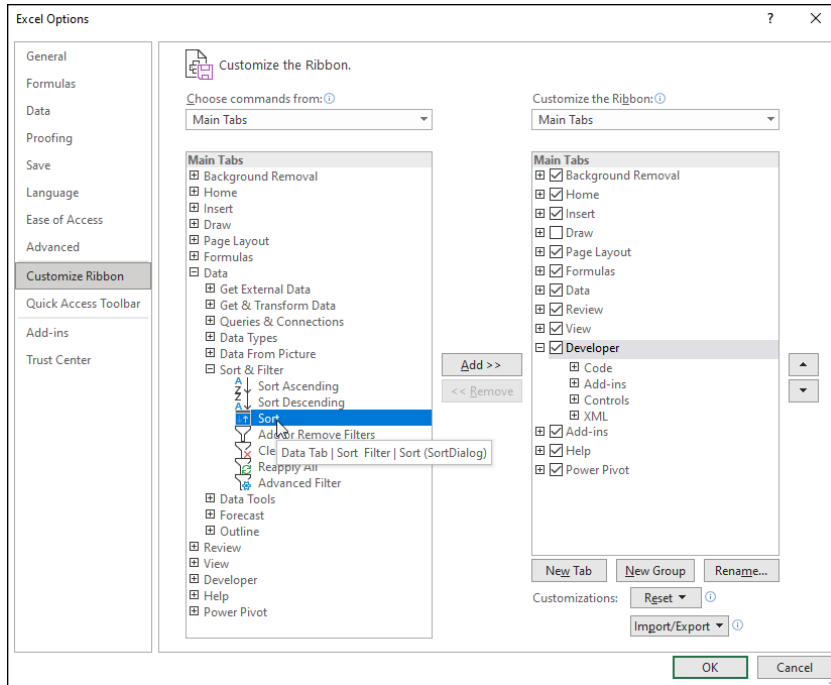
If you try to display a built-in dialog box in an incorrect context, Excel displays an error message. For example, here's a statement that displays the Format Number dialog box:

```
Application.CommandBars.ExecuteMso "NumberFormatsDialog"
```

If you execute this statement when it's not appropriate (for example, when a Shape is selected), Excel displays an error message because that dialog box is appropriate only for worksheet cells.

Excel has thousands of commands. How do you find the name of the one you need? One way is to use the Customize Ribbon tab of the Excel Options dialog box. The quick way to get there is to right-click any Ribbon control and choose Customize the Ribbon from the shortcut menu. Virtually every command available in Excel is listed in the left panel. Find the command you need and hover your mouse over it, and you see its secret command name in the tooltip (it's the part in parentheses). Figure 15-10 shows an example.

FIGURE 15-10:
Using the
Customize
Ribbon tab to
identify a
command name.



- » Finding out when to use UserForms
- » Understanding UserForm objects
- » Displaying a UserForm
- » Creating a UserForm that works with a useful macro

Chapter **16**

UserForm Basics

A UserForm is useful if your VBA macro must pause and get some information from a user. For example, your macro may have some options that can be specified in a UserForm. If only a few pieces of information are required (for example, a Yes/No answer or a text string), one of the techniques discussed in Chapter 15 may do the job. But if you need to obtain more information, you must create a UserForm, which is what this chapter is all about.

Knowing When to Use a UserForm

You use a UserForm when a simpler method won't work, such as if you need to gather more information than an input box can provide or you need more control over how the user provides that information. For example, if you want to provide a quick way for a user to change the case of text in a cell, you might find a UserForm to be a better option than an input box.

In this example, you want to allow the user to change the text in a cell among lowercase, uppercase, and proper case. Technically you only need one piece of information — the case to change to. You could use an input box and have the user type “lower,” “upper,” or “proper” and change the case based on the user's input. But that method requires the user to spell the words correctly and for you to include a long message about what are valid values to input.

This is a case where more control over the user's input makes for a better user experience. With a UserForm, you can include controls other than the text box that's on an input box and avoid the problem of misspelled cases and overly long prompts.

The following macro changes the text in each cell in the Selection to uppercase letters. It does this by using the VBA built-in UCase function:

```
Sub ChangeCase()  
    Dim WorkRange As Range, cell As Range  
  
    ' Exit if a range is not selected  
    If TypeName(Selection) <> "Range" Then Exit Sub  
    ' Process only text cells, no formulas  
    On Error Resume Next  
    Set WorkRange = Selection.SpecialCells _  
        (xlCellTypeConstants, xlCellTypeConstants)  
    For Each cell In WorkRange  
        cell.Value = UCase(cell.Value)  
    Next cell  
End Sub
```

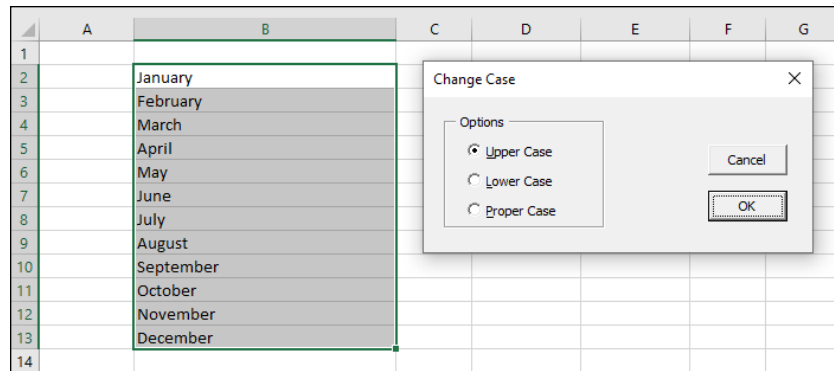
Because this macro only does one thing — change the case to upper — it doesn't require user input. If it could also change the text in the cells to either lowercase or proper case (that is, capitalizing the first letter in each word), it would be more useful. One approach is to create two additional macros — one for lowercase and one for proper case. Another approach is to modify the macro to handle these other options. If you use the second approach, you need some method of asking the user which type of change to make to the cells.

The solution is to display a dialog box like the one shown in Figure 16-1. You create this dialog box on a UserForm in the VBE and display it by using a VBA macro. The next section offers step-by-step instructions for creating this dialog box.



In VBA, the official name for a dialog box is a UserForm. But a UserForm is really an object that contains what's commonly known as a *dialog box*. This distinction isn't important, so you'll often hear these terms used interchangeably.

FIGURE 16-1:
You can get information from the user by displaying a UserForm.



Creating UserForms: An Overview

When creating a UserForm, you usually take the following general steps:

- 1. Determine how the dialog box will be used and at what point it will be displayed in your VBA macro.**
- 2. Press Alt+F11 to activate the VBE and to insert a new UserForm object.**

A UserForm object holds a single UserForm.

- 3. Add controls to the UserForm.**

Controls include items such as text boxes, buttons, check boxes, and list boxes.

- 4. Use the Properties window to modify the properties for the controls or for the UserForm itself.**
- 5. Write event-handler procedures for the controls (for example, a macro that executes when the user clicks a button in the dialog box).**

These procedures are stored in the Code window for the UserForm object.

- 6. Write a procedure (stored in a VBA module) that displays the dialog box to the user.**

Don't worry if some of these steps seem foreign. The following sections provide more details, along with step-by-step instructions for creating a UserForm.

When you're designing a UserForm, you're creating what developers call the *Graphical User Interface (GUI)* to your application.

Take some time before designing your UserForm to consider what it should look like and how your users are likely to want to interact with the elements on it. Try to guide them through the steps they need to take on the form by carefully considering the arrangement and wording of the controls. Like most things VBA-related, the more you do it, the easier it gets.

Working with UserForms

Each dialog box that you create is stored in its own UserForm object — one dialog box per UserForm. You create and access these UserForms in the Visual Basic Editor.

Inserting a new UserForm

Insert a UserForm object by following these steps:

1. **Activate the VBE by pressing Alt+F11.**
2. **Select the workbook that will hold the UserForm in the Project Explorer.**
3. **Choose Insert ⇨ UserForm.**

The VBE inserts a new UserForm object, which contains an empty dialog box.

Figure 16-2 shows a UserForm — an empty dialog box. Your job, if you choose to accept it, is to add some controls to this UserForm.

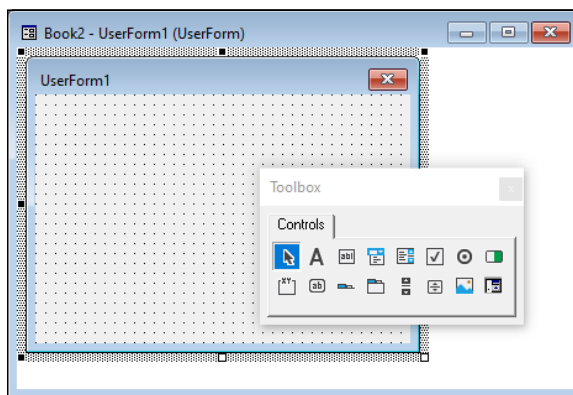


FIGURE 16-2:
A new UserForm
object.

Adding controls to a UserForm

When you activate a UserForm, the VBE displays the Toolbox in a floating window (refer to Figure 16-2). You use the tools in the Toolbox to add controls to your UserForm. If, for some reason, the Toolbox doesn't appear when you activate your UserForm, choose View ⇨ Toolbox.

To add a control, just click the desired control in the Toolbox and drag it into the dialog box to create the control. After you add a control, you can move and resize it by using standard techniques.

Table 16-1 lists the various tools, as well as their capabilities. To determine which tool is which, hover your mouse pointer over the control and read the small pop-up description.

TABLE 16-1

Toolbox Controls

Control	What It Does
Label	Shows text
TextBox	Allows the user to enter text
ComboBox	Displays a drop-down list
ListBox	Displays a list of items
CheckBox	Provides options such as on/off or yes/no
OptionButton	Allows the user to select one of several options; used in groups of two or more
ToggleButton	Enables the user to switch a button on or off
Frame	Contains other controls
CommandButton	Adds a clickable button
TabStrip	Displays tabs
MultiPage	Creates a tabbed container for other objects
ScrollBar	Enables the user to drag a bar to establish a setting
SpinButton	Enables the user to click a button to change a value
Image	Holds an image
RefEdit	Allows the user to select a range

Changing properties for a UserForm control

Every control you add to a UserForm has properties that determine how the control looks or behaves. In addition, the UserForm itself has its own set of properties. You can change these properties with the aptly named Properties window. Figure 16-3 shows the Properties window when a CommandButton control is selected.

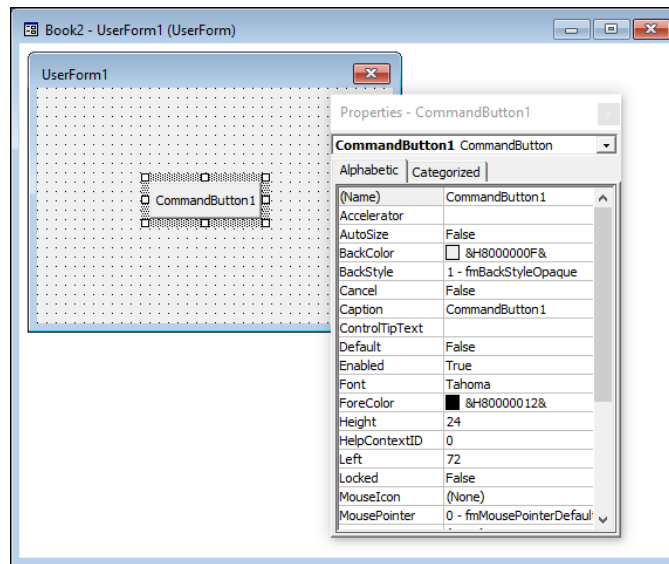


FIGURE 16-3: Use the Properties windows to change the properties of UserForm controls.

The Properties window appears when you press F4. Alternatively, you can choose View ⇄ Properties Window. The properties shown in this window depend on what is selected. If you select a different control, the properties change to those appropriate for that control. To hide the Properties window and get it out of the way, click the Close button in its title bar. Pressing F4 always brings it back when you need it.

Properties for controls include the following:

- » Name
- » Width
- » Height
- » Value
- » Caption

Each control has its own set of properties (although many controls have some common properties). To change a property using the Properties window, follow these steps:

1. **Make sure that the correct control is selected in the UserForm.**
2. **Make sure the Properties window is visible. (Press F4 if it's not.)**
3. **In the Properties window, click the property that you want to change.**
4. **Make the change in the right column of the Properties window.**

If you select the UserForm itself (not a control on the UserForm), you can use the Properties window to adjust UserForm properties.

Chapter 17 contains more information about working with dialog box controls.



TIP

Some of the UserForm properties serve as default settings for new controls you drag onto the UserForm. For example, if you change the Font property for the UserForm itself, controls that you subsequently add use that same font. Controls that are already on the UserForm aren't affected.

Viewing the UserForm Code pane

A UserForm consists of a UserForm object and a module. The module contains a code pane that holds the VBA code (that is, the event-handler procedures), which is executed when the user works with the dialog box (see Chapter 3 to learn about the relationship between modules and code panes). To view the module's code pane, choose Code from the View menu or press F7. The code pane is empty until you add some procedures. Choose Object from the View menu, or press Shift+F7 to return to the UserForm.

Another way to switch between the code pane and the UserForm display is to use the View Code and View Object buttons in the Project Explorer's title bar. In addition, you can also right-click the UserForm and choose View Code. If you're viewing code, double-click the UserForm name in the Project window to return to the UserForm.

Displaying a UserForm

You display a UserForm by using the UserForm's Show method in a VBA procedure.



REMEMBER

The macro that displays the dialog box must be in a VBA module — not in the UserForm's module.

The following procedure displays the dialog box named UserForm1:

```
Sub ShowDialogBox()  
    UserForm1.Show  
    ' Other statements can go here  
End Sub
```

When Excel displays the dialog box, the ShowDialogBox macro halts until the user closes the dialog box. Then VBA executes any remaining statements in the procedure. Most of the time, you won't have any more code in the procedure. As you later see, you put your event-handler procedures in the UserForm's module. These procedures run in response to events that occur when the user works with the controls on the UserForm.

Using information from a UserForm

The VBE provides a name for each control you add to a UserForm. The control's name corresponds to its Name property. Use this name to refer to a particular control in your code. For example, if you add a CheckBox control to a UserForm named UserForm1, the CheckBox control is named CheckBox1 by default. You can use the Properties box to make this control appear with a check mark, or you can write code to do it:

```
UserForm1.CheckBox1.Value = True
```

Most of the time, you write the code for a UserForm in the UserForm's module. If that's the case, you can omit the UserForm object qualifier and write the statement like this:

```
CheckBox1.Value = True
```

Your VBA code can also check various properties of the controls and take appropriate actions. The following statement executes a macro named PrintReport if the check box (named CheckBox1) is checked:

```
If CheckBox1.Value = True Then PrintReport
```



TIP

It's usually a good idea to change the default name the VBE gives to your controls to something more meaningful. You might consider naming the check box something like chkPrintReport. Note the three-letter prefix (chk). There is no technical reason for using chk as the prefix. This is just one example of using a naming

convention to differentiate objects in VBA. Using a naming convention like this makes your code easier to read. In the end, the convention you choose is a matter of what you're comfortable with.

A UserForm Example

This section's UserForm example is an enhanced version of the ChangeCase macro from the beginning of the chapter. The original version of this macro changes the text in the selected cells to uppercase. This modified version uses a UserForm to ask the user which type of change to make: uppercase, lowercase, or proper case.

This dialog box needs to obtain one piece of information from the user: the type of change to make to the text. Because the user has three choices, your best bet is a dialog box with three `OptionButton` controls. The dialog box also needs two more buttons: an `OK` button and a `Cancel` button. Clicking the `OK` button runs the code that does the work. Clicking the `Cancel` button causes the macro to finish without doing anything.



TIP

This workbook is available at the book's website, <https://www.dummies.com/go/excelvbaprogrammingfd6e>. However, you will get more out of this exercise if you follow the steps provided here and create it yourself.

Creating the UserForm

These steps create the UserForm. Start with an empty workbook, and follow these steps:

1. **Press Alt+F11 to activate the VBE.**
2. **If multiple projects are in the Project window, select the project that corresponds to the workbook you're using.**
3. **Choose Insert ⇨ UserForm.**
The VBE inserts a new UserForm object with an empty dialog box.
4. **Press F4 to display the Properties window.**
5. **In the Properties window, change the dialog box's Caption property to Change Case and its Name property to UChangeCase.**
6. **(Optional) The dialog box is a bit too large, so you might want to click it and use the handles (on the right and bottom sides) to make it smaller.**

You can do Step 6 after you position all the controls in the dialog box.

Adding the CommandButtons

Next add two CommandButtons — OK and Cancel — to the dialog box. Follow along:

1. **Make sure that the Toolbox is displayed; if it isn't, choose View ⇨ Toolbox.**
2. **If the Properties window isn't visible, press F4 to display it.**
3. **In the Toolbox, drag a CommandButton into the dialog box to create a button.**

As you see in the Properties box, the button has a default name and caption: CommandButton1.

4. **Make sure that the CommandButton is selected; then activate the Properties window and change the following properties:**

Property	Change To
Name	cmdOK
Caption	OK
Default	True

5. **Add a second CommandButton object to the UserForm and change the following properties:**

Property	Change To
Name	cmdCancel
Caption	Cancel
Cancel	True

6. **Adjust the size and position of the controls so your dialog box looks something like Figure 16-4.**

Adding the OptionButtons

In this section, you add three OptionButtons to the dialog box. Before adding the OptionButtons, you add a Frame object that contains the OptionButtons. The

Frame isn't necessary, but it makes the dialog box look a bit more professional so users won't think it was designed by an amateur.

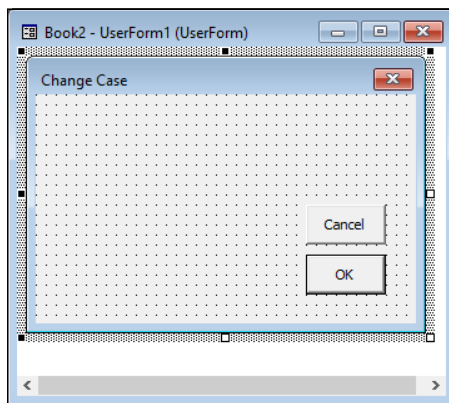


FIGURE 16-4:
The UserForm
with two
CommandButton
controls.

To add the OptionButtons, follow these steps:

- 1. In the Toolbox, click the Frame tool and drag it into the dialog box.**
This step creates a frame to hold the options buttons.
- 2. Use the Properties window to change the frame's name to frmOptions and its caption to Options.**
- 3. In the Toolbox, click the OptionButton tool and drag it into the dialog box (within the Frame).**
Doing this creates an OptionButton control.
- 4. Select the OptionButton and use the Properties window to change the following properties:**

Property	Change To
Name	optUpper
Caption	Upper Case
Accelerator	U
Value	True

Setting the Value property to True makes this OptionButton the default.

5. Add another **OptionButton** and use the Properties window to change the following properties:

Property	Change To
Name	optLower
Caption	Lower Case
Accelerator	L

6. Add a third **OptionButton** and use the Properties window to change the following properties:

Property	Change To
Name	optProper
Caption	Proper Case
Accelerator	P

7. Adjust the size and position of the **OptionButtons**, **Frame**, and dialog box.

Your UserForm should look something like Figure 16-5.

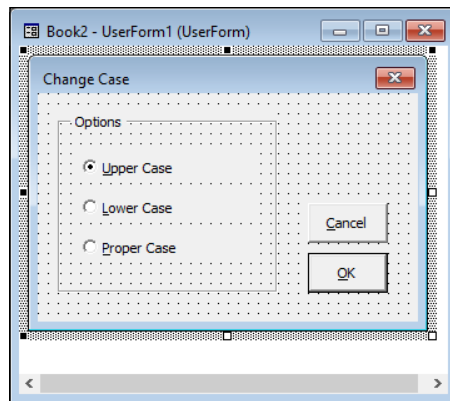


FIGURE 16-5:
This is the UserForm after adding three **OptionButton** controls inside a **Frame** control.

If you'd like a sneak preview to see what the UserForm looks like when it's displayed, press **F5**. None of the controls work yet, so you need to click the red **X** in the title bar to close the dialog box.

The Accelerator property determines which letter in the caption is underlined — and more importantly, it determines what Alt+key combination selects that control. For example, you can select the Lower Case option by pressing Alt+L because the L is underlined. Accelerator keys are optional, but some users prefer to use the keyboard to navigate dialog boxes.

You might wonder why the OptionButtons have accelerator keys but the CommandButtons don't. Generally, OK and Cancel buttons don't have accelerator keys because they can already be accessed from the keyboard. Pressing Enter is the same as clicking OK because the control's Default property is True. Pressing Esc is the same clicking Cancel because the control's Cancel property is True.

Adding event-handler procedures

Now it's time to make the UserForm actually do something. Here's how to add an event-handler procedure for the Cancel and OK buttons:

1. Double-click the Cancel button.

The VBE activates the Code window for the UserForm and inserts an empty procedure:

```
Private Sub cmdCancel_Click()  
  
End Sub
```

The procedure named cmdCancel_Click is executed when the Cancel button is clicked, but only when the dialog box is displayed. In other words, clicking the Cancel button when you're designing the dialog box won't execute the procedure. Because the Cancel button's Cancel property is set to True, pressing Esc also triggers the cmdCancel_Click procedure.

2. Insert the following statement inside the procedure (before the End Sub statement):

```
Unload Me
```

This statement closes the UserForm when the Cancel button is clicked.

When you're in a UserForm's module, the Me keyword refers to the UserForm itself. This keyword provides a bit of shortcut so you don't have to type out the UserForm's name. It also allows you to copy this procedure to another UserForm with a button named cmdCancel — something you wouldn't be able to do if you used the UserForm's name like:

```
Unload User form1
```



TECHNICAL
STUFF

3. **Press Shift+F7 to return to the UserForm.**
4. **Double-click the OK button.**

The VBE activates the UserForm's module and inserts an empty Sub procedure called cmdOK_Click.

When the UserForm is displayed, clicking OK executes this procedure. Because this button has its Default property set to True, pressing Enter also executes the cmdOK_Click procedure.

5. **Enter the following code so the procedure looks like this:**

```
Private Sub cmdOK_Click()  
    Dim WorkRange As Range  
    Dim cell As Range  
  
    ' Process only text cells, no formulas  
    On Error Resume Next  
    Set WorkRange = Selection.SpecialCells _  
        (xlCellTypeConstants, xlCellTypeConstants)  
  
    If Me.optUpper.Value Then 'Upper case  
        For Each cell In WorkRange  
            cell.Value = UCase(cell.Value)  
        Next cell  
    ElseIf Me.optLower.Value Then 'Lower case  
        For Each cell In WorkRange  
            cell.Value = LCase(cell.Value)  
        Next cell  
    ElseIf Me.optProper.Value Then  
        For Each cell In WorkRange  
            cell.Value = StrConv(cell.Value, vbProperCase)  
        Next cell  
    End If  
  
    Unload Me  
End Sub
```

The preceding code is an enhanced version of the original ChangeCase macro presented at the beginning of the chapter. The macro checks to see which of the options was selected using an If-ElseIf-EndIf structure, then loops through the cells, changing their cases, using a For Each-Next loop. The last statement closes the dialog box using the same Unload keyword you used in the cmdCancel_Click procedure.

Creating a macro to display the dialog box

You're almost finished with this project. The only thing missing is a way to display the dialog box. Follow these steps to create the procedure that makes the dialog box appear:

1. **In the VBE window, choose Insert ⇨ Module.**

The VBE adds an empty VBA module (named Module1) to the project.

2. **Enter the following code:**

```
Sub ChangeCase()  
    If TypeName(Selection) = "Range" Then  
        UChangeCase.Show  
    Else  
        MsgBox "Select a range.", vbCritical  
    End If  
End Sub
```

This procedure is pretty simple. It checks to make sure that a range is selected. If so, the dialog box is displayed (using the Show method). The user then interacts with the dialog box, and the code stored in the UserForm's Code pane is executed. If a range is not selected, the user sees a MsgBox with the text `Select a range`.

Making the macro available

At this point, everything should be working properly. But you still need an easy way to execute the macro. Assign a shortcut key (Ctrl+Shift+C) that executes the ChangeCase macro by following these steps:

1. **Activate the Excel window by pressing Alt+F11.**
2. **Choose Developer ⇨ Code ⇨ Macros, or press Alt+F8.**
3. **In the Macros dialog box, select the ChangeCase macro.**
4. **Click the Options button.**
Excel displays its Macro Options dialog box.
5. **Enter C for the Shortcut key (see Figure 16-6).**
6. **Enter a description of the macro in the Description field.**
7. **Click OK.**
8. **Click Cancel when you return to the Macro dialog box.**

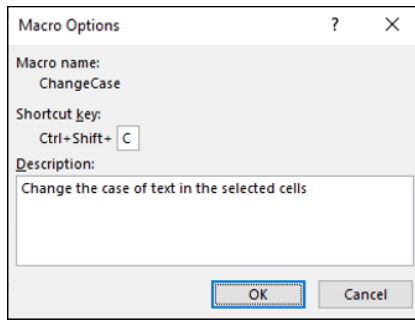


FIGURE 16-6: Assign a shortcut key to execute the ChangeCase macro.

After you perform this operation, pressing Ctrl+Shift+C executes the ChangeCase macro, which displays the UserForm if a range is selected.

You can also make this macro available from the Quick Access toolbar. Right-click the Quick Access toolbar and choose Customize Quick Access Toolbar. The Excel Options dialog box appears, and the ChangeCase macro is listed below Macros (see Figure 16-7).

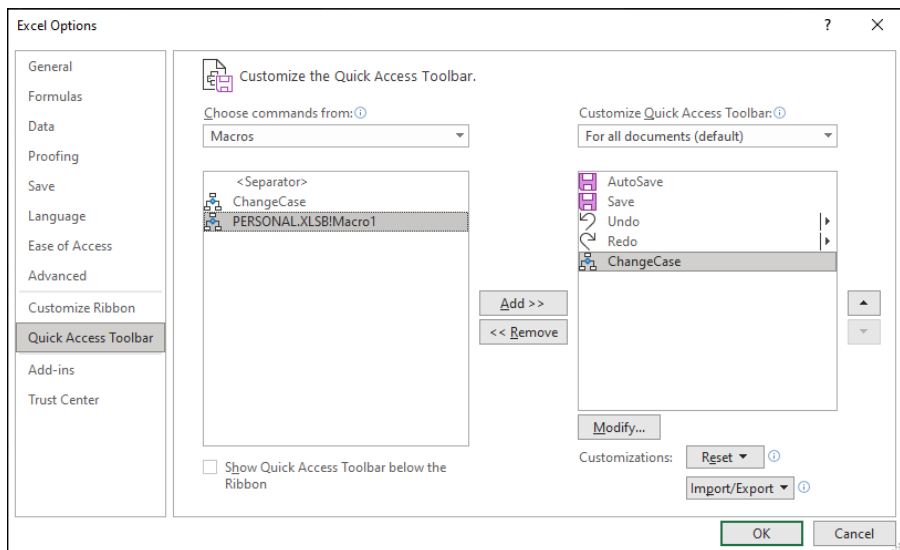


FIGURE 16-7: Adding the ChangeCase macro to the Quick Access toolbar.

Testing the macro

Finally, you need to test the macro and dialog box to make sure they work properly, as follows:

1. **Activate a worksheet (any worksheet in any workbook).**
2. **Select some cells that contain text.**

You can even select entire rows or columns.

3. **Press Ctrl+Shift+C.**

The UserForm appears. Figure 16-8 shows how it should look.

4. **Make your choice, and click OK.**

If you did everything correctly, the macro makes the specified change to the text in the selected cells.

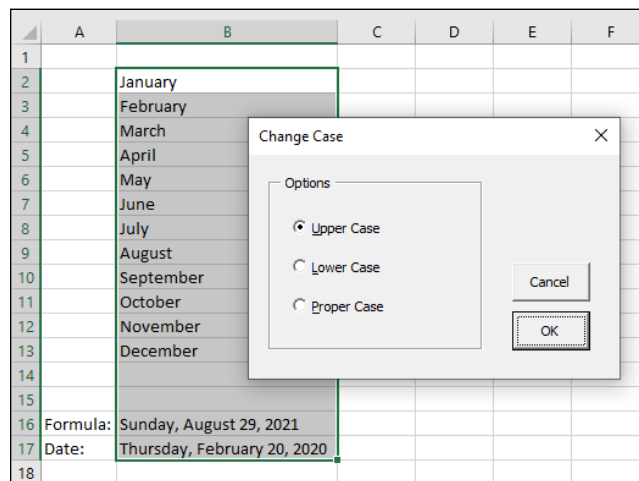


FIGURE 16-8:
The UserForm is
in action.

If you test this procedure when only one cell is selected, you'll find that *all* the cells on the worksheet are processed. That behavior is a byproduct of using the `SpecialCells` method. If you prefer to be able to process just one cell, change the first block of code in the `cmdOK_Click` event handler to this:

```

If Selection.Count > 1 Then
    Set WorkRange = Selection.SpecialCells _
        (xlCellTypeConstants, xlCellTypeConstants)
Else 'only one cell selected
    If Not Selection.HasFormula Then
        Set WorkRange = Selection
    End If
End If

```

Figure 16-9 shows the worksheet after converting the text to uppercase. The macro works only with cells that contain text. It did not work on cell B16 because it contains a formula, not text. Nor did it work on cell B17 because it contains a date, not text.

	A	B	C
1			
2		JANUARY	
3		FEBRUARY	
4		MARCH	
5		APRIL	
6		MAY	
7		JUNE	
8		JULY	
9		AUGUST	
10		SEPTEMBER	
11		OCTOBER	
12		NOVEMBER	
13		DECEMBER	
14			
15			
16	Formula:	Sunday, August 29, 2021	
17	Date:	Thursday, February 20, 2020	
18			

FIGURE 16-9:
The text has been converted to uppercase.

As long as the workbook is open, you can execute the macro from any other workbook. If you close the workbook that contains your macro, Ctrl+Shift+C no longer has any function.

If the macro doesn't work properly, double-check the preceding steps to locate and correct the error. Don't be alarmed; debugging is a normal part of developing macros. As a last resort, download the completed workbook from this book's website and try to figure out where you went wrong.

- » Understanding each type of dialog box control
- » Changing each control's properties
- » Manipulating dialog box controls in your UserForm object

Chapter 17

Using UserForm Controls

A user responds to a custom dialog box (also known as a *UserForm*) by using the various controls (buttons, text boxes, option buttons, and so on) that the dialog box contains. Your VBA code then uses of these responses to determine which actions to take. You have quite a few controls at your disposal and this chapter tells you about them.

If you worked through the hands-on example in Chapter 16, you already have some experience with UserForm controls. This chapter fills in some of the gaps.

Getting Started with Dialog Box Controls

In this section, you explore how to add controls to a UserForm, give them meaningful names, and adjust some of their properties.



REMEMBER

Before you can do any of these things, you need a UserForm. Add a UserForm to your project by selecting the project in the Project Explorer and choosing Insert ⇨ UserForm in the VBE.

Adding controls

Oddly enough, the VBE doesn't have menu commands that allow you to add controls to a dialog box. You use the floating Toolbox (described in Chapter 16) to add controls. Normally, the Toolbox pops up automatically when you activate a UserForm in the VBE. If it doesn't, you can display the Toolbox by choosing View ⇨ Toolbox. If the Toolbox menu item is grayed out, make sure you have a UserForm activated.

Follow along to add a control to the UserForm:

1. Click the Toolbox tool that corresponds to the control you want to add.
2. Click in the UserForm and drag to size and position the control.

Alternatively, you can simply drag a control from the Toolbox to the UserForm to create a control with the default dimensions. Figure 17-1 shows a UserForm that contains a few controls: two option buttons (inside a frame), a combo box, a check box, a scroll bar, and a command button.

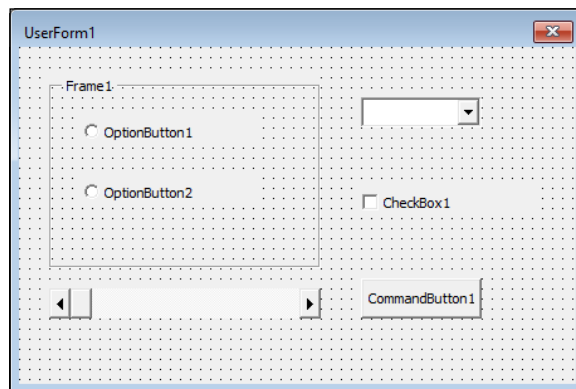


FIGURE 17-1:
A UserForm in the VBE, with a few controls added.



TIP

A UserForm may contain a vertical and horizontal grid, which help align the controls you add. When you add or move a control, the VBE aligns your controls to the closest dots on the grid. If you don't like this feature, you can turn off the grids by following these steps:

1. Choose Tools ⇨ Options in the VBE.
2. In the Options dialog box, select the General tab.
3. Set your desired options in the Form Grid Settings section.

Introducing control properties

Every control that you add to a UserForm has properties that determine how the control looks and behaves. You can change a control's properties at the following two times:

- » At design time — when you're designing the UserForm. You do so manually using the Properties window.
- » At runtime — while your macro is running. You do so by writing VBA code. Changes made at runtime are always temporary; they're made to the copy of the dialog box you're showing, not to the actual UserForm object you designed.

When you add a control to a UserForm, you almost always need to make some design-time adjustments to its properties. You make these changes in the Properties window. (To display the Properties window, press F4.) Figure 17-2 shows the Properties window, which displays properties for the object selected in the UserForm — which happens to be a CheckBox control.

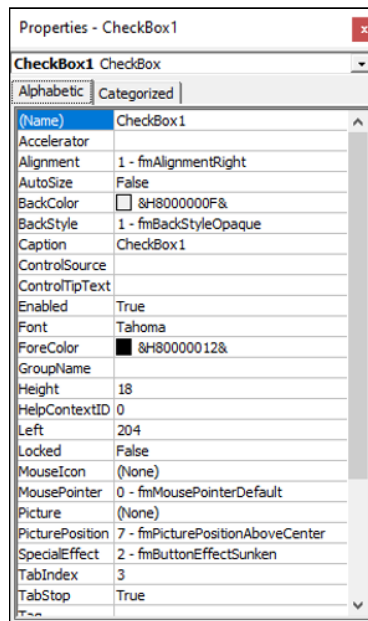


FIGURE 17-2: Use the Properties window to make design-time changes to a control's properties.



REMEMBER

To change a control's properties at runtime, you must write VBA code. For example, you might want to hide a particular control when the user clicks a check box. In such a case, you write code to change the control's Visible property.

Each control has its own set of properties. All controls, however, have some common properties, such as Name, Width, and Height. Table 17-1 lists some of the common properties available for several controls.

TABLE 17-1

Common Control Properties

Property	What It Affects
Accelerator	The letter underlined in the control's caption. The user presses this key in conjunction with the Alt key to select the control.
AutoSize	If True, the control resizes itself automatically based on the text in its caption.
BackColor	The control's background color.
BackStyle	The background style (transparent or opaque).
Caption	The text that appears on the control.
Enabled	If True, the user can interact with the control. Otherwise the control is displayed, but the user is unable to use it.
Left and Top	Values that determine the control's position.
Name	The control's name. By default, a control's name is based on the control type. You can change the name to any valid name, but each control's name must be unique within the dialog box.
Picture	A graphics image to display. The image can be from a graphics file, or you can select the Picture property and paste an image that you copied to the Clipboard.
Value	The control's value.
Visible	If False, the control is hidden.
Width and Height	Values that determine the control's size.

When you select a control, that control's properties appear in the Properties window. To change a property, just select it in the Properties window and make the change. Some properties give you some help. For example, if you need to change the `TextAlign` property, the Properties window displays a drop-down list that contains all valid property values, as shown in Figure 17-3.



TIP

For properties with a drop-down list, you can double-click the property value to cycle through all the possible values.

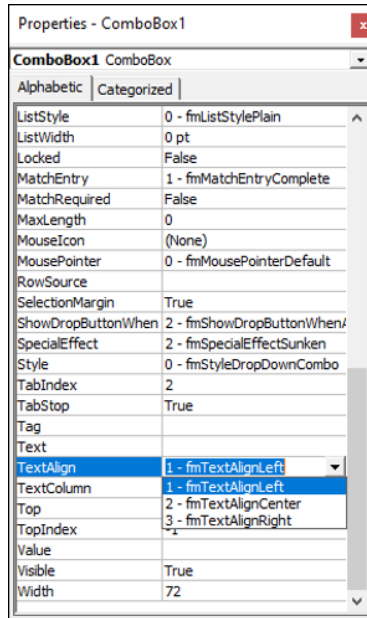


FIGURE 17-3: Change some properties by selecting from a drop-down list of valid property values.

Learning Dialog Box Controls Details

The following sections introduce each type of control you can use in custom dialog boxes and discuss some of the most useful properties. Not every property for every control is included because that would require a book that's about four times as thick (and very boring).



TIP

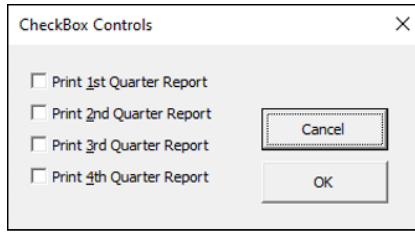
The Help system for controls and properties is thorough. To find complete details for a particular property, select the property in the Properties window and press F1.

All the examples in this section are available on this book's website at <https://www.dummies.com/go/excelvbprogrammingfd6e>.

CheckBox control

A *CheckBox control* is useful for getting a binary choice: yes or no, true or false, on or off, and so on. Figure 17-4 shows some examples of CheckBox controls.

FIGURE 17-4:
CheckBox
Controls in a
UserForm.



Following are a CheckBox control's most useful properties:

- » **Accelerator:** A character that lets the user change the value of the control by using the keyboard. For example, if the accelerator is A, pressing Alt+A changes the value of the CheckBox control (from checked to unchecked, or from unchecked to checked). In the example shown in Figure 17-4, numbers are the accelerators (Alt+1, Alt+2, and so on).
- » **ControlSource:** The address of a worksheet cell that's linked to the check box. The cell displays TRUE if the control is checked and FALSE if the control is not checked. This is optional. Most of the time, a check box is not linked to a cell.
- » **Value:** If True, the check box has a check mark. If False, the check box doesn't have a check mark.



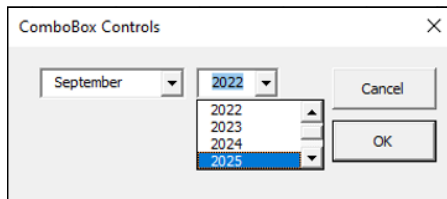
WARNING

Don't confuse CheckBox controls with OptionButton controls. They can look similar, but they're used for different purposes.

ComboBox control

A ComboBox control is a combination of a TextBox control and a ListBox control. It acts like a text box because it allows the user to type directly in the control. It acts like a list box because it allows the user to select from a list. Both text boxes and list boxes are discussed later in this section. Unlike a list box, the list of values the user can select from a combo box are in a drop-down box. Figure 17-5 shows two ComboBox controls. The control on the right (for the year) is being used, so it has dropped down to display its list of options.

FIGURE 17-5:
ComboBox
controls in a
UserForm.



Following are some useful ComboBox control properties:

- » **ControlSource:** A cell that stores the value selected in the combo box.
- » **ListRows:** The number of items to display when the list drops down.
- » **ListStyle:** The appearance of the list items.
- » **RowSource:** A range address that contains the list of items displayed in the combo box.
- » **Style:** Determines whether the control acts like a drop-down list or a combo box. A drop-down list doesn't allow the user to enter a new value.
- » **Value:** The text of the item selected by the user and displayed in the combo box.



If your list of items isn't in a worksheet, you can add items to a ComboBox control by using the AddItem method. More information on this method can be found in Chapter 18.

CommandButton control

A CommandButton control is a common clickable button, which is of no use unless you provide an event-handler procedure to execute when the button is clicked. Figure 17-6 shows a dialog box with nine command buttons. Two of these buttons feature clip-art images, which are added by copying the clip art and then pasting it into the Picture field in the Properties window.

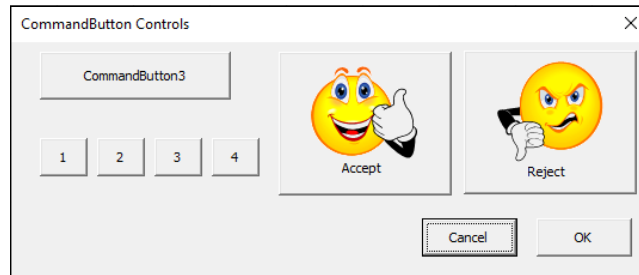


FIGURE 17-6:
CommandButton
controls.

When a command button is clicked, it executes an event-handler procedure with a name that consists of the command button's name, an underscore, and the word Click. For example, if a command button is named MyButton, clicking it executes the macro named MyButton_Click. This macro is stored in the UserForm's module.

Following are two useful `CommandButton` control properties:

- » **Cancel:** If True, pressing Esc executes the macro attached to the button. Only one of the form's buttons can have this option set to True.
- » **Default:** If True, pressing Enter executes the macro attached to the button. Again: Just one button can have this option set to True.

Frame control

A `Frame` control encloses other controls. You use it either for aesthetic purposes or to logically group a set of controls. A frame is particularly useful when the dialog box contains more than one set of `OptionButton` controls (see the section “`OptionButton` control” later in this chapter).

The following list describes some useful `Frame` control properties:

- » **BorderStyle:** The frame's appearance.
- » **Caption:** The text displayed at the top of the frame. The caption can be an empty string if you don't want the control to display a caption.

Image control

An `Image` control displays an image. You might want to use an `Image` control to display your company's logo in a dialog box. Figure 17-7 shows a dialog box with an `Image` control that displays a photo of a cute little kitten.

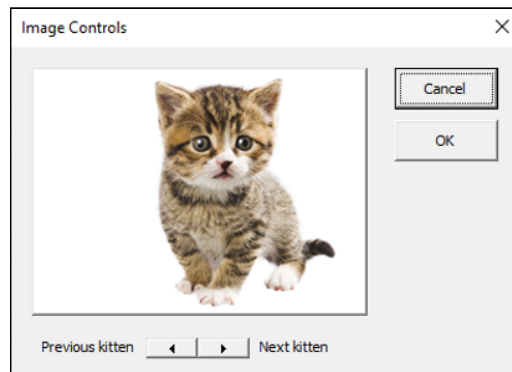


FIGURE 17-7: An `Image` control displays a photo.

The following list describes the most useful Image control properties:

- » **Picture:** The graphics image that is displayed
- » **PictureSizeMode:** How the picture is displayed if the control size doesn't match the image size

When you click the Picture property, you're prompted for a filename. However, the graphics image (after it's retrieved) is stored in the workbook. That way, if you distribute your workbook to someone else, you don't have to include a copy of the graphics file.



TIP

Rather than retrieve the image from a file, you can copy and paste. To search the web for images, activate Excel and choose Insert ⇨ Illustrations ⇨ Pictures ⇨ Online Pictures, and search for an image to place in your worksheet. Insert the image on to a worksheet. Then select the image, and press Ctrl+C to copy it to the Clipboard. Next, activate your UserForm, click the Image control, and select the Picture property in the Properties box. Press Ctrl+V to paste the copied image. You can then delete the image from the worksheet.



WARNING

Some graphics images are very large and can make your workbook size increase dramatically. For the best results, use the smallest image as possible.

Label control

A Label control simply displays text in your dialog box. Figure 17-8 shows a few Label controls. As you can see, you have a great deal of control of the formatting of a Label control.

The Caption property is the star of the show when it comes to Label controls. It holds the text that is displayed in the label. Other properties, like Font and Fore-Color, are useful for changing the control's appearance.

ListBox control

The ListBox control presents a list of items from which the user can choose one or more. Figure 17-9 shows a dialog box with two ListBox controls.

ListBox controls are very flexible. For example, you can specify a worksheet range that holds the list box items, and the range can consist of multiple columns. You can also fill the list box with items by using VBA code.

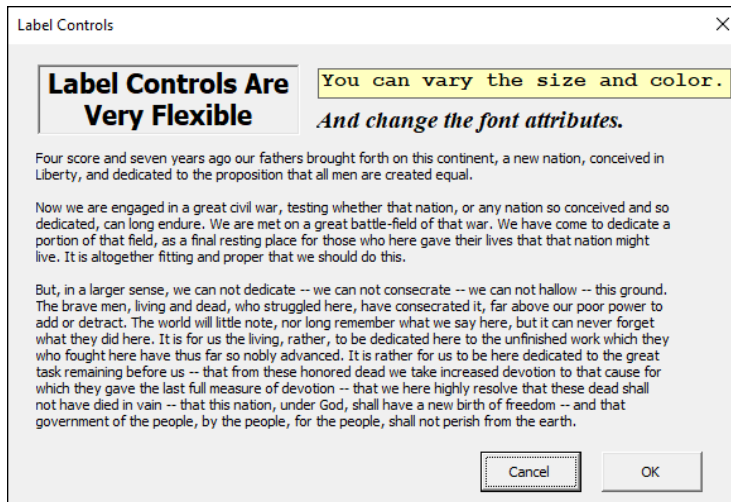


FIGURE 17-8:
Label controls can take on many different looks.

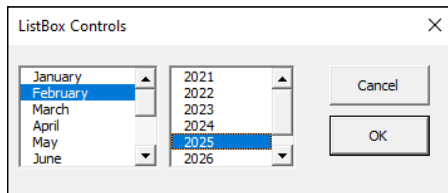


FIGURE 17-9:
ListBox controls.

If a list box isn't tall enough to display all the items in the list, a scrollbar appears so the user can scroll down to see more items.

The following list is a description of the most useful ListBox control properties:

- » **ControlSource:** A cell that stores the value selected in the list box.
- » **IntegralHeight:** This is True if the list box height adjusts automatically to display full lines of text when the list is scrolled vertically. If False, the list box may display partial lines of text when it is scrolled vertically. Note that when this property is True, the actual height of your list box may be slightly different, when your UserForm is shown, from what you had set it originally. In other words, the height may adjust to ensure that the last entry is entirely visible.
- » **ListStyle:** Determines whether an option button is displayed for each list item.

- » **MultiSelect:** Determines whether the user can select multiple items from the list.
- » **RowSource:** A range address that contains the list of items displayed in the list box.
- » **Value:** The text of the selected item in the list box.



REMEMBER

If the list box has its **MultiSelect** property set to 1 or 2, the user can select multiple items in the list box. In such a case, you can't specify a **ControlSource**; you need to write a macro that determines which items are selected. Chapter 18 demonstrates how to do so.

MultiPage control

A **MultiPage** control allows you to create tabbed dialog boxes, like the **Format Cells** dialog box (the one that appears when you press **Ctrl+1** in Excel). Figure 17-10 shows an example of a custom dialog box that uses a **MultiPage** control. This particular control has three pages, or tabs.

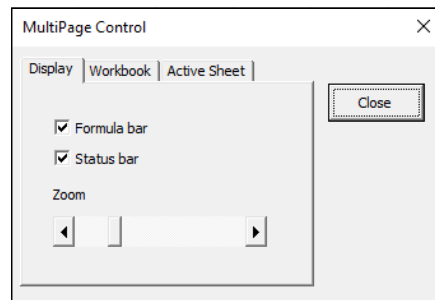


FIGURE 17-10: Use a **MultiPage** control to create a tabbed dialog box.

Descriptions of the most useful **MultiPage** control properties follow:

- » **Style:** Determines the appearance of the control. The tabs can appear normally (on the top), on the left, as buttons, or hidden (no tabs — your VBA code determines which page is displayed).
- » **Value:** Determines which page or tab is displayed. A Value of 0 displays the first page, a Value of 1 displays the second page, and so on.



TIP

By default, a **MultiPage** control has two pages. To add pages, right-click a tab and select **New Page** from the shortcut menu. You add controls to a **MultiPage** control's pages by dragging the control inside the **MultiPage** control's border. Click on the page's tab to switch pages before adding a control to that page.

OptionButton control

OptionButton controls are useful when the user needs to choose from a small number of mutually exclusive items. Option buttons are always used in groups of at least two. Figure 17-11 shows two sets of option buttons, and each set is contained in a frame.

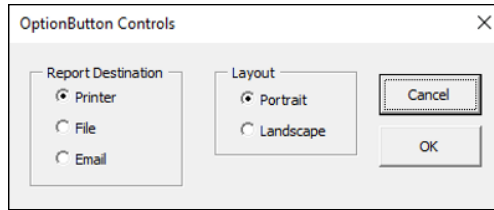


FIGURE 17-11: Two sets of OptionButton controls, each contained in a Frame control.

The following is a description of the most useful OptionButton control properties:

- » **GroupName:** A name that identifies an option button as being associated with other option buttons with the same GroupName property.
- » **ControlSource:** The worksheet cell that's linked to the option button. The cell displays TRUE if the control is selected or FALSE if the control is not selected.
- » **Value:** If True, the option button is selected. If False, the option button is not selected.



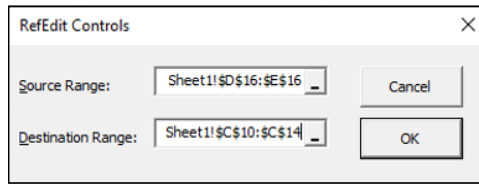
REMEMBER

If your dialog box contains more than one set of option buttons, you *must* change the GroupName property for all option buttons in a particular set. Otherwise, all option buttons become part of the same set. Alternatively, you can enclose each set of option buttons in a Frame control, which automatically groups the option buttons in the frame.

RefEdit control

In some cases, you might need the user to select a range of cells in order to pass a valid range to your VBA code. Your procedures can then use the selected range for some specific task. The RefEdit control is used when you need to let the user select a range in a worksheet. Figure 17-12 shows a UserForm with two RefEdit controls. Its Value property holds the address of the selected range (as a text string).

FIGURE 17-12:
Two RefEdit controls.



WARNING

The RefEdit control sometimes causes trouble in more complex UserForms. For best results, don't place a RefEdit control inside a Frame control or MultiPage control. There are known bugs in VBA that cause RefEdit controls to behave unpredictable when they are inside Frame controls or MultiPage controls.

ScrollBar control

When you add a ScrollBar control, you can make it horizontal or vertical. The ScrollBar control is similar to a SpinButton control (described in the next section). The difference is that the user can drag the scroll bar's scrollbox to change the control's value in larger increments. Another difference is that when you click the up button on a vertical scrollbar, the value decreases — which is a bit counterintuitive. So, a scrollbar is not always a good substitute for a spin button.

Figure 17-13 shows a ScrollBar control with a horizontal orientation. Its Value property is displayed in a Label control placed below the ScrollBar control.

FIGURE 17-13:
A ScrollBar control with a Label control below it.



Following are the most useful properties of a ScrollBar control:

- » **Value:** The control's current value.
- » **Min:** The control's minimum value.
- » **Max:** The control's maximum value.
- » **ControlSource:** The worksheet cell that displays the control's value.

- » **SmallChange:** The amount that the control's value is changed by click an arrow button.
- » **LargeChange:** The amount that the control's value is changed by clicking inside of the scrollbar.

The ScrollBar control is most useful for specifying a value that extends across a wide range of possible values.

SpinButton control

The SpinButton control lets the user select a value by clicking the control, which has two arrows (one to increase the value, and the other to decrease the value). Like a ScrollBar control, a SpinButton control can be oriented either horizontally or vertically. Figure 17-14 shows a dialog box that uses two vertically oriented SpinButton controls. Each control is linked to the Label control on the right (by using VBA procedures).

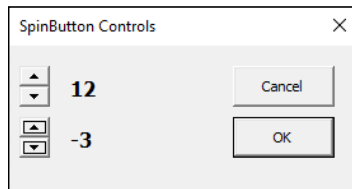


FIGURE 17-14: SpinButton controls.

The following descriptions explain the most useful properties of a SpinButton control:

- » **Value:** The control's current value.
- » **Min:** The control's minimum value.
- » **Max:** The control's maximum value.
- » **ControlSource:** The worksheet cell that displays the control's value.
- » **SmallChange:** The amount that the control's value is changed by a click. Usually, this property is set to 1, but you can make it any value.



WARNING

If you use a ControlSource for a spin button, you should understand that the worksheet is recalculated every time the control's value is changed. Therefore, if the user changes the value from 0 to 12, the worksheet is calculated 12 times. If your worksheet takes a long time to calculate, you might want to avoid using a ControlSource to store the value.

TabStrip control

A TabStrip control is designed to navigate different sets of values using a single page with the same set of controls. This control is rarely used, as the MultiPage control provides a much easier way to achieve the same functionality. You can effectively ignore it and use the MultiPage control instead.

TextBox control

A TextBox control lets the user enter text. Figure 17-15 shows a dialog box with two TextBox controls.

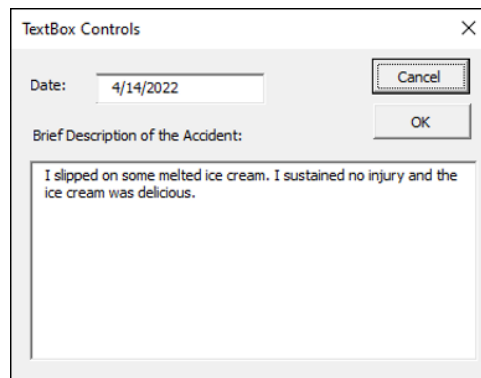


FIGURE 17-15:
TextBox controls.

Following are the most useful TextBox control properties:

- » **AutoSize:** If True, the control adjusts its size automatically, depending on the amount of text.
- » **ControlSource:** The address of a cell that contains the text in the text box.
- » **IntegralHeight:** If True, the text box height adjusts automatically to display full lines of text when the list is scrolled vertically. If False, the text box may display partial lines of text when it is scrolled vertically.
- » **MaxLength:** The maximum number of characters allowed in the text box. If 0, the number of characters is unlimited.
- » **MultiLine:** If True, the text box can display more than one line of text.
- » **TextAlign:** Determines if the text is aligned to the left, right, or center.

- » **WordWrap:** Determines whether text that is too wide for the control wraps to a new line.
- » **ScrollBars:** Determines whether horizontal or vertical scrollbars are displayed.



When you add a `TextBox` control, its `WordWrap` property is set to `True`, and its `MultiLine` property is set to `False`. The net effect? Word wrap doesn't work! So if you want the words to wrap in a `TextBox` control, make sure that you set the `MultiLine` property to `True`.

ToggleButton control

A `ToggleButton` control has two states: on and off. Clicking the button toggles between these two states, and the button changes its appearance when clicked. Its value is either `True` (pressed) or `False` (not pressed). Figure 17-16 shows a dialog box with four `ToggleButton` controls. The top one is pressed.

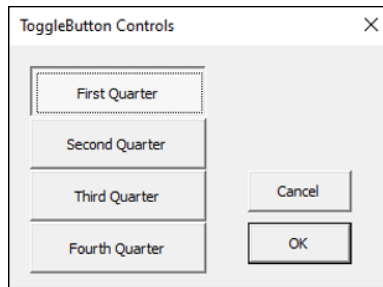


FIGURE 17-16: ToggleButton controls.

In general, use a toggle button when the effects of the change are immediate — that is, when you want to make a change as soon as the toggle button is changed. Use a check box when the user should confirm the change before it takes effect. Typically, the user will check one or more check boxes and click a button to confirm.

Working with Dialog Box Controls

This section offers a few pointers on moving, resizing, and aligning dialog box controls to get your `UserForms` looking just right by aligning your controls and providing consistent spacing between controls.

Moving and resizing controls

After you place a control in a dialog box, you can move and resize it by using standard mouse techniques. For more precise control, use the Properties window to enter a value for the control's Height, Width, Left, or Top property.



TIP

You can select multiple controls by Ctrl-clicking the controls. Or you can click and drag to “lasso” a group of controls. When multiple controls are selected, the Properties window displays only the properties common to all selected controls. You can change those common properties, and the change is made to all controls you select, which is much quicker than doing them one at a time.

A control can hide another control; in other words, you can stack one control on top of another. Unless you have a good reason for doing so, make sure that you don't overlap controls. Properly aligned and spaced controls make the UserForm look more professional and provide a better experience for the user.

Aligning and spacing controls

The Format menu in the VBE window provides several commands to help you precisely align and space the controls in a dialog box. Before you use these commands, select the controls with which you want to work. These commands are fairly self-explanatory.

Figure 17-17 shows a dialog box with several CheckBox controls that are about to be aligned.



TIP

When you select multiple controls, the last selected control appears with white handles rather than the normal black handles. The control with the white handles is the basis for aligning or resizing the other selected controls when you use the Format menu.

Accommodating keyboard users

Many users prefer to navigate through a dialog box by using the keyboard: Pressing Tab or Shift+Tab cycles through the controls, while pressing a hot key instantly activates a particular control.

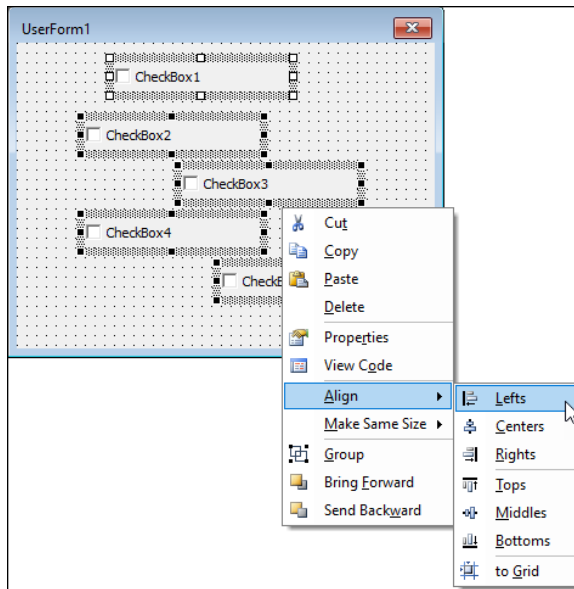


FIGURE 17-17:
Choose Format ⇨
Align to change
the alignment of
UserForm
controls.

To make sure that your dialog box works properly for keyboard users, be mindful of two issues:

- »» Tab order
- »» Accelerator keys

Changing the tab order

The tab order determines the order in which the controls are activated when the user presses Tab or Shift+Tab. It also determines which control has the initial *focus* — that is, which control is the active control when the dialog box first appears. For example, if a user is entering text in a text box, the text box has the focus. If the user clicks an option button, the option button has the focus. The first control in the tab order has the focus when Excel first displays a dialog box.

To set the control tab order, choose View ⇨ Tab Order. You can also right-click the dialog box and choose Tab Order from the shortcut menu. In either case, Excel displays the Tab Order dialog box, shown in Figure 17-18.

The Tab Order dialog box lists all the controls in the UserForm. The tab order in the UserForm corresponds to the order of the items in the list. To change the tab order of a control, select it in the list and then click the Move Up or Move Down button. You can choose more than one control (click while pressing Shift or Ctrl) and move them all at one time.

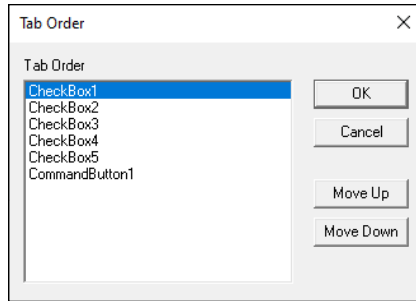


FIGURE 17-18:
The Tab Order dialog box.



TIP

Rather than use the Tab Order dialog box, you can set a control's position in the tab order by using the Properties window. The first control in the tab order has a `TabIndex` property of 0. If you want to remove a control from the tab order, set its `TabStop` property to `False`.



REMEMBER

Some controls (such as `Frame` controls or `MultiPage` controls) act as containers for other controls. The controls inside a container control have their own tab order. To set the tab order for a group of option buttons inside a `Frame` control, select the `Frame` control before you choose the `View <=> Tab Order` command.

Setting hot keys

Normally, you want to assign an accelerator key, or *hot key*, to dialog box controls. You do so by entering a letter for the `Accelerator` property in the Properties window. If a control doesn't have an `Accelerator` property (a text box, for example), you can still allow direct keyboard access to it by using a `Label` control. That is, assign an accelerator key to the label and put the label directly before the text box in the tab order.

Figure 17-19 shows a `UserForm` with three text boxes. The labels that describe the text boxes have accelerator keys, and each label precedes its corresponding text box in the tab order. Pressing `Alt+D`, for example, activates the text box next to the `Department` label.

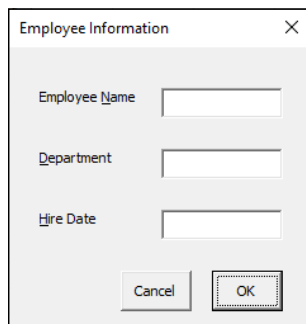


FIGURE 17-19:
Use labels to provide direct access to controls that don't have accelerator keys.

Testing a UserForm

The VBE offers three ways to test a UserForm without calling it from a VBA procedure:

- » Choose Run ⇄ Run Sub/UserForm.
- » Press F5.
- » Click the Run Sub/UserForm button on the Standard toolbar.

When a dialog box is displayed in this test mode, you can try the tab order and the accelerator keys.

Dialog Box Aesthetics

Dialog boxes can look good, bad, or somewhere in between. A good-looking dialog box is easy on the eye, has nicely sized and aligned controls, and its function is perfectly clear to the user. Bad-looking dialog boxes confuse the user, have misaligned controls, and give the impression that the developer didn't have a plan (or a clue).

If you have too many controls on a form, it can be hard for the user to easily understand the purpose of or to navigate the form. Try to limit the number of controls on your form. If you do need several controls — generally more than ten — consider using a MultiPage control to split the task the user has to do into logical (and smaller) steps. You can also group controls into Frame controls. The visual separation of the controls makes it easier for the user to understand the relationships between them, which means you can get away with putting a few more controls on a UserForm than you might otherwise.

A good rule to follow is to try to make your dialog boxes look like the Excel built-in dialog boxes. As you gain more experience with dialog box construction, you can duplicate almost all the features of the Excel dialog boxes.

IN THIS CHAPTER

- » Creating a dialog box: A hands-on example
- » Working with ListBox controls
- » Letting the user select a range from a UserForm
- » Showing a progress indicator for lengthy operations
- » Creating a stay-on-top dialog box
- » Displaying a chart in a UserForm
- » Presenting a handy checklist for creating dialog boxes

Chapter **18**

UserForm Techniques and Tricks

The previous chapters show you how to insert a UserForm (which contains a custom dialog box), add controls to the UserForm, and adjust some of the control's properties. These skills, however, won't do you much good unless you understand how to make use of UserForms and controls in your VBA code. This chapter provides these missing details and presents some useful techniques and tricks in the process.

Using Dialog Boxes

When you use a custom dialog box in your application, you normally write VBA code that does the following:

- » Initializes the UserForm controls. For example, you might write code that sets the default values for the controls.
- » Displays the dialog box by using the UserForm object's Show method.
- » Responds to the events that occur for the various controls — such as clicking a command button.
- » Validates the information provided by the user (if the user didn't cancel the dialog box). This step is not always necessary.
- » Takes some action with the information provided by the user (if the information is valid).
- » Closes the UserForm by using the Unload method.

A UserForm Example

This example demonstrates the six points described in the preceding section. In this example, you use a dialog box to get two pieces of information for a dinner event: a guest's name and their dinner choice. The dialog box uses a TextBox control to get the name, and it uses three option buttons to get the dinner choice (beef, chicken, or fish). The information collected in the dialog box is then sent to the next blank row in a worksheet.

Creating the dialog box

The first step is to design the dialog box. Figure 18-1 shows the finished UserForm for this example. For best results, start with a new workbook with only one worksheet in it. Then follow these steps:

1. **Press Alt+F11 to activate the VBE.**
2. **In the Project window, select the empty workbook and choose Insert ⇨ UserForm.**

An empty UserForm is added to the project.

3. Change the UserForm's properties.

If the Properties window isn't visible, press F4. Change the Name property to UDinnerEvent, and the Caption property to Dinner Event.

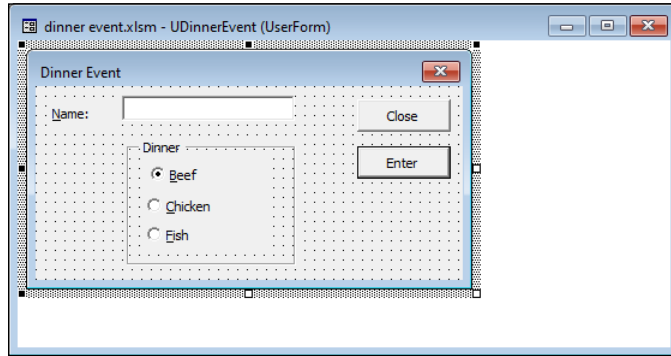


FIGURE 18-1: This dialog box logs dinner choices for guests.

This dialog box has eight controls with properties that were adjusted:

» Label

Property	Value
Accelerator	N
Caption	Name
TabIndex	0

» TextBox

Property	Value
Name	tbxGuest
TabIndex	1

» Frame

Property	Value
Caption	Dinner
TabIndex	2

»» **OptionButton**

Property	Value
Accelerator	B
Caption	Beef
Name	optBeef
Value	True
TabIndex	0

»» **Another OptionButton**

Property	Value
Accelerator	C
Caption	Chicken
Name	optChicken
TabIndex	1

»» **Another OptionButton**

Property	Value
Accelerator	F
Caption	Fish
Name	optFish
TabIndex	2

»» **CommandButton**

Property	Value
Caption	Enter
Default	True
Name	cmdEnter
TabIndex	3

» CommandButton

Property	Value
Caption	Close
Cancel	True
Name	cmdClose
TabIndex	4

If you're following along on your computer (and you should be), take a few minutes to create this UserForm by using the preceding information. Be sure to create the Frame control before adding the option buttons to it.

In some cases, you might find copying an existing control easier than creating a new one. To copy a control, press Ctrl while you drag the control.



TIP

If you prefer to cut to the chase, you can download the example from this book's website at <https://www.dummies.com/go/excelvbaprogrammingfd6e>.

Writing code to display the dialog box

After you add the controls to the UserForm, your next step is to develop some VBA code to display this dialog box:

1. In the VBE window, choose **Insert** ⇨ **Module** to insert a VBA module.
2. Enter the following macro:

```
Sub LogDinnerGuest()  
    UDinnerEvent.Show  
End Sub
```

This short procedure uses the UserForm object's Show method to display the dialog box.

Making the macro available

The next set of steps gives the user an easy way to execute the procedure:

1. **Activate Excel.**
2. **Choose Developer** ⇨ **Controls** ⇨ **Insert**, and click the **Button** icon in the **Form Controls** section.

3. Drag in the worksheet to create the button.

The Assign Macro dialog box appears.

4. Assign the LogDinnerGuest macro to the button.

5. Edit the button's caption so that it reads Create Entry.



TIP

If you want to get really fancy, you can add an icon to your Quick Access toolbar. Then click the icon to run the LogDinnerGuest macro. To set this up, right-click your Quick Access toolbar and choose Customize Quick Access Toolbar, which displays the Quick Access Toolbar tab of the Excel Options dialog box. From the Choose Commands From drop-down menu, select Macros. Then select the LogDinnerGuest macro and click Add. If you like, you can click the Modify button and change the icon. You can also make the Quick Access Toolbar icon visible only when the appropriate workbook is activated. Before you add the macro, use the drop-down control at the top-right of the Excel Options dialog box to specify the workbook name, rather than For All Documents (Default).

Trying out your dialog box

Follow these steps to test your dialog box:

1. Click the Create Entry button on the worksheet, or click the Quick Access Toolbar icon if you set one up.

The dialog box appears, as shown in Figure 18-2.

2. Enter some text in the edit box.

3. Click Enter or Close.

Nothing happens — which is understandable because you haven't created any procedures yet.

4. Click the X button on the dialog box's title bar to dismiss the dialog box.

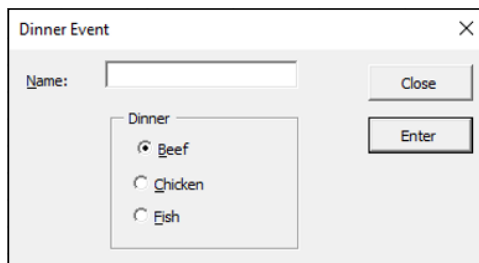


FIGURE 18-2: Executing the LogDinnerGuest procedure displays the dialog box.

Adding event-handler procedures

You'll often want certain procedures to trigger when certain events occur with your dialog boxes. For example, you might want to run a procedure when a dialog box opens. Or maybe you want to force Excel to save the workbook each time the dialog box closes.

This section walks you through an example of writing procedures that handle dialog box events.

Start by following these steps:

- 1. Press Alt+F11 to activate the VBE and then ensure that the UserForm is displayed.**
- 2. Double-click the Close button on the UserForm.**

The VBE activates the Code window for the UserForm and provides an empty procedure named `cmdClose_Click`.

- 3. Modify the procedure as follows:**

```
Private Sub cmdClose_Click()  
    Unload Me  
End Sub
```

This procedure, which is executed when the user clicks the Close button, simply unloads the dialog box from memory.

- 4. Press Shift+F7 to redisplay UserForm1.**
- 5. Double-click the Enter button, and enter the following procedure:**

```
Private Sub cmdEnter_Click()  
    Dim NextRow As Long  
  
    ' Make sure Sheet1 is active  
    Sheets("Sheet1").Activate  
  
    ' Determine the next empty row  
    NextRow = Application.WorksheetFunction. _  
        CountA(Range("A:A")) + 1  
  
    ' Transfer the name  
    Cells(NextRow, 1) = Me.tbxCustomerName.Text  
  
    ' Transfer the choice  
    If Me.optBeef.Value Then Cells(NextRow, 2) = Me.optBeef.Caption  
    If Me.optChicken.Value Then Cells(NextRow, 2) = Me.optChicken.Caption
```

```

If Me.optFish.Value Then Cells(NextRow, 2) = Me.optFish.Caption

' Clear the controls for the next entry
Me.tbxGuest.Text = ""
Me.optBeef.Value = True
Me.tbxGuest.SetFocus
End Sub

```

6. Activate Excel and run the procedure again by clicking the Data Entry button.

The dialog box works just fine. Figure 18-3 shows how this looks in action. While the figure shows column headers in row 1, that step is not necessary.

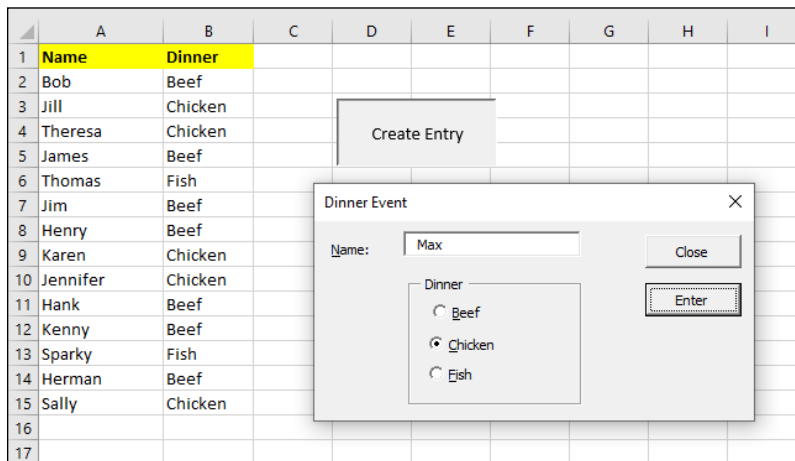


FIGURE 18-3: Use the custom dialog box for data entry.

Here's how the cmdEnter_Click procedure works:

1. The code makes sure that the proper worksheet (Sheet1) is active.
2. It then uses the Excel COUNTA function to count the number of entries in column A and to determine the next blank cell in the column.
3. The procedure transfers the text from the text box to column A.
4. It uses a series of If statements to determine which option button was selected and writes that option button's caption to column B.
5. The dialog box is reset to make it ready for the next entry.

Notice that clicking the Enter button doesn't close the dialog box, as the user will probably want to enter more data. To end data entry, click the Close button.

Validating the data

Play around with this routine some more, and you'll find that the macro has a small problem: It doesn't ensure that the user actually enters a name in the text box. The following code — which is inserted into the `EnterButton_Click` procedure before the text is transferred to the worksheet — ensures that the user enters some text in the text box. If the text box is empty, a message appears, and the routine stops. The dialog box remains open, however, so the user can correct the problem.

```
' Make sure a name is entered
  If Len(Me.tbxGuest.Text) = 0 Then
    MsgBox "You must enter a name."
    Exit Sub
  End If
```

Now the dialog box works

After making these modifications, the dialog box works flawlessly. In real life, you'd probably need to collect more information than just name and a dinner choice. However, the same basic principles apply. You just have to deal with more `UserForm` controls.

One more thing to remember: If the data doesn't begin in row 1 or if the data area contains any blank rows, the counting for the `NextRow` variable will be wrong. The `COUNTA` function is counting the number of cells in column A, and the assumption is that there are no blank cells above the last name in the column. Here's another way of determining the next empty row:

```
NextRow = Cells(Rows.Count, 1).End(xlUp).Row + 1
```

The statement simulates activating the last cell in column A, pressing `End`, pressing the up-arrow key, and then moving down one row. If you do that manually, the cell pointer will be in the next empty cell in column A — even if the data area doesn't begin in row 1 and contains blank rows.

A ListBox Control Example

List boxes are useful controls, but working with them can be a bit tricky. Before displaying a dialog box that uses a list box, you need to fill the list box with items. Then, when the dialog box is closed, you need to determine which item(s) the user selected.



REMEMBER

When dealing with list boxes, you need to know about the following properties and methods:

- » **AddItem:** You use this method to add an item to a list box.
- » **ListCount:** This property returns the number of items in the list box.
- » **ListIndex:** This property returns the index number of the selected item or sets the item that's selected (single selections only). The first item has a ListIndex of 0 (not 1).
- » **MultiSelect:** This property determines whether the user can select more than one item from the list box.
- » **RemoveAllItems:** Use this method to remove all items from a list box.
- » **Selected:** This property returns an array indicating selected items (applicable only when multiple selections are allowed).
- » **Value:** This property returns the selected item in a list box.



TIP

Most of the methods and properties that work with list boxes also work with combo boxes (see Chapter 17 for more on ComboBox controls). So after you've figured out how to handle list boxes, you can transfer that knowledge to your work with combo boxes.

Filling a ListBox Control

To keep things simple, start with an empty workbook. The example in this section assumes the following:

- » You've added a UserForm and named it UMonths.
- » The UserForm contains a ListBox control named lbxMonths.
- » The UserForm has a CommandButton control named cmdOK.
- » The UserForm has a CommandButton control named cmdCancel, which has the following event-handler procedure:

```
Private Sub cmdCancel_Click()  
    Unload Me  
End Sub
```

The following procedure is stored in the Initialize procedure for the UserForm. Follow these steps:

1. Select your UserForm, and press F7 to activate its Code pane.

The VBE displays the Code pane for your UserForm and is ready for you to input the code for the Initialize event.

2. From the Procedure drop-down list at the top of the Code pane, choose Initialize.

3. Add the initialization code for the UserForm:

```
Sub UserForm_Initialize()  
    ' Fill the list box  
    With Me.lbxMonths  
        .AddItem "January"  
        .AddItem "February"  
        .AddItem "March"  
        .AddItem "April"  
        .AddItem "May"  
        .AddItem "June"  
        .AddItem "July"  
        .AddItem "August"  
        .AddItem "September"  
        .AddItem "October"  
        .AddItem "November"  
        .AddItem "December"  
    End With  
  
    ' Select the first list item  
    Me.lbxMonths.ListIndex = 0  
End Sub
```

This initialization routine runs automatically whenever your UserForm is loaded. So when you use the Show method for the UserForm, the code is executed, and your list box is populated with 12 items, each added via the AddItem method.

4. Insert a VBA module, and type this short Sub procedure to display the dialog box:

```
Sub ShowList()  
    UMonths.Show  
End Sub
```

Determining the selected item

The preceding code merely displays a dialog box with a list box filled with month names. What's missing is a procedure to determine which item in the list box is selected.

Double-click the OK button, and add the following cmdOK_Click procedure:

```
Private Sub cmdOK_Click()  
    Dim Msg As String  
    Msg = "You selected item # "  
    Msg = Msg & Me.lbxMonths.ListIndex  
    Msg = Msg & vbCrLf  
    Msg = Msg & Me.lbxMonths.Value  
    MsgBox Msg  
    Unload Me  
End Sub
```

This procedure displays a message box with the selected item number and the selected item.

If no item in the list box is selected, the ListIndex property returns -1 . However, this will never be the case for this particular list box, because code in the User-Form_Initialize procedure selected the first item. It's impossible to unselect an item without selecting another item; there will *always* be a selected item.

Figure 18-4 shows how this looks.

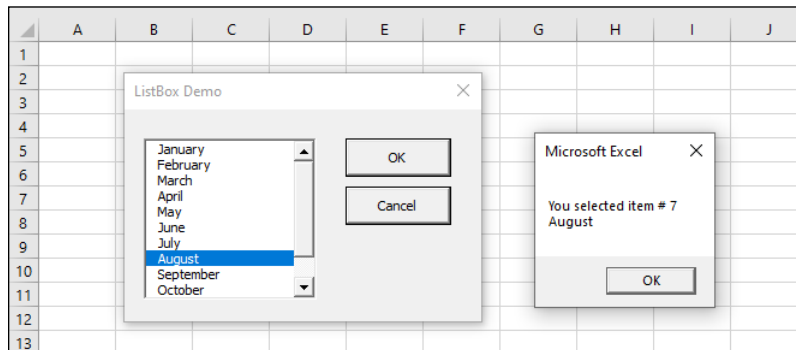


FIGURE 18-4: Determining which item in a list box is selected.



TECHNICAL
STUFF

The first item in a list box has a `ListIndex` of 0, not 1 (as you might expect). This is always the case, even if you use an Option Base 1 statement to change the default lower bound for arrays.

This example is available at this book's website at <https://www.dummies.com/go/excelvbprogrammingfd6e>.

Determining multiple selections

If your list box is set up so that the user can select more than one item, you find that the `ListIndex` property returns only the *last* item selected. To determine all selected items, you need to use the `Selected` property, which contains an array.



REMEMBER

To allow multiple selections in a list box, set the `MultiSelect` property to either 1 or 2. You can do so at design time by using the Properties window or at runtime by using a VBA statement such as this:

```
UMonths.lbxMonths.MultiSelect = 1
```

The `MultiSelect` property has three possible settings. The meaning of each is shown in Table 18-1.

TABLE 18-1

Settings for the MultiSelect Property

Value	VBA Constant	Meaning
0	<code>fmMultiSelectSingle</code>	Only a single item can be selected.
1	<code>fmMultiSelectMulti</code>	Clicking an item or pressing the space bar selects or deselects an item in the list.
2	<code>fmMultiSelectExtended</code>	Items are added to or removed from the selection set by holding down the Shift or Ctrl key as you click items.

The following procedure displays a message box that lists all selected items in a list box. Figure 18-5 shows an example.

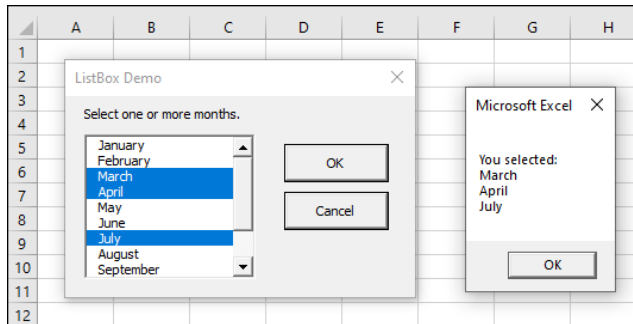
```
Private Sub cmdOK_Click()  
    Dim Msg As String  
    Dim i As Long  
    Dim Counter As Long  
    Msg = "You selected:" & vbNewLine  
    For i = 0 To Me.lbxMonths.ListCount - 1  
        If Me.lbxMonths.Selected(i) Then
```

```

Counter = Counter + 1
Msg = Msg & Me.lbxMonths.List(i) & vbNewLine
End If
Next i
If Counter = 0 Then Msg = Msg & "(nothing)"
MsgBox Msg
Unload Me
End Sub

```

FIGURE 18-5: Determining the selected items in a list box that allows multiple selections.



This routine uses a For-Next loop to cycle through each item in the list box. Notice that the loop starts with item 0 (the first item) and ends with the last item (determined by the value of the ListCount property minus 1). If an item's Selected property is True, it means that the list item was selected. The code also uses a variable (Counter) to keep track of how many items are selected. An If-Then statement modifies the message if nothing is selected.



TIP

This example is available at this book's website at <https://www.dummies.com/go/excelvbprogrammingfd6e>.

Selecting a Range

In some cases, you might want the user to select a range while a dialog box is displayed. An example of this type of range selection occurs in the Create Table dialog box, which is displayed when you choose Insert ⇨ Tables ⇨ Table. The Create Table dialog box has a range selector control that contains Excel's guess regarding the range to be converted — but you can use this control to change the range by selecting cells in the worksheet.

To allow a range selection in your dialog box, add a RefEdit control. The following example displays a dialog box with the current region's range address displayed in a RefEdit control, as shown in Figure 18-6. The current region is the block of nonempty cells that contains the active cell. The user can accept or change this range. When the user clicks OK, the procedure makes the range bold.

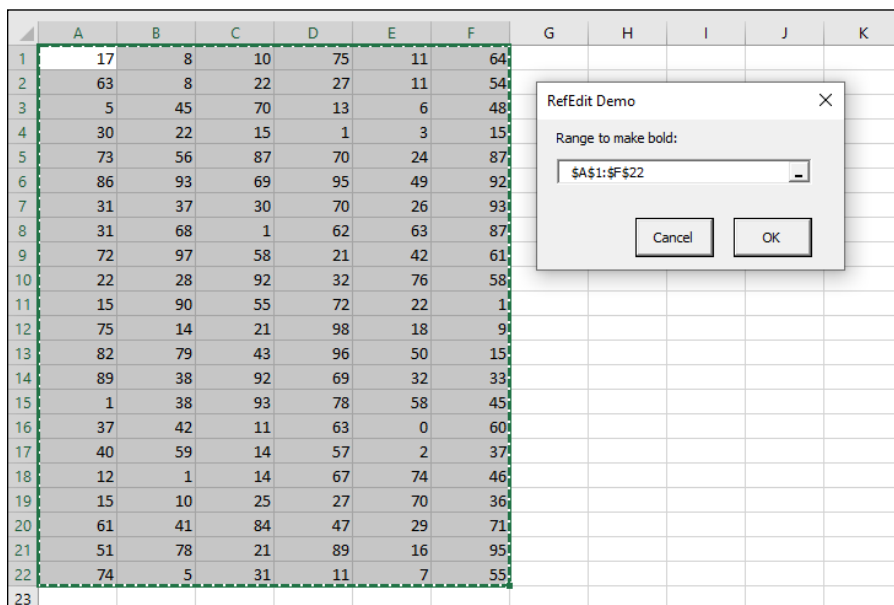


FIGURE 18-6: This dialog box lets the user select a range.

This example assumes the following:

- » You have a UserForm named UBold.
- » The UserForm contains a CommandButton control named cmdOK.
- » The UserForm contains a CommandButton control named cmdCancel.
- » The UserForm contains a RefEdit control named refBold.

The code is stored in a VBA module and shown here. This code does two things: initializes the dialog box by assigning the current region's address to the RefEdit control and displays the UserForm.

```

Sub BoldCells()
' Exit if worksheet is not active
  If TypeName(ActiveSheet) <> "Worksheet" Then Exit Sub

' Select the current region
  ActiveCell.CurrentRegion.Select

' Initialize RefEdit control
  UBold.refBold.Text = Selection.Address

' Show dialog
  UBold.Show
End Sub

```

The following procedure is executed when the OK button is clicked. This procedure does some simple error checking to make sure that the range specified in the RefEdit control is valid.

```

Private Sub cmdOK_Click()
  On Error GoTo BadRange
  Range(Me.refBold.Text).Font.Bold = True
  Unload Me
  Exit Sub
BadRange:
  MsgBox "The specified range is not valid."
End Sub

```

If an error occurs (most likely an invalid range specification in the RefEdit control), the code jumps to the BadRange label, and a message box is displayed. The dialog box remains open so the user can select another range.



TIP

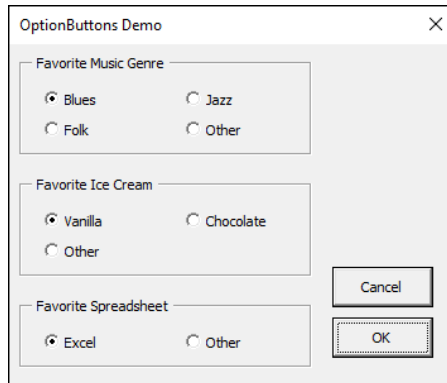
If getting a user selected range is the *only* function performed by your UserForm, you can simplify things by using the Application InputBox method (see Chapter 15).

Using Multiple Sets of Option Buttons

Figure 18-7 shows a custom dialog box with three sets of option buttons. If your UserForm contains more than one set of option buttons, make sure that each set of option buttons works as a group. You can do so in either of two ways:

- » Enclose each set of option buttons in a Frame control. This approach is easier and also makes the dialog box look more organized. It's easier to add the frame before adding the option buttons. You can, however, also drag existing option buttons into a frame.
- » Make sure that each set of option buttons has a unique GroupName property (which you specify in the Properties box). If the option buttons are in a frame, you don't have to be concerned with the GroupName property.

FIGURE 18-7: This dialog box contains three sets of OptionButton controls.



REMEMBER

Only one option button in a group can have a value of True. To specify a default option for a set of option buttons, just set the Value property for the default item to True. You can do this directly in the Properties box or by using VBA code:

```
UOptions.optMusicBlues.Value = True
```



TIP

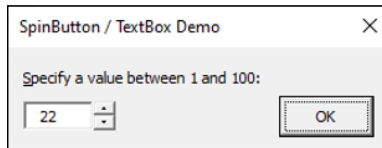
This example is available at this book's website at <https://www.dummies.com/go/excelvbaprogrammingfd6e>. It also has code that displays the selected options when the user clicks OK.

Using a Spin Button and a Text Box

A SpinButton control lets the user specify a number by clicking arrows. This control consists only of arrows (no text), so you usually want a method to display the selected number. One option is to use a Label control, but this has a disadvantage: The user can't type text in a label. A better choice is to use a text box.

A SpinButton control and TextBox control form a natural pair, and Excel uses them frequently. For example, check out Excel's Page Setup dialog box for a few examples. Ideally, the spin button and its text box are always in sync: If the user clicks the spin button, the spin button's value should appear in the text box. And if the user enters a value directly into the text box, the spin button should take on that value. Figure 18-8 shows a custom dialog box with a spin button and a text box.

FIGURE 18-8:
A UserForm with a spin button and a companion text box.



This UserForm contains the following controls:

- » A spin button named SpinButton1, with its Min property set to 1 and its Max property set to 100
- » A text box named TextBox1, positioned to the left of the spin button
- » A command button named cmdOK

The event-handler procedure for the spin button follows. This procedure handles the Change event, which is triggered whenever the spin button value is changed. When the spin button's value changes (when it's clicked), this procedure assigns the spin button's value to the text box. To create this procedure, double-click the spin button to activate the Code pane for the UserForm. Then enter this code:

```
Private Sub SpinButton1_Change()  
    Me.TextBox1.Text = Me.SpinButton1.Value  
End Sub
```

The event-handler for the text box, which is listed next, is a bit more complicated. To create this procedure, double-click the text box to activate the Code pane for the UserForm. This procedure is executed whenever the user changes the text in the text box.

```
Private Sub TextBox1_Change()  
    Dim NewVal As Long  
  
    NewVal = Val(Me.TextBox1.Text)  
    If NewVal >= Me.SpinButton1.Min And _  
        NewVal <= Me.SpinButton1.Max Then _  
        Me.SpinButton1.Value = NewVal  
End Sub
```

This procedure uses a variable, which stores the text in the text box (converted to a value with the Val function). It then checks to ensure that the value is within the proper range. If so, the spin button is set to the value in the text box. The net effect is that the spin button's value is always equal to the value in the text box (assuming that the spin button's value is in the proper range).



TECHNICAL
STUFF

When the line `Me.SpinButton1.Value = NewVal` is executed, the change event of the spin button immediately fires. In turn, the `SpinButton1_Change` event sets the value of `TextBox1`. Because its value is not actually changed by the `SpinButton1_Change` event, luckily, the `TextBox1_Change` event doesn't fire. But you can imagine a scenario where this effect can cause an endless loop of changing controls. Confused? Just remember that if your code changes the Value of a control, the Change event of that control will fire.



TIP

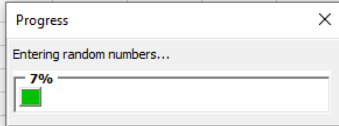
This example is available at this book's website at <https://www.dummies.com/go/excelvbaprogrammingfd6e>. It also has a few other bells and whistles you might find useful.

Using a UserForm as a Progress Indicator

If you have a macro that takes a long time to run, you might want to display a progress meter so people won't think Excel has crashed. You can use a UserForm to create an attractive progress indicator, as shown in Figure 18-9. Such a use of dialog boxes does, however, require a few tricks.

H	I	J	K	L	M	N	O	P
878	360	369	168	732	838	69	921	163
899	390	254	840	981	547	825	250	632
927	230	211	786	945	504	655	909	459
485	376	568	584	200	48	352	79	412
576	878	984	814	315	527	684	22	20
577	671	470	13	1	878	656	281	965
376	151	650	870	495	450	31	135	725
765	4						300	460
81	284						885	156
94	744						594	16
150	407						178	99
560	402						140	210
242	37						685	43
612	129						603	927
722	582						343	341
654	215						134	463
157	842						647	847
541	594						477	268
								660

FIGURE 18-9:
This UserForm
functions as a
progress
indicator for a
lengthy macro.



Creating the progress-indicator dialog box

The first step is to create your UserForm. In this example, the dialog box displays the progress while a macro inserts random numbers into 100 columns and 1,000 rows of the active worksheet. To create the dialog box, follow these steps:

1. **Activate the VBE, and insert a new UserForm named UProgress.**
2. **Change the UserForm's caption to Progress.**
3. **Add a Frame control, and set the following properties:**

Property	Value
Caption	0%
Name	frmProgress
SpecialEffect	2 — fmSpecialEffectSunken
Width	204
Height	28

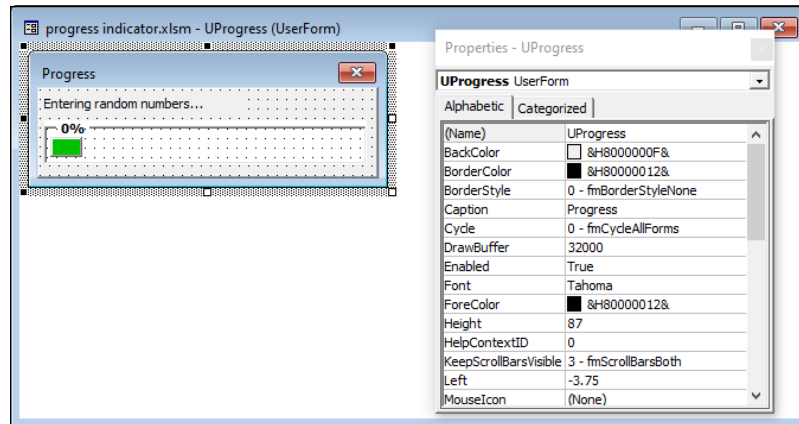
4. **Add a Label control inside the frame, and set the following properties:**

Property	Value
Name	lblProgress
BackColor	&H0000C000& (green)
Caption	(no caption)
SpecialEffect	1 — fmSpecialEffectRaised
Width	20
Height	13
Top	5
Left	2

5. **Add another label above the frame, and change its caption to Entering random numbers. . .**

The UserForm should resemble Figure 18-10.

FIGURE 18-10:
The progress-
indicator
UserForm.



The procedures

This example uses two procedures and two module-level variables:

- » **The module-level variables:** Located in a VBA module, the first variable holds the copy of the UserForm and the second stops the code from running multiple times:

```
Dim ufProgress As UProgress
Dim IsRunning As Boolean
```

- » **EnterRandomNumbers:** This procedure does all the work and is executed when the UserForm is shown. Notice that it calls the UpdateProgress procedure, which updates the progress indicator in the dialog box:

```
Sub EnterRandomNumbers()
' Inserts random numbers on the active worksheet
Dim Counter As Long
Dim RowMax As Long, ColMax As Long
Dim r As Long, c As Long
Dim PctDone As Single

If Not IsRunning Then
    IsRunning = True

    If TypeName(ActiveSheet) = "Worksheet" Then
' Create a copy of the form in a variable
        Set ufProgress = New UProgress

' Show form in modeless state
        ufProgress.Show vbModeless
```

```

Cells.Clear
Counter = 1
RowMax = 1000
ColMax = 100
For r = 1 To RowMax
    For c = 1 To ColMax
        Cells(r, c) = Int(Rnd * 1000)
        Counter = Counter + 1
    Next c
    PctDone = Counter / (RowMax * ColMax)
    UpdateProgress PctDone
Next r
Unload ufProgress
Set ufProgress = Nothing
End If
IsRunning = False
End IfEnd Sub

```

» **UpdateProgress:** This procedure accepts one argument and updates the progress indicator in the dialog box:

```

Sub UpdateProgress(pct)
    With ufProgress
        .frmProgress.Caption = Format(pct, "0%")
        .lblProgress.Width = pct * (.frmProgress _
        .Width - 10)
    End With
    ' The DoEvents statement is responsible for the form updating
    DoEvents
End Sub

```

How this example works

When the `EnterRandomNumbers` procedure is executed, it loads a copy of the `UserForm` into the module variable named `ufProgress`. Then it sets the width of the `lblProgress` label to 0 and displays the `UserForm` in modeless state (so the code will continue to run).

The `EnterRandomNumber` procedure checks the active sheet. If it's not a worksheet, the `UserForm` is closed, and the procedure ends with no action. If the active sheet is a worksheet, the procedure does the following:

1. Erases all cells on the active worksheet.

2. Loops through the rows and columns (specified by the RowMax and ColMax variables) and inserts a random number in each cell.
3. Increments the Counter variable and calculates the percentage completed (which is stored in the PctDone variable).
4. Calls the UpdateProgress procedure, which displays the percentage completed by changing the width of the lblProgress label and updating the caption of the Frame control.
5. Unloads the UserForm.

Using a progress indicator will, of course, make your macro run a bit slower because the code is doing additional work updating the UserForm. If speed is absolutely critical, think twice about using a progress indicator.



REMEMBER

If you adapt this technique for your own use, you need to figure out how to determine the macro's progress, which varies depending on your macro. Then call the UpdateProgress procedure at periodic intervals while your macro is executing.



TIP

This example is available at this book's website at <https://www.dummies.com/go/excelvbaprogrammingfd6e>.

Creating a Modeless Tabbed Dialog Box

Tabbed dialog boxes are useful because they let you present information in small, organized chunks. Excel's Format Cells dialog box (which is displayed when you right-click a cell and choose Format Cells) is a good example. The dialog box in this example uses three tabs to help organize some of Excel's display options.

Creating your own tabbed dialog boxes is relatively easy, thanks to the MultiPage control. Figure 18-11 shows a custom dialog box that uses a MultiPage control with three *pages*, or *tabs*. When the user clicks a tab, a new page is activated, and only the controls on that page are displayed.

Notice that this is a modeless dialog box. In other words, the user can keep it displayed while working. Each of the controls has an immediate effect, so there is no need to have an OK button. Here's the procedure that displays the UserForm so it stays on top:

```
Sub ShowDialog()  
    USettings.Show vbModeless  
End Sub
```

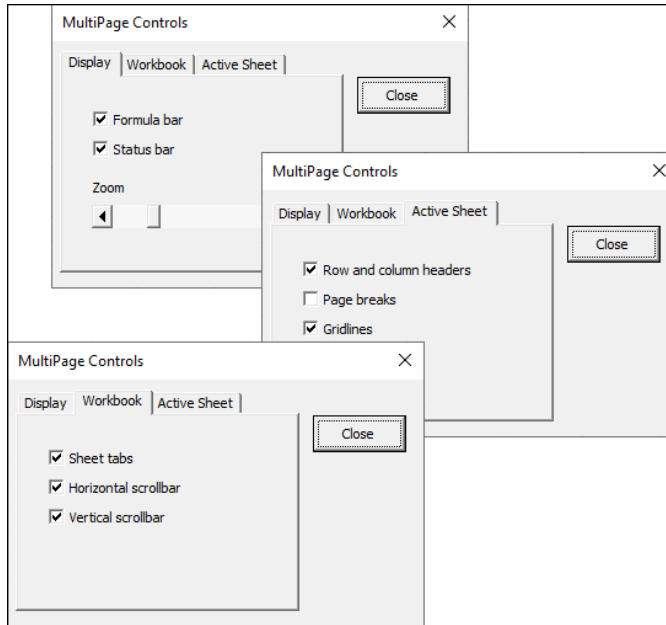


FIGURE 18-11:
The three tabs of
a MultiPage
control.



REMEMBER

Keep the following points in mind when using the MultiPage control to create a tabbed dialog box:

- » Use only one MultiPage control per dialog box. You can have more than one MultiPage control, but it tends to make the UserForm look cluttered and users may find it confusing.
- » To make some controls (such as OK, Cancel, and Close buttons) visible at all times, place these controls outside the MultiPage control.
- » Right-click a tab on the MultiPage control to display a shortcut menu that lets you add, remove, rename, or move a tab.
- » At design time, click a tab to activate the page. After it's activated, add other controls to the page by using normal procedures.
- » To select the MultiPage control itself (rather than a page on the control), click the border of the MultiPage control. Keep your eye on the Properties window, which displays the name and type of the selected control. You can also select the MultiPage control by selecting its name from the drop-down list in the Properties window.
- » You can change the look of the MultiPage control by changing the Style and TabOrientation properties.
- » The Value property of a MultiPage control determines which page is displayed. For example, if you write code to set the Value property to 0, the first page of the MultiPage control is displayed.



This example is available at this book's website at <https://www.dummies.com/go/excelvbaprogrammingfd6e>.

TIP

Displaying a Chart in a UserForm

If you need to display a chart in a UserForm, you find that Excel doesn't provide any direct way to do so. Therefore, you need to get creative. This section describes a technique that allows you to display one or more charts in a UserForm.

Figure 18-12 shows an example that displays three charts. The UserForm has an Image control. The trick is to use VBA code to save the chart as a GIF file and then specify that file as the Image control's Picture property (which loads the image from your disk). The Previous and Next buttons switch the displayed chart.

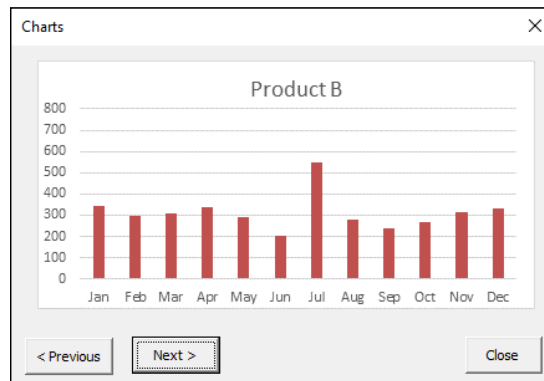


FIGURE 18-12: Displaying a chart in a UserForm.



TIP

In this example, which is also available on this book's website (<https://www.dummies.com/go/excelvbaprogrammingfd6e>), the three charts are on a sheet named Charts. The Previous and Next buttons determine which chart to display, and this chart number is stored as a variable named ChartNum, which is accessible to all procedures in the module. A procedure named UpdateChart, which is listed here, does the actual work.

```
Private Sub UpdateChart()  
    Dim CurrentChart As Chart  
    Dim FName As String  
  
    Set CurrentChart = _  
        Sheets("Charts").ChartObjects(ChartNum).Chart
```

```

CurrentChart.Parent.Width = 300
CurrentChart.Parent.Height = 150

' Save chart as GIF
Fname = ThisWorkbook.Path & "\temp.gif"
CurrentChart.Export FileName:=Fname, FilterName:="GIF"

' Show the chart
Me.imgChart.Picture = LoadPicture(Fname)
End Sub

```

This procedure determines a name for the saved chart, and then uses the `Export` method to export the GIF file. Finally, it uses the VBA `LoadPicture` function to specify the `Picture` property of the `Image` control.

A Dialog Box Checklist

Remember that a dialog box is an important way to communicate with your end user. As you start designing your own user interfaces, run down this checklist to ensure you're building dialog boxes that are both functional and intuitive:

- » Are the controls aligned with one another?
- » Are similar controls the same size?
- » Are the controls evenly spaced?
- » Does the dialog box have an appropriate caption?
- » Is the dialog box overwhelming? If so, you might want to use a series of dialog boxes or divide them over a `MultiPage` control.
- » Can the user access every control with an accelerator key?
- » Are any accelerator keys duplicated?
- » Are the controls grouped logically by function?
- » Is the tab order set correctly? The user should be able to tab through the dialog box and access the controls sequentially.
- » Will your VBA code take appropriate action if the user cancels the dialog box, presses `Esc`, or uses the `Close` button?
- » Does the text contain any misspellings? Unfortunately, the Excel spell checker doesn't work with `UserForms`, so you're on your own when it comes to spelling.

- » Will your dialog box fit on the screen in the lowest resolution to be used (usually, 1024 × 768 mode)? In other words, if you develop your dialog box by using a high-resolution video mode, your dialog box may be too big to fit on a lower-resolution screen.
- » Do all TextBox controls have the appropriate validation code?
- » If you intend to use the WordWrap property, is the MultiLine property also set to True?
- » Do all scroll bars and spin buttons allow valid values only?
- » Do all list boxes have their MultiSelect property set properly?

Start simply and experiment with the controls and their properties. And don't forget about the Help system; it's your best source for details about every control and property.

- » Discovering how to customize the Ribbon
- » Adding icons to the Quick Access toolbar
- » Modifying shortcut menus

Chapter **19**

Accessing Your Macros through the User Interface

The Ribbon is the primary user interface (UI) for Microsoft Office applications — and for that matter, it's the primary UI for Windows File Explorer. Its feature-rich set of controls make it an excellent UI. You can use those same controls to launch your macros.

You might expect to be able to create custom Ribbon commands using VBA. The bad news is that you can't use VBA to modify the Ribbon. The good news is that you're not completely out of luck, as this chapter describes some of the ways to work with Excel's UI.

Customizing the Ribbon

This section describes ways to customize the Ribbon. You can modify the Ribbon manually, but you can't make changes to the Ribbon using VBA. It's sad, but true. For example, if you write an application and you'd like to add a few new buttons

to the Ribbon, you need to program those changes outside Excel, using a tool called *RibbonX*.

Customizing the Ribbon manually

It's very easy to make changes to the Ribbon manually, but you must be using Excel 2010 or later. If you use Excel 2007, you should just skip this section because it doesn't apply to you.

You can customize the Ribbon in these ways:

»» Tabs

- Add a new custom tab.
- Delete custom tabs.
- Add a new group to a tab.
- Change the order of the tabs.
- Change the name of a tab.
- Hide built-in tabs.

»» Groups

- Add new custom groups.
- Add commands to a custom group.
- Remove commands from custom groups.
- Remove groups from a tab.
- Move a group to a different tab.
- Change the order of the groups within a tab.
- Change the name of a group.

That's a fairly comprehensive list of customization options, but there are some actions that you *can't* do (no matter how hard you try):

- »» Remove built-in tabs — but you *can* hide them.
- »» Remove commands from built-in groups.
- »» Change the order of commands in a built-in group.

You make manual changes to the Ribbon in the Customize Ribbon pane of the Excel Options dialog box (see Figure 19–1). The quickest way to display this dialog box is to right-click anywhere in the Ribbon and choose Customize the Ribbon from the shortcut menu.

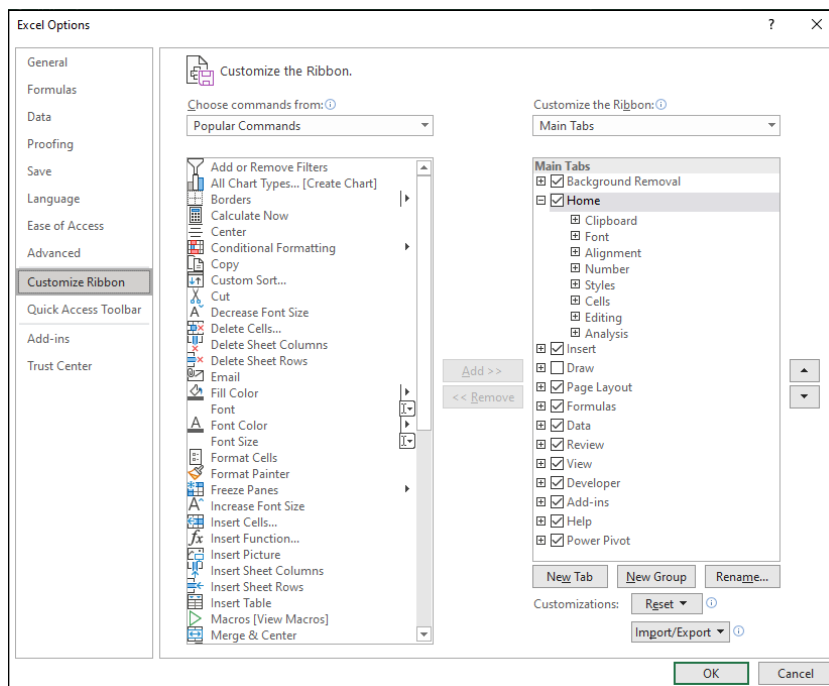


FIGURE 19-1:
The Customize Ribbon tab of the Excel Options dialog box.

The process of customizing the Ribbon is similar to customizing the Quick Access toolbar, which is described later in this chapter. The only difference is that you need to decide where to put the command within the Ribbon. Follow this general procedure:

1. Use the drop-down list on the left (labeled Choose Commands From) to display various groups of commands.
2. Locate the command in the list box on the left and select it.
3. Use the drop-down list on the right (labeled Customize the Ribbon) to choose a group of tabs.

Main tabs refer to the tabs that are always visible; Tool tabs refer to the context tabs that appear when a particular object is selected.

4. In the list box on the right, select the tab and the group where you would like to put the command.

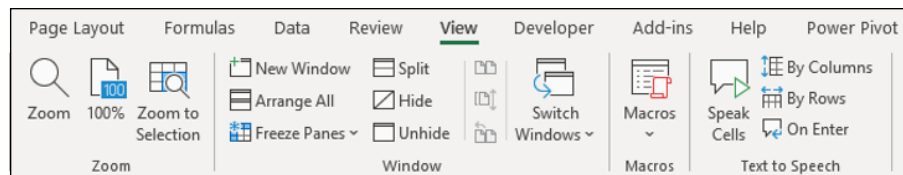
You need to click the plus-sign controls to expand the hierarchical lists.

5. Click the Add button in the middle to add the selected command from the left to the group on the right.

Keep in mind that you can click the New Tab button to create a new tab and the New Group button to create a new group within a tab. New tabs and groups are given generic names, so you probably want to give them more meaningful names. Use the Rename button to rename the selected tab or group. You can also rename built-in tabs and groups or rearrange them using the up and down buttons to the right of the list.

Figure 19-2 shows a custom group, named Text To Speech, that I added to the View tab (to the right of the Macros group). I added four commands to the new group; Speak Cells, By Columns, By Rows, and On Enter.

FIGURE 19-2:
The View tab with
a new group
named Text To
Speech.



REMEMBER

Although you can't remove a built-in tab, you can hide the tab by clearing the check box next to its name on the Customize Ribbon tab.

Adding a macro to the Ribbon

Fortunately, you can also add macros to the Ribbon. Follow the instructions in the previous section, but in Step 1, choose Macros from the drop-down list on the left. All the currently available macros are listed, ready to be added to the Ribbon. You just need to decide on a tab and group for the macro.

If you customize the Ribbon to include a macro, the macro command on the Ribbon is visible even when the workbook that contains the macro is not open. Clicking the command opens the workbook that contains the macro and then executes the macro.



REMEMBER

If you add a button to the Ribbon that executes a macro, that Ribbon modification applies to your copy of Excel only. The Ribbon modifications are not part of the workbook. In other words, if you give your workbook to a colleague, the Ribbon customizations you made won't appear on the colleague's system.

GETTING THE SOFTWARE

If you'd like to follow along with the Ribbon customization example, you need to download a small program called Custom UI Editor for Microsoft Office. This free program greatly simplifies the process of customizing the Ribbon in Microsoft Office applications. Using this software still requires a lot of work, but it's a lot easier than doing it manually.

The download location tends to change, so search the web for "*Custom UI Editor for Microsoft Office*" to find the software. It's a small, free download.

Explaining all the intricate details involved in customizing the Ribbon is well beyond the scope of this book. However, this chapter does walk you through a quick example that demonstrates the steps required to add a new Ribbon group to the Home tab. The new Ribbon group is named Excel VBA For Dummies, and it contains one button, labeled Click Me. Clicking that button runs a VBA macro named ShowMessage.

Customizing the Ribbon with XML

In some situations, you might want to automatically modify the Ribbon when a workbook or add-in is opened. Doing so makes it easy for the user to access your macro. It also eliminates the need for the user to modify the Ribbon manually by using the Excel Options dialog box.

You can make automatic changes to the Ribbon with Excel 2007 and later versions, but it's not a simple task. Modifying the Ribbon involves writing XML code in a text editor, copying that XML file into the workbook file, editing a bunch of XML files that also are stashed away inside the workbook file (which in reality is nothing more than a zipped container of individual files), and then writing VBA procedures to handle the clicking of the controls you put in the XML file.

Fortunately, software is available to assist you with customizing the Ribbon — but you still need to be on familiar terms with XML.



TIP

You can download a sample file from this book's website (<https://www.dummies.com/go/excelvbaprogrammingfd6e>), which contains this customization. If you'd like to create it yourself, follow these steps exactly:

1. **Create a new Excel workbook.**
2. **Save the workbook, and name it `ribbon modification.xlsx`.**
3. **Close the workbook.**

4. Launch the Custom UI Editor for Microsoft Office.

If you don't have this software, you need to find it and install it. Refer to the nearby sidebar "Getting the software."

5. In the Custom UI Editor, choose File ⇨ Open and find the workbook you saved in Step 2.

6. Choose Insert ⇨ Office 2007 Custom UI Part.

Choose this command even if you're using Excel 2010 or a later version.

7. Type the following code in the code panel (named customUI.xml) displayed in the Custom UI Editor (see Figure 19-3):

```
<customUI xmlns='http://schemas.microsoft.com/office/2006/01/customui'>
<ribbon>
<tabs>
<tab idMso='TabHome'>
  <group id='Group1' label='Excel VBA For Dummies'>
    <button id='Button1'
      label='Click Me'
      size='large'
      onAction='ShowMessage'
      imageMso='FileStartWorkflow' />
  </group>
</tab>
</tabs>
</ribbon>
</customUI>
```

8. Click the Validate button on the toolbar.

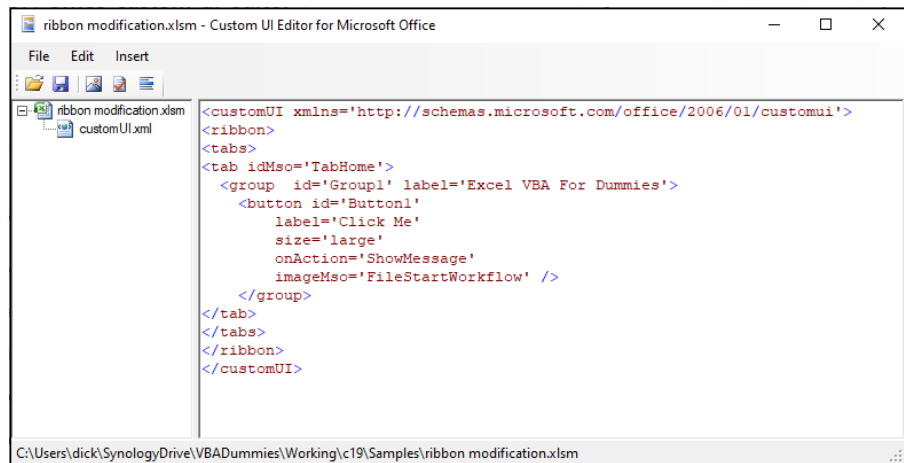
If the code has any syntax errors, you get a message that describes the problem. If any errors are identified, you must correct them.

9. Click the Generate Callback button.

The Custom UI Editor creates a VBA Sub procedure that is executed when the button is clicked (see Figure 19-4). This procedure is not actually inserted into the workbook, so you need to copy it for later use (or memorize it, if you have a good memory).

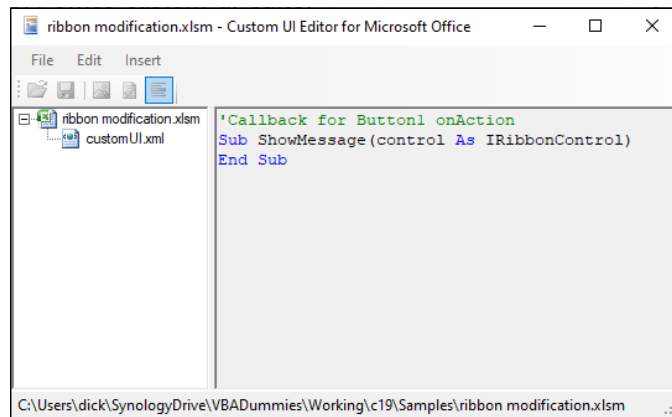
10. Go back to the customUI.xml module and choose File ⇨ Save (or click the Save icon on the toolbar).

FIGURE 19-3:
RibbonX code
displayed in the
Custom UI Editor.



```
<customUI xmlns='http://schemas.microsoft.com/office/2006/01/customui'>
<ribbon>
<tabs>
<tab idMso='TabHome'>
<group id='Group1' label='Excel VBA For Dummies'>
<button id='Button1'
label='Click Me'
size='large'
onAction='ShowMessage'
imageMso='FileStartWorkflow' />
</group>
</tab>
</tabs>
</ribbon>
</customUI>
```

FIGURE 19-4:
The VBA callback
procedure that is
executed by
clicking the
Ribbon button.



```
'Callback for Button1 onAction
Sub ShowMessage(control As IRibbonControl)
End Sub
```

- 11. Close the file by choosing File ⇨ Close.**
- 12. Open the workbook in Excel, and click the Home tab.**

You should see the new Ribbon group and Ribbon button. But it doesn't work yet.
- 13. Press Alt+F11 to activate the VBE.**

14. **Insert a new VBA module; paste (or type) the callback procedure that was generated in Step 9; and add a MsgBox statement, so you'll know whether the procedure is actually being executed.**

The procedure is

```
Sub ShowMessage(control As IRibbonControl)
    MsgBox "Congrats. You found the new Ribbon command."
End Sub
```

15. **Press Alt+F11 to jump back to Excel, and click the new button on the Ribbon.**

If all goes well, you see the MsgBox shown in Figure 19-5.

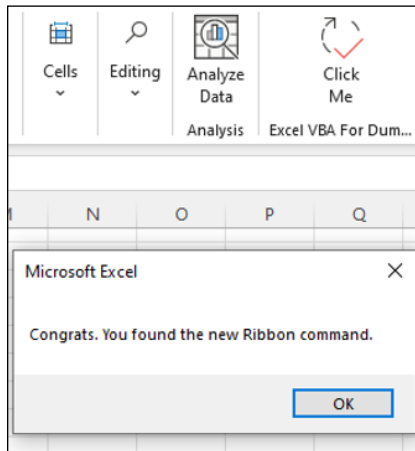


FIGURE 19-5: Proof that adding a new Ribbon command using XML is actually possible.



REMEMBER

In the Custom UI Editor, when you choose Insert ⇄ Office 2007 Custom UI Part, you insert a UI part for Excel 2007. The Custom UI Editor also has an option to insert a UI part for Excel 2010. (Note, this software hasn't been updated for subsequent versions of Office.) For maximum compatibility, use the Excel 2007 Custom UI Part.

When you add XML to modify the Ribbon to a workbook, it only displays when the workbook is open. And if you send the workbook to someone else, the Ribbon change goes with it.

You probably realize that modifying the Ribbon using XML is not exactly intuitive. Even with a good tool to help (such as the Custom UI Editor), you still need to understand XML. If that sounds appealing to you, search the web or find a book devoted exclusively to customizing the Ribbon interface in Microsoft Office. Unfortunately, this book isn't one of them.

ADDING A BUTTON TO THE QUICK ACCESS TOOLBAR

If you create a macro that you use frequently, you might want to add a new button to the Quick Access toolbar. Doing so is easy, but you must do it manually. The Quick Access toolbar is intended to be customized by end users only — not programmers. Here's how to do it:

- 1. Right-click the Quick Access toolbar and select Customize Quick Access Toolbar from the shortcut menu to display the Quick Access toolbar tab of the Excel Options dialog box.**
- 2. From the drop-down list labeled Choose Commands From, select Macros.**
- 3. Select your macro from the list.**
- 4. Click the Add button to add the macro to the Quick Access toolbar list on the right.**
- 5. If you like, click the Modify button to change the icon and (optionally) the display name.**

When you click a macro button on the Quick Access toolbar, the workbook that contains the macro is opened (if it's not already open). And the macro can be executed when any workbook is open.

You'll also find an option to display the Quick Access Toolbar button only when a particular workbook is open. Before you add the macro, use the drop-down control at the top-right of the Excel Options dialog box and specify the workbook name rather than For All Documents (Default).

If you have macros that are useful for many workbooks, storing them in your Personal Macro Workbook is a good idea (see Chapter 6 for more about the Personal Macro Workbook).

Customizing the Excel UI with VBA

If you're not ready to dive into the world of RibbonX, you can still use VBA to make some modifications. Your results using VBA won't be as polished as those you get using RibbonX, but using VBA is easier and still provides quick access to your macros.

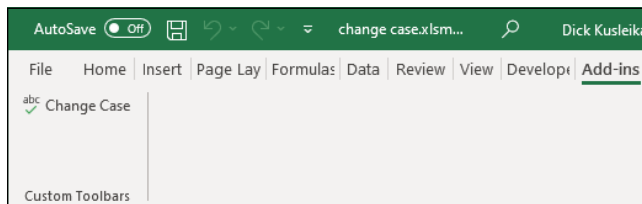
Before Excel 2007, VBA programmers used the `CommandBar` object for creating custom menus, custom toolbars, and custom shortcut (right-click) menus. If you write code to customize a menu or a toolbar, Excel displays your UI changes on a catch-all Ribbon tab named `Add-Ins`.

Adding commands to the Add-ins Ribbon tab

To add a button to the `Add-Ins` Ribbon tab, you need to manipulate two objects: `CommandBar` and `CommandBarButton`. The following code adds a button captioned `Change Case` that you can see in Figure 19-6:

```
Sub AddToAddins()  
    Dim Bar As CommandBar  
    Dim NewControl As CommandBarButton  
    DeleteFromAddin  
    Set Bar = Application.CommandBars.Add("MyBar")  
    Bar.Visible = True  
    Set NewControl = Bar.Controls.Add _  
        (Type:=msoControlButton, _  
         ID:=2, _  
         temporary:=True)  
    With NewControl  
        .Caption = "&Change Case"  
        .OnAction = "ChangeCase"  
        .Style = msoButtonIconAndCaption  
    End With  
End Sub
```

FIGURE 19-6: A control on the `Add-in` tab isn't flashy, but it gets the job done.



TIP

This example is available at this book's website, <https://www.dummies.com/go/excelvbaprogrammingfd6e>. The first thing this procedure does is try to delete a `CommandBar` named `MyBar`. You can't have two custom toolbars with the same name. Next, it creates a custom toolbar named `MyBar` and makes it visible. You have to set the `Visible` property to `True` — it's not `True` by default.

Next, the procedure creates a new control to the custom toolbar. The ID argument can be any number you want; it just can't be the same ID as any other control on the toolbar. The OnAction property is set to the name of the macro you want to run when it's clicked (which must be in a VBA module). The procedure to delete an existing toolbar is as follows:

```
Sub DeleteFromAddin()  
    On Error Resume Next  
    Application.CommandBars("MyBar").Delete  
End Sub
```

Adding a new item to the Cell shortcut menu

In addition to creating a custom toolbar, you can modify an existing toolbar. The only existing toolbars that are visible in Excel are called shortcut menus or *right-click menus* — those menus that appear when you right-click on something. The AddToShortcut procedure adds a new menu item to the Cell shortcut menu. You can adapt it to point to your own macros by changing the Caption and OnAction properties of the object named NewControl.

```
Sub AddToShortCut()  
    Dim Bar As CommandBar  
    Dim NewControl As CommandBarButton  
    DeleteFromShortcut  
    Set Bar = Application.CommandBars("Cell")  
    Set NewControl = Bar.Controls.Add _  
        (Type:=msoControlButton, ID:=1, _  
        temporary:=True)  
    With NewControl  
        .Caption = "&Change Case"  
        .OnAction = "ChangeCase"  
        .Style = msoButtonIconAndCaption  
    End With  
End Sub
```



REMEMBER

When you modify a shortcut menu, that modification remains in effect until you restart Excel. In other words, modified shortcut menus don't reset themselves when you close the workbook containing the VBA code. Therefore, if you write code to modify a shortcut menu, you almost always write code to reverse the effect of your modification.

The DeleteFromShortcut procedure removes the new menu item from the Cell shortcut menu:

```
Sub DeleteFromShortcut()  
    On Error Resume Next  
    Application.CommandBars("Cell").Controls _  
        ("&Change Case").Delete  
End Sub
```

Figure 19-7 shows the new menu item displayed after you right-click a cell.

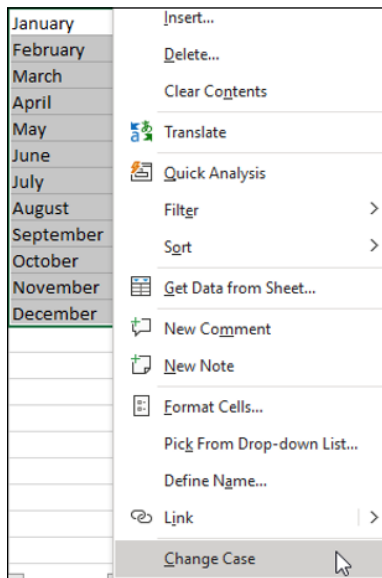


FIGURE 19-7: The Cell shortcut menu showing a custom menu item: Change Case.

You probably noticed a lot of similarities between customizing an existing toolbar and creating a new custom toolbar. Rather than using the Add method of the CommandBar object, the code simply sets the Bar variable to the Cell toolbar. The procedure to delete the customization differs in that the entire custom toolbar is deleted versus just the added control being deleted from the built-in toolbar.

Adding customizations automatically

You need a way to create the custom toolbar or to add the shortcut menu item when the workbook is opened, and to delete it when the workbook is closed. Doing this is easy . . . if you've read Chapter 11. Just add these two event procedures to the ThisWorkbook code module:

```

Private Sub Workbook_Open()
    AddToAddin
    AddToShortCut
End Sub

Private Sub Workbook_BeforeClose(Cancel As Boolean)
    DeleteFromAddin
    DeleteFromShortcut
End Sub

```

The `Workbook_Open` procedure is executed when the workbook is opened, and the `Workbook_BeforeClose` procedure is executed before the workbook is closed. Just what the doctor ordered.

Understanding shortcut menus and the single document interface

Before Excel adopted the single document interface, if your code modified a shortcut menu, that modification was in effect for all workbooks. For example, if you added a new item to the Cell right-click menu, that new item would appear when you right-clicked a cell in *any* workbook (plus other workbooks that you open later on). In other words, shortcut menu modifications were made at the *application* level.

Since the single document interface, changes that you make to shortcut menus only affect the active workbook window. When you execute the code that modifies the shortcut menu, the shortcut menu for windows other than the active window aren't changed. This is a radical departure from how things used to work.

Another twist: If the user opens a workbook (or creates a new workbook) when the active window displays the modified shortcut menu, the new workbook also displays the modified shortcut menu. In other words, new windows display the same shortcut menus as the window that was active when the new windows were opened.

Bottom line: In the past, if you opened a workbook or add-in that modified shortcut menus, you could be assured that the modified shortcut menus would be available in all workbooks. You no longer have that assurance.

5 Putting It All Together

IN THIS PART . . .

Find out why you might want to create custom worksheet functions.

Make your custom functions work just like Excel's built-in functions.

Discover Excel add-ins.

Create simple add-ins.

IN THIS CHAPTER

- » Knowing why custom worksheet functions are so useful
- » Understanding the basics of custom worksheet functions
- » Writing your own functions
- » Exploring functions that use various types of arguments
- » Examining function examples
- » Understanding the Insert Function dialog box

Chapter 20

Creating Worksheet Functions

For many macro mavens, VBA's main attraction is the capability to create custom worksheet functions — functions that look, work, and feel just like those that Microsoft built into Excel. A *custom function* offers the added advantage of working exactly how you want it to (because *you* wrote it). Chapter 5 introduces the concept of custom functions. In this chapter, you take a deeper dive with some real-world examples.

Create Custom Functions to Simplify Your Work

You're undoubtedly familiar with Excel's worksheet functions; even Excel novices know how to use common worksheet functions such as SUM, AVERAGE, and

IF. Excel contains more than 450 predefined worksheet functions. And if that's not enough, you can create functions by using VBA.

With all the functions available in Excel and VBA, you might wonder why you would ever need to create functions. The answer: to simplify your work. With a bit of planning, custom functions are very useful in worksheet formulas and VBA procedures. Often, for example, you can significantly shorten a formula by creating a custom function. After all, shorter formulas are more readable and easier to work with.

WHAT CUSTOM WORKSHEET FUNCTIONS CAN'T DO

As you develop custom functions for use in your worksheet formulas, it's important that you understand a key point. VBA worksheet Function procedures are essentially *passive*. For example, code within a Function procedure cannot manipulate ranges, change formatting, or do many of the other things that are possible with a Sub procedure. An example may help.

It might be useful to create a function that changes the color of text in a cell based on the cell's value. Try as you might, however, you can't write such a function. It always returns an error value.

Just remember this: A function used in a worksheet formula returns a value. It doesn't perform actions with objects.

That said, this rule has a few exceptions. For example, here's a Function procedure that changes the text in a cell comment:

```
Function ChangeComment(cell, NewText)
    cell.Comment.Text = NewText
End Function
```

And here's a formula that uses the function. It works only if cell A1 already has a comment. When the formula is calculated, the comment is changed.

```
=ChangeComment(A1,"I changed the comment!")
```

It's unclear whether this is an oversight or a feature. But it's a rare example of a VBA function that changes something in a worksheet.

Understanding VBA Function Basics

A VBA *function* is a procedure that's stored in a VBA module and returns a value. You can use these functions in other VBA procedures or in your worksheet formulas. Custom functions can't be created with the macro recorder, although the macro recorder can help you identify relevant properties and methods.

A *module* can contain any number of functions. You can use a custom function in a formula just as though it were a built-in function. If the function is defined in a different workbook, however, you must precede the function name with the workbook name. Suppose that you develop a function called `DiscountPrice` (which takes one argument), and the function is stored in a workbook named `pricing.xlsm`.

To use this function in the `pricing.xlsm` workbook, enter a formula such as this:

```
=DiscountPrice(A1)
```

If you want to use this function in a *different* workbook, enter a formula such as this (and make sure the `pricing.xlsm` file is open):

```
=pricing.xlsm!discountprice(A1)
```



TIP

If the custom function is stored in an add-in, you don't need to precede the function name with the workbook name. Chapter 21 provides an overview of add-ins.

Custom functions appear in the Insert Function dialog box, in the User Defined category. Pressing Shift+F3 is one way to display the Insert Function dialog box.

Writing Functions

Remember, a function's name acts like a variable. The final value assigned to the function's name is the value returned by the function. To demonstrate, examine the following function, which returns the user's first name:

```
Function FirstName()  
    Dim FullName As String  
    Dim FirstSpace As Long  
    FullName = Application.UserName  
    FirstSpace = InStr(FullName, " ")  
    If FirstSpace = 0 Then  
        FirstName = FullName
```

```
Else
    FirstName = Left(FullName, FirstSpace - 1)
End If
End Function
```

This function starts by assigning the `UserName` property of the `Application` object to a variable named `FullName`. Next, it uses the VBA `InStr` function to locate the position of the first space in the name. If there is no space, `FirstSpace` is equal to 0, and `FirstName` is equal to the entire name. If `FullName` *does* have a space, the `Left` function extracts the text to the left of the space and assigns it to `FirstName`.

Notice that `FirstName` is the name of the function and is also used as a variable name *in* the function. The final value of `FirstName` is the value that's returned by the function. Several intermediate calculations may be going on in the function, but the function always returns the last value assigned to the function's name.



TIP

All the examples in this chapter are available at this book's website at <https://www.dummies.com/go/excelvbaprogrammingfd6e>.

Working with Function Arguments

To work with functions, you need to understand how to work with arguments. An argument is not a disagreement between variables. Rather, it's information that is passed to the function and then used by the function to do its thing.

The following points apply to the arguments for Excel worksheet functions and custom VBA functions:

- » *Arguments* can be cell references, variables (including arrays), constants, literal values, or expressions.
- » Some functions have no arguments.
- » Some functions have one or more required arguments.
- » Some functions have one or more optional arguments.
- » Some functions have a combination of required and optional arguments.

The examples in this section demonstrate how to work with various types of arguments.

A function with no argument

Some functions don't use any arguments. For example, Excel has a few built-in worksheet functions that don't use arguments. These include RAND, TODAY, and NOW.

Here's an example of a custom function with no arguments. The following function returns the UserName property of the Application object. This name appears in the General tab of the Excel Options dialog box. This simple but useful example shows the only way you can get the user's name to appear in a worksheet cell:

```
Function User()  
' Returns the name of the current user  
  User = Application.UserName  
End Function
```

When you enter the following formula into a worksheet cell, the cell displays the current user's name:

```
=User()
```

As with the Excel built-in functions, you must include a set of empty parentheses when using a function with no arguments. Otherwise, Excel tries to interpret the function as a named range.

A function with one argument

The single-argument function in this section is designed for sales managers who need to calculate the commissions earned by their salespeople. The commission rate depends on the monthly sales volume; those who sell more earn a higher commission rate. The function returns the commission amount based on the monthly sales (which is the function's only argument — a required argument). The calculations in this example are based on Table 20-1.

TABLE 20-1

Commission Rates by Sales

Monthly Sales	Commission Rate
\$0-\$9,999	8.0%
\$10,000-\$19,999	10.5%
\$20,000-\$39,999	12.0%
\$40,000+	14.0%

You can use several approaches to calculate commissions for sales amounts entered into a worksheet. You *could* write a lengthy worksheet formula like this:

```
=IF(AND(A1>=0,A1<=9999.99),A1*0.08,IF(AND(A1>=10000,A1<=19999.99),A1*0.105,IF(AND(A1>=20000,A1<=39999.99),A1*0.12,IF(A1>=40000,A1*0.14,0))))
```

We've all dealt with long formulas and the tedium of matching up parentheses — or worse, trying to figure out why they don't match. Formulas like this are difficult to edit, which makes it easy to introduce errors.

A better approach is to create a table of commission values and look up the rate to compute the commissions:

```
=VLOOKUP(A1,Table,2)*A1
```

Another approach, which doesn't require a table of commissions, is to create a custom function:

```
Function Commission(Sales)
' Calculates sales commissions
Const Tier1 As Double = 0.08
Const Tier2 As Double = 0.105
Const Tier3 As Double = 0.12
Const Tier4 As Double = 0.14
Select Case Sales
    Case 0 To 9999.99: Commission = Sales * Tier1
    Case 10000 To 19999.99: Commission = Sales * Tier2
    Case 20000 To 39999.99: Commission = Sales * Tier3
    Case Is >= 40000: Commission = Sales * Tier4
End Select
Commission = Round(Commission, 2)
End Function
```

Notice that the four commission rates are declared as constants rather than hard-coded in the statements. This makes it very easy to modify the function if the commission rates change.

After you define this function in a VBA module, you can use it in a worksheet formula. Entering the following formula into a cell produces a result of 3,000. The amount of 25,000 qualifies for a commission rate of 12 percent:

```
=Commission(25000)
```

Figure 20-1 shows a worksheet that uses the Commission function in formulas in column C.

	A	B	C	D
1	Name	Sales	Commission	
2	Adams	\$61,983.00	\$8,677.62	
3	Baker	\$3,506.00	\$280.48	
4	Douglas	\$38,973.00	\$4,676.76	
5	Emmett	\$32,092.00	\$3,851.04	
6	Franklin	\$27,354.00	\$3,282.48	
7	Johnson	\$17,833.00	\$1,872.46	
8	Kent	\$41,598.00	\$5,823.72	
9	Mays	\$32,000.00	\$3,840.00	
10	Quincy	\$5,000.00	\$400.00	
11	Randall	\$68,793.00	\$9,631.02	
12	Smith	\$31,093.00	\$3,731.16	
13	Walker	\$24,509.00	\$2,941.08	
14	Zeller	\$41,544.00	\$5,816.16	
15				

FIGURE 20-1:
Using the Commission function in a worksheet.

A function with two arguments

The next example builds on the preceding one. Imagine that the sales manager implements a new policy to reward long-term employees: The total commission paid increases by 1% for every year the salesperson has been with the company.

You can modify the Commission function (defined in the preceding section) so that it takes two arguments, both of which are required arguments. Call this new function Commission2:

```
Function Commission2(Sales, Years)
'   Calculates sales commissions based on years in service
  Const Tier1 As Double = 0.08
  Const Tier2 As Double = 0.105
  Const Tier3 As Double = 0.12
  Const Tier4 As Double = 0.14
  Select Case Sales
    Case 0 To 9999.99: Commission2 = Sales * Tier1
    Case 10000 To 19999.99: Commission2 = Sales * Tier2
    Case 20000 To 39999.99: Commission2 = Sales * Tier3
    Case Is >= 40000: Commission2 = Sales * Tier4
  End Select
  Commission2 = Commission2 + (Commission2 * Years / 100)
  Commission2 = Round(Commission2, 2)
End Function
```

The procedure simply adds the second argument (Years) to the Function statement and includes an additional computation that adjusts the commission before exiting the function. This additional computation multiplies the original commission by the number of years in services, divides by 100, and then adds the result to the original computation.

Here's an example of how you can write a formula by using this function. (It assumes that the sales amount is in cell A1; cell B1 specifies the number of years the salesperson has worked.)

```
=Commission2(A1,B1)
```

Figure 20-2 shows a worksheet that uses the Commission2 function.

	A	B	C	D	E
19	Name	Sales	Years	Commission2	
20	Adams	\$61,983.00	4	\$9,024.72	
21	Baker	\$3,506.00	3	\$288.89	
22	Douglas	\$38,973.00	2	\$4,770.30	
23	Emmett	\$32,092.00	1	\$3,889.55	
24	Franklin	\$27,354.00	8	\$3,545.08	
25	Johnson	\$17,833.00	3	\$1,928.64	
26	Kent	\$41,598.00	2	\$5,940.19	
27	Mays	\$32,000.00	1	\$3,878.40	
28	Quincy	\$5,000.00	1	\$404.00	
29	Randall	\$68,793.00	4	\$10,016.26	
30	Smith	\$31,093.00	2	\$3,805.78	
31	Walker	\$24,509.00	2	\$2,999.90	
32	Zeller	\$41,544.00	3	\$5,990.64	
33					

FIGURE 20-2:
Using the Commission2 function, which takes two arguments.

A function with a range argument

Using a worksheet range as an argument is not at all tricky; Excel takes care of the behind-the-scenes details. Here's a simple function that sums only the odd numbers in a range.

```
Function SumOdd(Values)
    Dim cell As Range
    For Each cell In Values.Cells
        If cell.Value Mod 2 = 1 Then
            SumOdd = SumOdd + cell.Value
        End If
    Next cell
End Function
```


It uses a For Each-Next construct to loop through each cell in the range. It then uses the Mod operator to determine if the number is odd. The Mod operator returns the remainder after you divide by the second number. Any number that has a remainder of 1 after dividing by 2 is odd. If the number is odd, it's added to SumOdd, the function name and return variable.

Figure 20-3 shows an example. The odd numbers are in a larger font so they're easier to identify.

	A	B	C	D	E	F
1						
2		20	41			
3		15				
4		12				
5		7				
6		18				
7		10				
8		8				
9		10				
10		19				
11		8				
12						

FIGURE 20-3:
Using a custom
function to sum
only odd
numbers.

Here's another example of a function that uses a range argument. Assume that you want to calculate the average of the five largest values in a range named Data. Excel doesn't have a function that can do this, so you would probably write a formula:

```
=(LARGE(Data,1)+LARGE(Data,2)+LARGE(Data,3)+  
LARGE(Data,4)+LARGE(Data,5))/5
```

This formula uses Excel's LARGE function, which returns the *n*th largest value in a range. The formula adds the five largest values in the range named Data and then divides the result by 5. The formula works fine, but it's rather unwieldy. And what if you decide that you need to compute the average of the top six values? You would need to rewrite the formula — and make sure that you update all copies of the formula.

Wouldn't this be easier if Excel had a function named TopAvg? Then you could compute the average by using the following (nonexistent) function:

```
=TopAvg(Data,5)
```

This example shows a case in which a custom function can make things much easier for you. The following custom VBA function, named `TopAvg`, returns the average of the N largest values in a range:

```
Function TopAvg(InRange, N)
' Returns the average of the highest N values in InRange
  Dim Sum As Double
  Dim i As Long
  Sum = 0
  For i = 1 To N
    Sum = Sum + WorksheetFunction.Large(InRange, i)
  Next i
  TopAvg = Sum / N
End Function
```

This function takes two arguments: `InRange` (which is a worksheet range) and N (the number of values to average). It starts by initializing the `Sum` variable to 0. It then uses a `For-Next` loop to calculate the sum of the N largest values in the range. Note the Excel `LARGE` function within the loop. Finally, `TopAvg` is assigned the value of the `Sum` divided by N .



TIP

You can use all Excel worksheet functions in your VBA procedures *except* those that have equivalents in VBA. For example, VBA has a `Rnd` function that returns a random number. Therefore, you can't use the Excel `RAND` function in a VBA procedure.

A function with an optional argument

Many Excel built-in worksheet functions use optional arguments. An example is the `LEFT` function, which returns characters from the left side of a string. Its official syntax follows:

```
LEFT(text[,num_chars])
```

The first argument is required, but the second (in square brackets) is optional. If you omit the optional argument, Excel assumes a value of 1. Therefore, the following formulas return the same result:

```
=LEFT(A1,1)
=LEFT(A1)
```

The custom functions you develop in VBA also can have optional arguments. You specify an optional argument by preceding the argument's name with the

keyword `Optional`. The argument's name is then followed by an equal sign and the default value. If the optional argument is missing, the code uses the default value.



REMEMBER

One caveat: If you use optional arguments, they must always come after all required arguments in the argument list.

The following example shows a custom function that uses an optional argument:

```
Function DrawOne(InRange, Optional Recalc = False)
'   Chooses one cell at random from a range

    Randomize
'   Make function volatile if Recalc is 1
    If Recalc Then Application.Volatile True

'   Determine a random cell
    DrawOne = InRange(Int((InRange.Count) * Rnd + 1))
End Function
```

DEBUGGING CUSTOM FUNCTIONS

Debugging a Function procedure can be a bit more challenging than debugging a Sub procedure. If you develop a function for use in worksheet formulas, you find that an error in the Function procedure simply results in an error display in the formula cell (usually, #VALUE!). In other words, you don't receive the normal runtime error message that helps you locate the offending statement.

You can choose among three methods for debugging custom functions:

- Place `MsgBox` functions or `Debug.Print` statements at strategic locations to monitor the value of specific variables. Fortunately, message boxes in Function procedures pop up when you execute the procedure. Make sure that only one formula in the worksheet uses your function. Otherwise, the message boxes appear for each formula that's evaluated — which could get very annoying.
- Test the procedure by calling it from a Sub procedure. Runtime errors normally appear in a pop-up window, and you can either correct the problem (if you know it) or jump right into the debugger.
- Set a breakpoint in the function and then use the Excel debugger to step through the function. You can then access all the usual debugging tools. Refer to Chapter 13 to find out about the debugger.

This function randomly chooses one cell from an input range. If the second argument is 1, the selected value changes whenever the worksheet is recalculated. (The function is made *volatile*.) If the second argument is 0 (or is omitted), the function is not recalculated unless one of the cells in the input range is modified.

The Randomize statement ensures that a different random number “seed” is chosen each time the function executes. Without this statement, the same random numbers are generated each time the workbook is opened.

You can use this function for choosing lottery numbers, selecting a winner from a list of names, and so on.

Introducing Wrapper Functions

This section contains some relatively simple wrapper functions that can be useful in a wide array of tasks. Wrapper functions consist of code that’s wrapped around intrinsic VBA elements. In other words, they allow you to use VBA functions in worksheet formulas.

The earlier section in this chapter, “A function with no argument,” shows an example of a wrapper function:

```
Function User()  
    ' Returns the name of the current user  
    User = Application.UserName  
End Function
```

This function, in essence, lets your formulas access the UserName property of the Application object.

The remainder of this section contains some additional wrapper functions.

The NumberFormat function

This function simply displays the number format for a cell. It can be useful if you need to ensure that a group of cells all have the same number format.

```
Function NumberFormat(Cell)  
    ' Returns the cell's number format  
    NumberFormat = Cell(1).NumberFormat  
End Function
```

Notice the use of `Cell(1)`? If a multi-cell range is used as an argument, only the first cell is used.

You can easily write similar functions that return a cell's text color, background color, font, and so on.

The ExtractElement function

This wrapper function returns a substring from a text string that contains multiple elements, separated by a separator character. For example, this formula returns `cow`, which is the third element in a string that uses a space as a separator. The arguments, of course, could be cell references.

```
=ExtractElement("dog horse cow cat", 3, " ")
```

Here's the code, which is a wrapper for VBA's `Split` function:

```
Function ExtractElement(Txt, n, Sep)
' Returns the nth element of a text string, where the
' elements are separated by a specified separator character
ExtractElement = Split(Application.Trim(Txt), Sep)(n - 1)
End Function
```

Figure 20-4 shows the `ExtractElement` function used in worksheet formulas. Column A contains the text string, Column B contains the element number to be extracted, and Column C contains the delimiter (cells that appear to be blank contain a space character).

	A	B	C	D	E	F
1	123-45-78	2	-	45		
2	abcdefg	3		c		
3	a b c d	3		c		
4	Jennifer Kelley	1		Jennifer		
5	Jennifer Kelley	2		Kelley		
6	Jennifer Kelley	3		#VALUE!		
7	55/98/44/23	3	/	44		
8	1,2,3,4,5,6,7,8,9,10	5	,	5		
9	98--74--872--9823--23	3	--	872		
10						

FIGURE 20-4: Using the `ExtractElement` function to return an element from a string.

The SayIt function

This simple function is a wrapper for the Speak method of the Application.Speech object. It uses a synthesized voice to “speak” the argument.

```
Function SayIt(txt)
    '   Speaks the argument
    Application.Speech.Speak txt, True
End Function
```

Here's an example:

```
=IF(C10>10000,SayIt("Over budget"),"OK")
```

The formula checks cell C10. If the value is greater than 10,000, the function speaks the text: “Over budget.” If the value is less than 10,000, the function displays the text OK (and doesn't say anything).

Use sparingly. If you use this function more than one time, it can be very confusing. Also, remember that this function is evaluated each time the worksheet is calculated, so the voice may get very annoying if you're making many changes. This function is probably more suited for amusement purposes.

The IsLike function

VBA's Like operator is a very flexible way to compare text strings. With the Like operator, you can use wildcards in your comparisons. This function brings that power to your worksheet formulas:

```
Function IsLike(text, pattern)
    '   Returns true if the first argument is like the second
    IsLike = text Like pattern
End Function
```

You can use the following wildcards in the pattern of the Like operator:

- » Question mark (?): A placeholder for a single character of any type.
- » Asterisk (*): A placeholder for zero or more characters of any type.
- » Pound (#): A placeholder for a single character, numeric only.

- » Brackets ([]): A placeholder for a single character that matches a character inside the brackets.
- » Exclamation (!): When used as the first character inside brackets, it's a placeholder for a single character that doesn't match a character inside the brackets.

For example, `=IsLike("guitar","g*")` returns `TRUE` because `guitar` is a word that starts with a `g` followed by zero or more characters. In contrast, `=IsLike("guitar","g[a-e]*")` returns `FALSE` because the second character isn't in the range `a` through `e`. See the Help system for more information on the wildcards and a lot more examples.

Working with Functions That Return an Array

Array formulas are one of Excel's most powerful features. If you're familiar with array formulas, you'll be happy to know that you can create VBA functions that return an array.

Returning an array of month names

A simple example of an array is the `MonthNames` function. It returns a 12-element array of — you guessed it — month names.

```
Function MonthNames()  
    MonthNames = Array("January", "February", "March", _  
        "April", "May", "June", "July", "August", _  
        "September", "October", "November", "December")  
End Function
```

To use the `MonthNames` function in a worksheet, you must enter it as a 12-cell array formula. For example, select range `A2:L2` and enter `=MonthNames()`. Then press `Ctrl+Shift+Enter` to enter the array formula in all 12 selected cells. Figure 20-5 shows the result.

FIGURE 20-5:
Using the `MonthNames` function to return a 12-element array.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1													
2	January	February	March	April	May	June	July	August	September	October	November	December	
3													

If you want the month names to display in a column, select 12 cells in a column and use this array formula. (Don't forget to enter it by pressing Ctrl+Shift+Enter.)

```
=TRANSPOSE(MonthNames())
```

You can also pick out a single month from the array. Here's a formula (not an array formula) that displays the fourth element of the array: April.

```
=INDEX(MonthNames(),4)
```

Returning a sorted list

Suppose that you have a list of names you want to show in sorted order in another range of cells. The latest version of Excel has a SORT worksheet function. But if you're on a previous version, that won't be available to you until you upgrade.

The custom function in this section does just that: It takes a single-column range of cells as its argument and then returns an array of those cells sorted. Figure 20-6 shows how it works. Range A2:A13 contains some names. Range C2:C13 contains this multi-cell array formula. (Remember, you must enter the formula by pressing Ctrl+Shift+Enter.)

```
=Sorted(A2:A13)
```

	A	B	C	D	E
1	Unsorted		Sorted		
2	Keith		Abigail		
3	Frank		Ann		
4	Jackie		Darren		
5	Gomer		Frank		
6	Ann		Gomer		
7	Louise		Jackie		
8	Zola		Keith		
9	Opie		Louise		
10	Ralph		Mary		
11	Mary		Opie		
12	Abigail		Ralph		
13	Darren		Zola		
14					

FIGURE 20-6: Using a custom function to return a sorted range.

Here's the code for the Sorted function:

```
Function Sorted(Rng As Range)
    Dim SortedData() As Variant
    Dim Cell As Range
    Dim Temp As Variant, i As Long, j As Long
    Dim NonEmpty As Long

    ' Transfer data to SortedData
    For Each Cell In Rng
        If Not IsEmpty(Cell) Then
            NonEmpty = NonEmpty + 1
            ReDim Preserve SortedData(1 To NonEmpty)
            SortedData(NonEmpty) = Cell.Value
        End If
    Next Cell

    ' Sort the array
    For i = 1 To NonEmpty
        For j = i + 1 To NonEmpty
            If SortedData(i) > SortedData(j) Then
                Temp = SortedData(j)
                SortedData(j) = SortedData(i)
                SortedData(i) = Temp
            End If
        Next j
    Next i

    ' Transpose the array and return it
    Sorted = Application.Transpose(SortedData)
End Function
```

The Sorted function starts by creating an array named SortedData. This array contains all the nonblank values in the argument range. Next, the SortedData array is sorted, using a bubble-sort algorithm. Because the array is a horizontal array, it must be transposed before it's returned by the function.

The Sorted Function works with a range of any size, as long as it's in a single column or row. If the unsorted data is in a row, your formula needs to use Excel's TRANSPOSE function to display the sorted data horizontally. For example:

```
=TRANSPOSE(Sorted(A16:L16))
```

Using the Insert Function Dialog Box

The Excel Insert Function dialog box is a handy tool that allows you to choose a worksheet function from a list and prompts you for the function's arguments. As noted earlier in this chapter, your custom worksheet functions also appear in the Insert Function dialog box. Custom functions appear in the User Defined category.



TIP

Function procedures defined with the Private keyword don't appear in the Insert Function dialog box. Therefore, if you write a Function procedure that's designed to be used only by other VBA procedures (but not in formulas), you should declare the function as Private.

Displaying the function's description

The Insert Function dialog box displays a description of each built-in function. But as shown in Figure 20-7, a custom function displays the following text as its description: No help available.

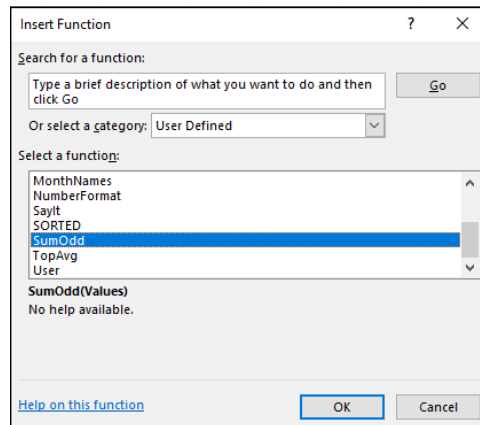


FIGURE 20-7: By default, the Insert Function dialog box doesn't provide a description for custom functions.

To display a meaningful description of your custom function in the Insert Function dialog box, perform a few additional (nonintuitive) steps:

1. **Activate a worksheet in the workbook that contains the custom function.**
2. **Choose Developer ⇨ Code ⇨ Macros (or press Alt+F8).**

The Macro dialog box appears.

3. In the Macro Name field, type the function's name.

Note that the function doesn't appear in the list of macros; you must type the name.

4. Click the Options button.

The Macro Options dialog box appears.

5. In the Description field, type a description of the function.

6. Click OK.

7. Click Cancel.

Now the Insert Function dialog box displays the description of your function (see Figure 20-8).

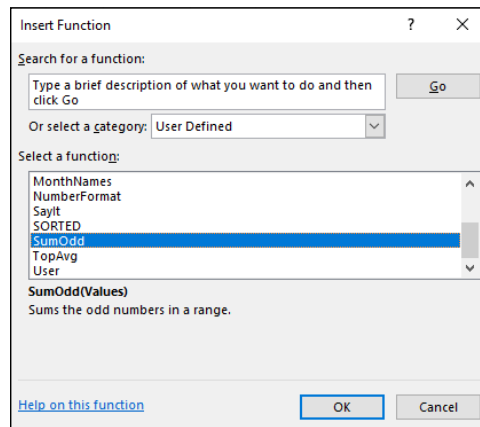


FIGURE 20-8:
The custom function now displays a description.



TIP

Custom functions, by default, are listed in the User Defined category. To add a function to a different category, you need to use VBA. This statement, when executed, adds the TopAvg function to the Math & Trig category (which is category 3):

```
Application.MacroOptions Macro:="TopAvg", Category:=3
```

Check the Help system for other category numbers. See Chapter 4 for how to access the Help system.



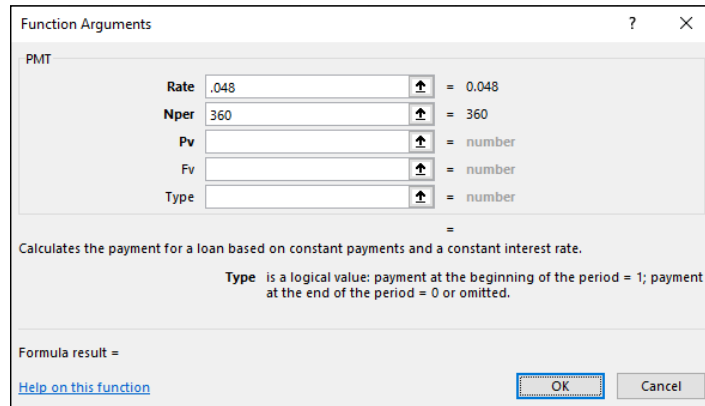
REMEMBER

You need to execute this statement only one time. After you execute it (and save the workbook), the category number is permanently assigned to the function.

Adding argument descriptions

When you access a built-in function from the Insert Function dialog box, the Function Arguments dialog box displays descriptions of the arguments (see Figure 20-9).

FIGURE 20-9: By default, the Function Arguments dialog box displays argument descriptions for built-in functions only.



In the past, it was not possible to add argument descriptions. But beginning with Excel 2010, Microsoft finally implemented this feature. You provide argument descriptions by using the MacroOptions method. Here's an example that adds descriptions for the arguments used by the TopAvg function:

```
Sub AddArgumentDescriptions()  
    Application.MacroOptions Macro:="TopAvg", _  
        ArgumentDescriptions:= _  
        Array("Range that contains the values", _  
            "Number of values to average")  
End Sub
```

You need to execute this procedure only one time. After you execute it, the argument descriptions are stored in the workbook and are associated with the function.

Notice that the argument descriptions appear as arguments for the Array function. You must use the Array function even if you're assigning a description for a function that has only one argument.

This chapter provides lots of information about creating custom worksheet functions. Use these examples as models when you create functions for your own work. As usual, the online help provides additional details. Turn to Chapter 21 if you want to find out how to make your custom functions more accessible by storing them in an add-in.

- » Using add-ins: What a concept!
- » Knowing why you might want to create your own add-ins
- » Creating custom add-ins
- » Reviewing an add-in example

Chapter **21**

Creating Excel Add-Ins

One of the slickest features of Excel is the capability to create add-ins. Excel add-ins make it possible for you to package up your VBA procedures, and make them part of the Excel user interface. Best of all, you can share these packages with others so that they gain the benefit of your VBA prowess.

In this chapter, you explore how to create add-ins by using only the tools built into Excel.

Add-Ins Defined

An Excel add-in is a normal macro-enabled workbook file with the following differences:

- » The `IsAddin` property of the `Workbook` object is `True`.
- » The workbook window is hidden and can't be unhidden by choosing `View` ⇨ `Window` ⇨ `Unhide`.
- » The workbook isn't a member of the `Workbooks` collection. Rather, it's in the `AddIns` collection.



TIP

Excel ships with several add-ins, including the Analysis ToolPak and Solver. You can also get Excel add-ins from third-party suppliers or as shareware.

You can convert any workbook file to an add-in, but not all workbooks are good candidates. Because add-ins are always hidden, you can't display worksheets or chart sheets contained in an add-in. However, you can access an add-in's VBA Sub and Function procedures and display dialog boxes contained on UserForms.



REMEMBER

Excel add-ins have an XLAM file extension, not the typical XLSM extension for macro-enabled workbooks.

Reasons to Create Add-Ins

You might decide to convert your Excel application to an add-in for any of the following reasons:

- » **Keep your code separate from your data.** When you distribute VBA to other people, it's a good practice to keep all your code in an add-in, all your data in some other file like an XLSX workbook or a text file, and all your templates in separate XLST files. That way if you need to update your code or a template, you won't destroy the user's data.
- » **Make it more difficult to access your code.** When you distribute an application as an add-in (and you protect its VBA project), casual users can't view the sheets in the workbook. If you use proprietary techniques in your VBA code, you can make it more difficult for others to copy the code. Excel's protection features aren't perfect, though, and password-cracking utilities are available.
- » **Avoid confusion.** If a user loads your application as an add-in, the file is invisible and therefore less likely to confuse novice users or get in the way. Unlike a hidden workbook, the contents of an add-in can't be revealed.
- » **Simplify access to worksheet functions.** Custom worksheet functions that you store in an add-in don't require the workbook name qualifier. For example, if you store a custom function named MOVAVG in a workbook named NEWFUNC.XLSM, you must use syntax like the following to use this function in a different workbook:

```
=NEWFUNC.XLSM!MOVAVG(A1:A50)
```

But if this function is stored in an add-in file that's open, you can use much simpler syntax because you don't need to include the file reference:

```
=MOVAVG(A1:A50)
```

- » **Provide easier access for users.** After you identify the location of your add-in, it appears in the Add-Ins dialog box, with a friendly name and a description of what it does. The user can easily enable or disable your add-in.

- » **Gain better control over loading.** Add-ins can be opened automatically when Excel starts, regardless of the directory in which they're stored.
- » **Avoid displaying prompts when unloading.** When an add-in is closed, the user never sees the dialog box prompt asking whether to save changes in the file.

Working with Add-Ins

You load and unload add-ins by using the Add-Ins dialog box. To display this dialog box, choose File ⇨ Options ⇨ Add-Ins. Then select Excel Add-Ins from the drop-down list at the bottom of this dialog box and click Go. Or take the fast track and choose Developer ⇨ Add-Ins ⇨ Excel Add-Ins. But the easiest method is to just press Alt+TI (the old Excel 2003 keyboard shortcut).

Any of these methods displays the Add-Ins dialog box, shown in Figure 21-1. The list box contains the names of all add-ins that Excel knows about. In this list, check marks identify any currently open add-ins. You can open and close add-ins from the Add-Ins dialog box by selecting or deselecting the check boxes.

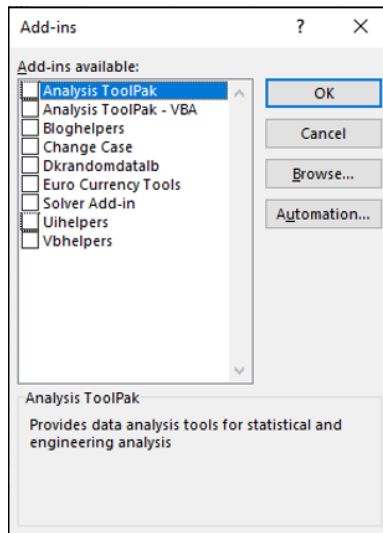


FIGURE 21-1:
The Add-Ins dialog box lists all the add-ins known to Excel.

To add a new add-in to the list, click Browse and then locate the XLAM file.



WARNING

You can also open most add-in files (as though they were workbook files) by choosing File ⇨ Open ⇨ Browse. An add-in opened in this manner doesn't appear in the Add-Ins dialog box. In addition, if you open the add-in by choosing the Open command, you can't close it by choosing File ⇨ Close. You can remove the add-in only by exiting and restarting Excel or by writing a macro to close the add-in.

When you open an add-in, you may or may not notice anything different. In many cases, however, the Ribbon changes in some way; Excel displays a new tab or one or more new groups on an existing tab. For example, opening the Analysis Tool-Pak add-in gives you a new item on the Data tab: Analysis ⇨ Data Analysis. If the add-in contains only custom worksheet functions, the new functions appear in the Insert Function dialog box, and you see no change in Excel's user interface.

Understanding Add-In Basics

Although you can convert any workbook to an add-in, not all workbooks benefit from this conversion. A workbook with no macros makes a useless add-in. In fact, the only types of workbooks that benefit from being converted to an add-in are those with macros. For example, a workbook that consists of general-purpose macros (Sub and Function procedures) makes an ideal add-in.

Creating an add-in isn't difficult, but it does require a bit of extra work. Follow these steps to create an add-in from a normal workbook file:

1. Develop your application, and make sure that everything works properly.

Don't forget to include a method for executing the macro or macros. You might want to define a shortcut key or customize the user interface in some way (see Chapter 19). If the add-in consists only of functions, there's no need to include a method to execute them because they appear in the Insert Function dialog box.

2. Test the application by executing it when a *different* workbook is active.

Doing so simulates the application's behavior when it's used as an add-in because an add-in is never the active workbook.

3. Activate the VBE and select the workbook in the Project window; choose Tools ⇨ *VBAProject Properties* and click the Protection tab; select the Lock Project for Viewing check box and enter a password (twice); then click OK.

This step is necessary only if you want to prevent others from viewing or modifying your macros or UserForms.

- 4. Back in Excel, choose File → Info, and select Show All Properties at the bottom of the right panel.**

Excel expands the list of properties displayed.
- 5. Enter a brief descriptive title in the Title field and a longer description in the Comments field.**

Steps 4 and 5 aren't required but make the add-in easier to use, because the descriptions you enter appear in the Add-Ins dialog box when your add-in is selected.
- 6. Still in Backstage, click Save As in the left pane.**
- 7. Click Browse on the Save As screen. In the Save As dialog box, select Excel Add-in (*.xlam) from the Save as Type drop-down list.**
- 8. Specify the folder that will store the add-in.**

Excel proposes its default add-ins folder (named AddIns), but you can save the file in any folder you like.
- 9. Click Save.**

A copy of your workbook is converted to an add-in and saved with an XLAM extension. Your original workbook remains open.

Looking at an Add-In Example

This section discusses the basic steps involved in creating a useful add-in. The example is based on the Change Case text conversion utility described in Chapter 16.



TIP

The XLSM version of this example is available at this book's website (<https://www.dummies.com/go/excelvbaprogrammingfd6e>). You can create an add-in from this workbook.

Setting up the workbook

The workbook consists of one blank worksheet, a VBA module, and a UserForm. Chapter 19 shows how to implement code that adds a new item to the Cell shortcut menu.

The original version of the utility includes options for uppercase, lowercase, and proper case. The add-in version includes two options to the UserForm so it has the same options as the built-in tool in Microsoft Word:

- » **Sentence Case:** Makes the first letter uppercase and all other letters lowercase.
- » **Toggle Case:** All uppercase characters are converted to lowercase, and vice versa.

Figure 21-2 shows UserForm1. The five OptionButton controls are inside a Frame control. In addition, the UserForm has a Cancel button (named CancelButton) and an OK button (named OKButton).

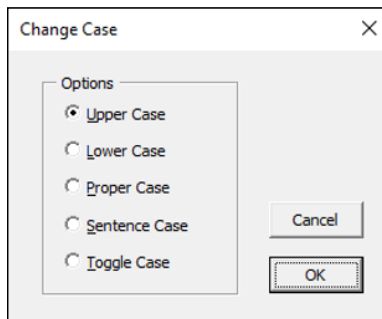


FIGURE 21-2:
The UserForm for
the Change Case
add-in.

The code executed when the Cancel button is clicked is very simple. This procedure unloads the UserForm with no action:

```
Private Sub cmdCancel_Click()  
    Unload Me  
End Sub
```

The code that's executed when the OK button is clicked follows. This code does all the work:

```
Sub cmdOK_Click()  
    Dim TextCells As Range  
    Dim cell As Range  
    Dim Text As String  
    Dim i As Long  
  
    ' Create an object with just text constants  
    On Error Resume Next
```

```

Set TextCells = Selection.SpecialCells(xlConstants, _
    xlTextValues)

' Turn off screen updating
Application.ScreenUpdating = False

' Loop through the cells
For Each cell In TextCells.Cells
    Text = cell.Value
    Select Case True
        Case OptLower.Value 'lowercase
            cell.Value = LCase(cell.Value)
        Case OptUpper.Value 'UPPERCASE
            cell.Value = UCase(cell.Value)
        Case OptProper.Value 'Proper Case
            cell.Value = StrConv(cell.Value, vbProperCase)
        Case OptSentence.Value 'Sentence case
            Text = UCase(Left(cell.Value, 1))
            Text = Text & LCase(Mid(cell.Value, 2, Len(cell.Value)))
            cell.Value = Text
        Case OptToggle.Value 'tOGGLE CASE
            For i = 1 To Len(Text)
                If Mid(Text, i, 1) Like "[A-Z]" Then
                    Mid(Text, i, 1) = LCase(Mid(Text, i, 1))
                Else
                    Mid(Text, i, 1) = UCase(Mid(Text, i, 1))
                End If
            Next i
            cell.Value = Text
    End Select
Next cell

Unload Me
End Sub

```

In addition to the two new options, this version of the Change Case utility differs from the version in Chapter 16 in two other ways:

- » The SpecialCells method creates an object variable that consists of the cells in the selection that contain a text constant (not a formula). This technique makes the routine run a bit faster if the selection contains many formula cells. See Chapter 14 for more information on this technique.

» The AddToShortcut subroutine in the new workbook adds the Change Case menu item to the Cell, Row, and Column shortcut menus so you can now execute the utility by right-clicking a range selection, a complete row selection, or a complete column selection. Each of these actions displays the Change Case item on the shortcut menu.

Testing the workbook

Test the add-in before converting this workbook. To simulate what happens when the workbook is an add-in, you should test the workbook when a different workbook is active. Because an add-in is never the active sheet or workbook, testing it when a different workbook is open may help you identify some potential errors.

1. Open a new workbook and enter information in some cells.

For testing purposes, enter various types of information, including text, values, and formulas. Or just open an existing workbook and use it for your tests. Remember that any changes to the workbook cannot be undone, so you may want to use a copy.

2. Select one or more cells (or entire rows and columns).

3. Execute the ChangeCase macro by choosing the new Change Case command from your Cell (or Row or Column) shortcut menu.



REMEMBER

If the Change Case command doesn't appear on your shortcut menu, there are two likely reasons. First, you might not have enabled macros when you opened the change case.xlsm workbook. Close the workbook and then reopen it — then make sure that you enable macros. Second, when you use shortcut menus as your user interface, only workbooks opened after the workbook that modifies the shortcut menu will show that change. Once your code is in an add-in, it will open when Excel starts so that won't be an issue.

Adding descriptive information

Although not required, it's considered to be a best practice to enter a description of your add-in. Follow these steps to add a description:

1. Activate the change case.xlsm workbook.

2. Choose File ⇨ Info, and click Show All Properties at the bottom right.

Excel expands the Properties list.

3. Enter a title for the add-in in the Title field.

This text appears in the list of add-ins in the Add-Ins dialog box. For this example, enter **Change Case**.

4. In the Comments field, enter a description.

This information appears at the bottom of the Add-Ins dialog box when the add-in is selected. For this example, enter **Changes the case of text in selected cells**. Access this utility by using the shortcut menu.

Figure 21-3 shows the Properties section with the Title and Comments fields filled out.

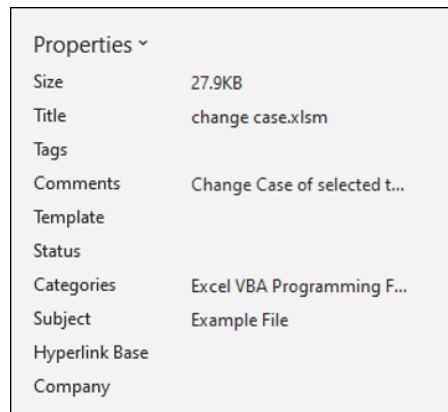


FIGURE 21-3: Use the Properties section to enter descriptive information about your add-in.

Protecting the VBA code

If you want to add a password to prevent others from viewing the VBA code, follow these steps:

1. **Activate the VBE, and select the change case.xlsm workbook in the Project window.**
2. **Choose Tools ⇨ VBAProject Properties, and click the Protection tab on the dialog box that appears.**
3. **Select the Lock Project for Viewing check box, and enter a password (twice).**
4. **Click OK.**
5. **Save the workbook by choosing File ⇨ Save in the VBE or by going back to the Excel window and choosing File ⇨ Save.**

Creating the add-in

At this point, you've tested the change case.xlsm file, and it's working correctly. The next step is creating the add-in. Follow these steps:

- 1. If needed, reactivate Excel.**
- 2. Activate the change case.xlsm workbook, and choose File ⇨ Save As ⇨ Browse.**
- 3. From the Save as Type drop-down menu, choose Excel Add-In (*.xlam).**
- 4. Specify the location, and click Save.**

Excel displays its Save As dialog box.

A new add-in file (with an .xlam extension) is created, and the original XLSM version remains open.

Opening the add-in

To avoid confusion, close the XLSM workbook before opening the add-in that you created from that workbook.

Open the add-in by following these steps:

- 1. Choose Developer ⇨ Add-Ins ⇨ Excel Add-Ins (or press Alt+TI).**
- 2. Click the Browse button.**
- 3. Locate and select the add-in you just created.**
- 4. Click OK to close the Browse dialog box.**
- 5. Make sure that your new add-in is selected in the Add-Ins dialog box.**
- 6. Click OK to close the dialog box.**

Excel displays the Add-Ins dialog box.

After you find your new add-in, the Add-Ins dialog box lists the add-in. As shown in Figure 21-4, the Add-Ins dialog box also displays the descriptive information you provided in the Document Properties panel.

Excel opens the add-in. Now you can use it with all your workbooks. As long as it remains selected in the Add-Ins dialog box, the add-in opens every time you start Excel.

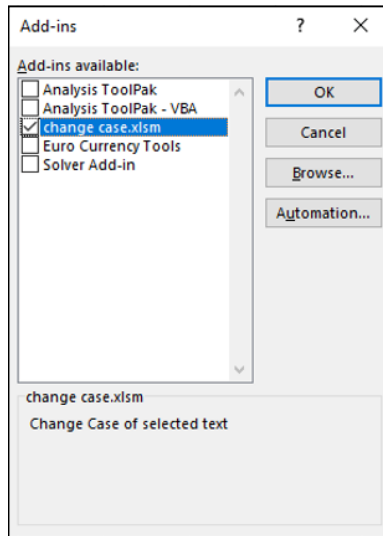


FIGURE 21-4:
The Add-Ins dialog box has the new add-in selected.

Distributing the add-in

If you're in a generous mood, you can distribute this add-in to other Excel users simply by giving them a copy of the XLAM file. (They don't need the XLSM version.) When they open the add-in, the new Change Case command appears on the shortcut menu when they select a range, one or more rows, or one or more columns. If you lock the VBA project with a password, others cannot view your macro code unless they know the password.

Modifying the add-in

An add-in can be edited just like any other workbook. You can edit the XLAM file directly (you don't need to work with the original XLSM version) by following these steps:

1. **Open your XLAM file, if it's not already open.**
2. **Activate the VBE.**
3. **Double-click the project's name in the Project window.**
If you protected the code, you're prompted for the password.
4. **Enter your password, and click OK.**
5. **Make your changes to the code.**
6. **Save the file by choosing File ⇨ Save.**



TIP

If you create an add-in that stores information in a worksheet, you must set the workbook's `IsAddIn` property to `False` to view the workbook. You do this in the Properties window when the `ThisWorkbook` object is selected (see Figure 21-5). After you've made your changes to the workbook, make sure that you set the `IsAddIn` property back to `True` before you save the file.

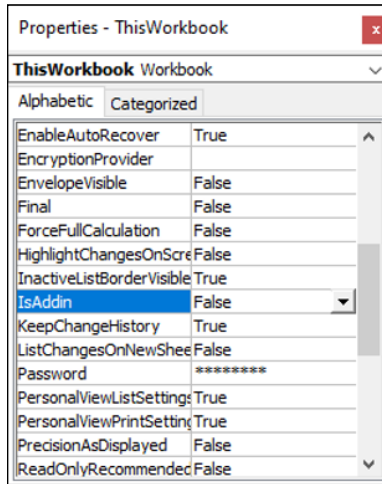


FIGURE 21-5:
Making an add-in
not an add-in.

6

The Part of Tens

IN THIS PART . . .

Discover tips on using the VBE.

Expand your knowledge with Excel resources.

Find out what you should and shouldn't do in Excel VBA.

IN THIS CHAPTER

- » Applying block comments
- » Copying multiple lines of code at once
- » Jumping between modules and procedures
- » Teleporting to your functions
- » Staying in the right procedure
- » Stepping through your code
- » Stepping to a specific line in your code
- » Stopping your code at a predefined point
- » Seeing the beginning and end of variable values
- » Turning off auto syntax check

Chapter **22**

Ten Handy Visual Basic Editor Tips

If you're going to be spending time working the Visual Basic Editor, you should take advantage of a few of the built-in tools that can make your job easier. Whether you're a fresh-faced analyst new to programming, or a jaded veteran living on Mountain Dew and sunflower seeds, these tips can greatly improve your macro programming experience.

Applying Block Comments

Placing a single apostrophe in front of any statement effectively tells Excel to skip that statement. This is called *commenting out code*. You can use the single apostrophe to also create comments or notes in your code (see Figure 22-1).

```
'first char must be letter or underscore
Do Until LCase(Left$(sReturn, 1)) Like sLETTERS Or
    sReturn = Mid$(sReturn, 2, Len(sReturn))
Loop

'no spaces
sReturn = Replace(sReturn, Space(1), "")

'no slashes
sReturn = Replace(sReturn, "/", sUNDERSCORE)

'max 255 chars
sReturn = Left$(sReturn, 1MAXLEN)

'not a cell ref
On Error Resume Next
    Set rTest = Range(sReturn)
On Error GoTo 0
```

FIGURE 22-1:
A single apostrophe in front of any line turns that line into a comment.

It's sometimes beneficial to comment out multiple lines of code. This way, you can test certain lines of code while telling Excel to ignore the commented lines. For example, you might have code that manipulates some data and writes it to a text file. If you want to test the data manipulation part without creating the text file, you have to comment out that part of the code.

Instead of spending time commenting out one line at a time, you can use the Edit toolbar to comment out whole blocks of code.

You can activate the Edit toolbar by choosing View ⇄ Toolbars ⇄ Edit.

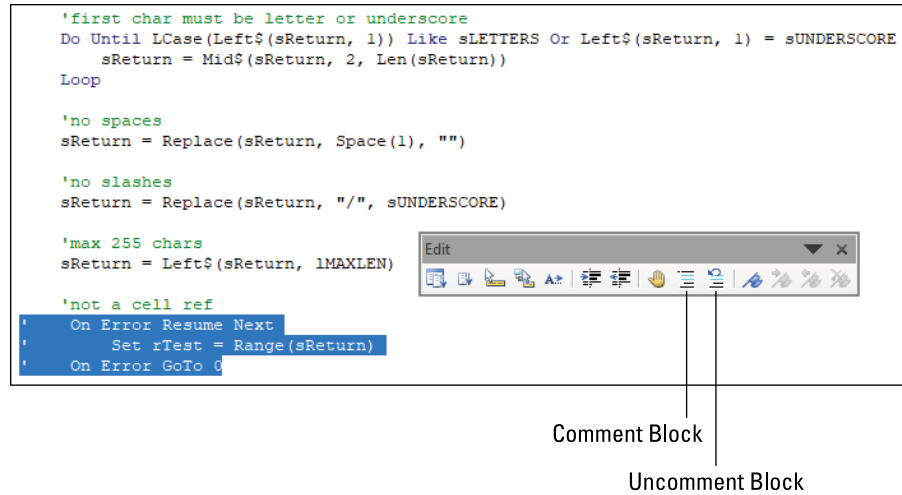
Select the lines of code you want commented out and then click the Comment Block icon on the Edit toolbar (see Figure 22-2).



TIP

You can ensure the Edit toolbar is always visible by dragging it up to the VBE menu bar. It anchors itself to the location you choose.

FIGURE 22-2:
The Edit toolbar allows you to select entire blocks of code and apply comments to all the lines at once.

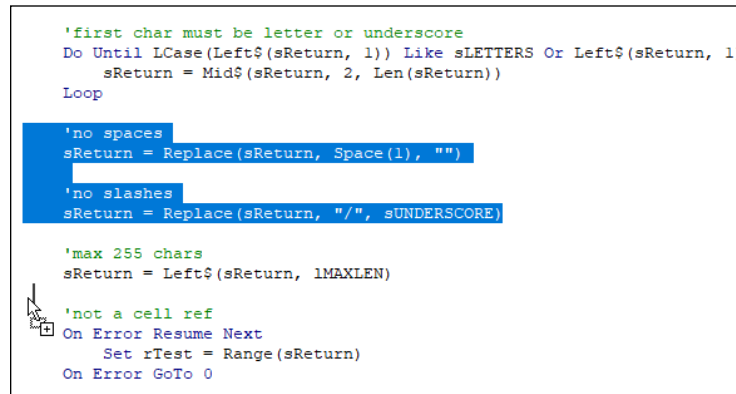


Copying Multiple Lines of Code at Once

You can copy entire blocks of code by highlighting the lines you need and then holding down the Ctrl key on your keyboard while dragging the block where you need it. This is an old Windows trick that works even when you drag across modules.

You know you're dragging a copy when your mouse pointer shows a plus symbol next to it, as shown in Figure 22-3.

FIGURE 22-3:
Holding down the Ctrl key while dragging code creates a copy of that code.



Jumping between Modules and Procedures

After your cache of macro code starts to grow, it can be a pain to quickly move between modules and procedures. You can ease the pain by using a few shortcuts:

- » Press Ctrl+Tab to quickly move between modules.
- » Press Ctrl+Page Up and Ctrl+Page Down to move between procedures within a module.
- » Press Ctrl+R to select the current module in the Project Explorer and use the arrow keys to move to another module.

Teleporting to Your Functions

When reviewing a macro, you might sometimes encounter a variable or function name that's obviously pointing to some other piece of code. Instead of scouring through all the modules to find where that function or variable name comes from, you can simply place your cursor on that function/variable name, right-click, and choose Definition (or press Shift+F2).

As Figure 22-4 shows, you're instantly teleported to the origin of that function or variable name.

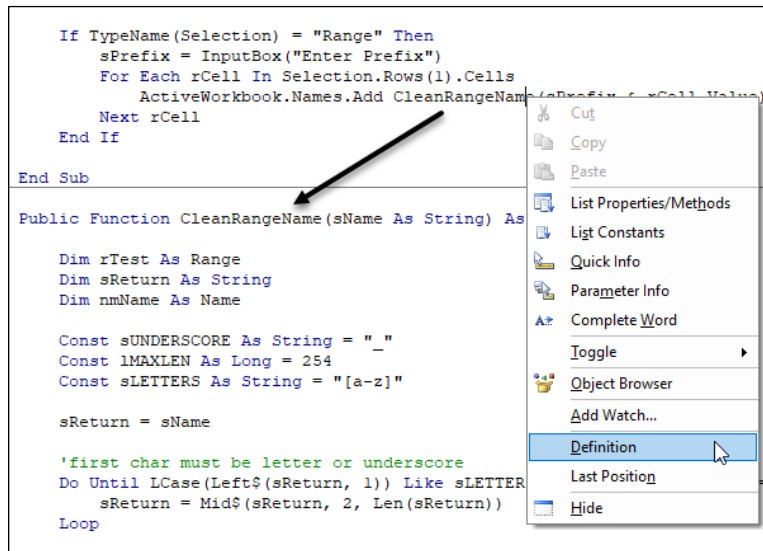


FIGURE 22-4: Pressing Shift+F2 with your cursor on a function or variable name takes you to it.

Right-click and choose Last Position (or press Ctrl+Shift+F2) to go back to where you started.

Staying in the Right Procedure

When your modules contain multiple procedures, you may find it less distracting to only work with one procedure at a time. The VBE provides two modes in which to work, the Procedure View mode and the Full Module View mode.

In Full Module View mode, all the procedures in the module are displayed in the code pane and you scroll through the code pane to find the procedure you want. In Procedure View mode, the code pane displays only one procedure at a time (as shown in Figure 22-5). To switch procedures in this Procedure View mode, you can use the drop-down lists at the top of the code pane or Ctrl+PgUp and Ctrl+PgDown. Use the two buttons at the bottom-left of the code pane to switch modes.

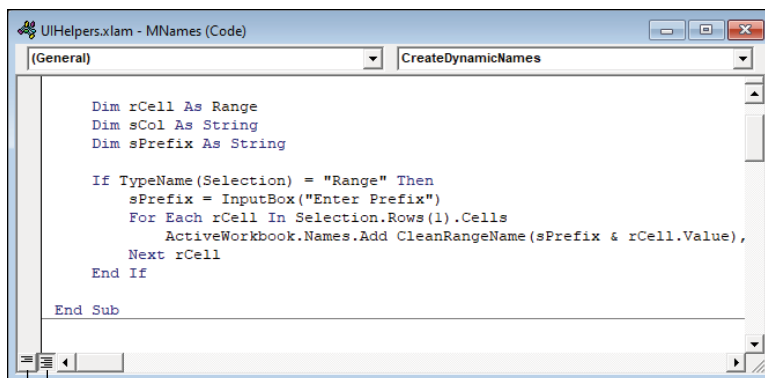


FIGURE 22-5:

Click the Procedure View button to show only the active procedure.

Show all procedures

Show only one procedure

Stepping through Your Code

VBA offers several tools to help you “debug” your code. In programming, *debugging* means finding and correcting errors in code.

One of the more useful debugging tools is the ability to step through your code one line at a time. When you step through code, you’re literally watching as each line executes.

To step through your code, place your cursor anywhere within your macro and press F8. Your macro goes into debug mode.

The first line of code is highlighted and a small arrow appears in the Code window's left margin (see Figure 22-6). Press F8 again to execute the highlighted line of code and move to the next line. You can keep pressing F8 to watch each line be executed until the end of the macro.

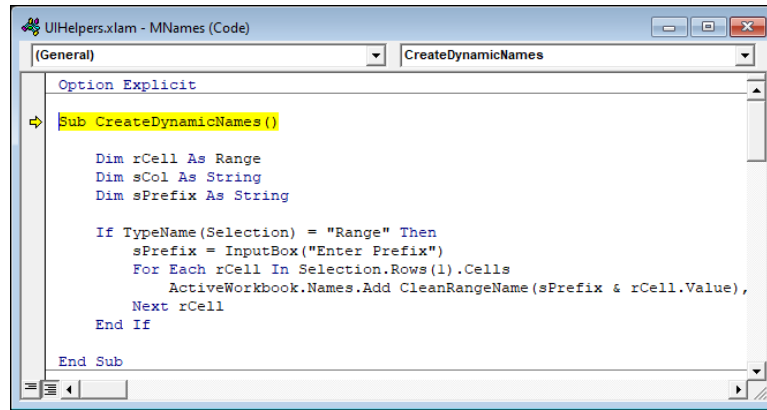


FIGURE 22-6: Press F8 key to step through each line of your macro at your own pace.

As a bonus, while stepping through the code, you can hover over any string or numeric variable to see the current value of that variable.

To get out of debug mode, choose Debug ⇄ Step Out.



TIP

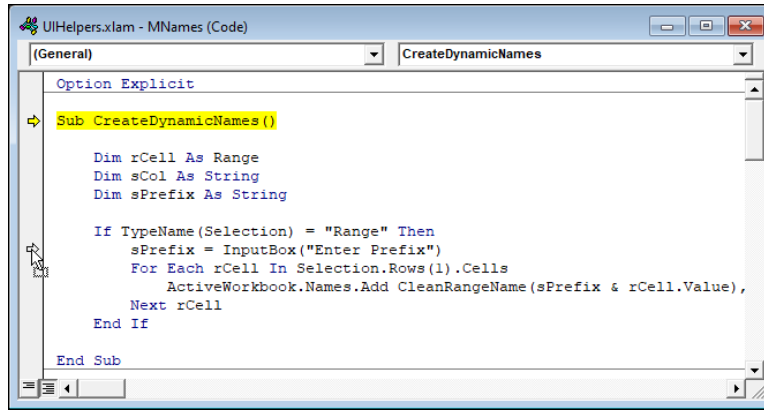
Turn to Chapter 13 for a detailed look at the ins and outs of debugging your VBA code.

Stepping to a Specific Line in Your Code

The last section showed how you can step through your code by placing your cursor anywhere within your macro and pressing F8.

This is great, but what if you want to start stepping through your code at a specific line? Well, you can do just that by simply moving the arrow!

When a line of code is highlighted in debug mode, you can click and drag the arrow in the left margin of the Code window upward or downward, dropping it at whichever line of code you want to execute next. (See Figure 22-7.)



```
UIHelpers.xlam - MNames (Code)
(General) CreateDynamicNames
Option Explicit
Sub CreateDynamicNames ()
    Dim rCell As Range
    Dim sCol As String
    Dim sPrefix As String

    If TypeName(Selection) = "Range" Then
        sPrefix = InputBox("Enter Prefix")
        For Each rCell In Selection.Rows(1).Cells
            ActiveWorkbook.Names.Add CleanRangeName(sPrefix & rCell.Value),
            Next rCell
        End If
    End Sub
```

FIGURE 22-7: You can click and drag the yellow arrow while stepping through your code.



REMEMBER

VBA executes your code from top to bottom, one line at a time. If you skip lines using this method, you might not get the results you expect.

Stopping Your Code at a Predefined Point

Another useful debugging tool is the ability to set a breakpoint in your code. When you set a breakpoint, your code runs as normal and then halts at the line of code where you defined the breakpoint.

This debugging technique comes in handy when you want to run tests on small blocks of code at a time. For example, if you suspect there is an error in your macro but you know that the majority of the macro runs without any problems, you can set a breakpoint starting at the suspect line of code and then run the macro. When the macros reaches your breakpoint, execution halts. At this point, you can then press F8 to watch as the macro runs one line at a time.

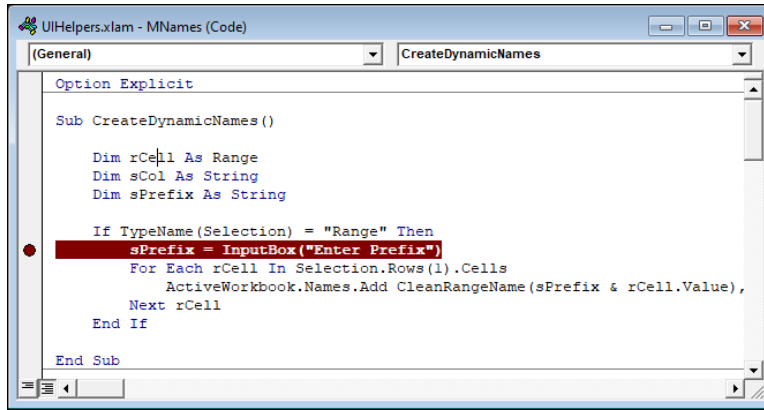
To set a breakpoint in your code, place your cursor where you want the breakpoint to start, and press F9. As Figure 22-8 shows, VBA clearly marks the breakpoint with a dot in the Code window's left margin, and the code line itself is shaded.



REMEMBER

When your macro hits a breakpoint, it's effectively in debug mode. To get out of debug mode, choose Debug ⇄ Step Out.

FIGURE 22-8:
A breakpoint is marked by a dot in the left margin along with shaded text.



Seeing the Beginning and End of Variable Values

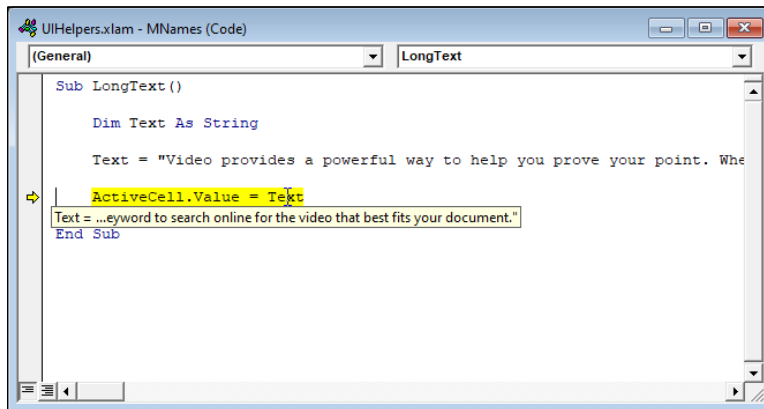
If you hover over a string or numeric variable in VBA while in debug mode, you can see the value of that variable in a tooltip. You can then see the values that are being passed in and out of variables — very useful.

However, these tooltips can only hold 77 characters (including the variable name). This basically means if the value in your variable is too long, it gets cut off.

To see the last 77 characters, hold down the Ctrl key while you hover.

Figure 22-9 shows what the tooltip looks like when holding down Ctrl and hovering over a variable in debug mode.

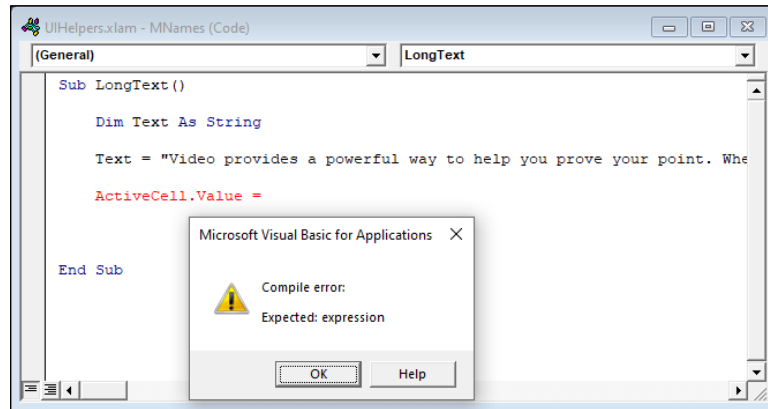
FIGURE 22-9:
Showing the ending characters in a variable tooltip.



Turning Off Auto Syntax Check

Oftentimes, while working on some code, you find that you need to go to another line to copy something. You're not done with the line — you just need to leave it for a second. But the VBE immediately stops you in your tracks with an error message, similar to the one shown in Figure 22-10, warning you about something you already know.

FIGURE 22-10:
Leaving an unfinished line of code, even for a second, results in a jarring error message.



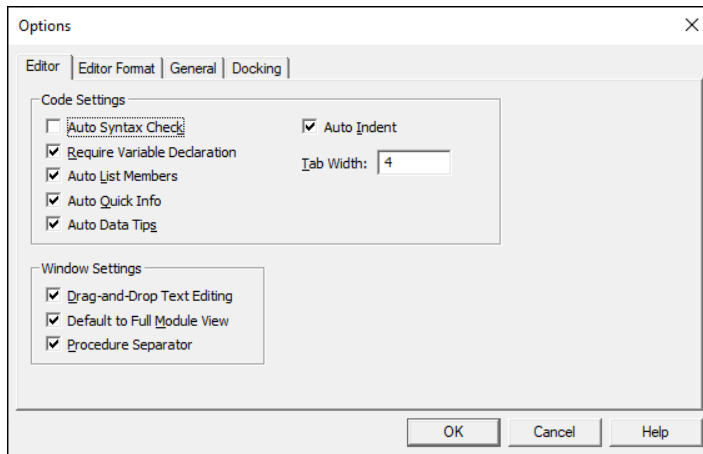
These message boxes force you to stop what you're doing to acknowledge the error by clicking OK. After a half day of these abrupt message boxes, you'll be ready to throw your computer against the wall.

Well, you can save your computer and your sanity by turning off Auto Syntax Check by choosing Tools ⇨ Options.

On the Editor tab of the Options dialog box, uncheck the Auto Syntax Check option to stop these annoying error messages. See Figure 22-11.

Don't worry about missing a legitimate mistake. Your code still turns red if you make a mistake, providing a visual indication that something is wrong.

FIGURE 22-11: Uncheck the Auto Syntax Check option to prevent warning messages while coding.



IN THIS CHAPTER

- » Letting Excel write code for you
- » Using the VBA help files
- » Pilfering code from the internet
- » Leveraging user forums
- » Visiting expert blogs
- » Mining YouTube for video training
- » Attending live and online training classes
- » Learning from the Microsoft Office Dev Center
- » Dissecting the other Excel files in your organization
- » Asking your local Excel Guru

Chapter **23**

Resources for VBA Help

No one is going to become a VBA expert in one day. VBA is a journey of time and practice. The good news is that plenty of resources are out there that can help you on your path. In this chapter, you discover ten of the most useful places to turn to when you need an extra push in the right direction.

Letting Excel Write Code for You

One of the best places to get macro help is the macro recorder in Excel. When you record a macro with the macro recorder, Excel writes the underlying VBA for you. After recording, you can review the code, see what the recorder did, and then try to turn the code it creates into something more suited to your needs.

For example, say you need a macro that refreshes all the pivot tables in your workbook and clears all the filters in each pivot table. Writing this macro from a blank canvas would be a daunting task. Instead, you can start the macro recorder and record yourself refreshing all the pivot tables and clearing all the filters. After you stop recording, you can review the macro and make any changes you deem necessary.



TIP

Need a refresher on using the macro recorder? Pop over to Chapter 6, where you can find a detailed overview.

Referencing the Help System

The Help system for Microsoft Office (Excel included) has improved immensely over the last few versions. And because it is either online or pulls from an online source, the Help system is generally up to date.

You need to remember two basic tenets of the Excel Help system:

- » **Location matters when asking for help.** If you press F1 in Excel to show the Help task pane and type in some VBA search terms, you won't get any useful results. When searching for VBA help, start from the VBE.
- » **VBA help moved online.** Pressing F1 in the VBE now opens a browser window (assuming you're connected) and takes you to the VBA language reference website hosted by Microsoft. If your cursor happens to be on a keyword, object name, or property or method name, it might take you right to the relevant page.

Pilfering Code from the Internet

The dirty secret about programming in the internet-age is that there is no original code anymore. All the macro syntax that will ever be needed has been documented somewhere on the internet. In many ways, programming has become less about

the code you can create from scratch, and more about how to take existing code and apply it creatively to a particular scenario.

If you're stuck trying to create a macro for a particular task, describe the task you're trying to accomplish via your favorite search engine. For the best results, enter "Excel VBA" before your description.

For example, if you're trying to write a macro that deletes all blank rows in a worksheet, search for "Excel VBA delete blank rows in a worksheet." You can bet two months' salary that someone has tackled the same problem and posted example code that gives you the nugget of information you need to build your own macro.

Leveraging User Forums

If you find yourself in a bind, post your question in a forum to get customized guidance based on your scenario.

User forums are online communities that revolve around a particular topic. In these forums, you can post questions and have experts offer advice on how to solve particular problems. The folks answering the questions are typically volunteers who have a passion for helping the community solve real-world challenges.

Many forums are dedicated to all things Excel. To find an Excel Forum, type "Excel Forum" in your favorite search engine.

Here are a few tips for getting the most out of user forums:

- » **Always read and follow the forum rules before you get started.** These rules often include advice on posting question and community etiquette guidelines.
- » **Check whether your question has already been asked and answered.** Save time by leveraging the forum's archive of questions. Take a moment to search the forum to see whether your question has been asked before.
- » **Use concise and accurate subject titles for your questions.** Don't create forum questions with abstract titles like: Need Advice or Please Help.
- » **Keep the scope of your questions as narrow as possible.** Don't ask questions like: How do I build an invoicing macro in Excel?

- » **Be patient.** Remember the folks answering your questions are volunteers who typically have day jobs. Give the community some time to answer your question.
- » **Check back often.** After posting your question, you might receive requests for more details about your scenario. Do everyone a favor and return to your posting to either review the answers or respond to follow-up questions.
- » **Thank the expert who answered your question.** If you receive an answer that helps you, take a moment to post a thank-you to the expert who helped you out.

Visiting Expert Blogs

There are a few dedicated Excel Gurus that share their knowledge through blogs. These blogs are often treasure troves of tips and tricks, offering nuggets that can help build your skills. Best of all, they're free!

Although these blogs won't necessarily speak to your particular needs, they offer articles that advance your knowledge of Excel and can even provide general guidance on how to apply Excel in practical business situations.

Here is a list of a few of the best Excel blogs today:

- » **ExcelGuru:** Ken Puls is a Microsoft Excel MVP who shares knowledge at his blog, <https://www.excelguru.ca/blog>. In addition to his blog, Ken offers several learning resources for advancing your knowledge in Excel.
- » **Chandoo.org:** Purna "Chandoo" Duggirala is a Microsoft Excel MVP out of India, who burst on the scene in 2007. His innovative blog (<https://chandoo.org>) offers many free templates and articles aimed at "making you awesome in Excel."
- » **Contextures:** Debra Dagleish is a Microsoft Excel MVP and the owner of a popular Excel site, <https://www.contextures.com>. With an alphabetized list of over 350 Excel topics, you're sure to find something that will interest you.
- » **DailyDose:** Yours truly is the owner of the longest running Excel blog, www.dailydoseofexcel.com. Although I don't actively post anymore, there is over ten years' worth of articles and examples.
- » **MrExcel:** Bill Jelen is the larger-than-life ambassador of Excel. This long-time Excel MVP offers over a thousand free videos and a huge library of training resources on his site, <https://www.mrexcel.com>.

Mining YouTube for Video Training

If you find that you absorb video training better than articles, consider mining YouTube. Dozens of channels are run by amazing folks who have a passion for sharing knowledge. You'll be surprised at how many free high-quality video tutorials you can find.

Go to www.youtube.com and search for "Excel VBA."

Attending Live and Online Training Classes

Live and online training events are an awesome way to absorb Excel knowledge from a diverse group of people. Not only is the instructor feeding you techniques, but the lively discussions during the class are a wealth of ideas and new tips you might never even have thought of. If you thrive in the energy of live training events, then consider searching for Excel classes.

Here are a few sites that provide excellent instructor-led Excel courses:

- » <http://academy.excelhero.com/excel-hero-academy-tuition>
- » <https://chandoo.org/wp/vba-classes>
- » <https://exceljet.net>

Learning from the Microsoft Office Dev Center

The Microsoft Office Dev Center is dedicated to helping new developers get a quick start in programming Office products. You can get to the Excel portion of this site by going to <https://docs.microsoft.com/en-us/office/client-developer/excel/excel-home>.

Dissecting the Other Excel Files in Your Organization

Like finding gold in your backyard, the existing files in your organization are often a treasure trove for learning. Consider opening Excel files that contain macros, and have a look under the covers. See how others in your organization use macros. Try to go through the macros line-by-line and see if you can spot new techniques.

You could find a few new tricks you never thought of. You might even stumble upon entire chunks of useful code you can copy and implement in your own workbooks.

Asking Your Local Excel Guru

Do you have an Excel genius in your company, department, organization, or community? Make friends with that person today. What you have there is your own personal Excel forum.

Most Excel experts love sharing their knowledge. So don't be afraid to approach your local Excel Guru to ask questions or seek advice on how to tackle certain macro problems.

- » Discovering five VBA-related things you should do
- » Discovering five VBA-related things you should not do

Chapter **24**

Ten VBA Do's and Don'ts

If you're reading this final chapter, you've probably read most of the content of this book and are familiar with Excel VBA. Or maybe you just skipped to the end because you wanted to see whether the butler actually did it.

This chapter gives you some advice you should take into account when you start developing your own VBA solutions. Following these guidelines is no panacea to keep you out of (programming) trouble, but following them can help you avoid pitfalls that others have stumbled over.

Do Declare All Variables

How convenient it is: Simply start typing your VBA code without having to go through the tedious chore of declaring each and every variable you want to use. Although Excel allows you to use undeclared variables, doing so is simply asking for trouble.

The first commandment of VBA programming should be this:

Thou shalt declare every variable.

To force yourself to obey that commandment, add an "Option Explicit" statement at the top of your modules. That way, your code won't even run if it includes one

or more undeclared variables. Not declaring all variables has only one advantage: You save a few seconds. But using undeclared variables will eventually come back to haunt you. And it will take you more than a few seconds to figure out the problem.

Don't Confuse Passwords with Security

You spent months creating a killer Excel app, with some amazing macros. You're ready to release it to the world, but you don't want others to see your incredible macro programming. Just password-protect the VBA project, and you're safe, right? Wrong.

Using a VBA password can keep most casual users from viewing your code. But if someone *really* wants to check it, they'll figure out how to crack the password.

Bottom line? If you absolutely, positively need to keep your code a secret, Excel isn't the best choice for a development platform.

Do Clean Up Your Code

After your app is working to your satisfaction, you should clean it up. Code house-keeping tasks include the following:

- » Make sure every variable is declared.
- » Make sure all the lines are indented properly so the code structure is apparent.
- » Remove any debugging aids, such as MsgBox statements or Debug.Print statements.
- » Rename any poorly named variables. For example, if you use the variable MyVariable, there's a pretty good chance that you can make the variable name more descriptive. You'll thank yourself later.
- » Your modules probably have a few "test" procedures that you wrote while trying to figure something out. They've served their purpose, so delete them.
- » Add comments so you'll understand how the code works when you revisit it 6 months from now.

- » Make sure everything is spelled correctly — especially text in UserForms and message boxes.
- » Check for redundant code. If you have two or more procedures that have identical blocks of code, consider creating a new procedure that other procedures can call.

Don't Put Everything in One Procedure

Want to make an unintelligible program? An efficient way to accomplish that is to put all your code inside one nice big procedure. If you ever revisit this program again to make changes, you're bound to make mistakes and introduce some fine-looking bugs.

The solution is modular code. Split your program into smaller chunks, with each chunk designed to perform a specific task. After you pick up this habit, you'll find that writing bug-free code is easier than ever.

Do Consider Other Software

Excel is an amazingly versatile program, but it's not suitable for everything. When you're ready to undertake a new project, take some time to consider all your options. To paraphrase an old saying, "When all you know is Excel VBA, everything looks like a VBA macro."

Don't Assume That Everyone Enables Macros

As you know, Excel allows you to open a workbook with its macros disabled. In fact, it's almost as though the designers of recent versions of Excel *want* users to disable macros.

Enabling macros when you open a workbook from an unknown source is not a good idea, of course. So, you need to know your users. In some corporate environments, all Microsoft Office macros are disabled, and the user has no choice in the matter.

One thing to consider is adding a digital signature to the workbooks that you distribute to others. That way, the user can be assured that the workbooks actually come from you and that they haven't been altered. Consult the Help system for more information about digital signatures.

Do Get in the Habit of Experimenting

When working on a large-scale Excel project, spend time writing small VBA “experiments.” For example, if you’re trying to find out about a new object, method, or property, write a simple Sub procedure and play around with it until you’re satisfied that you have a thorough understanding of how it works — and the potential problems.

Setting up simple experiments is almost always much more efficient than incorporating a new idea into your existing code without understanding what those experiments bring.

Don't Assume That Your Code Will Work with Other Excel Versions

When you create an Excel app, you have absolutely no guarantee that it will work flawlessly in older versions of Excel (or in future versions for that matter). In some cases, the incompatibilities will be obvious. For example, if your code refers to a new feature introduced in the latest version of Excel, you know that it won't work in prior versions. But you'll also find that things that should work with an earlier version don't work.

Excel includes a handy compatibility checker (choose File ⇨ Info ⇨ Check For Issues ⇨ Check Compatibility), but it only checks the workbook and ignores the VBA code. The only way to be sure that your application works with versions other than the one you created it with is to test it in those versions.

Do Keep Your Users in Mind

Excel apps fall into two main categories: those that you develop for yourself and those that you develop for others to use. If you develop apps for others, your job is much more difficult because you can't make the same types of assumptions. For example, you can be more lax with error handling if you're the only user. If an error crops up, you'll have a pretty good idea where to look so you can fix it. If someone else is using your app and the same error appears, they will be out of luck. And when you're working with your own application, you can usually get by without instructions.

You need to understand the skill level of those who will be using your workbooks and try to anticipate problems that they might have. Try to picture yourself as a new user of your application, and identify all areas that may cause confusion or problems.

Don't Forget about Backups

Nothing is more discouraging than a hard drive crash without a backup. If you're working on an important project, ask yourself a simple question: "If my computer dies tonight, what will I have lost?" If your answer is more than a few hours of work, you need to take a close look at your data backup procedure. You do have a data backup procedure, right?

Index

A

- Abs function, 142
- absolute mode, macro recorder, 86–87
- Accelerator property, UserForm controls, 284
- Activate event, 173
- activation events, 181–184
- active objects, 15
- Add Watch dialog box, 215
- add-ins
 - adding description, 372–373
 - creating, 374
 - customizing with macros, 12
 - defined, 365–366
 - distributing, 375
 - modifying, 375–376
 - opening, 374–375
 - overview, 368–369
 - protecting VBA code, 373
 - reasons to create, 366–367
 - setting up workbook, 369–372
 - testing workbook, 372
 - working with, 367–368
- Add-ins Ribbon tab, adding commands to, 338–339
- AddItem method, ListBox control, 310
- Addition operator, 114
- Address property, Range objects, 126–127
- And operator, 115
- Application object, 53–56
- arguments
 - defined, 60
 - GetOpenFilename statement, 257
 - GetSaveAsFilename method, 259
 - worksheet functions
 - no-argument functions, 349
 - optional arguments, 354–356
 - overview, 348
 - range argument, 352–354
 - single-argument function, 349–351
 - two-argument function, 351–352
- Array function, 142
- arrays
 - declaring, 116–117
 - defined, 116
 - dynamic, 117–118
 - MonthNames function, 359–360
 - multidimensional, 117
 - SORT function, 360–361
- assignment statements
 - equal sign operator, 114
 - logical operators, 115
 - operator precedence, 114–115
 - overview, 113–114
 - smooth operators, 114–116
- Auto Data Tips option, VBE Editor tab, 46
- Auto Indent setting, VBE Editor tab, 46
- Auto List Members feature, VBE, 45, 64–65

- Auto Quick Info option, VBE, 46
- Auto Syntax Check, VBE, 44, 387–388
- automatic event procedures. *See* events
- AutoSize property, UserForm controls, 284

B

- BackColor property, UserForm controls, 284
- BackStyle property, UserForm controls, 284
- backups, 399
- BeforeClose event, 172, 179–180
- BeforeDoubleClick event, 173, 185
- BeforePrint event, 172
- BeforeRightClick event, 173, 185–186
- BeforeSave event, 172, 180–181
- beyond-your-control bugs, 206
- Boolean data type, 103
- BorderStyle property, Frame control, 288
- breakpoints, setting, 211–214
- bugs. *See also* debugging
 - beyond-your-control bugs, 206
 - extreme-case bugs, 206
 - identifying, 207
 - incorrect context bugs, 206
 - logic flaws in code, 206
 - preventative measures, 217
 - wrong data-type bugs, 206
 - wrong version bugs, 206

- built-in dialog boxes, 260–262
- built-in functions, 136–144
 - Abs function, 142
 - Array function, 142
 - Choose function, 142
 - Chr function, 142
 - CurDir function, 142
 - Date function, 142
 - DateAdd function, 142
 - DateDiff function, 142
 - DatePart function, 142
 - dates and times, 136–138
 - DateSerial function, 142
 - DateValue function, 142
 - Day function, 142
 - Dir function, 142
 - Err function, 142
 - Error function, 142
 - Exp function, 142
 - FileLen function, 142
 - Fix function, 142
 - Format function, 142
 - GetSetting function, 142
 - Hour function, 142
 - identifying objects and data, 139–140
 - InputBox function, 141, 142
 - InStr function, 142
 - InStrRev function, 142
 - Int function, 142
 - IsArray function, 142
 - IsDate function, 142
 - IsEmpty function, 143
 - IsError function, 143
 - IsMissing function, 143
 - IsNull function, 143
 - IsNumeric function, 143
 - LBound function, 143
 - LCase function, 143
 - Left function, 143
 - Len function, 143
 - manipulating strings, 138–139
 - Mid function, 143

- Minute function, 143
- Month function, 143
- MsgBox function, 141, 143
- Now function, 143
- overview, 141–143
- Replace function, 143
- RGB function, 143
- Right function, 143
- Rnd function, 143
- Second function, 143
- Shell function, 141, 143
- side benefits, 140–141
- Space function, 143
- Split function, 143
- Sqr function, 143
- String function, 143
- Time function, 143
- Timer function, 143
- TimeSerial function, 143
- TimeValue function, 143
- Trim function, 144
- TypeName function, 144
- UBound function, 144
- UCase function, 144
- Val function, 144
- Weekday function, 144
- Year function, 144
- buttons, customizing, 12
- Buttons argument, MsgBox function, 247
- ButtonText argument, GetOpenFilename statement, 257
- Byte data type, 103

C

- calculation modes, 111
- calling procedures
 - Function procedures
 - from Immediate window, 79–80
 - from Sub procedure, 78–79

- from worksheet formula, 80–81
- Sub procedures
 - from another procedure, 77
 - from button or shape, 75–76
 - directly, 72–73
 - from Immediate window, 77
 - from Macro dialog box, 73
 - overview, 70–72
 - with shortcut key, 74–75
- Cancel property, CommandButton control, 288
- Caption property
 - Frame control, 288
 - Label control, 289
 - UserForm controls, 284
- Cell shortcut menu, adding new item to, 339–340
- Cells property, Range objects, 122
- Chandoo.org blog, 392
- Change event, 173, 186–187
- ChangeCase macro, 277–278
- charts, displaying in UserForms, 325–326
- Charts object, 54
- Cheat Sheet, 6
- CheckBox control, 267, 285–286
- Choose function, 142
- Chr function, 142
- class modules, 34
- Clear method, Range objects, 133
- ClearContents method, Range objects, 133
- ClearFormats method, Range objects, 133
- cmdOK_Click procedure, ListBox control, 312–313
- code. *See also* VBA code
 - cleaning up, 396–397
 - commenting out, 380–381
 - copying blocks of, 381

- formatting with indentation, 217
 - logic flaws in, 206
 - modular code, 397
 - testing, 207
- Code Colors option, VBE Editor Format tab, 47
- Code pane, VBE
 - declarations, 37
 - entering code into module, 38–44
 - function procedures, 37
 - minimizing and maximizing windows, 36–37
 - overview, 33, 36
 - sub procedures, 37
- collections (collection objects), 54–55
 - charts, 54
 - defined, 15
 - sheets, 54
 - workbooks, 54
 - worksheets, 54
- color values, 129–130
- Column property, Range objects, 126
- ComboBox control, 267, 286–287
- CommandButton control, 267, 272, 287–288
- commands, customizing, 11
- comments
 - overview, 99–101
 - using to minimize bug issues, 217
- Commission function, 351
- compatibility checker, 398
- concatenation
 - defined, 115
 - String concatenation operator, 114
- constants
 - MsgBox function, 249, 252
 - premade, 110–111
 - scope of, 110
- Contextures blog, 392
- controls, UserForm
 - adding, 267, 282
 - aesthetics, 300
 - aligning and spacing, 297
- CheckBox control, 267, 285–286
- ComboBox control, 267, 286–287
- CommandButton control, 267, 287–288
- Frame control, 267, 288
- Image control, 267, 288–289
- keyboard, 297–300
- Label control, 267, 289
- ListBox control, 267, 289–291
- moving and resizing, 297
- MultiPage control, 267, 291
- OptionButton control, 267, 292
- overview, 281
- properties
 - Accelerator property, 284
 - AutoSize property, 284
 - BackColor property, 284
 - BackStyle property, 284
 - Caption property, 284
 - Enabled property, 284
 - Height property, 284
 - Left property, 284
 - Name property, 284
 - Picture property, 284
 - Top property, 284
 - Value property, 284
 - Visible property, 284
 - Width property, 284
- RefEdit control, 267, 292–293
- ScrollBar control, 267, 293–294
- SpinButton control, 267, 294
- TabStrip control, 267, 295
- testing, 300
- TextBox control, 267, 295–296
- ToggleButton control, 267, 296
- ControlSource property
 - ComboBox control, 287
 - OptionButton control, 292
 - ScrollBar control, 293
 - SpinButton control, 294
- Copy method, Range objects, 132–133
- Count property, Range objects, 126
- CubeRoot function, 69, 72, 78–79
- CurDir function, 142
- Currency data type, 103
- custom functions
 - debugging, 355
 - overview, 148–149
- Custom UI Editor program, 333, 335–336
- customizing
 - add-ins, 12
 - buttons, 12
 - commands, 11
 - Quick Access toolbar, 337
- Ribbon
 - adding macro to, 332
 - manually, 330–332
 - overview, 329–330
 - with XML, 333–336
- user interface
 - adding commands to Add-ins Ribbon tab, 338–339
 - adding new item to Cell shortcut menu, 339–340
 - automatically adding customizations, 340–341
 - overview, 337–338
 - shortcut menus, 341
 - single document interface, 341
- VBE
 - Docking tab, 48–49
 - Editor Format tab, 47
 - Editor tab, 44–47
 - General tab, 48
 - worksheet functions, 12

D

- DailyDose blog, 392
- Dalglish, Debra, 392
- data types
 - Boolean data type, 103
 - Byte data type, 103
 - Currency data type, 103
 - Date data type, 103
 - defined, 69
 - Double data type, 103
 - Integer data type, 103
 - Long data type, 103
 - Long data type, 103
 - Object data type, 103
 - Single data type, 103
 - String data type, 103
 - Variant data type, 103
- Date data type, 103
- Date function, 142
- DateAdd function, 142
- DateDiff function, 142
- DatePart function, 142
- dates, 112–113
- DateSerial function, 142
- DateValue function, 142
- Day function, 142
- Deactivate event, 172, 173
- debugging
 - beyond-your-control bugs, 206
 - custom functions, 355
 - Debug.Print statements, 210
 - defined, 206
 - examining code, 208
 - extreme-case bugs, 206
 - identifying, 207
 - incorrect context bugs, 206
 - logic flaws in code, 206
 - with MsgBox function, 208–210
 - preventative measures, 217
 - tools, 210–216
 - breakpoints, 211–214, 385–386
 - Locals window, 216
 - overview, 210–211, 383–384
 - skipping to specific line of code, 384–385
 - Watches window, 214–216
 - wrong data-type bugs, 206
 - wrong version bugs, 206
- Debug.Print statements, 210
- decision-making
 - Do-Until loop, 152
 - Do-While loop, 152
 - For-Next loop, 152
 - GoTo statement, 152–153
 - If-Then structure
 - Elseif statement, 157–158
 - If-Then-Else statement, 155–156
 - overview, 154–155
- overview, 151–152
- Select Case structure, 152, 158–161
- declarations, defined, 37
- declaring
 - arrays, 116–117
 - variables, 103–106, 395–396
- Default property,
 - CommandButton control, 288
- Default to Full Module View option, VBE, 46
- Delete method, Range objects, 133–134
- Description option, Record Macro dialog box, 92
- Developer Tab
 - displaying, 17–18
 - Relative References button, 19
- dialog boxes
 - built-in, 260–262
 - FileDialog method, 259–260
 - Frame controls, 292, 300, 305, 317
 - GetOpenFilename statement, 256–259
 - GetSaveAsFilename method, 259
- InputBox function, 252–256
- MsgBox function
 - Buttons argument, 247
 - constants used as return values for, 252
 - constants used in, 249
 - customizing message boxes, 250–252
 - displaying simple message box, 247–248
 - getting response from message box, 248–250
 - Prompt argument, 247
 - Title argument, 247
- overview, 245–246
- UserForms
 - adding
 - CommandButtons, 272
 - adding controls to, 267, 282
 - adding event-handler procedures, 275–276, 307–308
 - adding OptionButtons, 272–275
 - aesthetics, 300
 - aligning and spacing, 297
 - ChangeCase macro, 277–278
 - changing properties for, 268–269
 - CheckBox control, 267, 285–286
 - ComboBox control, 267, 286–287
 - CommandButton control, 267, 287–288
 - creating, 302–305
 - determining selected item, 312–313
 - displaying, 269–270, 277
 - displaying chart in, 325–326
 - ensuring functionability, 326–327
 - Frame control, 267, 288
 - Image control, 267, 288–289
 - inserting new, 266
 - keyboard, 297–300

- Label control, 267, 289
- ListBox control, 267, 289–291, 309–311
- modeless tabbed dialog boxes, 323–325
- moving and resizing, 297
- MultiPage control, 267, 291
- MultiSelect property, 313–314
- option buttons, 316–317
- OptionButton control, 267, 292
- overview, 263–266, 281, 301–302
- progress indicator dialog box, 319–323
- properties, 283–285
- range selection, 314–316
- RefEdit control, 267, 292–293
- ScrollBar control, 267, 293–294
- SpinButton control, 267, 294, 317–319
- TabStrip control, 267, 295
- testing, 300, 306
- testing macro, 278–280
- TextBox control, 267, 295–296, 317–319
- ToggleButton control, 267, 296
- UserForm Code pane, 269
- using information from, 270–271
- validating data, 309
- digital signatures, 398
- Dir function, 142
- Disable VBA macros except digitally signed macros option, 4
- Disable VBA macros with notification option, 4, 26
- Disable VBA macros without notification option, 4
- Division operator, 114
- Docking tab, VBE, 48–49
- dot operator, 53
- Double data type, 103

- Do-Until loop, 152
- Do-While loop, 152
- Drag-and-Drop Text Editing option, VBE, 46
- Duggirala, Purna, 392
- dynamic arrays, 117–118

E

- Editor Format tab, VBE, 47
- Editor tab, VBE, 44–47
 - Auto Data Tips option, 46
 - Auto Indent setting, 46
 - Auto List Members option, 45
 - Auto Quick Info option, 46
 - Auto Syntax Check option, 44
 - Default to Full Module View option, 46
 - Drag-and-Drop Text Editing option, 46
 - Procedure Separator option, 46
 - Require Variable Declaration option, 45
 - Tab Width setting, 46
- Elseif statement, 157–158
- Enable VBA macros option, 4
- Enabled property, UserForm controls, 284
- EnterRandomNumbers procedure, 321–322
- EnterSquareRoot procedure, 198–199
- equal sign operator, 114
- Err function, 142
- Error function, 142
- errors
 - EnterSquareRoot procedure, 198–199
 - erroneous macro example, 194–198
 - On Error statement, 200
 - intentional errors, 203–204
 - overview, 193–194
 - Resume Statement, 200–202

- event-handler procedures, 174–177
 - adding to UserForms, 275–276, 307–308
 - overview, 174–175
 - writing, 175–177
- events
 - defined, 171–172
 - event-handler procedures, 174–177, 275–276, 307–308
 - learning when to use, 173–174
 - not associated with objects
 - Keypress events, 190–191
 - OnTime event, 188–190
 - object, 61–62
 - workbook events
 - Activate, 172
 - activation events, 181–184
 - BeforeClose event, 172, 179–180
 - BeforePrint event, 172
 - BeforeSave event, 172, 180–181
 - Deactivate event, 172
 - NewSheet event, 172
 - Open event, 172, 177–179
 - SheetActivate event, 172
 - SheetBeforeDoubleClick event, 172
 - SheetBeforeRightClick event, 172
 - SheetChange event, 172
 - SheetDeactivate event, 172
 - SheetSelectionChange event, 172
 - WindowActivate event, 172
 - WindowDeactivate event, 172
 - worksheet events
 - Activate event, 173
 - BeforeDoubleClick event, 173, 185
 - BeforeRightClick event, 173, 185–186
 - Change event, 173, 186–187
 - Deactivate event, 173
 - SelectionChange event, 173

- Excel add-ins
 - adding description, 372–373
 - creating, 374
 - customizing with macros, 12
 - defined, 365–366
 - distributing, 375
 - modifying, 375–376
 - opening, 374–375
 - overview, 368–369
 - protecting VBA code, 373
 - reasons to create, 366–367
 - setting up workbook, 369–372
 - testing workbook, 372
 - working with, 367–368

- Excel object model
 - collections, 15, 54–55
 - events, 61–62
 - methods, 60–61
 - object hierarchy, 52–53
 - overview, 51–52
 - properties, 58–60
 - referring to objects, 53–54
 - simplifying object references, 55–56
 - VBA resources
 - Auto List Members feature, 64–65
 - Object Browser, 63–64
 - VBA Help system, 62–63

- Excel Options dialog box, customizing Ribbon with, 331–332

- ExcelGuru blog, 392

- executing
 - Function procedures
 - from Immediate window, 79–80
 - from Sub procedure, 78–79
 - from worksheet formula, 80–81

- Sub procedures
 - from another procedure, 77
 - from button or e, 75–76
 - directly, 72–73

- from Immediate window, 77
- from Macro dialog box, 73
- overview, 70–72
 - with shortcut key, 74–75
- Exit For statement, For-Next loops, 164–165
- Exp function, 142
- expert blogs, 392
- Exponentiation operator, 114
- ExtractElement function, 357
- extreme data, testing code with, 207
- extreme-case bugs, 206

F

- FileDialog method, 259–260

- FileFilter argument
 - GetOpenFilename statement, 257
 - GetSaveAsFilename method, 259

- FileLen function, 142

- FilterIndex argument
 - GetOpenFilename statement, 257
 - GetSaveAsFilename method, 259

- Fix function, 142

- fixed-length strings, 111–112

- Font option, VBE, 47

- Font property
 - Label control, 289
 - Range objects, 128

- ForeColor property, Label control, 289

- Format function, 142

- forms, 34–35

- Formula property, Range objects, 130–131

- For-Next loops

- defined, 152

- Exit For statement, 164–165

- nested, 165–167

- overview, 162–163

- Step value, 163–164

- Frame control, 267, 292, 300, 305, 317

- BorderStyle property, 288

- Caption property, 288

- Full Module View mode, VBE, 383

- Function procedures

- defined, 14, 37

- executing

- from Immediate window, 79–80

- from Sub procedure, 78–79

- from worksheet formula, 80–81

- naming, 69–70

- overview, 67–69

- functions

- built-in

- Abs function, 142

- Array function, 142

- Choose function, 142

- Chr function, 142

- CurDir function, 142

- Date function, 142

- DateAdd function, 142

- DateDiff function, 142

- DatePart function, 142

- dates and times, 136–138

- DateSerial function, 142

- DateValue function, 142

- Day function, 142

- Dir function, 142

- Err function, 142

- Error function, 142

- Exp function, 142

- FileLen function, 142

- Fix function, 142

- Format function, 142

- GetSetting function, 142

- Hour function, 142

- identifying objects and data, 139–140

- InputBox function, 141, 142

InStr function, 142
InStrRev function, 142
Int function, 142
IsArray function, 142
IsDate function, 142
IsEmpty function, 143
IsError function, 143
IsMissing function, 143
IsNull function, 143
IsNumeric function, 143
LBound function, 143
LCase function, 143
Left function, 143
Len function, 143
manipulating strings,
138–139
Mid function, 143
Minute function, 143
Month function, 143
MsgBox function, 141, 143
Now function, 143
overview, 141–143
Replace function, 143
RGB function, 143
Right function, 143
Rnd function, 143
Second function, 143
Shell function, 141, 143
side benefits, 140–141
Space function, 143
Split function, 143
Sqr function, 143
String function, 143
Time function, 143
Timer function, 143
TimeSerial function, 143
TimeValue function, 143
Trim function, 144
TypeName function, 144
UBound function, 144
UCase function, 144
Val function, 144

Weekday function, 144
Year function, 144
custom functions, 148–149
overview, 135–136
worksheet functions
arguments, 348–356
arrays, 359–361
calculating mortgage
payment, 145–146
customizing with macros, 12
entering, 147
finding maximum value in
range, 145
Insert Function dialog box
and, 362–364
overview, 144, 345–346
VBA function, 347
VBA functions, 347
VLOOKUP function, 146–147
wrapper functions, 356–359
writing, 347–348

G

General tab, VBE, 48
GetOpenFilename statement
constructing, 256
selecting file with, 256–258
GetSaveAsFilename method,
259–260
GetSetting function, 142
GoTo method, Range
objects, 132
GoTo statement, 152–153
Graphical User Interface
(GUI), 265
GroupName property,
OptionButton control, 292

H

HasFormula property, Range
objects, 127–128
Height property, UserForm
controls, 284

Help system, 111, 390
hot keys, setting, 299
Hour function, 142

I

If-Then structure
decision-making
Elseif statement, 157–158
If-Then-Else statement,
155–156
overview, 154–155
defined, 152
Image control, 267, 288–289
Immediate window
breakpoints and, 214
executing Function procedures
from, 79–80
executing Sub procedures
from, 77
VBE, 33–34
incorrect context bugs, 206
indentation, formatting code
with, 217
InitialFileName argument,
GetSaveAsFilename
method, 259
InputBox function, 141, 142,
203–204, 252–256
Insert Function dialog box,
80–81
adding argument
description, 364
displaying function
description, 362–363
InStr function, 142
InStrRev function, 142
Int function, 142
Integer data type, 103
Integer division operator, 114
intentional errors, 203–204
Interior property, Range objects,
128, 130
IsArray function, 142
IsDate function, 142

IsEmpty function, 143
IsError function, 143
IsLike function, 358–359
IsMissing function, 143
IsNull function, 143
IsNumeric function, 143

J

Jelen, Bill, 392

K

keyboard controls, UserForms
 changing tab order, 298–299
 overview, 297–298
 setting hot keys, 299
Keypress events, 190–191

L

Label control, 267, 289
labels, 118
LargeChange property, ScrollBar
 control, 294
LBound function, 143
LCase function, 143
Left function, 143
Left property, UserForm
 controls, 284
Len function, 143
line continuation character, 113
list boxes, 309–311
ListBox control, 267, 289–291
 AddItem method, 310
 cmdOK_Click procedure,
 ListBox control, 312–313
 filling, 310–311
 ListCount property, 310
 ListIndex property, 310
 MultiSelect property, 310,
 313–314
 RemoveAllItems method, 310
 Selected property, 310
 Value property, 310

ListCount property, ListBox
 control, 310
ListIndex property, ListBox
 control, 310
ListRows property, ComboBox
 control, 287
ListStyle property, ComboBox
 control, 287
live and online training
 events, 393
Locals window, VBA
 debugger, 216
logic flaws in code, 206
logical operators, 115
Long data type, 103
Long data type, 103
looping, 162–170
 Do-Until loop, 168
 Do-While loop, 167–168
 For Each-Next loops, 168–170
 For-Next loops
 Exit For statement,
 164–165
 nested, 165–167
 overview, 162–163
 Step value, 163–164
 through ranges, 225–227

M

Macro dialog box,
 executing Sub procedures
 from, 73
Macro name option, Record
 Macro dialog box, 91
macro recorder
 absolute mode, 86–87
 overview, 83–85
 preparing to record, 85
 recording process, 89–91
 relative mode, 87–89
 specifying recording options,
 91–92
 streamlining code generated
 by, 92–95
 as VBA resource, 390

macro-enabled file type, 25
macros
 adding to Ribbon, 332
 automating repetitive
 operations with, 11
 automating tasks with, 11
 creating custom add-ins
 with, 12
 creating custom buttons
 with, 12
 creating custom commands
 with, 11
 creating custom worksheet
 functions with, 12
 defined, 10
 Developer Tab, 17–18
 enabling, 397
 erroneous macro example,
 194–198
 inserting text with, 11
 modifying, 24–25
 preparing environment, 18–19
 recording, 19–21
 running, 21–22
 saving workbooks that
 contain, 25
 security, 25–27
 viewing in VBE, 22–23
Margin Indicator Bar option,
 VBE, 47
Max property
 ScrollBar control, 293
 SpinButton control, 294
menu bar, VBE, 33
methods
 defined, 16
 Fast-food analogy, 57–58
 FileDialog method, 259–260
 GetSaveAsFilename
 method, 259
 ListBox control, 310
 Range objects
 Clear method, 133
 ClearContents method, 133
 ClearFormats method, 133

- Copy method, 132–133
- Delete method, 133–134
- GoTo method, 132
- Paste method, 132–133
- Select method, 132
- specifying, 16
- taking action with, 60–61
- Microsoft Excel Objects, 34, 35
- Microsoft Office Dev Center, 393
- Mid function, 143
- Min property
 - ScrollBar control, 293
 - SpinButton control, 294
- Minute function, 143
- modeless tabbed dialog boxes, 323–325
- modifying
 - add-ins, 375–376
 - macros, 24–25
- module-level variables
 - overview, 107–108
 - UserForms, 321–322
- modules
 - class modules, 34
 - forms, 34–35
 - Microsoft Excel Objects, 34, 35
 - VBA modules
 - adding to project, 35–36
 - copying code into, 44
 - defined, 34
 - entering code directly, 38–41
 - macro recorder, 41–43
- Modulo arithmetic operator, 114
- Month function, 143
- MonthNames function, 359–360
- MrExcel blog, 392
- MsgBox function, 141, 143, 208–210
 - Buttons argument, 247
 - constants, 249, 252
 - customizing message boxes, 250–252

- displaying simple message box, 247–248
- getting response from message box, 248–250
- Prompt argument, 247
- Title argument, 247
- multidimensional arrays, 117
- MultiPage control, 267, 291, 324
- Multiplication operator, 114
- MultiSelect argument, GetOpenFilename statement, 257
- MultiSelect property
 - ListBox control, 310, 313–314
 - UserForms, 313–314

N

- Name property, UserForm controls, 284
- nested For-Next loops, 165–167
- NewSheet event, 172
- no-argument worksheet functions, 349
- Not operator, 115
- Now function, 143
- NumberFormat function, 356–357
- NumberFormat property, Range objects, 131

O

- Object Browser, 63–64
- Object data type, 103
- Object drop-down list, VBE, 175–176
- object model
 - collections, 15, 54–55
 - events, 61–62
 - methods, 60–61
 - object hierarchy, 52–53
 - overview, 51–52
 - properties, 58–60

- referring to objects, 53–54
- simplifying object references, 55–56

VBA resources

- Auto List Members feature, 64–65
- Object Browser, 63–64
- VBA Help system, 62–63

objects

- active objects, 15
- Fast-food analogy, 57–58
- identifying with built-in functions, 139–140
- methods, 16
- object model, 14
- properties of, 15
- Range objects
 - Address property, 126–127
 - assigning values in multicell range to variable, 125
 - Cells property, 122
 - Clear method, 133
 - ClearContents method, 133
 - ClearFormats method, 133
 - Column property, 126
 - Copy method, 132–133
 - Count property, 126
 - defined, 119
 - Delete method, 133–134
 - Font property, 128
 - Formula property, 130–131
 - GoTo method, 132
 - HasFormula property, 127–128
 - Interior property, 128, 130
 - methods, 131–134
 - NumberFormat property, 131
 - Offset property, 122–123
 - overview, 119–121
 - Paste method, 132–133
 - properties, 122–131
 - referring to, 121–123

- objects (*continued*)
 - Resize property, 123–124
 - Row property, 126
 - Select method, 132
 - Text property, 125–126
 - Value property, 124–125
- specifying position in object hierarchy, 15
- Offset property, Range objects, 122–123
- On Error Resume Next statement, 217
- On Error statement, 200
- online resources
 - Cheat Sheet, 6
 - expert blogs, 392
 - Help system, 390
 - live and online training events, 393
 - Microsoft Office Dev Center, 393
 - user forums, 391–392
 - YouTube, 393
- OnTime event, 188–190
- Open event, 172, 177–179
- operator precedence, 114–115
- operators
 - Addition, 114
 - Division, 114
 - dot operator, 53
 - equal sign, 114
 - Exponentiation, 114
 - Integer division, 114
 - logical, 115
 - Modulo arithmetic, 114
 - Multiplication, 114
 - Not operator, 115
 - operator precedence, 114–115
 - Or operator, 115
 - smooth, 114–116
 - String concatenation, 114
 - Subtraction, 114
 - Xor operator, 115

- Option Explicit statement, 217
- optional arguments, worksheet functions, 354–356
- OptionButton controls, 267, 292
- OptionButtons, adding to UserForms, 272–275
- Or operator, 115

P

- Paste method, Range objects, 132–133
- Picture property
 - Image control, 289
 - UserForm controls, 284
- PictureSizeMode property, Image control, 289
- premade constants, 110–111
- Procedure drop-down list, VBE, 175–176
- Procedure Separator option, VBE, 46
- Procedure View mode, VBE, 383
- procedure-only variables, 106–107
- procedures
 - event-handler procedures, 174–177, 275–276, 307–308
 - Function procedures
 - executing, 78–81
 - naming, 69–70
 - overview, 67–69
 - Sub procedures
 - defined, 14, 37
 - executing, 70–77
 - naming, 69–70
 - overview, 67–68
 - UserForms
 - EnterRandomNumbers procedure, 321–323
 - UpdateProgress procedure, 322
- programming for users, 399
- programs, defined, 10

- progress indicator dialog box, 319–323
 - overview, 319–321
 - procedures, 321–323
- Project Explorer
 - VBE
 - class modules, 34
 - forms, 34
 - Microsoft Excel Objects, 34, 35
 - overview, 33
 - VBA modules, 34, 35–36
- Prompt argument, 247
- properties
 - ComboBox control
 - ControlSource property, 287
 - ListRows property, 287
 - ListStyle property, 287
 - RowSource property, 287
 - Style property, 287
 - Value property, 287
 - CommandButton control
 - Cancel property, 288
 - Default property, 288
 - Frame control
 - BorderStyle property, 288
 - Caption property, 288
 - Image control
 - Picture property, 289
 - PictureSizeMode property, 289
 - Label control
 - Caption property, 289
 - Font property, 289
 - ForeColor property, 289
 - ListBox control
 - ControlSource property, 290
 - IntegralHeight property, 290
 - ListStyle property, 290
 - MultiSelect property, 291
 - RowSource property, 291
 - Value property, 291

- MultiPage control
 - Style property, 291
 - Value property, 291
- object
 - Fast-food analogy, 57–58
 - setting, 58–60
- OptionButton control
 - ControlSource property, 292
 - GroupName property, 292
 - Value property, 292
- Range objects
 - Address property, 126–127
 - Cells property, 122
 - Column property, 126
 - Count property, 126
 - Font property, 128
 - Formula property, 130–131
 - HasFormula property, 127–128
 - Interior property, 128, 130
 - NumberFormat property, 131
 - Offset property, 122–123
 - Resize property, 123–124
 - Row property, 126
 - Text property, 125–126
 - Value property, 124–125
- ScrollBar control
 - ControlSource property, 293
 - LargeChange property, 294
 - Max property, 293
 - Min property, 293
 - SmallChange property, 294
 - Value property, 293
- SpinButton control
 - ControlSource property, 294
 - Max property, 294
 - Min property, 294
 - SmallChange property, 294
 - Value property, 294
- TextBox control
 - AutoSize property, 295
 - ControlSource property, 295

- IntegralHeight property, 295
- MaxLength property, 295
- MultiLine property, 295
- ScrollBars property, 296
- TextAlign property, 295
- WordWrap property, 296
- UserForm controls
 - Accelerator property, 284
 - AutoSize property, 284
 - BackColor property, 284
 - BackStyle property, 284
 - Caption property, 284
 - Enabled property, 284
 - Height property, 284
 - Left property, 284
 - Name property, 284
 - Picture property, 284
 - Top property, 284
 - Value property, 284
 - Visible property, 284
 - Width property, 284
- public variables, 108
- Puls, Ken, 392

Q

- Quick Access toolbar, 337

R

- range argument, worksheet functions, 352–354
- Range objects
 - assigning values in multicell range to variable, 125
 - defined, 119
 - methods
 - Clear method, 133
 - ClearContents method, 133
 - ClearFormats method, 133
 - Copy method, 132–133
 - Delete method, 133–134
 - GoTo method, 132

- Paste method, 132–133
- Select method, 132
- overview, 119–121
- properties
 - Address property, 126–127
 - Cells property, 122
 - Column property, 126
 - Count property, 126
 - Font property, 128
 - Formula property, 130–131
 - HasFormula property, 127–128
 - Interior property, 128, 130
 - NumberFormat property, 131
 - Offset property, 122–123
 - Resize property, 123–124
 - Row property, 126
 - Text property, 125–126
 - Value property, 124–125
- referring to, 121–123
- ranges
 - copying, 220–223
 - looping through, 225–227
 - moving, 224–225
 - prompting for cell value, 227–228
 - selecting row or column, 224
 - selecting to end of row or column, 223–224
 - selecting while dialog box is displayed, 314–316
- read-only properties, Range objects
 - Address property, 124, 126–127
 - Column property, 126
 - Count property, 126
 - HasFormula property, 127
 - Row property, 126
 - Text property, 125

- read-write properties, Range objects
 - Formula property, 130
 - NumberFormat property, 131
 - Value property, 124
- real-life data, testing code with, 207
- recording macros, 19–21. *See also* macro recorder
- RefEdit control, 267, 292–293, 315–316
- referring to objects, 53–54, 121–123
- relative mode, macro recorder, 87–89
- Relative References button, Developer Tab, 19
- Remember icon, 5
- RemoveAllItems method, ListBox control, 310
- repetitive operations, automating, 11
- Replace function, 143
- Require Variable Declaration option, VBE, 45
- Resize property, Range objects, 123–124
- resources
 - Auto List Members feature, 64–65
 - Object Browser, 63–64
 - online resources
 - Cheat Sheet, 6
 - expert blogs, 392
 - Help system, 390
 - live and online training events, 393
 - Microsoft Office Dev Center, 393
 - user forums, 391–392
 - YouTube, 393
 - VBA Help system, 62–63
- Resume Statement, 200–202
- RGB function, 143

- Ribbon
 - adding macro to, 332
 - customizing with XML, 333–336
 - manually customizing, 330–332
 - overview, 329–330
- Right function, 143
- Rnd function, 143
- Row property, Range objects, 126
- RowSource property, ComboBox control, 287
- running macros, 21–22
- running procedures
 - Function procedures
 - from Immediate window, 79–80
 - from Sub procedure, 78–79
 - from worksheet formula, 80–81
 - Sub procedures
 - from another procedure, 77
 - from button or e, 75–76
 - directly, 72–73
 - from Immediate window, 77
 - from Macro dialog box, 73
 - overview, 70–72
 - with shortcut key, 74–75
- runtime errors, 194, 207. *See also* errors

S

- SayIt function, 358
- scoping variables, 106
- ScrollBar control, 267, 293–294
- security
 - Excel Security Warnings, 26–27
 - Macro settings, 3–4, 25–27
 - Disable VBA macros except digitally signed macros option, 4
 - Disable VBA macros with notification option, 4, 26
 - Disable VBA macros without notification option, 4
 - Enable VBA macros option, 4
 - passwords vs., 396
 - trusted locations, 27
 - Trusted Locations option, 4
- Select Case structure, 152, 158–161
- Select method, Range objects, 132
- Selected property, ListBox control, 310
- SelectionChange event, 173
- SheetActivate event, 172
- SheetBeforeDoubleClick event, 172
- SheetBeforeRightClick event, 172
- SheetChange event, 172
- SheetDeactivate event, 172
- Sheets object, 54
- SheetSelectionChange event, 172
- Shell function, 141, 143
- Shortcut key option, Record Macro dialog box, 74–75, 92
- shortcut menus, 341
- simplified data, testing code with, 207
- simplifying object references, 55–56
- Single data type, 103
- single document interface, 341
- single-argument function, worksheet functions, 349–351
- Size setting, VBE, 47
- SmallChange property
 - ScrollBar control, 294
 - SpinButton control, 294
- smooth operators, 114–116
- SORT function, 360–361

- Space function, 143
- SpinButton control, 267, 294, 317–319
- Split function, 143
- Sqr function, 143
- Standard toolbar, VBE, 33
- statements
 - assignment statements
 - equal sign operator, 114
 - logical operators, 115
 - operator precedence, 114–115
 - overview, 113–114
 - smooth operators, 114–116
 - Debug.Print statements, 210
 - Elseif statement, 157–158
 - On Error Resume Next statement, 217
 - On Error statement, 200
 - Exit For statement, 164–165
 - GetOpenFilename statement
 - constructing, 256
 - selecting file with, 256–258
 - GoTo statement, 152–153
 - If-Then-Else statement, 155–156
 - Option Explicit statement, 217
 - Resume Statement, 200–202
- static variables, 108–109
- Step value, For-Next loops, 163–164
- Store Macro In option, Record Macro dialog box, 92
- String concatenation operator, 114
- String data type, 103
- String function, 143
- strings
 - fixed-length, 111–112
 - manipulating with built-in functions, 138–139
 - variable-length, 111–112
- Style property
 - ComboBox control, 287
 - MultiPage control, 291

- Sub procedures
 - defined, 14, 37
 - executing
 - from another procedure, 77
 - from button or shape, 143
 - from button or shape, 75–76
 - directly, 72–73
 - from Immediate window, 77
 - from Macro dialog box, 73
 - overview, 70–72
 - with shortcut key, 74–75
 - executing Function procedures from, 78–79
 - naming, 69–70
 - overview, 67–68
- substandard Sub procedures, 14
- Subtraction operator, 114

T

- Tab Width setting, VBE, 46
- tabbed dialog boxes, 323–325
- TabStrip control, 267, 295
- tasks, automating, 11
- Technical Stuff icon, 5
- testing
 - code, 207
 - UserForms, 300, 306
- text, inserting, 11
- Text property, Range objects, 125–126
- TextBox control, 267, 295–296, 317–319
- Time function, 143
- Timer function, 143
- TimeSerial function, 143
- TimeValue function, 143
- Tip icon, 5
- Title argument, 247
 - GetOpenFilename statement, 257
 - GetSaveAsFilename method, 259
- ToggleButton control, 267, 296

- toolbars
 - Quick Access toolbar, 337
 - VBE Standard toolbar, 33
- Top property, UserForm controls, 284
- Trim function, 144
- Trust Center dialog box, 25–26
- trusted locations, 27
- two-argument worksheet function, 351–352
- TypeName function, 144
- typographical conventions
 - code, 3
 - key combinations, 2
 - menu commands, 2–3

U

- UBound function, 144
- UCase function, 144
- UDFs (User Defined Functions)
 - debugging, 355
 - overview, 148–149
- UI (user interface)
 - customizing Ribbon
 - adding macro to, 332
 - manually, 330–332
 - overview, 329–330
 - with XML, 333–336
 - customizing with VBA
 - adding commands to Add-ins Ribbon tab, 338–339
 - adding new item to Cell shortcut menu, 339–340
 - automatically adding customizations, 340–341
 - overview, 337–338
 - shortcut menus, 341
 - single document interface, 341
- UpdateProgress procedure, UserForms, 322
- Use Relative References, macro recorder, 89

- User Defined Functions (UDFs)
 - debugging, 355
 - overview, 148–149
- user forums, 391–392
- user interface. *See* UI
- UserForm Code pane, 269
- UserForms. *See also* dialog boxes
 - adding CommandButtons, 272
 - adding event-handler procedures, 275–276, 307–308
 - adding OptionButtons, 272–275
- ChangeCase macro, 277–278
- changing properties for, 268–269
- controls
 - adding, 267, 282
 - aesthetics, 300
 - aligning and spacing, 297
 - CheckBox control, 267, 285–286
 - ComboBox control, 267, 286–287
 - CommandButton control, 267, 287–288
 - Frame control, 267, 288
 - Image control, 267, 288–289
 - keyboard, 297–300
 - Label control, 267, 289
 - ListBox control, 267, 289–291, 309–311
 - moving and resizing, 297
 - MultiPage control, 267, 291
 - OptionButton control, 267
 - OptionButton controls, 292
 - overview, 281
 - properties, 283–285
 - RefEdit control, 267, 292–293
 - ScrollBar control, 267, 293–294
 - SpinButton control, 267, 294
 - TabStrip control, 267, 295

- testing, 300
- TextBox control, 267, 295–296
- ToggleButton control, 267, 296
- creating, 302–305
- determining selected item, 312–313
- displaying, 269–270, 277
- displaying chart in, 325–326
- ensuring functionality, 326–327
- inserting new, 266
- ListBox control
 - AddItem method, 310
 - cmdOK_Click procedure, ListBox control, 312–313
 - filling, 310–311
 - ListCount property, 310
 - ListIndex property, 310
 - MultiSelect property, 310, 313–314
 - RemoveAllItems method, 310
 - Selected property, 310
 - Value property, 310
- modeless tabbed dialog boxes, 323–325
- MultiSelect property, 313–314
- option buttons, 316–317
- overview, 263–266, 301–302
- progress indicator dialog box
 - overview, 319–321
 - procedures, 321–323
- range selection, 314–316
- SpinButton control, 317–319
- testing, 306
- testing macro, 278–280
- TextBox control, 317–319
- UserForm Code pane, 269
- using information from, 270–271
- validating data, 309

V

- Val function, 144
- Value property
 - ComboBox control, 287
 - ListBox control, 310
 - MultiPage control, 291
 - OptionButton control, 292
 - Range objects, 124–125
 - ScrollBar control, 293
 - SpinButton control, 294
 - UserForm controls, 284
- values
 - assigning to variables, 15
 - color values, 129–130
- variable-length strings, 111–112
- variables
 - assigning values to, 15
 - declaring, 103–106, 395–396
 - defined, 15
 - module-level, 107–108, 321–322
 - overview, 101–103
 - procedure-only, 106–107
 - public, 108
 - removing from memory, 109
 - scoping, 106
 - static, 108–109
- variable-size ranges, 221–223
- Variant data type, 103
- VBA
 - advantages of, 12–13
 - arrays
 - declaring, 116–117
 - dynamic, 117–118
 - multidimensional, 117
 - assignment statements
 - equal sign operator, 114
 - logical operators, 115
 - operator precedence, 114–115
 - overview, 113–114
 - smooth operators, 114–116

- comments, 99–101
- constants, 110–111
- customizing Excel UI with
 - adding commands to Add-ins Ribbon tab, 338–339
 - adding new item to Cell shortcut menu, 339–340
 - automatically adding customizations, 340–341
 - overview, 337–338
 - shortcut menus, 341
 - single document interface, 341
- data types, 103
- dates, 112–113
- defined, 9
- disadvantages of, 13
- ensuring Excel compatibility, 16
- general discussion, 14–16
- labels, 118
- macros
 - automating repetitive operations with, 11
 - automating tasks with, 11
 - creating custom add-ins with, 12
 - creating custom buttons with, 12
 - creating custom commands with, 11
 - creating custom worksheet functions with, 12
 - inserting text with, 11
- overview, 10–11
- resources
 - Auto List Members feature, 64–65
 - Object Browser, 63–64
 - VBA Help system, 62–63
- strings, 111–112
- variables
 - declaring, 103–106
 - life of, 109
 - module-only, 107–108
 - overview, 101–103
 - procedure-only, 106–107
 - public, 108
 - scoping, 106
 - static, 108–109
- VBA code
 - event-handler procedures, 174–177, 275–276, 307–308
 - Function procedures
 - executing, 78–81
 - naming, 69–70
 - overview, 67–69
 - Sub procedures
 - defined, 14, 37
 - executing, 70–77
 - naming, 69–70
 - overview, 67–68
 - UserForms
 - EnterRandomNumbers procedure, 321–323
 - UpdateProgress procedure, 322
- VBA debugger
 - breakpoints
 - Immediate window, 214
 - overview, 211–213
 - stepping through code, 214
 - Locals window, 216
 - overview, 210–211
 - Watches window, 214–216
- VBA Help system, 62–63
- VBA modules
 - adding to project, 35–36
 - copying code into, 44
 - declarations, 37
 - defined, 34
 - entering code directly, 38–41
 - function procedures, 37
 - macro recorder, 41–43
 - sub procedures, 37
- VBE (Visual Basic Editor)
 - activating, 32
 - Auto Syntax Check, 387–388
 - Code pane
 - declarations, 37
 - entering code into module, 38–44
 - function procedures, 37
 - minimizing and maximizing windows, 36–37
 - overview, 33, 36
 - sub procedures, 37
 - commenting out code, 380–381
 - copying blocks of code, 381
 - customizing
 - Docking tab, 48–49
 - Editor Format tab, 47
 - Editor tab, 44–47
 - General tab, 48
 - debugging tools
 - breakpoints and, 385–386
 - overview, 383–384
 - skipping to specific line of code, 384–385
 - editing macros in, 24–25
 - Full Module View mode, 383
 - Immediate window, 33–34
 - jumping to function, 382–383
 - menu bar, 33
 - moving between modules and procedures, 382
 - Object drop-down list, 175–176
 - overview, 31
 - Procedure drop-down list, 175–176
 - Procedure View mode, 383
 - Project Explorer
 - class modules, 34
 - forms, 34
 - Microsoft Excel Objects, 34, 35
 - overview, 33
 - VBA modules, 34, 35–36
 - seeing variable values, 386
 - Standard toolbar, 33
 - viewing macros in, 22–23
- Visible property, UserForm controls, 284
- Visual Basic Editor. *See* VBE

Visual Basic for Applications.
See VBA

VLOOKUP function, 146–147

W

Warning icon, 6

Watches window, VBA debugger,
214–216

Weekday function, 144

Width property, UserForm
controls, 284

WindowActivate event, 172

WindowDeactivate event, 172

With-End With structure, 56, 94

workbook events

activation events, 172, 181–184

BeforeClose event, 172,
179–180

BeforePrint event, 172

BeforeSave event, 172,
180–181

Deactivate event, 172

NewSheet event, 172

Open event, 172, 177–179

SheetActivate event, 172

SheetBeforeDoubleClick
event, 172

SheetBeforeRightClick
event, 172

SheetChange event, 172

SheetDeactivate event, 172

SheetSelectionChange
event, 172

WindowActivate event, 172

WindowDeactivate event, 172

Workbook_SheetActivate event-
handler procedure, 183

Workbook_SheetDeactivate
event-handler
procedure, 183

worksheet events

Activate event, 173

BeforeDoubleClick event,
173, 185

BeforeRightClick event, 173,
185–186

Change event, 173, 186–187

Deactivate event, 173

overview, 173

SelectionChange event, 173

worksheet functions

arguments

no-argument functions, 349

optional arguments, 354–356

overview, 348

range argument, 352–354

single-argument function,
349–351

two-argument function,
351–352

arrays

MonthNames function,
359–360

SORT function, 360–361

calculating mortgage payment,
145–146

customizing with macros, 12

entering, 147

finding maximum value in
range, 145

Insert Function dialog box and

adding argument
description, 364

displaying function
description, 362–363

overview, 144, 345–346

VBA functions, 347

VLOOKUP function, 146–147

wrapper functions, 356–359

writing, 347–348

wrapper functions

ExtractElement function, 357

IsLike function, 358–359

NumberFormat function,
356–357

SayIt function, 358

wrong data-type bugs, 206

wrong version bugs, 206

X

xlCalculationAutomatic
calculation mode, 111

xlCalculationManual calculation
mode, 111

xlCalculationSemiautomatic
calculation mode, 111

XLSM extension, 25

XML, customizing Ribbon with,
333–336

Xor operator, 115

Y

Year function, 144

YouTube, as VBA resource, 393

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Dedication

To Nancy.

Author's Acknowledgments

Thanks to the team at Wiley for their tireless efforts in completing this book. And thanks also to Rod Stephens for catching errors and providing valuable suggestions.

Publisher's Acknowledgments

Acquisitions Editor: Elizabeth Stilwell

Project Editor: Jan Lynn Neal

Development Editor: Jan Lynn Neal

Copy Editor: Colleen Diamond

Technical Editor: Rod Stephens

Proofreader: Debbye Butler

Production Editor: Mohammed Zafar Ali

Cover Image: © BEST-BACKGROUNDS/
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