

# Succeeding in Business™

with Microsoft®

# Excel® 2013

*A Problem-Solving Approach*

Debra Gross  
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# Succeeding in Business™ with Microsoft® Excel® 2013: A Problem-Solving Approach

*“With knowledge comes opportunity,  
with opportunity comes success.”*

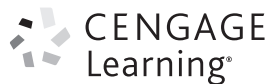
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**Succeeding in Business™ with Microsoft®****Excel® 2013: A Problem-Solving Approach**

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# Preface

## THE SUCCEEDING IN BUSINESS™ SERIES

### Because you're ready for more.

Increasingly students are coming into the classroom with stronger computer skills. As a result, they are ready to move beyond “point and click” skills and learn to use these tools in a way that will assist them in the business world.

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We're excited about the new classroom opportunities this new approach affords, and we hope you are too.



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A unique approach requires unique instructor support; and we have you covered. We take the next step in providing you with outstanding Instructor Resources—developed by educators and experts and tested through our rigorous Quality Assurance process. Whether you use one resource or all the resources provided, our goal is to make the teaching and learning experience in your classroom the best it can be. With our resources, you'll spend less time preparing, and more time teaching.

To access any of the items mentioned below, go to [www.cengage.com](http://www.cengage.com) or contact your Cengage Learning Consultant.

### **Instructor's Manual**

The instructor's manual offers guidance through each level of each chapter. You will find lecture notes that provide an overview of the chapter content along with background information and teaching tips. Also included are classroom activities and discussion questions that will get your students thinking about the business scenarios and decisions presented in the book.

### **ExamView® Test Bank**

ExamView features a user-friendly testing environment that allows you to not only publish traditional paper and LAN-based tests, but also Web-deliverable exams. In addition to the traditional multiple-choice, true/false, completion, short answer, and essay, questions, the **Succeeding in Business Series** emphasizes new critical thinking questions. Like the textbook, these questions challenge your students with questions that go beyond defining key terms and focus more on the real-world decision making process they will face in business, while keeping the convenience of automatic grading for you.

**Student Data Files and Solution Files**

All student data files necessary to complete the hands-on portion of each level and the end-of chapter material are provided along with the solution files.

**Annotated Solution Files and Rubrics**

Challenging your students shouldn't make it more difficult to set grading criteria. Each student assignment in your textbook will have a correlating Annotated Solution File that highlights what to look for in your students' submissions. Grading Rubrics list these criteria in an auto-calculating table that can be customized to fit the needs of your class. Electronic file format of both of these tools offers the flexibility of online or paper-based grading. This complete grading solution will save you time and effort on grading.

**PowerPoint Presentations**

The PowerPoint presentations deliver visually impressive lectures filled with the business and application concepts and skills introduced in the text. Use these to engage your students in discussion regarding the content covered in each chapter. You can also distribute or post these files for your students to use as an additional study aid.

**Figure Files**

Every figure in the text is provided in an easy to use file format. Use these to customize your PowerPoint Presentations, create overheads, and many other ways to enhance your course.

**Sample Syllabus**

A sample syllabus is provided to help you get your course started. Provided in a Word document, you can use the syllabus as is or modify it for your own course.

## Succeeding in Business Series Walk-Through

The Succeeding in Business approach is unique. It moves beyond point-and-click exercises to give your students more real-world problem solving skills that they can apply in business. In the following pages, step through *Succeeding in Business with Microsoft Excel 2013* to learn more about the series pedagogy, features, design, and reinforcement exercises.

Thought-provoking quotes at the beginning of each chapter set the stage for the concepts to be presented.

The Learning Objectives provide a quick reference for topics covered in the chapter.

Each chapter begins with an introduction that provides an overview of the skills and concepts students will learn.

This listing offers quick reference to the skills that students will be introduced to in the chapter.

A business case about a sporting goods company is used throughout the Excel text, placing the concepts covered in a real-life context.

### Applying Fundamental Excel Skills and Tools in Problem Solving

Finance: Analyzing Costs and Projected Revenues for a New Product

*"When the only tool you own is a hammer, every problem begins to resemble a nail."*  
—Abraham Maslow

**LEARNING OBJECTIVES**

**Level 1**

- Define common Excel error messages
- Correct basic formatting problems in a worksheet
- Correct errors in formulas
- Understand precision vs. display of cell values

**Level 2**

- Work with multiple worksheets
- Calculate total, average, minimum, and maximum values with functions
- Understand how functions work: syntax, arguments, and algorithms
- Use the AutoSum feature to perform calculations quickly
- Calculate the number of values using both COUNT and COUNTA

**Level 3**

- Organize a workbook
- Understand relative, absolute, and mixed cell referencing
- Write formulas with different types of cell references
- Copy formulas with different types of cell references
- Name a cell or cell range

**FUNCTIONS COVERED IN THIS CHAPTER**

AVERAGE	MIN
COUNT	MAX
COUNTA	SUM

Microsoft product screenshots used with permission from Microsoft Corporation.

Applying Fundamental Excel Skills and Tools in Problem Solving

Chapter Introduction

Microsoft Excel 2013 provides a variety of tools for working with a spreadsheet, which is referred to as a **worksheet**. A spreadsheet is a sheet organized into columns and rows. Excel provides many features that make the worksheet easy and efficient to use. An Excel file can contain multiple worksheets combined into a single file.

This chapter presents some of the fundamental skills for working with Excel to solve problems and support decisions. You will learn how to write formulas in cells to perform calculations and how these calculations can be automatically updated when input values change. This chapter discusses some of the formatting options and ranges of cells.

One important, but frequently overlooked, skill is identifying errors. The more complex the spreadsheet, the more likely errors will be identified by Excel error messages. This chapter explains how to identify these common mistakes.

You will learn about some of the rules that affect calculations performed in an Excel worksheet. The chapter covers some of the most frequently used and simplest functions, formulas, and tasks. Finally, you will explore the results of copying and pasting formulas and cell references. For those unfamiliar with basic spreadsheet terminology and the Excel interface, be sure to read the Introduction chapter.

**Case Scenario**

The product design team at TheZone has been assigned the task of bringing to market a new and significantly different athletic shoe. This new shoe, called TZEdege, will combine the support of superior European footwear with the comfort and styling of American running shoes. The design team recently created a worksheet containing the component costs related to manufacturing this new athletic shoe. The product design team has asked Paul Gomez, a financial analyst for the company, to review the worksheet for several reasons. First, they want to ensure that it is formatted properly and contains no errors. Second, they need Paul to perform some cost calculations to determine the value of different pricing alternatives and to provide feedback on the preliminary budget and projected revenue. Paul and the product design team can then use the worksheet as an analytical tool, which in turn will help management make sound business decisions regarding the launch of the new athletic shoe.

Applying Fundamental Excel Skills and Tools in Problem Solving

Case Scenario

Finance

Chapter 1 Applying Fundamental Excel Skills and Tools in Problem Solving

**LEVEL 1**  
**Identifying and Correcting Common Errors in Formatting and Formulas**

**Examining a Basic Worksheet for Errors**

The product design team is working with Paul and the production engineers to estimate production costs for the TZEEdge athletic shoe. Although costs will not be the overriding factor in the business decision to launch this new shoe, production cost goals must be met to place the shoe in the correct market niche. After the product design team has all the information in place, Paul will analyze the costs and make recommendations.

The product design team started to tabulate the material costs of the TZEEdge shoe. Figure 1.1 shows the Excel worksheet developed so far, which is contained in a workbook named TZEEdge\_Material\_Costs. To open the workbook file, Paul clicks the FILE tab on the ribbon and selects Open in the navigation bar of the Backstage view. You can access all commands for opening, saving, and printing files from the Backstage view. When you start Excel, the ribbon with the HOME tab displayed is pinned to the worksheet by default. To minimize the ribbon, click the Collapse the ribbon button [X] located in the lower-right corner of the ribbon. Minimizing the ribbon will give you more work area. The ribbon remains minimized until you pin it to a worksheet again. To pin the ribbon to the worksheet, click the Pin the ribbon button [P] located in the lower-right corner of the ribbon when it is displayed.

**Figure 1.1: Initial worksheet for TZEEdge**

From your work with Excel, you know that Excel cells can contain numeric values, such as the number 12 in cell C5; text labels, such as the word *Company* in cell A2; and calculated values, such as the total 50 shown in cell D16. As you can see, the worksheet

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Chapters contain three levels of complexity. The levels first introduce an application concept, then lead students through a problem-solving exercise using the software. With each level, the complexity of the material increases, while the exercises become less structured.

Large, clear figures provide a visual aid to the concepts presented, making it easy for students to follow along.

Steps to Success activities within each level offer students the opportunity to apply the skills they have learned before moving to the next level.

Chapter 10 Troubleshooting Workbooks and Automating Excel Applications

**Steps To Success: Level 3**

One of Kishi's colleagues in HR uses an Excel worksheet to keep track of daily information regarding appointments and visitors expected at the company's campus. Each morning this information is printed and distributed to each of the receptionists and administrative assistants. The receptionists are given one version and the administrative assistants another. Kishi's colleague would like your help in creating a macro to print out the worksheet in the two required formats. To make it easy for anyone to produce the appointment and visitor lists, HR would like the capability of launching the macro from a shortcut key sequence, a macro button on a custom ribbon tab, and a custom button directly on the worksheet.

- Open the workbook named *DailyList.xlsx* located in the Chapter 10 folder, and save the file as the macro-enabled workbook *DailyList\_Monday.xlsx*. If the DEVELOPER tab is not already visible, add it to the ribbon.
- TROUBLESHOOTING:** In order to complete this step, the macro settings on your computer must be enabled. If you receive a Security Warning saving macros have been disabled or the file can't be saved as a macro-enabled workbook, open the Trust Center to check the macro security settings. If you don't have access to the Trust Center, contact your instructor or computer support person for assistance.
- Enter your name and current date in the cells highlighted in yellow.
- Plan the macro steps and then record the macro, naming it *PrintText*, and saving it in the current workbook. Assign the macro to the Ctrl-Shift-F shortcut key combination. Enter a description for the macro. Perform the following steps while recording the macro:
  - For the first printout, specify:
    - Custom header with **Visitors – Admin List** in the top center and page number on the top right
    - Landscape orientation
    - Print document to default printer (printer currently selected)
  - For the second printout and to reset the worksheet, make the following modifications:
    - Hide columns G and H
    - Change the custom header to **Visitors – Receptionist List**
    - Set the orientation to Portrait
    - Print the document to the default printer
    - Unhide columns G and H
- Run the macro to test it. If it doesn't perform all the tasks you planned, re-record the macro using the same name. (*Hint:* You must enter a new shortcut key because Ctrl-Shift-F has already been assigned to the first macro you recorded.)
- Add a custom button on the Monday worksheet with the label **PRINT VISITOR LISTS** to run the macro. Place it at the top of the worksheet around columns F and G.

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Troubleshooting paragraphs offer tips and hints to help students work more efficiently and avoid errors as they work through the steps.

Applying Fundamental Excel Skills and Tools in Problem Solving Chapter 1

**How To**

**Change a Cell Reference to an Absolute or Mixed Cell Reference**

- Type the cell reference in your formula, or click the cell you want to include in the formula.
- Type the dollar sign(s) needed to make the cell reference absolute or mixed.

OR

- Type the cell reference in your formula, or click the cell you want to include in the formula.
- Press the F4 function key to add the dollar sign(s) needed to make the cell reference absolute or mixed. The F4 function key cycles through the display of dollar signs. If you press F4 once, the cell reference changes to an absolute reference, with dollar signs before both the row and column. If you press F4 twice, only the row is made absolute, and pressing F4 a third time makes only the column absolute. Pressing F4 again clears all absolute references to the cell address.

**Naming a Cell or Cell Range**

Another technique that you can use to refer to a cell as an absolute cell reference is to give the cell a name. You can name a single cell or a cell range, and then use that name directly in a formula. To name a cell or range, you first highlight the cell or cells to be named and then click the Name box, just below the ribbon on the left. If Paul names cell B1 pair, for example, then instead of using the cell reference B\$B1 in the formula, he could write =pair\*B1\*CS. Note that range names, unlike text labels, are not enclosed in quotation marks when used in formulas. If you attempt to use a name that has not been defined, Excel displays the error message #NAME!

**Writing a Formula to Subtotal the Cost of Goods Sold**

The next calculation Paul needs to perform is to subtotal the Cost of Goods Sold (COGS). Paul can write the formula in cell C14 as =SUM(C11:C13). However, because Paul needs to copy the formula across the row, he must consider whether any absolute cell references are required. In this case, the cost values for each pricing alternative needs to change, so the cell references are relative and no dollar signs are required.

**Best Practice**

**Using Absolute Cell References Appropriately**

When you copy a formula both down a column and across a row, the placement of the absolute sign (\$) is critical, or the incorrect values will result. When copying in only one direction, either across a row or down a column, when the addition of extra absolute signs will not affect the calculated outcome, but they can result in less efficient and confusing formulas. For example, you might be tempted to write the formula =SUM(C11:C13) as =SUM(C\$11:C\$13) because you want the column references to change, but you do not want the row references to change when the formula is copied across the row. However, when you are only copying a formula across a

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Best Practice boxes offer tips to help students become more efficient users of the application.

How To boxes offer a quick reference to the steps needed to complete certain tasks.

8. Describe two ways to document information in a workbook.
9. Explain the difference between precedent and dependent cells.
10. What are false positives and false negatives, and which are harder to detect in worksheets?
11. What is a macro? How could you use one in an Excel workbook?
12. Identify three ways to run a macro in Excel.
13. What is the difference between saving a macro to the current workbook versus a personal macro workbook?
14. What is VBA?
15. What is the first line of VBA code in a macro?
16. What is the major difference between an Excel workbook with an .xlsm filename extension and an .xlsx extension?

Case Problems

Level 1 – Troubleshooting Formulas and Data Entry in a Payroll Data Workbook for Irene’s Scrapbooking World



Similar to other small businesses, Irene’s Scrapbooking World outsources the processing of its payroll to its accounting firm. Twice per month, Irene Watson, the owner of Irene’s Scrapbooking World, creates a workbook that contains her employees’ payroll information to send to the accounting firm of Wipson & Lynn, LLP. Wipson & Lynn then uses that information to prepare the paychecks for the employees and calculate Irene’s Scrapbooking World’s payroll liabilities to the government and other entities, and to prepare its payroll-related reports, such as the Federal 941 forms.

Wipson & Lynn charges Irene based on the number of paychecks it processes for her company. A number of Irene’s payroll-related workbooks have contained data-entry errors that the firm’s personnel had to fix before it could process the payroll. Wipson & Lynn also charges Irene for the time it takes to track down and fix those errors.

Irene has asked you to use the Excel data validation and protection tools to troubleshoot the current payroll workbook and set up the workbook to help prevent errors from occurring in the future.

Business-focused case problems provide additional practice for the problem-solving concepts and skills presented in each level.

The Chapter Summary provides a brief review of the lessons in the chapter.

6. Add a macro button named **Print Visitor List** to a new ribbon tab named **CUSTOM** in a group called **Macros**. Place this new ribbon tab at the end of all existing tabs. Add the command buttons to **Hide Columns** and to **Unhide Columns** in this ribbon group. (*Hint:* Search for the commands **Hide Columns** and **Unhide Columns** from the **All Commands List**.)
7. Save the workbook, and then test the macro buttons.
8. View the code in the Visual Basic Editor. Copy the code starting from the beginning (Sub) until the first End With statement. (*Hint:* Select the code to highlight it and then use Ctrl+C to copy the code to the Clipboard.) Exit the VBA Editor, and then paste (press Ctrl+V) the code onto a new worksheet named code.
9. Save and close the **DailyList\_Monday.xlsm** workbook.

Chapter Summary

This chapter explored creating error-free Excel applications that function as decision support systems. In Level 1, you customized an Excel application so that others can easily use it. You validated data entry and protected the worksheet structure. You also provided thorough documentation for users, including a documentation worksheet and cell comments.

In Level 2, you audited formulas and evaluated error messages in cells using the Excel formula auditing tools to trace and correct errors. In Level 3, you automated a workbook by creating and running a macro. You made the macro easy to use by assigning it to a custom button that users can click to run the macro and learned how to customize and insert ribbon tabs, groups, and command buttons. Finally, you viewed the Visual Basic Editor window to get a better understanding of how a macro works.

Conceptual Review

1. What is a decision support system?
2. Data validation can be used to minimize this type of mistake when creating Excel applications.
3. What is a data validation rule? When would you use the **Circle Invalid Data** feature?
4. What is the difference between an input message and an error alert in the context of Excel data validation?
5. What style of error alert prevents a user from storing an invalid entry in a worksheet?
6. Explain the two basic steps you must perform to protect the contents of a worksheet.
7. What feature can be used to prevent users from inserting, deleting, or renaming worksheets in a workbook?

Conceptual Review questions provide a brief review of key concepts covered throughout the chapter.

The Case scenario for the Level 3 problem builds through the text, giving students the opportunity to build a portfolio of projects.

6. Airline tickets are assigned a fare category based on the base fare ticket price (column G) and the categories listed on the **Fees** worksheet. In cell I3, write a formula that determines the fare category for this ticket. Copy the formula to cells I4:I6.
7. The **Discounts** worksheet contains a two-dimensional table that has been set up to find the discount category of a ticket based on the weekday of travel and the fare category. In cell J5, write a formula that determines the discount category for this ticket. Copy the formula to cells J4:J6.
8. In a separate area of the **Discounts** worksheet, create a horizontal lookup table based on the following discount information:
  - Fare discount category AA: 0% discount of the published base fare
  - Fare discount category X: 25% discount of the published base fare
  - Fare discount category Y: 50% discount of the published base fare
  - Fare discount category Z: 65% discount of the published base fare
9. In cell K3 of the **Requests** worksheet, write a formula that determines the discounted fare price (base fare minus discount) of this flight using the table you created in the **Discounts** worksheet. Fares should be rounded to the nearest dollar. (*Hint:* Do not use an IF function.) Copy this formula to cells K4:K6.
10. In cell L3, calculate the airport fee based on the fee schedule in the **Fees** worksheet. Note that the airport fee is based on the discounted fare. Copy this formula to cells L4:L6.
11. In cell M3, calculate the total ticket price that America Travels can obtain (discounted fare plus airport fees). Copy this formula to cells M4:M6.
12. In cell N3, compare the America Travels total ticket price to the corporate fare that Convertro found. Return a TRUE value if the America Travels price is less than the corporate fare Convertro was offered. Copy this formula to cells N4:N6.
13. Format your worksheet so that it is easy to read and understand.
14. Save and close the **Convertro Travel Quotes.xlsx** workbook.

Level 3 – Creating a Cost Estimate Form for CKG Auto



As part of its product line, CKG Auto has nine basic models, each with different options and features. Although many car buyers are concerned about the initial cost of a car, customers are also becoming increasingly concerned about the yearly operating expenses they can expect. They frequently want to compare two or more purchase options to see how much a car costs to run each year. Although they might be willing to spend an extra \$5,000 to purchase a sports utility vehicle or luxury car with many options, customers might reconsider when they calculate the annual cost of gas and insurance.

Each case problem focuses on a specific business discipline, such as accounting, finance, marketing, sales, and operations management. Marginal icons representing each discipline make it easy to see which disciplines are covered in each case problem.

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## About the Authors

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### Debra Gross

Debra is a former faculty member at The Ohio State University in the department of Computer Science and Engineering. During her tenure, she taught students to use business software tools, such as Microsoft Excel, for problem solving. Prior to teaching, Debra spent 17 years in the corporate world in various aspects of capital project management and business process redesign in the food and chemical industries. She has co-authored several books and a series of case study problems. Debra currently teaches at the Ohio State University in the department of Computer Science and Engineering where she is also the Course Coordinator for several classes teaching the use of spreadsheet and databases to solve problems. Debra received her MBA from the University of Chicago Graduate School of Business in Finance and Accounting and an S.B. from MIT in Chemical Engineering.

### Frank Akaiwa

#### Indiana University

Frank E. Akaiwa has been teaching in the Kelley School of Business at Indiana University since 1997. He holds degrees from Tennessee Technological University and Indiana University. Prior to teaching at Indiana University, Mr. Akaiwa worked as a civilian engineer for the U. S. Navy. Bringing together his engineering and operations background with his affinity for technology, Mr. Akaiwa has thoroughly enjoyed helping students learn how to apply technology to contemporary business situations. Many of the ideas and concepts presented in this textbook were developed to help students move beyond simple “point and click” usages of computer applications. The author resides in Bloomington, IN with his wife, Carolyn Cooke, their three children, Jonathon, Benjamin, and Abigail, a menagerie of animals, and a closet full of old computers.

### Karleen Nordquist

#### Smarthinking, Inc.

Karleen Nordquist has been tutoring Accounting and Finance topics for post-secondary students through Smarthinking, Inc., since 2000. She also has over a dozen years of experience teaching information systems and business-related courses, and enjoys reading and learning about technology of all forms. Teaching and learning is in Ms. Nordquist’s blood, as she comes from a family rife with educators. She also works as an accounting and information systems analyst and consultant. Ms. Nordquist has earned degrees at Minnesota State University Moorhead and the University of North Dakota. Prior to entering the teaching profession, she worked in public accounting and as an auditor.

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— Debra Gross  
— Frank Akaiwa  
— Karleen Nordquist

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— Debby

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— Frank

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—Karleen

# Introduction to Problem Solving and Decision Making with Microsoft Excel 2013

*“We are continuously faced by great opportunities brilliantly disguised as insoluble problems.”*

—Lee Iacocca

## LEARNING OBJECTIVES

- Understand concepts related to problem solving and decision making
- Identify the different steps in the problem-solving process
- Explain the role Excel can play in problem solving and decision making
- Describe how problem solving is presented in this text
- Explore the basics of Excel 2013

Microsoft product screenshots used with permission from Microsoft Corporation.



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## About This Book and Microsoft Office Excel 2013

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The traditional study of computer applications has mostly involved acquiring skills related to an application's features and functions. Although this approach is important in teaching the mechanics required to perform certain tasks, it does not address *when* a particular tool is most appropriate or *how* it should best be used to solve a specific problem.

This book focuses on teaching how to solve problems using Microsoft Excel 2013, although the concepts and tasks presented could apply to a variety of computer applications and programming languages. Excel is widely used in business as a tool for solving problems and supporting decision making. There are two perceptions of Excel to consider: one is that Excel is the obvious extension of the desktop calculator into the personal computer; the other is that Excel is a powerful tool for the manipulation and analysis of data. Data is usually analyzed to provide support for deciding whether or not to take some course of action—a decision. Not all decisions require a spreadsheet for analysis, but many of the complexities faced in business are made simpler and easier to understand when a tool like Excel is employed properly. This book helps you learn what kinds of problems are best solved using spreadsheets and how to solve them; however, for in-depth exploration of effective decision making, further study is recommended. One of the main goals of this book is that you will “learn how to learn,” becoming confident in your own ability to explore new Excel features and tools to solve problems and support your decisions.

When you work with Excel, using the correct tools can greatly increase your ability to deal with not only the immediate problem presented, but also the inevitable “what-if” analysis. One example of how an organization might perform what-if analysis is with a financial model of its business in a spreadsheet. The model summarizes various pieces of financial data to determine information such as assets, liabilities, sales, and profitability—creating a representation or model of the organization in the spreadsheet. In this example, the spreadsheet could be used to evaluate what would happen if:

- The organization cut sales prices by 5%.
- The sales volume increased by 10%.
- The organization improved its inventory turnover by 8%.
- The organization issued \$1,000,000 in bonds.

Using a spreadsheet allows the organization to quickly change various inputs (think of these as independent variables in a mathematical equation) and see what happens to the outputs (think of these as dependent variables in a mathematical equation). The ability to model the potential impacts of decisions before they are made is very valuable in today's complex business environment. As a result, many organizations spend hundreds of hours building models in spreadsheets. Of course, a model is limited by the detail and quality of the data used to build it.

One benefit of spreadsheet modeling lies in the ability to quickly revise and update the data and mathematical formulas used to generate the answers or results. Consider the typewriter: It provides just as much productive value as a word-processing program until you need to revise what you are writing. Easy revision and calculation are important features of Excel, but its power as a decision-making tool is what moves it far beyond paper and pencil. What-if analysis is often a key element in the decision-making process, allowing decision makers to see the impact of changes to their businesses. This type of analysis is extremely valuable because the only sure thing in business today is that nothing will stay the same.

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## **The Relationship Between Problem Solving and Decision Making**

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In his book, *Management Challenges for the 21st Century* (Oxford, UK: Elsevier Ltd., 1999), Peter Drucker states the following:

The most important, and indeed the truly unique, contribution of management in the 20th century was the fifty-fold increase in the productivity of the “manual worker” in manufacturing. The most important contribution management needs to make in the 21st century is similarly to increase the productivity of “knowledge work” and the “knowledge worker.” The most valuable assets of a 20th-century company were its production equipment. The most valuable asset of a 21st-century institution, whether business or non-business, will be its knowledge workers and their productivity.

**Knowledge workers** are those people who work with and develop knowledge. Data and information are their raw materials. Knowledge workers use this raw material to analyze a particular situation and evaluate a course of action. As a reader of this text, you are most likely a knowledge worker or trying to become one. The rise of the knowledge worker over the last century has followed a corresponding rise in the value of information in business and society. More knowledge and information are readily available now than at any other time in history.

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## **Information Overload**

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How much information is created every year? According to a study by Peter Lyman and Hal Varian (Lyman and Varian, 2003), researchers at the University of California, Berkeley, “Print, film, magnetic, and optical storage media produced about 5 exabytes of new information in 2002. Ninety-two percent of the new information was stored on magnetic media, mostly in hard disks.” This figure was roughly double the amount of information created in 1999, the first year the pair looked at this issue, and surely is continuing to grow. The amount of information generated was so large that a new term, the exabyte (EB), was coined to describe it. An exabyte is the equivalent of 1,000,000 terabytes (TB). A TB is the equivalent of 1000 gigabytes (GB). Five EBs of information is equivalent in size to the information contained in 37,000 new libraries the size of the Library of Congress, which has the largest book collection in the world.

What is information and where does it come from? The term *information* can mean many things to different people. For the purpose of this discussion, **information** is defined as data that is organized in some meaningful way. **Data** can be words, images, numbers, or even sounds. Using data to make decisions depends on an organization's ability to collect, organize, and otherwise transform data into information that can be used to support those decisions—a process more commonly referred to as **analysis**.

The amount of information available can overwhelm or overload many decision makers as they try to determine which sets of data/information are important and which should be ignored. The result is a complex world in which decision makers can no longer rely on intuition and back-of-the-envelope calculations to make effective decisions; they need tools that support decision making and help them to solve problems.

### Which Comes First: The Problem or the Decision?

You have been trained since grade school to solve problems. These problems start with simple addition and subtraction, and then move to multiplication and division. You might start by counting on your fingers and then learn to become a “human calculator” by memorizing multiplication tables. These are skills you use every day to solve simple problems, such as dividing the lunch bill and figuring out the tip. These problems result from the need to make a decision. Do you want to pick up the entire lunch tab? If not, you need to figure out what each person owes.

Decision making and problem solving are interrelated—two sides of the same coin. **Decision making** is simply making up your mind about something. A **problem** can be thought of in two ways: as an obstacle or a difficulty that prevents you from reaching some goal, or as a question to be answered. So, which comes first, the problem or the need to make a decision? It depends. You might encounter an obstacle that must be removed in order to move forward, or you might be presented with a choice that requires certain questions to be answered before you can make a decision. The complexity of the situation determines the number of problems requiring solutions and choices requiring decisions. Thus, problem solving and decision making are interrelated.

The complexity of decision making in today's business world often requires that a great deal of time be spent considering the available options and what their potential outcomes will be. To do this well, you need to learn some new skills. Specifically, you need to learn how to use applications that can support your decision making. In technical terms, this type of application is referred to as a **decision support system**, or **DSS**. Decision making utilizing computer models is part of a larger concept of decision support systems that can encompass a variety of diverse topics, such as management science, decision theory, mathematical modeling, operations management, artificial intelligence, cognitive science, psychology, and database management. This text focuses on how to use Excel as a decision support tool and shows you that a spreadsheet is far more than a sophisticated calculator; it is used extensively at the highest level of decision making.

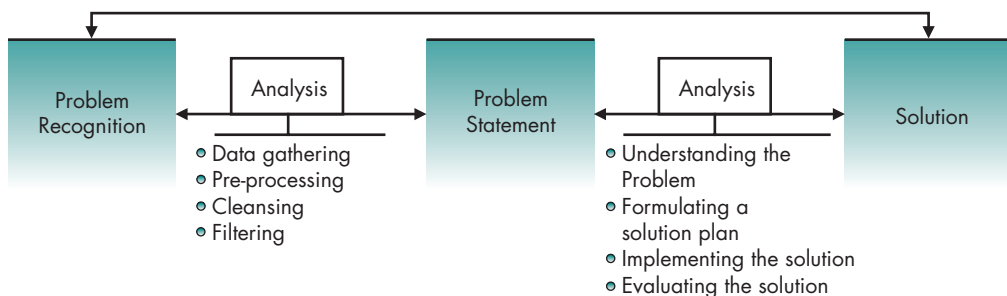
Problem solving in Excel has a numbers-oriented, or quantitative, basis. These problems can be expressed in numeric terms. Although Excel can be a powerful tool to manipulate text, it is strongest in *quantitative* analysis. But decisions are rarely based solely on numbers. There is a more subjective, or *qualitative*, side that is hard to put into numeric terms, but which can determine the success or failure of any implementation. Consider outsourcing as an example. Outsourcing is the action of obtaining a product, component, or service from an outside supplier instead of making or doing it in-house. The quantitative basis for such a decision revolves around comparing the costs and benefits of each alternative. The qualitative factors that need to be considered include the supplier's reputation for quality and performance, as well as how much effort would be required to integrate the supplier into the organization's business processes. Regardless of the quantitative or qualitative nature of the situation, the interrelationship of problem solving and decision making will continue.

## A Problem-Solving Process

Problem solving is, of course, the process used to find a solution to a given problem. But how do you know what the problem is in the first place? As mentioned earlier, a problem can be thought of as something that keeps you from achieving your goals. Usually it is the result of some sort of stoppage or obstacle—something that gets in the way of your progress—and you need to figure out a way to deal with it.

There are probably as many problem-solving approaches as there are problems. Figure 1 illustrates a general model of a problem-solving process, consisting of three main phases—Problem Recognition, Problem Statement, and Solution—with detailed analysis activities occurring to move from one phase to the next.

**Figure 1: General model of a problem-solving process**



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## Problem Recognition

The first step in solving a problem is to recognize what the problem is or even if any problem exists. After a problem is recognized, it needs to be described and analyzed further.

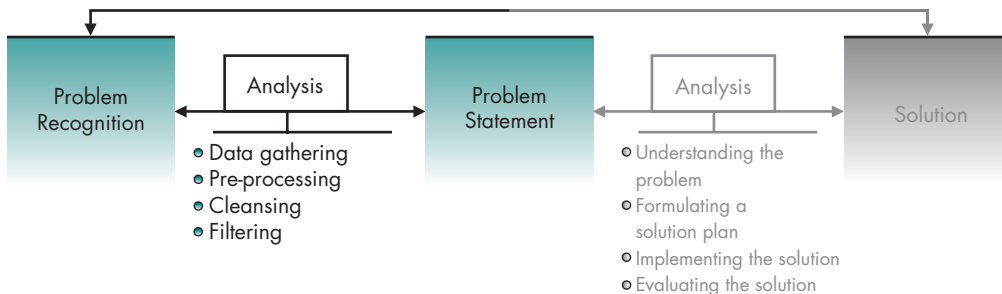
How do you make sense of all the information around you when faced with a problem to solve? Every day, people are presented with information that they must process in order to function in their personal and professional lives. In the morning, you might use the weather report in the newspaper, on the radio, or on television to guide you on how to dress for the day. Should you wear a coat, add a sweater, or even carry an umbrella? You can rely on carefully calculated weather data indicating there is a 60% chance of rain that day, or you could look at the sky and decide based on your intuition and experience that it might rain. Both are equally valid strategies. After all, what is the risk? You might get wet, but eventually you'll dry out.

Some decisions carry a bit more risk and might require more thought before acting. How do you think about making a decision and what role does gathering information play in that thought process? Using the previous example, most people have all the information they need to decide how to dress for the weather, based on past experiences. They don't need to gather raw data and take surveys. Many times in business, however, people don't have enough information to make a decision. Consider the example of an airline company that is deciding whether to enter a new market. The airline executives could make the decision based on intuition and experience, but the company's investors might be more comfortable if the decision could be justified based on market research and sound analysis by industry experts. Information is required to do any such analysis.

## Analyzing the Problem

As shown in Figure 2, four analysis steps are required to move from the Problem Recognition phase to the Problem Statement phase.

**Figure 2: Analyzing the problem**



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The first step in analyzing the problem is **data gathering**. Data can come from a variety of sources, such as an enterprise-wide data system or industry market analyses. After sources have been identified, credibility, reliability, and accuracy of the data should be considered. Data is rarely in exactly the right format you need and is often corrupt in some way. This brings up the next step in analysis—**pre-processing**, in which the data is manipulated

into the needed format. After the format is set, you move to the **cleansing** step, in which any data corruption is identified and corrected, if possible. Corrupt data is missing some element or is incorrect in some way. Corruption can be caused by data loss due to computer problems, but is often caused by human error. The final step in analysis involves **filtering** out data that isn't useful or necessary. As you narrow your sources of data, you are beginning to transform it into information and are getting closer to being able to recognize problems that exist. After firmly establishing the problem or problems that exist, you move to the next phase of the process: articulating the problem statement.

## Problem Statement

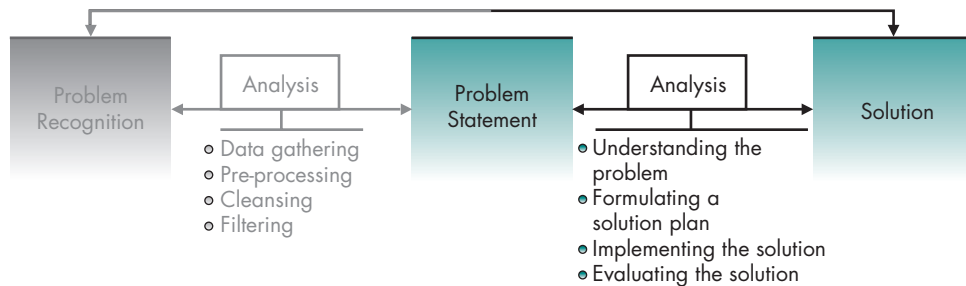
The problem statement can be similar to a typical math word problem found in early education. The key characteristic of any problem statement or word problem is that some missing piece of information is identified that is required to solve a problem or make a decision. Unlike answers to word problems in math, you will not find answers to today's business problems in the back of a book. The problems are real, and the answers are unknown.

When you are confident that you understand the problem and can articulate the problem statement, you're ready to move toward a solution.

## Solution

As illustrated in Figure 3, most problems require a minimum of four steps to move from the problem statement to a solution: understanding the problem, formulating a solution plan, implementing the solution, and evaluating the solution.

**Figure 3: Analyzing the solution**



Although this process might appear to be a sequential set of tasks, it is often a reiterative process that moves back and forth through the steps. For a simple problem that you have seen many times before, these steps might require no more than a few seconds to complete; whereas more complex problems might require many hours of going back and forth formulating, implementing, and evaluating the solution.

When using Excel to solve problems, you might underestimate the time it takes to set up and use a spreadsheet model on a computer. In general, solving a problem for the first time on the computer takes at least the same amount of time as it would if you did it by hand,

if not more. However, the advantage of using productivity software tools comes when dealing with more complex problems and larger amounts of data. In the same way that a lever is a tool that allows you to increase your own physical force, a spreadsheet can increase or improve your mental force. The spreadsheet can become a “thinking tool” that helps you organize and analyze data in ways that are impossible by hand. You gain additional benefits when corrections or changes are required—and from the ability to adapt the solution to other similar problems. To reap these advantages, it is important to plan your spreadsheets to take advantage of Excel’s capabilities.

### Understanding the Problem

After you have recognized and defined the problem, you need to gain an understanding of what solving the problem will require. Specifically, you need to know the following:

- What data is needed and what data or information is already known?
- Is the data or information reliable and accurate?
- What is the likely range of potential solutions for the problem?
- What type of output is required—a single value, a table, a graph, and so on?

Consider a simple problem such as calculating the cost of a new computer system for the sales group in your company. It might take you no more than a moment to decide you need to list the price of each component and calculate the total price of the system. On the other hand, if you were asked to create a cost calculator in Excel for the sales group that would automatically retrieve the price, discount, and sales tax of a specific order, it might require hours of data gathering to determine which items to price, what prices to apply, what discounts are available, and by localities, what sales taxes apply. You would also need to speak with the sales personnel to determine what type of output is needed—a single value or a value for each component—and how they would use it. Would the sales personnel be able to manipulate an Excel spreadsheet, or would they need a different type of tool in which they could enter a few items and the answer would be displayed?

### Formulating a Solution Plan

After you have a better understanding of the problem and its scope, you need to begin planning how you will use Excel to reach a solution. What steps will you need to take to solve the problem? Will you be performing a numeric calculation, determining if a value meets specific criteria, organizing data in a specific format, or a combination of several of these steps?

One common mistake people make is to immediately jump to a specific implementation, often worrying about how to use a particular function or tool before determining if that is the right function or tool to use. If you are unsure at all, it is always wise to ask yourself, “How would I solve this problem without a computer?” Invariably, if you think about what you need to do and define the steps you need to take, you can better surmise how to formulate a solution plan.