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FOR INVESTMENTS

Troy A. Adair, Jr.

Excel Applications for Investments

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University of Michigan



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EXCEL APPLICATIONS FOR INVESTMENTS

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PREFACE

Purpose of the Book

This book is meant to assist in the adoption of spreadsheets into the finance classroom. It is intended to serve as either a supplement to a traditional, introductory text on investments or as a stand-alone text for a more advanced course on using spreadsheets in finance.

A spreadsheets' flexibility and built-in functions allow users to model very complicated situations and to change them to perform "what if" analyses very quickly and efficiently, making these programs very popular with business professionals. Unfortunately, the financial education environment has lagged well behind the business world in its adoption of spreadsheets: most finance students still learn finance using financial calculators. These calculators, while a definite improvement over the methods we used prior to their introduction, suffer from several problems, including both a lack of advanced functions and idiosyncratic notation. Until recently, though, the high cost of technology made it prohibitively expensive to use anything else.

However, this cost has decreased dramatically in the past few years, and finance professors find themselves, more and more, teaching in classrooms where all of the students do have access to computers. The push towards ubiquitous computing on many campuses, as well as the increasing availability of Personal Digital Assistants (PDAs) capable of running fairly powerful spreadsheet programs, dictate that this trend is only likely to accelerate.

The spreadsheet program of choice amongst business professionals, and the one used to construct the examples in this book, is Microsoft Excel; its flexibility and built-in functions and tools make it easy to construct even the most complicated financial models. The introduction of enhanced access to external data sources seen in the most recent versions, as well as the continued abundance of available third-party add-ons, make it likely that Excel will continue to be the financial tool of choice for quite some time to come.

The SimNet XPert Excel Tutorial

Though the first section of this book does provide a very brief review of the most crucial aspects of Microsoft Excel, it is not intended to be a student's first exposure to Excel. For those students who are new to Excel, or for those needing a refresher, we've included the *SimNet XPert Excel Tutorial CD-ROM*, a stand-alone tutorial that has proven very effective at helping students get up to speed quickly.

Organization of the Book

The first section of this book is intended both as a brief refresher for readers who may not have used Excel recently and as a guide to setting up Excel for our purposes. Even if

you're fairly comfortable with using Excel, you may wish to at least skim the first section for tips before you skip ahead to Chapter 3.

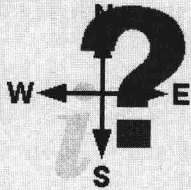

Starting with Chapter 3, this book is organized to cover the major topics of investments in a logical format. Given the large differences in the order of treatment of the included topics in the more common investments texts, the order of coverage here probably will not mirror that of your investments text exactly, but you should find it fairly easy to skip around in this book as needed.

TYPOGRAPHICAL CONVENTIONS

This book consistently uses the following typographical conventions throughout to make directions and guidance more concise and understandable:

| Convention | <i>Explanation</i> |
|---------------------------|--|
| Abbreviated Menu Commands | <p><i>Directions and examples of menu item selections will be indicated by quotation marks, with pauses before subsequent selections indicated by ellipsis marks.</i></p> <p><i>For example, the direction to choose "View ... Toolbars ... Customize" means that you should click on "View," move the cursor to "Toolbars," and then select "Customize."</i></p> |
| Cell References | <p><i>We will follow standard Excel techniques for referencing cells: individual cells will be referred to by their Column Letter, Row Number combination.</i></p> <p><i>For example, "C3" refers to the cell in Column C, Row 3.</i></p> <p><i>Ranges of cells will be referenced by listing the cells bounding the range.</i></p> <p><i>For example, "C4:E4" refers to the cells on Row 4 from columns C through E, inclusive.</i></p> |

| Convention | Explanation | | | | | | | | | | | | | | | |
|--------------------|--|--------|---|---|---|---|--|---|---|--|---|---|--------|---|--|--|
| Excel Functions | <p><i>Built-in functions in Excel often have extended lists of arguments. These arguments will be explained and detailed when we first discuss a function, but subsequent references to that function will be indicated by a pair of parentheses after the function name. Also, when referring to the extended syntax of a function, boldface will be used to indicate required parameters.</i></p> <p><i>For example, the Net Present Value function will be written out as NPV(rate, value1, value2, ...) when first defined, meaning that the interest rate and at least one value must be entered if the function is used. After the syntax is defined, subsequent usage will simply refer to the NPV() function.</i></p> | | | | | | | | | | | | | | | |
| Formula Entry | <p><i>As we develop examples of worksheets, it is going to be helpful if you can see both the formula that I enter in a cell as well as the value displayed. To support this goal, example spreadsheets will display the formulas for key calculations side-by-side with their results. The formula will have a grey background, and the result and formula will be surrounded by a common border.</i></p> <p><i>For example:</i></p> <table><tr><td></td><td>A</td><td>B</td></tr><tr><td>1</td><td>1</td><td></td></tr><tr><td>2</td><td>2</td><td></td></tr><tr><td>3</td><td>3</td><td>=A1+A2</td></tr><tr><td>4</td><td></td><td></td></tr></table> <p><i>The formula shown in cell B3 is the formula actually used in cell A3. The values from A1 and A2 (1 and 2, respectively) are added to get 3.</i></p> <p><i>Directions on how to enter this formula would use quotation marks around what you're supposed to type (e.g., "=A1+A2").</i></p> | | A | B | 1 | 1 | | 2 | 2 | | 3 | 3 | =A1+A2 | 4 | | |
| | A | B | | | | | | | | | | | | | | |
| 1 | 1 | | | | | | | | | | | | | | | |
| 2 | 2 | | | | | | | | | | | | | | | |
| 3 | 3 | =A1+A2 | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | |
| Keyboard Shortcuts | <p><i>Keyboard shortcuts will be indicated by a plus sign (+) separating two or more key names.</i></p> <p><i>For example, Ctrl+V, which is the keyboard shortcut for the paste action, indicates that you need to hold the Ctrl key while pressing V.</i></p> | | | | | | | | | | | | | | | |

| Convention | <i>Explanation</i> |
|---|---|
| Additional Guidance and Alternative Practices | <p data-bbox="587 322 1398 472"><i>As we go over different procedures and techniques, additional guidance or descriptions of alternative practices will be enclosed in grey boxes to differentiate them from the main body of the text:</i></p> <div data-bbox="587 496 1398 741">  <p data-bbox="858 574 1318 645">This is an example of an additional guidance box.</p> </div> <p data-bbox="587 809 1334 880"><i>This guidance will usually be more involved and complex than the time-saving tips discussed below.</i></p> |
| Time-Saving Tips | <p data-bbox="587 946 1318 1017"><i>Hints and tips that intended to save you time will also be displayed in grey boxes, but will use a different graphic:</i></p> <div data-bbox="587 1048 1398 1293">  <p data-bbox="858 1126 1361 1197">This is an example of a time-saving tip box.</p> </div> <p data-bbox="587 1361 1382 1432"><i>These tips will usually be fairly straight-forward and easy for you to use.</i></p> |

| Convention | Explanation |
|---|--|
| <p><i>Typographical Conventions in Sample Spreadsheets for End-of-Chapter Assignments</i></p> | <p><i>In the sample workbooks provided for the end-of-chapter assignments downloadable from the book's web site, inputs are designated by a blue box and outputs are designated by a red box. Unless otherwise directed by your instructor, you may structure the rest of each workbook as you wish, but <u>the inputs and outputs should appear in your workbook in exactly the same places and order that they appear in the corresponding sample workbook</u> (and, no, you don't have to put blue and red borders around them, though it would make your instructor's life a little easier.)</i></p> <p><i>Additionally, while the majority of the formulas throughout the sample worksheets are hidden, a selected few of the cell's formulae have been "revealed" to provide you some guidance; these "revealed" cells are identified by a light green background. Your workbook, though, should not have any cells with a green background when you submit it, and all of your cells must be fully revealed.</i></p> <p><i>The first worksheet of each example will give you additional guidance concerning the mechanics of the workbooks and of the ranges of valid inputs. To insure that your workbook is "flexible" enough, you should try (at least) several different sets of inputs within that range on both your workbook and on the sample workbook, ensuring that you receive the same results using both.</i></p> |

Acknowledgements

A very special "Thank You!" to my wife, Tiffany, and our daughters, Genevieve and Isabella, for their love and support during the writing of this book: thanks for putting up with me.

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PART I - EXCEL: SETTING THE STAGE

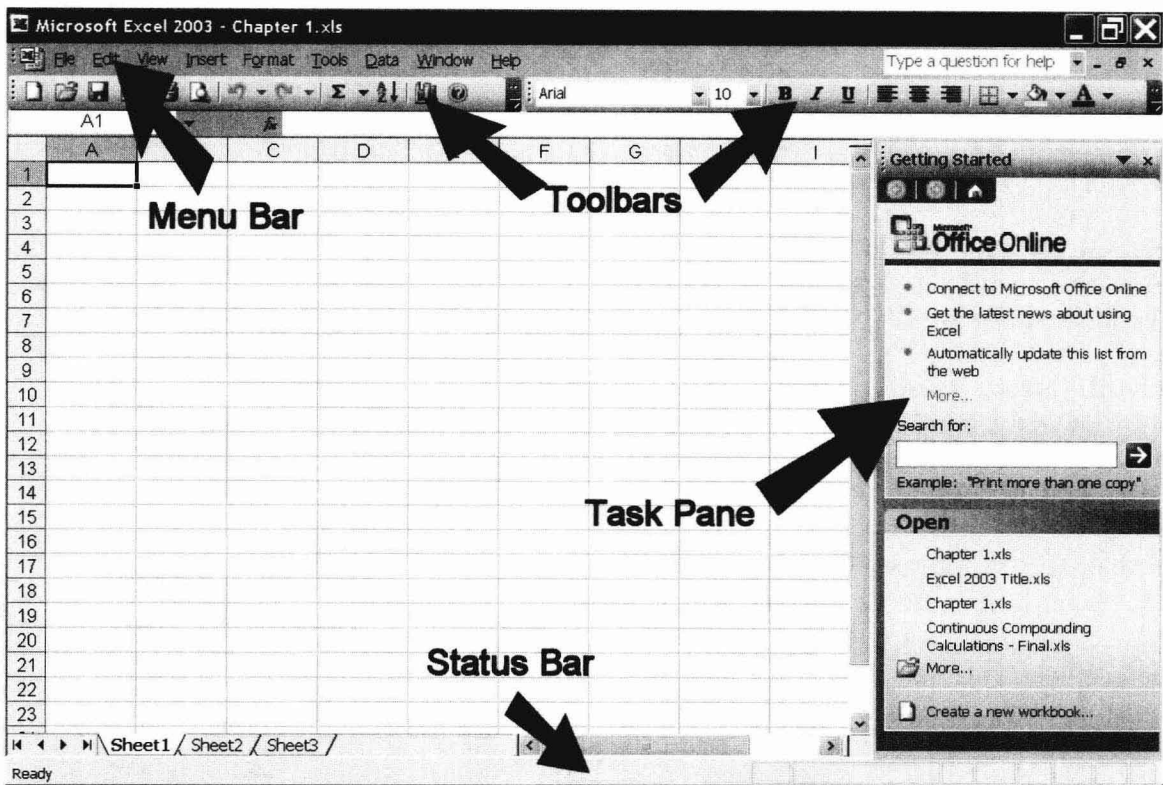
This book is not intended to take the place of an introductory text on Excel; there are quite a few texts already available for that purpose. However, there are some selected topics for which a brief refresher will be helpful. Also, as you'll note throughout this book, there are a few features and functions that we'll need to study more intensively than they are covered in the usual "Intro" book. The following two chapters are intended to fulfill those needs.

Chapter 1 - Making and Using Spreadsheets

1.1 The Excel Interface

The basic Excel document is called a “workbook,” which can contain a number of two-dimensional tables called “worksheets.” When you first open a workbook, you will see an empty worksheet arranged as shown below in Figure 1-1.

Figure 1-1



The Status Bar, Menu Bar and Toolbars should be fairly familiar to you from other Microsoft Office[®] applications, though there are some new menu items and buttons that we will cover as we use them throughout the book. The Task Pane is a relatively recent feature, also shared by other Office applications, but we will be closing it in a moment to free up more workspace.

The Worksheet Area is broken up into “cells,” and each of these cells can be used to hold a value, a formula, or an object such as a picture or graph. At any given time, the Active Cell is the cell that will have its value changed if we type in information or if we choose one of the menu items that affects a cell or range of cells. By default, when you first open a workbook, the cell in column A, row 1 (“A1”) is set to be the active cell. This is

indicated both by a black border around the cell and by shadowing of the respective row and column designators. You can change the active cell by clicking with the mouse on a new cell or by using the arrow keys to move the black border to a new cell.

If we have a cell selected, any value or formula for that cell will be displayed in the Formula Bar, and we can enter new information by simply typing it. If there is already information in that cell, we can edit the existing information either by clicking on the Formula Bar or by pressing the F2 key.

By default, Excel creates three worksheets in each new workbook¹. We can switch our focus from one worksheet to another by clicking on the respective Sheet Tab at the bottom of the worksheet. As we shall see, multiple sheets are particularly handy for organizing our analyses. For example, when we are calculating a firm's *pro forma* net income statements on one worksheet, we can put the figures for the corporate tax schedule on another worksheet so that they are out of the way but still accessible for necessary calculations.

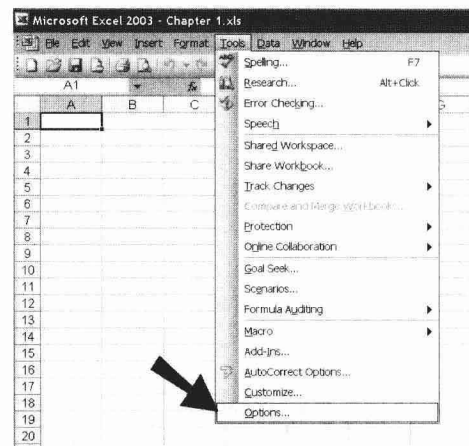
1.2 Simplifying the Interface

Before we proceed, let's alter the look and layout of Excel to better suit our needs. However, please note that the following recommendations are just that: recommendations. If you prefer not to make these changes, don't feel obligated to do so.

Get Rid of the Task Pane

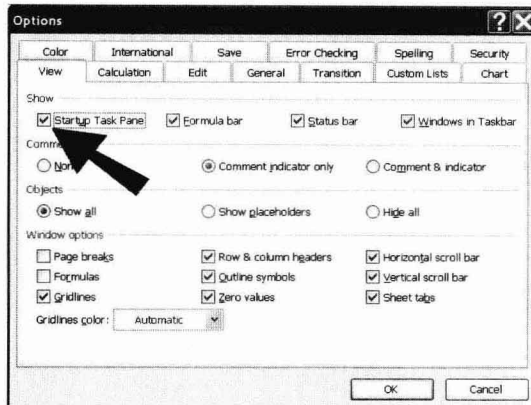
The Task Pane is handy if you find yourself repeatedly opening the same workbooks, but it can be a little burdensome if you are repeatedly creating new workbooks as we are going to do. Since we will usually use the blank workbook that is opened by default when we start Excel, we really don't want to have to manually close the Task Pane, right? To change the Task Pane settings so that it WON'T open automatically with Excel, we will need to select "Tools ... Options" on the Menu Bar as shown in Figure 1-2 ...

Figure 1-2



¹ You can change the default number of worksheets created in new workbooks to any value up to 255 by selecting "Tools ... Options ... General" through the Menu Bar.

Figure 1-3



... and then deselect the “Show Task Pane” box on the View tab shown in Figure 1-3.

Make Room for More Buttons

By default, Excel puts the Standard and Formatting toolbars together on one line. That line is already crowded, and it will only get more so as we add additional items to these toolbars, so let's change things so that each toolbar is on its own line. To do so, select “View ... Toolbars ... Customize” as shown in Figure 1-4.

Figure 1-5

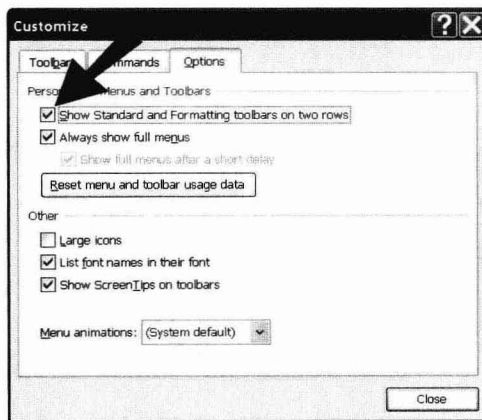
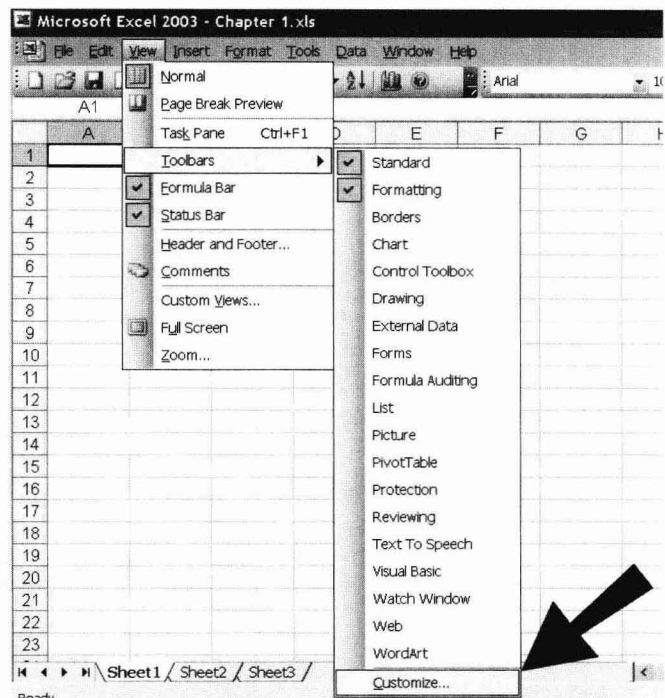
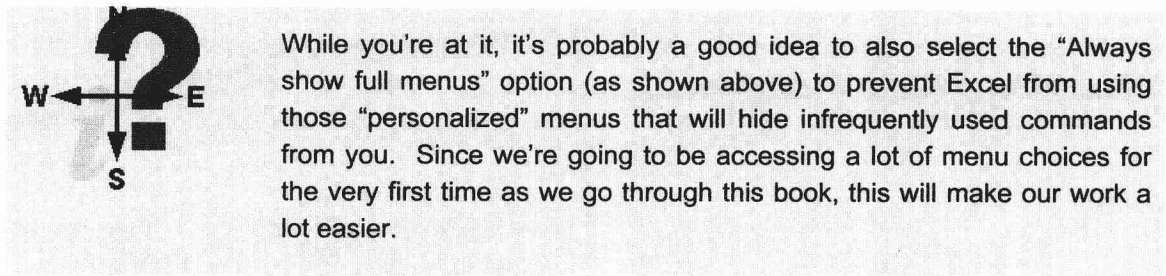


Figure 1-4



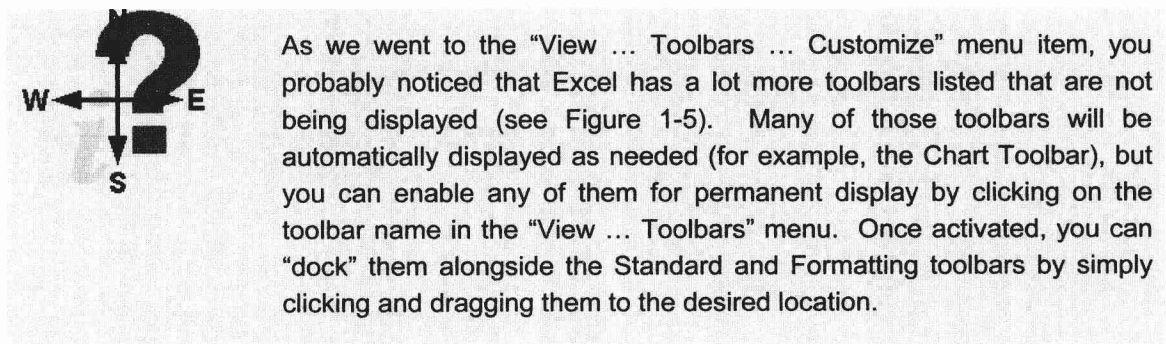
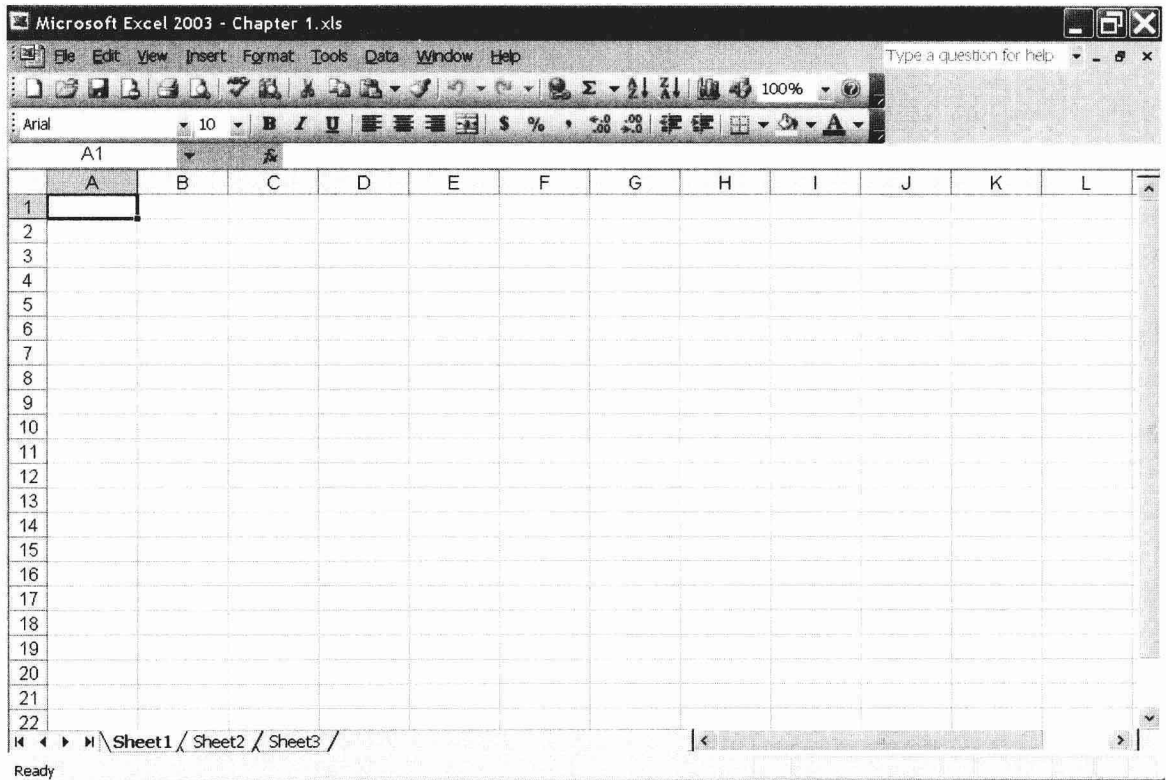
This will open up the Customize dialogue box shown in Figure 1-5. (If necessary, please click on the “Options” tab.)

Select the “Show Standard and Formatting toolbars on two rows” option.



Once you've made these changes, close the dialogue box. The screen will then be less cluttered, as shown in Figure 1-6.

Figure 1-6



Turbo-charge Excel with Some Add-Ins

The last thing that we're going to change is to enable some additional features of Excel that aren't "turned on" when Excel is first installed. Enabling these features does involve a tradeoff; they will load automatically when Excel is opened. This will slow down the startup time, but the delay is miniscule with today's computers, and these features will be crucial to some of our analyses.

To enable these features, choose "Tools ... Add-Ins" to display the Add-Ins dialogue box shown in Figure 1-7.

Figure 1-7

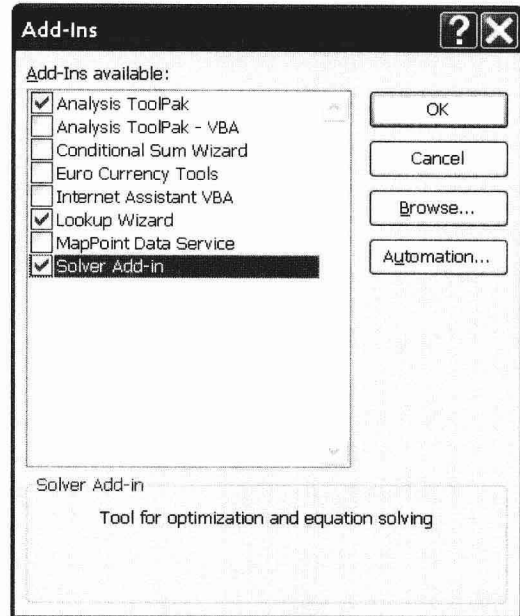
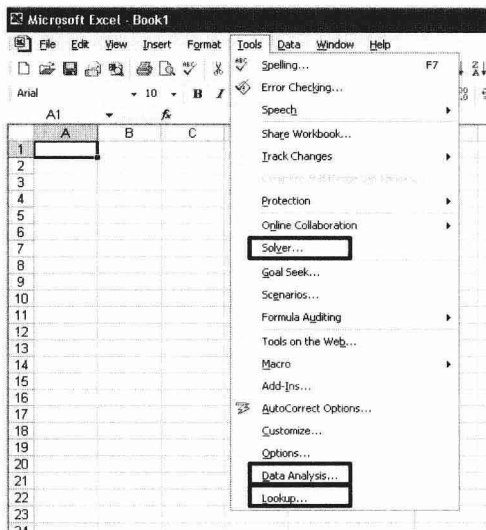


Figure 1-8



As indicated, we will want to select the Analysis ToolPak, the Lookup Wizard, and the Solver Add-in. After we do so, the Analysis ToolPak and Solver will be accessible through the Tools menu as shown in Figure 1-8.

1.3 Building a Worksheet

To get an idea of the power of Excel and how we're going to use it in this book, let's create a worksheet that will show us how much a given amount, invested today, would