Decision Support Systems (DSS) are computer programs used to help managers solve complex business problems. DSS programs are commonly found in large, integrated packages called enterprise resource planning software that provide information services to an organization. Software packages such as SAP™, Microsoft Dynamics™, and PeopleSoft™ offer sophisticated DSS capabilities. However, many business problems can be modeled for solutions using less complex tools, such as Visual Basic, Microsoft Access, and Microsoft Excel.

A DSS program is actually a model representing a quantitative business problem. The problem can range from finding a desired product mix to sales forecasts to risk analysis, but almost all of the problems examine financial outcomes. The model itself contains the data and the algorithms (mathematical processes) needed to solve the problem.

In a DSS program, the user manually inputs data or the program accesses data from a file in the system. The program runs the data through its algorithms and displays output formatted as information; the manager uses this data to decide what action to take to solve the problem. Some sophisticated DSS programs display multiple solutions and recommend one based on predefined parameters.

Managers often find the Excel spreadsheet program particularly useful for their DSS needs. Excel contains hundreds of built-in arithmetic, statistical, logical, and financial functions. It can import data in numerous formats from large database programs, and it can be set up to display well-organized, visually appealing tables and graphs from the output.

This tutorial is organized into four sections:

1. **Spreadsheet and DSS Basics**—This section lets you “get your feet wet” by creating a DSS program in Excel. The program is a cash flow model for a small business looking to expand. You will get an introduction to spreadsheet design, building a DSS, and using financial functions.

2. **Scenario Manager**—Here you will learn how to use the Excel Scenario Manager. A DSS typically gives you one set of answers based on one set of inputs—the real value of the tool lies in its ability to play “what if” and take a comparative look at all the solutions based on all combinations of the inputs. Rather than inputting and running the DSS several times manually, you can use Scenario Manager to run and display the outputs from all possible combinations of the inputs. The output is summarized on a separate worksheet in the Excel workbook.

3. **Practice Using Scenario Manager**—Next, you will be given a new problem to model as a DSS, using Scenario Manager to display your solutions.

4. **Review of Excel Basics**—This section reviews additional information that will help you complete the spreadsheet cases that follow this tutorial. You will learn some basic operations, logical functions, and cash flow calculations.

**SPREADSHEET AND DSS BASICS**

You are the owner of a thrift shop that resells clothing and housewares in a university town. Many of your customers are college students. Your business is unusual in that sales actually increase during an economic recession. Your cost of obtaining used items basically follows the consumer price index. It is the end of 2013, and business has been very good due to the continuing recession. You are thinking of expanding your business to an adjacent storefront that is for sale, but you will have to apply for a business loan to finance the purchase. The bank requires a projection of your profit and cash flows for the next two years before it will loan you the money to expand, so you have to determine your net income (profit) and cash flows for 2014 and 2015. You decide that your forecast should be based on four factors: your 2013 sales dollars, your cost of goods sold per sales dollar, your estimates of the underlying economy, and the business loan payment amount and interest rate.
Because you will present this model to your prospective lenders, you decide to use an Income and Cash Flow Statements framework. You will input values for two possible states of the economy for 2014 and 2015: R for a continuing recession and B for a “boom” (recovery). Your sales in the recession were growing at 20% per year. If the recession continues and you expand the business, you expect sales to continue growing at 30% per year. However, if the economy recovers, some of your customers will switch to buying “new,” so you expect sales growth for your thrift shop to be 15% above the previous year (only 5% growth plus 10% for the business expansion). If you do not expand, your recession or boom growth percentages will only be 20% and 5%, respectively. To determine the cost of goods sold for purchasing your merchandise, which is currently 70% of your sales, you will input values for two possible consumer price outlooks: H for high inflation (1.06 multiplied by the average cost of goods sold) and L for low inflation (1.02 multiplied by the cost of goods sold).

You currently own half the storefront and will need to borrow $100,000 to buy and renovate the other half. The bank has indicated that, depending on your forecast, it may be willing to loan you the money for your expansion at 5% interest during the current recession with a 10-year repayment compounded annually (“R”). However, if the prime rate drops at the start of 2014 because of an economic turnaround (“B”), the bank can drop your interest rate to 4% with the same repayment terms.

As an entrepreneur, an item of immediate interest is your cash flow position with the additional burden of a loan payment. After all, one of your main objectives is to make a profit (Net Income After Taxes). You can use the DSS model to determine if it is more profitable not to expand the business.

**Organization of the DSS Model**

A well-organized spreadsheet will make the design of your DSS model easier. Your spreadsheet should have the following sections:

- Constants
- Inputs
- Summary of Key Results
- Calculations (with separate calculations for Expansion vs. No Expansion)
- Income and Cash Flow Statements (with separate statements for Expansion vs. No Expansion)

Figures C-1 and C-2 illustrate the spreadsheet setup for the DSS model you want to build.
Each spreadsheet section is discussed in detail next.

The Constants Section
This section holds values that are needed for the spreadsheet calculations. These values are usually given to you, and generally do not change for the exercise. However, you can change these values later if necessary; for example, you might need to borrow more or less money for your business expansion (cell C5). For this tutorial, the constants are the Tax Rate and the Loan Amount.

The Inputs Section
The Inputs section in Figure C-1 provides a place to designate the two possible economic outlooks and the two possible inflation outlooks. If you wanted to make these outlooks change by business year, you could leave blanks under both business years. However, as you will see later when you use Scenario Manager, this approach would greatly increase the complexity of interpreting the results. For simplicity’s sake, assume that the same outlooks will apply to both 2014 and 2015.

The Summary of Key Results Section
This section summarizes the Year 2 and 3 Net Income after Taxes (profit) and the End-of-year Cash on Hand both for expanding the business and for not expanding. These cells are copied from the Income and Cash Flow Statements section at the bottom of the sheet. Summary sections are frequently placed near the top of a spreadsheet to allow managers to see a quick “bottom line” summary without having to scroll down the spreadsheet to see the final result. Summary sections can also make it easier to select cells for charting.

The Calculations Sections (Expansion and No Expansion)
The following areas are used to compute the following necessary results:

- The Total Sales Dollars, which is a function of the Year 2013 value and the Economic Outlook input
- The Cost of Goods Sold, which is the Total Sales Dollars multiplied by the Cost of Goods Sold (as a percent of Sales)
- The Cost of Goods Sold (as a percent of Sales), which is a function of the Year 2013 value and the Inflation Outlook input
- In addition, the Calculations section for the expansion includes the interest rate, which is also a function of the Economic Outlook input. This interest rate will be used to determine the Business Loan Payment in the Income and Cash Flow Statements section.

You could make these formulas part of the Income and Cash Flow Statements section. However, it makes more sense to use the approach shown here because it makes the formulas in the Income and Cash Flow
Statements less complicated. In addition, when you create other DSS models that include unit costing and pricing calculations, you can enter the formulas in this section to facilitate managerial accounting cost analysis.

The Income and Cash Flow Statements Sections (Expansion and No Expansion)

These sections are the financial or accounting “body” of the spreadsheet. They contain the following values:

- **Beginning-of-year Cash on Hand**, which equals the prior year’s End-of-year Cash on Hand.
- **Sales (Revenue)**, which in this tutorial is simply the results of the Total Sales Dollars copied from the Calculations section.
- **Cost of Goods Sold**, which also is copied from the Calculations section.
- **Business Loan Payment**, which is calculated using the PMT (Payment) function and the inputs for loan amount and interest rate from the Constants and Calculations sections. Note that only the Income and Cash Flow Statement for Expansion includes a value for Business Loan Payment. If you do not expand, you do not need to borrow the money.
- **Income before Taxes**, which is Sales minus the Cost of Goods Sold; for the expansion scenarios, you also subtract the Business Loan Payment.
- **Income Tax Expense**, which is zero when there is no income or the income is negative; otherwise, this value is the Income before Taxes multiplied by the Tax Rate from the Constants section.
- **Net Income after Taxes**, which is Income before Taxes minus Income Tax Expense.
- **End-of-year Cash on Hand**, which is Beginning-of-year Cash on Hand plus Net Income after Taxes.

Note that this Income and Cash Flow Statement is greatly simplified. It does not address the issues of changes in Inventories, Accounts Payable, and Accounts Receivable, nor any period expenses such as Selling and General Administrative expenses, utilities, salaries, real estate taxes, insurance, or depreciation.

Construction of the Spreadsheet Model

Next, you will work through three steps to build the spreadsheet model:

1. **Make a skeleton or “shell” of the spreadsheet.** Save it with a name you can easily recognize, such as TUTC.xlsx or Tutorial C YourName.xlsx. When submitting electronic work to an instructor or supervisor, include your last name and first initial in the filename.
2. **Fill in the “easy” cell formulas.**
3. **Then enter the “hard” spreadsheet formulas.**

Making a Skeleton or “Shell”

The first step is to set up the skeleton worksheet. The skeleton should have headings, text labels, and constants. Do not enter any formulas yet.

Before you start entering data, you should first try to visualize a sensible structure for your worksheet. In Figures C-1 and C-2, the seven sections are arranged vertically down the page; the item descriptions are in the first column (A), and the time periods (years) are in the next three columns (B, C, and D). This is a widely accepted business practice, and is commonly called a “horizontal analysis.” It is used to visually compare financial data side by side through successive time periods.

Because your key results depend on the Income and Cash Flow Statements, you usually set up that section first, and then work upward to the top of the sheet. In other words, you set up the Income and Cash Flow Statements section, then the Calculations section, and then the Summary of Key Results, Inputs, and Constants sections. Some might argue that the Income and Cash Flow Statements should be at the top of the sheet, but when you want to change values in the Constants or Inputs section or examine the Summary of Key Results, it does not make sense to have to scroll to the bottom of the worksheet. When you run the model, you do not enter anything in the Income and Cash Flow Statements—they are all calculations. So, it makes sense to put them last.

Here are some other general guidelines for designing effective DSS spreadsheets:

- **Decide which items belong in the Calculations section.** A good rule of thumb is that if your items have formulas but do not belong in the Income and Cash Flow Statements, put them in the...
Calculations section. Good examples are intermediate calculations such as unit volumes, costs and prices, markups, or changing interest rates.

- The Summary of Key Results section should be just that—key results. These outputs help you make good business decisions. Key results frequently include net income before taxes (profit) and end-of-year cash on hand (how much cash your business has). However, if you are creating a DSS model on alternative capital projects, your key results can also include cost savings, net present value of a project, or rate of return for an investment.
- The Constants section holds known values needed to perform other calculations. You use a Constants section rather than just including the values in formulas so that you can input new values if they change. This approach makes your DSS model more flexible.

**AT THE KEYBOARD**

Enter the Excel skeleton shown in Figures C-1 and C-2.

**NOTE**

When you see NA (Not Applicable) in a cell, do not enter any values or formulas in the cell. The cells that contain values in the 2013 column are used by other cells for calculations. In this example, you are mainly interested in what happens in 2014 and 2015. The rest of the cells are “Not Applicable.”

### Filling in the “Easy” Formulas

The next step in building a spreadsheet is to fill in the “easy” formulas. To begin, format all the cells that will contain monetary values as Currency with zero decimal places:

- Constants—C5
- Summary of Key Results—C12 to C15, D12 to D15
- Calculations (Expansion)—C18, C19, D18, D19
- Calculations (No Expansion)—C24, C25, D24, D25
- Income and Cash Flow Statements (Expansion)—B36, C29 to C36, D29 to D36
- Income and Cash Flow Statements (No Expansion)—B45, C39 to C45, D39 to D45

**NOTE**

With the insertion point in cell C12 (where the $0 appears), note the editing window—the white space at the top of the spreadsheet to the right of the fx symbol. The cell’s contents, whether it is a formula or value, should appear in the editing window. In this case, the window shows =C35.

The Summary of Key Results section (see Figure C-3) will contain the values you calculate in the Income and Cash Flow Statements sections. To copy the cell contents for this section, move your cursor to cell C12, click the cell, type =C35, and press Enter. If you formatted your money cells properly, a $0 should appear in cell C12.

**FIGURE C-3** Value from cell C35 (Net Income after Taxes) copied to cell C12

Because cell C35 does not contain a value yet, Excel assumes that the empty cell has a numerical value of 0. When you put a formula in cell C35 later, cell C12 will echo the resulting answer. Because Net Income
Cells C14, C15, D14, and D15 represent Net Income after Taxes and End-of-year Cash on Hand for both years of No Expansion; these cells are mirrors of cells C44, C45, D44, and D45 in the last section. Select cell C14, type =C44, and press Enter. Select cell C14 again, use the Copy command, and paste the contents into cell D14 (see Figure C-4).

Because Excel uses relative cell references by default, copying cell C14 into cell D14 will copy and paste the contents of cell D44 (the cell adjacent to C44) into cell D14. See Figure C-5.

Use the Copy command again, this time downward from cells C14 and D14, to complete cells C15 and D15. If you are successful, the formula in the editing window for cell C15 will be “=C45” and for cell D15 will display “=D45.”
You will create the formulas for the two Calculations sections last because they are the hardest formulas. Next, you will create the formulas for the two Income and Cash Flow Statements sections; all the cells in these two sections should be formatted as Currency with zero decimal places.

As shown in Figure C-6, the Beginning-of-year Cash on Hand for 2014 is the End-of-year Cash on Hand for 2013. In cell C29, type =B36. A handy shortcut is to type the “=” sign, immediately move your mouse pointer to the cell you want to designate, and then click the left mouse button. Excel will enter the cell location into the formula for you. This shortcut is especially useful if you want to avoid making a typing error.

Likewise, copy the other three End-of-year Cash on Hand cells to the Beginning-of-year Cash on Hand cells for both Income and Cash Flow Statements (cells D29, C39, and D39).

The Sales (Revenue) cells C30, D30, C40, and D40 are simply copies of cells C18, D18, C24, and D24, respectively, from the Calculations sections (both Expansion and No Expansion). Use the shortcut method to copy these cells. Note that all four cells will display $0 until you enter the formulas in the Calculations sections (see Figure C-7).
The Cost of Goods Sold cells C31, D31, C41, and D41 are simply copies of the contents of cells C19, D19, C25, and D25, respectively, from the Calculations sections. Because the cells in both locations are directly below the Sales cells in the four locations, you can use the Copy command to fill those cells easily. As you can see in Figure C-8, you can drag your mouse pointer over both cells C40 and D40, right-click to see the floating toolbar, and select Copy. Move your mouse pointer to select cells C41 and D41, right-click the mouse, and select Paste. If you are uncomfortable copying and pasting with the mouse, you can type =C19, =D19, =C25, and =D25 in cells C31, D31, C41, and D41.

![Image](source: Used with permission from Microsoft Corporation)

**FIGURE C-8** Cost of Goods Sold cells copied from the Calculations sections

Next you determine the Business Loan Payment for cells C32 and D32—notice that it is only present in the Income and Cash Flow Statements (Expansion) section, because if you do not expand the business, you do not need the business loan of $100,000. Excel has financial formulas to figure out loan payments. To determine a loan payment, you need to know three things: the amount being borrowed (cell C5 in the Constants section), the interest rate (cell B21 in the Calculations-Expansion section), and the number of payment periods. At the beginning of the tutorial, you learned that the bank was willing to loan money at either 5% or 4% interest compounded annually, to be paid over 10 years. Normally, banks require businesses to make monthly payments on their loans and compound the interest monthly, in which case you would enter 120 (12 months/year × 10 years) for the number of payments and divide the annual interest rate by 12 to get the period interest rate. This formula is important to remember when you enter the business world, but for now you will simplify the calculation by specifying one loan payment per year compounded annually. To put in the payment formula, click cell C32, then click the $f_x$ symbol next to the editing window (circled in
Figure C-9). The Payment function is called PMT, so type PMT in the Insert Function window—you will immediately see a short description of the function with its arguments, as shown in Figure C-9.

Source: Used with permission from Microsoft Corporation

FIGURE C-9 Accessing the PMT function in Excel for cell C32

NOTE

Rate is the interest rate per period of the loan, Nper is an abbreviation for the number of loan periods, and Pv is an abbreviation for Present Value, the amount of money you are borrowing “today.” The PMT function can determine a series of equal loan payments necessary to pay back the amount borrowed, plus the accumulated compound interest over the life of the loan.
When you click OK, the resulting window allows you to enter the cells or values needed in the function arguments (see Figure C-10). In the Rate text box, enter B21, which is the cell that will contain the calculated interest rate. In the Nper text box, enter 10 (for 10 years). In the Pv text box, enter C5, which is the cell that contains the loan amount.

Source: Used with permission from Microsoft Corporation

Figure C-10  The Function Arguments dialog box for the PMT function with the values filled in

**NOTE**

Be careful if you decide to copy the PMT formula from cell C32 into cell D32, because the Copy command will change the cells in the formula arguments to the next adjacent cells. To make the Copy command work correctly, you have two options. First, you can change the Rate and Pv cells in the cell C32 formula from relative reference (B21, C5) to absolute reference ($B$21, $C$5). Your other option is to re-insert the PMT function into cell D32 and type the same arguments as before in the boxes. Absolute referencing of a cell (using $ signs in front of the Column and Row designators) “anchors” the cell so that when the Copy command is used, the destination cell will refer back to the same cells that the source cell used. If necessary, consult the Excel online Help for an explanation of relative and absolute cell references.

When you click OK ($10,000) should appear in cell C32. Payments in Excel always appear as negative numbers, which is why the number has parentheses around it. (Depending on your cell formatting, the number may also appear in red.) Next, you need to have the same payment amount in cell D32 (for 2015). Because the PMT function creates equal payments over the life of the loan, you can simply type =C32 into cell D32.

The next line in the Income and Cash Flow Statements is Income before Taxes, which is an easy calculation. It is the Sales minus the Cost of Goods Sold, minus the Business Loan Payment. However, because the PMT function shows the loan payment as a negative number, you will instead add the Business Loan Payment. In cell C33, enter =C30-C31+C32. Again, a negative $10,000 should be displayed, as the cells other than the loan payment currently have zero in them. Copy cell C33 to cell D33. In cell C42 of the next section below (No Expansion), enter =C40+C41. (There is no loan payment in this section to put in the calculation.) Next, copy cell C42 to cell D42. At this point, your Income and Cash Flow Statements should look like Figure C-11.
Income Tax Expense is the most complex formula for these sections. Because you do not pay income tax when you have no income or a loss, you must use a formula that allows you to enter 0 if there is no income or a loss, or to calculate the tax rate on a positive income. You can use the IF function in Excel to enter one of two results in a cell, depending on whether a defined logical statement is true or false. To create an IF function, select cell C34, then click the $f_x$ symbol next to the cell editing window (circled in Figure C-12). When the Insert Function dialog box appears, type IF in the “Search for a function” text box, and click the Go button if necessary. The IF function should appear. When you click OK, the Function Arguments dialog box appears (see Figure C-13).
Type the following in the Function Arguments dialog box:

- Next to Logical_test, type C33<=0.
- Next to Value_if_true, type 0.
- Next to Value_if_false, type C33*C4 (the Income before Taxes multiplied by the Tax Rate for 2014).

As you fill in the arguments, Excel writes the formula for you in the formula editing window (circled in Figure C-13).

Once you have entered the arguments, click OK; Excel enters the formula into the cell. Because you had negative income, the cell should display a zero for now. Because the same formula will be used in 2015 (but with the 2015 tax rate), you can simply copy and paste the formula from cell C34 to cell D34. You also have to calculate the income tax for the Income and Cash Flow Statements (No Expansion). In cell D43, use the same IF function, but in the Logical_test, Value_if_true, and Value_if_false arguments, you must type C42<=0, 0, and C42*C4, respectively. Again, the cell will display $0 for an answer. Copy cell C43 to cell D43 to complete the Income Tax Expense line for No Expansion.

Net Income after Taxes is simply the Income before Taxes minus the Income Tax Expense. Enter the formula into cell C35, then copy cell C35 over to cells D35, C44, and D44. If you did this correctly, cells C35 and D35 will display a negative $10,000, and cells C44 and D44 will display $0.

End-of-year Cash on Hand, the last line in both Income and Cash Flow Statements sections, is not difficult either. Conceptually, the cash you have at the end of the year is equal to your Beginning-of-year Cash on Hand plus your Net Income after Taxes. Enter the formula into cell C36, then copy cell C36 over to cell D36. Note that because the Income and Cash Flow Statements (No Expansion) do not have a line item for Business Loan Payment, you cannot copy the same command down to it. You have to enter the formula manually for cell C45, which is =C39+C44. However, you can copy cell C45 to cell D45 to finish the Income and Cash Flow Statements sections. The completed sections should look like Figure C-14.
Filling in the “Hard” Formulas

To finish the spreadsheet, you will enter values in the Inputs section and write the formulas in both Calculations sections.

**AT THE KEYBOARD**

In cell C8, enter an R for Recession, and in cell C9, enter H for High Inflation. You could enter any values here, but these two values will work with the IF functions you will write later. Recall that you did not use separate inputs for 2014 and 2015. You are assuming that the economic outlook or inflation rate that exists for 2014 will extend into 2015. However, because you are using the same inputs from these two locations, you must remember to use absolute cell references to both cells C8 and C9 in the various IF statements if you want to use a Copy command for adjacent cells. Your Inputs section should look like the one in Figure C-15.

<table>
<thead>
<tr>
<th>Sales Growth Forecast—Collegetown Thrift Shop</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Business Expansion</strong></td>
</tr>
<tr>
<td>Recession (R)</td>
</tr>
<tr>
<td>Boom (B)</td>
</tr>
</tbody>
</table>
You will use IF formulas to forecast Total Sales Dollars. Click cell C18, then bring up the IF function and type the following in the text boxes:

Logical_test: $C8="R" (Note that you must use absolute cell referencing for cell B8 and quotation marks for Excel to recognize a text string.)

Value_if_true: B18*1.3 (the 2013 sales multiplied by 1.3 for 30% sales growth)
Value_if_false: B18*1.15 (the 2013 sales multiplied by 1.15 for 15% sales growth)

Compare your entries to Figure C-16.

When you click OK, cell C18 should display $455,000, because 30% of $350,000 is $105,000, and $350,000 plus $105,000 equals $455,000. So, it appears that the formula returned a “true” value with an R inserted in cell C8. Because you “anchored” cell C8 by entering $C8, copy this formula over to cell D18 for the year 2015.

Once you complete the Total Sales Dollars cells for the Expansion scenario, go down to the Calculations (No Expansion) section and use IF statements to enter formulas for the Total Sales Dollars. Use a 20% sales growth factor for Recession and 5% for Boom. You can copy the formula from cell C18 into cell C24, but you then will have to use the editing window to change the values in the true and false arguments from 1.3 and 1.15 to 1.2 and 1.05, respectively, to reflect the fact that you did not expand the business. See Figure C-17.
As before, you can now copy cell C24 to cell D24. You have completed the Total Sales Dollars calculations.

The Cost of Goods Sold (cells C19, D19, C25, and D25) is the Total Sales Dollars multiplied by the Cost of Goods Sold as a percent of Sales. In cell C19, type =C18*C20 and press Enter. Copy cell C19 and paste the contents into cells D19, C25, and D25. Your answers will be $0 until you enter the formulas for the Cost of Goods Sold as a percent of Sales.

The Cost of Goods Sold as a percent of Sales (cells C20, D20, C26, and D26) was 70% in 2013. In variety merchandising for resold items, it is easier to use an aggregate measure such as Cost of Goods Sold as a percent of Sales rather than trying to capture an individual Cost of Goods Sold for each item. From the 2013 data, you determined that for every dollar of sales you collected in 2013, you spent 70 cents purchasing the item and preparing it for resale. You will use that percentage as a basis for forecasting Cost of Goods Sold as a percent of Sales, applying an appropriate inflation factor for the cost of acquiring the stock for sale. The following table lists the predicted inflation percentages for Cost of Goods Sold:

<table>
<thead>
<tr>
<th>Cost of Goods Sold Forecast—Collegetown Thrift Shop</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Inflation</td>
</tr>
<tr>
<td>Low Inflation</td>
</tr>
</tbody>
</table>

As with Total Sales Dollars previously, you will again use the IF function to calculate the Cost of Goods Sold as a percent of Sales. Now that you are familiar with the IF function, you can probably enter the function without using the dialog boxes. In cell C20, type the following:

=IF($C$9="H",B20*1.06,B20*1.02)

This expression means that if the text string in cell C9 is the letter H, you multiply the value in cell B20 by 1.06 (6% inflation). If the value in cell C9 is not an H, multiply the value in cell B20 by 1.02 (2% inflation). The value in cell B20 was the baseline Cost of Goods Sold as a percent of Sales in 2013, which was 70%. You can now copy cell C20 and paste the contents into cell D20.

Because the inflation percentages were exactly the same for both the Expansion and No Expansion calculations, you can also copy cell C20 and paste the contents into cells C26 and D26. Your Calculations sections should now look like Figure C-18.
The last item in the Calculations section is the Interest Rate for Business Loan (cell B21). Remember the bank’s statement that if the economy recovers, it could lower the interest rate from 5% to 4%. So, you will need one more IF function to insert into cell B21 based on the economic outlook. If the economic outlook is for a Recession (R), then the interest rate will be 5% annually; if the outlook is for a Boom (B), then the interest rate will be 4% annually. Now that you are familiar with the IF function, you can simply type the expression into the cell yourself. Click cell B21, type =IF(C8="R",5%,4%), and press Enter.

You will immediately notice that 5% appears in the cell because you have R in the input cell for Economic Outlook. You may also notice that you now have a negative $12,950 in the Business Loan Payment cells (C32 and D32). See Figure C-19 to compare your results.
You can change the economic inputs in four different combinations: R-H, R-L, B-H, B-L. This allows you to see the impact on your net income and cash on hand both for expanding and not expanding. However, you have another more powerful way to do this. In the next section, you will learn how to tabulate the financial results of the four possible combinations using an Excel tool called Scenario Manager.

**SCENARIO MANAGER**

You are now ready to evaluate the four possible outcomes for your DSS model. Because this is a simple, four-outcome model, you could have created four different spreadsheets, one for each set of outcomes, and then transferred the financial information from each spreadsheet to a Summary Report.

In essence, Scenario Manager performs the same task. It runs the model for all the requested outcomes and presents a tabular summary of the results. This summary is especially useful for reports and presentations needed by upper managers, financial investors, or in this case, the bank.

To review, the four possible combinations of input values are: R-H (Recession and High Inflation), R-L (Recession and Low Inflation), B-H (Boom and High Inflation), and B-L (Boom and Low Inflation). You could consider each combination of inputs a separate scenario. For each of these scenarios, you are interested in four outputs: Net Income after Taxes for Expansion and No Expansion, and End-of-year Cash on Hand for Expansion and No Expansion.

Scenario Manager runs each set of combinations and then records the specified outputs as a summary into a separate worksheet. You can use these summary values as a table of numbers and print it, or you can copy them into a Microsoft Word document or a PowerPoint presentation. You can also use the data table to build a chart or graph, which you can put into a report or presentation.

When you define a scenario in Scenario Manager, you name it and identify the input cells and input values. Then you identify the output cells so Scenario Manager can capture the outputs in a summary sheet.

**AT THE KEYBOARD**

To start, click the Data tab on the Ribbon. In the Data Tools group, click the What-If Analysis button, then click Scenario Manager from the menu that appears (see Figure C-20).

Scenario Manager appears (see Figure C-21), but no scenarios are defined. Use the dialog box to add, delete, or edit scenarios.
To define a scenario, click the Add button. The Edit Scenario dialog box appears. Enter Recession-High Inflation in the field under Scenario name. Then type the input cells in the Changing cells field (in this case, C8:C9). Better yet, you can use the button next to the field to select the cells in your spreadsheet. If you do, Scenario Manager changes the cell references to absolute cell references, which is acceptable (see Figure C-22).
Click OK to open the Scenario Values dialog box. Enter the input values for the scenario. In the case of Recession and High Inflation, the values will be R and H for cells C8 and C9, respectively (see Figure C-23). Note that if you already have entered values in the spreadsheet, the dialog box will display the current values. Make sure to enter the correct values.

![Figure C-23](source)

Source: Used with permission from Microsoft Corporation

**FIGURE C-23** Entering values for the input cells

Click OK to return to the Scenario Manager dialog box. Enter the other three scenarios: Recession-Low Inflation, Boom-High Inflation, and Boom-Low Inflation (R-L, B-H, and B-L), and their related input values. When you finish, you should see the names and changing cells for the four scenarios (see Figure C-24).

![Figure C-24](source)

Source: Used with permission from Microsoft Corporation

**FIGURE C-24** Scenario Manager dialog box with all four scenarios entered

You can now create a summary sheet that displays the results of running the four scenarios. Click the Summary button to open the Scenario Summary dialog box, as shown in Figure C-25. You must now enter the output cell addresses in Excel—they will be the same for all four scenarios. Recall that you created a section in your spreadsheet called Summary of Key Results. You are primarily interested in the results at the end of 2015, so you will choose the four cells that represent the Net Income after Taxes and End-of-year Cash on Hand, and then use them for both the expansion scenario and the non-expansion scenario. These cells are D12 to D15 in your spreadsheet. Either type D12:D15 or use the button next to the Result cells field and select those cells in the spreadsheet.
Another good reason for having a Summary of Key Results section is that it provides a contiguous range of cells to define for summary output. However, if you want to add output from other cells in the spreadsheet, simply separate each cell or range of cells in the dialog box with a comma. Next, click OK. Excel runs each set of inputs in the background, collects the results from the result cells, and then creates a new sheet called Scenario Summary (the name on the sheet’s lower tab), as shown in Figure C-26.

As you can see, the output created by the Scenario Summary sheet is not formatted for easy reading. You do not know which results are the net income and cash on hand, and you do not know which results are for Expansion vs. No Expansion, because Scenario Manager listed only the cell addresses. Scenario Manager also listed a separate column (column D) for the current input values in the spreadsheet, which are the same as the values in column E. It also left a blank column (column A) in the spreadsheet.

Fortunately, it is fairly easy to format the output. Delete columns D and A, put in the labels for cell addresses in the new column A, and then retitle the Scenario Summary as Collegetown Thrift Shop Financial Forecast, End of Year 2015 (because you are looking only at Year 2015 results). You can also make the results columns narrower by breaking the column headings into two lines; place your cursor in the editing window where you want to break the words, and then press Alt+Enter. Add a heading for column B (Cell Address). Finally, merge and center the title, and center the column headings and the input cell values (R, B, H, and L). Leave your financial data right-justified to keep the numbers lined up correctly. Finally, put some border boxes around each column of results. Figure C-27 shows a formatted Scenario Summary worksheet.
Interpreting the Results

Now that you have good data, what do you do with it? Remember, you wanted to see if taking a $100,000 business loan to expand the thrift shop was a good financial decision. This is a relatively simple business case, and the shop’s success so far ($350,000 of sales in 2013) would seem to make expansion a good risk. But how good a risk is the expansion?

After building the spreadsheet and doing the analysis, you can make comparisons and interpret the results. Regardless of the economic outlook or inflation, all four scenarios indicate that expanding the business should provide greater Net Income After Taxes and End-of-year Cash on Hand (after two years) than not expanding. So, the DSS model not only provides a quantitative basis for expanding, it provides an analysis that you can present to prospective lenders.

What decision would you make about expansion if you looked only at the 2014 forecast? You could go back to the original spreadsheet and look at the figures for 2014, or you can go to Scenario Manager and create a new summary, specifying the 2014 cells C12 through C15. See Figure C-28.

When you click OK, Excel creates a second Scenario Summary (appropriately named Scenario Summary 2), but this time the output values come from 2014, not 2015. After editing and formatting, the 2014 Scenario Summary should look like Figure C-29.
As you can see, not expanding the business yields slightly better financial results at the end of 2014. As the original Scenario Summary points out, it will take two years for the business expansion to start making more money when compared with not expanding. You can also revise the original spreadsheet to copy the columns out to 2016, 2017, and beyond to forecast future income and cash flows. However, note that the accuracy of a forecast gets worse as you extend it in time.

Managers must also maintain a healthy skepticism about the validity of their assumptions when formulating a DSS model. Most assumptions about economic outlooks, inflation, and interest rates are really educated guesses. For example, who could have predicted the economic meltdown in 2007? Business DSS models for investments, new product launches, business expansion, or major capital projects commonly look at three possible outcomes: best case, most likely, and worst case. The most likely outcome is based on previous years’ data already collected by the firm. The best-case and worst-case outcomes are formulated based on some percentage of performance that falls above or below the most likely scenario. At least these are data-driven forecasts, or what people in the business world call “guessing—with data.”

So, how do you reduce risk when making financial decisions based on DSS model results? It helps to formulate the model based on valid data and to use conservative estimates for success. More importantly, collecting pertinent data and tracking the business results after deciding to invest or expand can help reduce the risk of failure for the enterprise.

Summary Sheets
When you start working on the Scenario Manager spreadsheet cases later in this book, you will need to know how to manipulate summary sheets and their data. Some of these operations are explained in the following sections.

Rerunning Scenario Manager
The Scenario Summary sheet does not update itself when you change formulas or inputs in the spreadsheet. To get an updated Scenario Summary, you must rerun Scenario Manager, as you did when changing the outputs from 2015 to 2014. Click the Summary button in the Scenario Manager dialog box, and then click OK. Another summary sheet is created; Excel numbers them sequentially (Scenario Summary, Scenario Summary2, etc.), so you do not have to worry about Excel overwriting any of your older summaries. That is why you should rename each summary with a description of the changes.

Deleting Unwanted Scenario Manager Summary Sheets
When working with Scenario Manager, you might produce summary sheets you do not want. To delete an unwanted sheet, move your mouse pointer to the group of sheet tabs at the bottom of the screen and right-click the tab of the sheet you want to delete. Click Delete from the menu that appears (see Figure C-30).
Charting Summary Sheet Data

You can easily chart Summary Sheet results using the Charts group in the Insert tab, as discussed in Tutorial F. Figure C-31 shows a clustered column chart prepared from the data in the Scenario Summary for 2015. Charts are useful because they provide a visual comparison of results. As the chart shows, the best economic climate for the thrift shop is a Recession with Low Inflation.

Copying Summary Sheet Data to the Clipboard

As you can with almost everything else in Microsoft Office, you can copy summary sheet data to other Office applications (a Word document or PowerPoint slide, for example) by using the Clipboard. Follow these steps:

1. Select the data range you want to copy.
2. Right-click the mouse and select Copy from the resulting menu.
3. Open the Word document or PowerPoint presentation into which you want to copy.
4. Click your cursor where you want the upper-left corner of the copied data to be displayed.
5. Right-click the mouse and select Paste from the resulting menu. The data should now appear on your document.
PRACTICE EXERCISE—TED AND ALICE’S HOUSE PURCHASE DECISION

Ted and Alice are a young couple who have been living in an apartment for the first two years of their marriage. They would like to buy their first house, but do not know whether they can afford it. Ted works as a carpenter’s apprentice, and Alice is a customer service specialist at a local bank. In 2013, Ted’s “take home” wages were $24,000 after taxes and deductions, and Alice’s take-home salary was $30,000. Ted gets a 2% raise every year, and Alice gets a 3% raise. Their apartment rent is $1,200 per month ($14,400 per year), but the lease is up for renewal and the landlord said he needs to increase the rent for the next lease.

Ted and Alice have been looking at houses and have found one they can buy, but they will need to borrow $200,000 for a mortgage. Their parents are helping them with the down payment and closing costs. After talking to several lenders, Ted and Alice have learned that the state legislature is voting on a first-time home buyers’ mortgage bond. If the bill passes, they will be able to get a 30-year fixed mortgage at 3% interest. Otherwise, they will have to pay 6% interest on the mortgage.

Because of the depressed housing market, Ted and Alice are not figuring equity value into their calculations. In addition, although the mortgage interest and real estate taxes will be deductible on their income taxes, these deductions will not be higher than the standard allowable tax deduction, so they are not figuring on any savings there either. Ted and Alice’s other living expenses (such as car payments, food, and medical bills), the utilities expenses for either renting or buying, and estimated home maintenance expenses are listed in the Constants section (see Figure C-32).

Ted and Alice’s primary concern is their cash on hand at the end of years 2014 and 2015. They are thinking of starting a family, but they know it will be difficult without adequate savings.

Getting Started on the Practice Exercise

If you closed Excel after the first tutorial exercise, start Excel again—it will automatically open a new workbook for you. If your Excel workbook from the first tutorial is still open, you may find it useful to start a new worksheet in the same workbook. Then you can refer back to the first tutorial when you need to structure or format the spreadsheet; the formatting of both exercises in this tutorial is similar. Set up your new worksheet as explained in the following sections.

Constants Section

Your spreadsheet should have the constants shown in Figure C-32. An explanation of the line items follows the figure.

Source: Used with permission from Microsoft Corporation

FIGURE C-32  Constants section

- Non-Housing Living Expenses—This value represents Ted and Alice’s estimate of all their other living expenses for 2014 and 2015.
- Mortgage Amount for Home Purchase
- Real Estate Taxes and Insurance on Home—A lender has given Ted and Alice estimates for these values; they are usually paid monthly with the house mortgage payment. The money is placed in an escrow account and then paid by the mortgage company to the state or county and insurance company.
- Utilities Expense—Apartment—This value is Ted and Alice’s estimate for 2014 and 2015 based on their 2013 bills.
• Utilities Expense—House—Currently the apartment rent includes fees for water, sewer, and trash disposal. If they get a house, Ted and Alice expect the utilities to be higher.

• House Repair and Maintenance Expenses—in an apartment, the landlord is responsible for repair and maintenance. Ted and Alice will have to budget for repair and maintenance on the house.

Inputs Section
Your spreadsheet should have the inputs shown in Figure C-33. An explanation of line items follows the figure.

![Figure C-33 Inputs section](source: Used with permission from Microsoft Corporation)

- Rental Occupancy (H=High, L=Low)—When the housing market is depressed (in other words, people are not buying homes), rental housing occupancy percentages are high, which allows landlords to charge higher rents when leases are renewed. Ted and Alice think their rent will increase in 2014. The amount of the increase depends on the Rental Occupancy. If the occupancy is high, Ted and Alice expect to see a 10% increase in rent in both 2014 and 2015. If occupancy is low, they only expect a 3% increase for each year.

- First Time Buyer Bond Loans Available (Y=Yes, N=No)—As described earlier, when housing markets are depressed, local governments will frequently pass a bond bill to provide low-interest mortgage money to first-time home buyers. If the bond loans are available, Ted and Alice can obtain a 30-year fixed mortgage at only 3%, which is half the interest rate they would otherwise pay for a conventional mortgage.

Summary of Key Results Section
Figure C-34 shows what key results Ted and Alice are looking for. They want to know their End-of-year Cash on Hand for both 2014 and 2015 if they decide to stay in the apartment and if they decide to purchase the house.

![Figure C-34 Summary of Key Results section](source: Used with permission from Microsoft Corporation)

These results are copied from the End-of-year Cash on Hand sections of the Income and Cash Flow Statements sections (for both renting and buying).

Calculations Section
Your spreadsheet will need formulas to calculate the apartment rent, house payments, and interest rate for the mortgage (see Figure C-35). You will use the rent and house payments later in the Income and Cash Flow Statements for both renting and buying.

![Figure C-35 Calculations section](source: Used with permission from Microsoft Corporation)
• Apartment Rent—The 2013 amount is given. Use IF formulas to increase the rent by 10% if occupancy rates are high, or by 3% if occupancy rates are low.
• House Payments—This value is the total of the 12 monthly payments made on the mortgage. An important point to note is that house mortgage interest is always compounded monthly, not annually, as in the thrift shop tutorial. To properly calculate the house payments for the year, you divide the annual interest rate by 12 to determine the monthly interest. You also have to multiply a 30-year mortgage by 12 to get 360 payments, and then multiply the PMT formula by 12 to get the total amount for your annual house payments. Also, you will precede the PMT function with a negative sign to make the payment amount a positive number. Your formula should look like the following:
  \[=\text{PMT}(B22/12,360,C5)*12\]
• Interest Rate for House Mortgage—Use the IF formula to enter a 3% interest rate if the bond money is available, and a 6% interest rate if no bond money is available.

**Income and Cash Flow Statements Sections**

As with the thrift shop tutorial, you want to see the Income and Cash Flow Statements for two scenarios—in this case, for continuing to rent and for purchasing a house. Each section begins with cash on hand at the end of 2013. As you can see in Figure C-36, Ted and Alice have only $4,000 in their savings.

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Income and Cash Flow Statement (Continue to Rent)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 Beginning-of-year Cash on Hand</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 Ted’s Take Home Wages</td>
<td>$24,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27 Alice’s Take Home Salary</td>
<td>$30,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28 Total Take Home Income</td>
<td>$54,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29 Apartment Rent</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 Utilities (Apartment)</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 Non-Housing Living Expenses</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 Total Expenses</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33 End-of-year Cash on Hand</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>35 Beginning-of-year Cash on Hand</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36 Ted’s Take Home Wages</td>
<td>$24,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37 Alice’s Take Home Salary</td>
<td>$30,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38 Total Take Home Income</td>
<td>$54,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39 House Payments</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40 Real Estate Taxes and Insurance</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41 Utilities (House)</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42 House Repair and Maintenance Expenses</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>43 Non-Housing Living Expenses</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>44 Total Expenses</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45 End-of-year Cash on Hand</td>
<td>$4,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Used with permission from Microsoft Corporation

**FIGURE C-36** Income and Cash Flow Statements sections (for both rent and purchase)

- Beginning-of-year Cash on Hand—This value is the End-of-year Cash on Hand from the previous year.
- Ted’s Take Home Wages—This value is given for 2013. To get values for 2014 and 2015, increase Ted’s wages by 2% each year.
- Alice’s Take Home Salary—This value is given for 2013. To get values for 2014 and 2015, increase Alice’s salary by 3% each year.
- Total Take Home Income—The sum of Ted and Alice’s pay.
- Apartment Rent—The rent is copied from the Calculations section.
- House Payments—The house payments are also copied from the Calculations section.
- Real Estate Taxes and Insurance, Utilities (Apartment or House), House Repair and Maintenance Expense, and Non-Housing Living Expenses—These values all are copied from the Constants section.
- Total Expenses—This value is the sum of all the expenses listed above. Note that the house payment is now a positive number, so you can sum it normally with the other expenses.
- End-of-year Cash on Hand—This value is the Beginning-of-year Cash on Hand plus the Total Take Home Income minus the Total Expenses.

**Scenario Manager Analysis**

When you have completed the spreadsheet, set up Scenario Manager and create a Scenario Summary sheet. Ted and Alice want to look at their End-of-year Cash on Hand in 2015 for renting or buying under the following four scenarios:

- High occupancy and bond money available
- High occupancy and no bond money available
- Low occupancy and bond money available
- Low occupancy and no bond money available

If you have done your spreadsheet and Scenario Manager correctly, you should get the results shown in Figure C-37.

![Scenario Summary results](source)

**FIGURE C-37 Scenario Summary results**

**Interpreting the Results**

Based on the Scenario Summary results, what should Ted and Alice do? At first glance, it looks like the safe decision is to stay in the apartment. Actually, their decision hinges on whether they can get the lower-interest mortgage from the first-time buyers’ bond issue. If they can, and if occupancy levels in apartments stay high, purchasing a house will give them about $3,300 more in savings at the end of 2015 than if they continued renting. Some other intangible factors are that home owners do not need permission to have pets, detached houses are quieter than apartments, and homes usually have a yard for pets and children to play in. Also, for the purposes of this exercise, you did not consider the tax benefits of home ownership. Depending on the amount of mortgage interest and real estate taxes Ted and Alice have to pay, they may be able to itemize their deductions and pay less income tax. If the income tax savings are more than $1,500, they can purchase the house even at the higher interest rate. In any case, because you did the DSS model for them, Ted and Alice now have a quantitative basis to help them make a good decision.

**Visual Impact: Charting the Results**

Charts and graphs often add visual impact to a Scenario Summary. Using the data from the Scenario Summary output table, try to create a chart similar to the one in Figure C-38 to illustrate the financial impact of each outcome.
Printing and Submitting Your Work

Ask your instructor which worksheets need to be printed for submission. Make sure your printouts of the spreadsheet, the Scenario Manager Summary table, and the graph (if you created one) fit on one printed page apiece. Click the File tab on the Ribbon, click the Print button, and then click Page Setup at the bottom of the Print Navigation pane. When the Page Setup dialog box opens, click the Page tab if it is not already open, then click the Fit to radio button and click 1 page wide by 1 page tall. Your spreadsheet, table, and graph will be fitted to print on one page apiece.

REVIEW OF EXCEL BASICS

This section reviews some basic operations in Excel and provides some tips for good work practices. Then you will work through some cash flow calculations. Working through this section will help you complete the spreadsheet cases in the following chapters.

Save Your Work Often—and in More Than One Place

To guard against data loss in case of power outages, computer crashes, and hard drive failure, it is always a good idea to save your work to a separate storage device. Copying a file into two separate folders on the same hard disk is not an adequate safeguard. If you are working on your college’s computer network and you have been assigned network storage, the network storage is usually “mirrored”; in other words, it has duplicate drives recording data to prevent data loss if the system goes down. However, most laptops and home computers lack this feature. An excellent way to protect your work from accidental deletion is to purchase a USB “thumb” drive and copy all of your files to it.

When you save your Excel files, Windows will usually store them in the My Documents folder unless you specify the storage location. Instead of just clicking the Save icon, a good idea is to click the File group in the Ribbon (or the Office Button in Office 2007), and then click the Save As button. A dialog box will appear with icons on the left side, as shown in Figure C-39. If you have previously saved your file to a particular location, it will appear in the Save in text box at the top of the dialog box. To save the file in the same location, click Save. If your work is stored elsewhere, you can find the location using the icons on the left side of the dialog box. If you are saving to a USB thumb drive, it will appear as a storage device when you click the My Computer icon. Click the folder where you want to save your file.
NOTE
If you are trying an operation that might damage your spreadsheet and you do not want to use the Undo command, you can use the Save As command, and then add a number or letter to the filename to save an additional copy to “play with.” Your original work will be preserved.

Source: Used with permission from Microsoft Corporation

FIGURE C-39 The Save As dialog box in Excel

Basic Operations
To begin, you will review the following topics: formatting cells, displaying the spreadsheet cell formulas, circular reference errors, using the AND and OR logical operators in IF statements, and using nested IF statements to produce more than two outcomes.

Formatting Cells

Cell Alignment
Headings for columns are usually centered, while numbers in cells are usually aligned to the right. To set the alignment of cell data:

1. Highlight the cell or cell range to format.
2. Select the Home tab.
3. In the Alignment group, click the button representing the horizontal alignment you want for the cell (Left Align, Center, or Right Align).
4. Also in the Alignment group, above the horizontal alignment buttons, click the vertical alignment you want (Top Align, Middle, or Bottom Align). Middle Align is the most common vertical alignment for cells.
Cell Borders

Bottom borders are common for headings, and accountants include borders and double borders to indicate subtotals and grand totals on spreadsheets. Sometimes it is also useful to put a “box” border around a table of values or a section of a spreadsheet. To create borders:

1. Highlight the cell or cell range that needs a border.
2. Select the Home tab.
3. In the Font group, click the drop-down arrow of the Border icon. A menu of border selections appears (see Figure C-40).
4. Choose the desired border for the cell or group of cells. Note that All Borders creates a box border around each cell, while Outside Borders draws a box around a group of cells.

![Figure C-40: Selections in the Borders menu](source)

Number Formats

For financial numbers, you usually use the Currency format. (Do not use the Accounting format, as it places the $ sign to the far left side of the cell). To apply the appropriate Currency format:

1. Highlight the cell or cell range to be formatted.
2. Select the Home tab.
3. In the Number group, select Currency in the Number Format drop-down list.
4. To set the desired number of decimal places, click the Increase Decimal or Decrease Decimal button in the bottom-right corner of the group (see Figure C-41).
If you do not know what a button does in Office, hover your mouse pointer over the button to see a description.

**Format “Painting”**

If you want to copy all the format properties of a certain cell to other cells, use the Format Painter. First, select the cell whose format you want to copy. Then click the Format Painter button (the paintbrush icon) in the Clipboard Group under the Home tab (see Figure C-42). When you click the button, the mouse pointer turns into a paintbrush. Click the cell you want to reformat. To format multiple cells, select the cell whose format you want to copy, and then click twice on the Format Painter button. The mouse cursor will become a paintbrush, and the paint function will stay on so you can reformat as many cells as you want. To turn off the Format Painter, click its button again or press the Esc key.

**Showing the Excel Formulas in the Cells**

Sometimes your instructor might want you to display or print the formulas in the spreadsheet cells. If you want the spreadsheet cells to display the actual cell formulas, follow these steps:

1. While holding down the Ctrl key, press the key in the upper-left corner of the keyboard that contains the back quote (’) and tilde (~). The spreadsheet will display the formulas in the cells. The columns may also become quite wide—if so, do not resize them.
2. The Ctrl+’~ key combination is a toggle; to restore your spreadsheet to the normal cell contents, press Ctrl+’~ again.

**Understanding Circular Reference Errors**

When entering formulas, you might make the mistake of referring to the cell in which you are entering the formula as part of the formula, even though it should only display the output of that formula. Referring a cell
back to itself in a formula is called a circular reference. For example, suppose that in cell B2 of a worksheet, you enter =B2-B1. A terrible but apt analogy for a circular reference is a cannibal trying to eat himself! Fortunately, Excel informs you when you try to enter a circular reference into a formula (see Figure C-43). Excel also warns you if you try to open an existing spreadsheet that has one or more circular references. Before you can use the spreadsheet, you must fix the formulas that contain circular references.

Using AND and OR Functions in IF Statements

Recall that the IF function has the following syntax:

IF(test condition, result if test is True, result if test is False)

The test conditions in the previous example IF statements tested only one cell’s value, but a test condition can test more than one value of a cell.

For example, look at the thrift shop tutorial again. The Total Sales Dollars for 2014 depended on the economic outlook (recession or boom). The original IF statement was =IF($C$8="R",B18*1.3,B18*1.15), as shown in Figure C-44. This function increased the baseline 2013 Total Sales Dollars by 30% if there was continued recession (“R” entered in cell C8), but only increased the total by 15% if there was a boom.

To take the IF argument one step further, assume that the Total Sales Dollars for 2014 depended not only on the Economic Outlook, but on the Inflation Outlook (High or Low). Suppose there are two possibilities:

- Possibility 1: If the economic outlook is for a Recession and the inflation outlook is High, the Total Sales Dollars for 2014 will be 30% higher than in 2013.
- Possibility 2: For the other three cases (Recession and Low Inflation, Boom and High Inflation, and Boom and Low Inflation), assume that the 2014 Total Sales Dollars will only be 15% higher than in 2013.
The first possibility requires two conditions to be true at the same time: \( C8 = "R" \) and \( C9 = "H" \). You can include an AND() function inside the IF statement to reflect the additional condition as follows:

\[
\text{=IF(AND($C$8= "R", $C$9= "H"), B18*130%, B18*115%)}
\]

When the test argument uses the AND() function, conditions “\( R \)” and “\( H \)” both must be present at the same time for the statement to use the true result (multiplying last year’s sales by 130%). Any of the other three outcome combinations will cause the statement to use the false result (multiplying last year’s sales by 115%).

You can also use an OR() function in an IF statement. For example, assume that instead of both conditions (Recession and High Inflation) having to be present, only one of the two conditions needs to be present for sales to increase by 30%. In this case, you use the OR() function in the test argument as follows:

\[
\text{=IF(OR($C$8= "R", $C$9= "H"), B18*130%, B18*115%)}
\]

In this case, if either of the two conditions (\( C8 = "R" \) or \( C9 = "H" \)), is true, the function will return the true argument, multiplying the 2013 sales by 130%. If neither of the two conditions is true, then the function will return the false argument, multiplying the 2013 sales by 115% instead.

**Using IF Statements Inside IF Statements (Also Called “Nesting IFs”)**

By now you should be familiar with IF statements, but here is a quick review of the syntax:

\[
\text{=IF(test condition, result if test is True, result if test is False)}
\]

In the preceding examples, only two courses of action were possible for each of the inputs: Recession or Boom, High Inflation or Low Inflation, Rental Occupancy High or Low, Bond Money Available or No Bond Money Available. The tutorial used only two possible outcomes to keep them simple.

However, in the business world, decision support models are frequently based on three or more possible outcomes. For capital projects and new product launches, you will frequently project financial outcomes based on three possible scenarios: Most Likely, Worst Case, and Best Case. You can modify the IF statement by placing another IF statement inside the result argument if the first test is false, creating the ability to launch two more alternatives from the second IF statement. This is called “nesting” your IF statements.

Try a simple nested IF statement: In your thrift shop example, assume that three economic outlooks are possible: Recession (\( R \)), Boom (\( B \)), or Stable (\( S \)). As before, the 2014 Total Sales Dollars (cell C18) will be the 2013 Total Sales Dollars increased by some fixed percentage. In a Recession, sales will increase by 30%, in a Boom they will increase by 15%, and for a Stable Economic Outlook, sales will increase by 22%, which is roughly midway between the other two percentages. You can “nest” the IF statement in cell C18 to reflect the third outcome as follows:

\[
\text{=IF($C$8= "R", B18*130%, IF($C$8= "B", B18*115%, B18*122%))}
\]

Note the added IF statement inside the False value argument. You can break down this statement:

- If the value in cell C8 is “\( R \)”, multiply the value in cell B18 by 130%, and enter the result in cell C18.
- If the value in cell C8 is not “\( R \)”, check whether the value in cell C8 is “\( B \)”. If it is, multiply the value in cell B18 by 115%, and enter the result in cell C18.
- If the value in cell C8 is not “\( B \)”, multiply the value in cell B18 by 122%, and enter the result in cell C18.

If you have four or more alternatives, you can keep nesting IF statements inside the false argument for the outer IF statements. (Excel 2007 and later versions have a limit of 64 levels of nesting in the IF function, which should take care of every conceivable situation.)

**NOTE**

The “embedded IFs” in a nested IF statement are not preceded by an equals sign. Only the first IF gets the equals sign.
Cash Flow Calculations: Borrowing and Repayments

The Scenario Manager cases that follow in this book require accounting for money that the fictional company will have to borrow or repay. This money is not like the long-term loan that the Collegetown Thrift Shop is considering for its expansion. Instead, this money is short-term borrowing that companies use to pay current obligations, such as purchasing inventory or raw materials. Such short-term borrowing is called a line of credit, and is extended to businesses by banks, much like consumers have credit cards. Lines of credit usually involve interest payments, but for simplicity's sake, focus instead on how to do short-term borrowing and repayment calculations.

To work through cash flow calculations, you must make two assumptions about a company’s borrowing and repayment of short-term debt. First, you assume that the company has a desired minimum cash level at the end of a fiscal year (which is also its cash level at the start of the next fiscal year), to ensure that the company can cover short-term expenses and purchases. Second, assume the bank that serves the company will provide short-term loans (a line of credit) to make up the shortfall if the end-of-year cash falls below the desired minimum level.

NCP stands for Net Cash Position, which equals beginning-of-year cash plus net income after taxes for the year. NCP represents the available cash at the end of the year, before any borrowing or repayment.

For the three examples shown in Figure C-45, set up a simple spreadsheet in Excel and determine how much the company needs to borrow to reach its minimum year-end cash level. Use the IF function to enter 0 under Amount to Borrow if the company does not need to borrow any money.

![Figure C-45 Examples of borrowing](source)

You can also assume that the company will use some of its cash on hand at the end of the year to pay off as much of its outstanding debt as possible without going below its minimum cash on hand required. The “excess” cash is the company’s NCP less its minimum cash on hand required—any cash above the minimum is available to repay any debt. In the examples shown in Figure C-46, compute the excess cash and then compute the amount to repay. In addition, compute the ending cash on hand after the debt repayment.

![Figure C-46 Examples of debt repayment](source)

In the Scenario Manager cases of the following chapters, your spreadsheets may need two bank financing sections beneath the Income and Cash Flow Statements sections. You will build the first section to calculate any needed borrowing or repayment at year’s end to compute year-end cash on hand. The second section will calculate the amount of debt owed at the end of the year after any borrowing or repayment.

Return to the Collegetown Thrift Shop tutorial and assume that it includes a line of credit at a local bank for short-term cash management. The first new section extends the end-of-year cash calculation, which was shown for the thrift shop in Figure C-19. Figure C-47 shows the structure of the new section highlighted in boldface.
The heading in cell A36 was originally End-of-year Cash on Hand in Figure C-19, but you will add line-of-credit borrowing and repayment to the end-of-year totals. You must add the line-of-credit borrowing from the bank to the NCP and subtract the line-of-credit repayments to the bank from the NCP to obtain the End-of-Year Cash on Hand.

The second new section you add will compute the End-of-year debt owed. This section is called Debt Owed, as shown in Figure C-48.

As you can see, the thrift shop currently owes $47,000 on its line of credit at the end of 2013. The End-of-year debt owed equals the Beginning-of-year debt owed plus any new borrowing from the bank’s line of credit, minus any repayment to the bank’s line of credit. Therefore, the formula in cell C46 would be:

\[ \text{End-of-year debt owed} = \text{Beginning-of-year debt owed} + \text{Borrowing from bank line of credit} - \text{Repayment to bank line of credit} \]

Assume that the amounts for borrowing and repayment (cells C44 and C45) were calculated in the first new section (for the year 2014, the amounts would be in cells C38 and C39), and then copied into the second section. The formula for cell C44 would be \( =C38 \), and for cell C45 would be \( =C39 \). The formula for cell C43, Beginning-of-year debt owed in 2014, would simply be the End-of-year debt owed in 2013, or \( =B46 \).

Now that you have added the spreadsheet entries for borrowing and repayment, consider the logic for the borrowing and repayment formulas.

**Calculation of Borrowing from the Bank Line of Credit**

When using logical statements, it is sometimes easier to state the logic in plain language and then turn it into an Excel formula. For borrowing, the logic in plain language is:

If (cash on hand before financing transactions is greater than the minimum cash required,

then borrowing is not needed; else,

borrow enough to get to the minimum)

You can restate this logic as the following:

If (NCP is greater than minimum cash required,

then borrowing from bank=0;

else, borrow enough to get to the minimum)

### Figure C-47

Calculation section for End-of-Year Cash on Hand with borrowing and repayments added.

### Figure C-48

Debt Owed section.
You have not added minimum cash at the end of the year as a requirement, but you could add it to the Constants section at the top of the spreadsheet (in this case the new entry would be cell C6). Assume that you want $50,000 as the minimum cash on hand at the end of both 2014 and 2015. Assuming that the NCP is shown in cell C37, you could restate the formula for borrowing (cell C38) as the following:

\[ \text{IF}(\text{NCP} > \text{Minimum Cash}, 0; \text{otherwise}, \text{borrow enough to get to the minimum cash}) \]

You have cell addresses for NCP (cell C37) and for Minimum Cash (cell $C$6). To develop the formula for cell C38, substitute the cell address for the test argument; the true argument is simply zero (0), and the false argument is the minimum cash minus the current NCP. The formula stated in Excel for cell C38 would be:

\[ =\text{IF}(\text{C37} > = \text{C6}, 0, \text{C6} - \text{C37}) \]

**Calculation of Repayment to the Bank Line of Credit**

Simplify the statements first in plain language:

\[ \text{IF}(\text{beginning of year debt} = 0, \text{repay 0 because nothing is owed, but}) \]

\[ \text{IF}(\text{NCP} \text{ is less than the minimum}, \text{repay 0, because you must borrow), but}) \]

\[ \text{IF}(\text{extra cash equals or exceeds the debt}, \text{repay the whole debt,}) \]

ELSE (to stay above the minimum cash, repay the extra cash above the minimum)

Look at the following formula. If you assume that the repayment amount will be in cell C39, the beginning-of-year debt is in cell C43, and the minimum cash target is still in cell $C$6, the repayment formula for cell C39 with the nested IFs should look like the following:

\[ =\text{IF}(\text{C43} = 0, 0, \text{IF}(\text{C37} <= \text{C6}, 0, \text{IF}(\text{C37} - \text{C6} >= \text{C43}, \text{C43}, \text{C37} - \text{C6}))) \]

The new sections of the thrift shop spreadsheet would look like those in Figure C-49.

![FIGURE C-49](source: Used with permission from Microsoft Corporation)

**FIGURE C-49**  Thrift shop spreadsheet with line-of-credit borrowing, repayments, and Debt Owed added
Answers to the Questions about Borrowing and Repayment

Figures C-50 and C-51 display solutions for the borrowing and repayment calculations.

\[ \text{In Figure C-50, the formula in cell D2 for the amount to borrow is } =\text{IF}(B2>=C2,0,C2-B2). \]

\[ \text{In Figure C-51, the formula in cell E10 for the amount to repay is } =\text{IF}(B10>=C10,\text{IF}(D10>0,\text{MIN}(B10-C10,D10),0),0). \]

Note the following points about the repayment calculations shown in Figure C-51.

- In Example 1, only $2,000 is available for debt repayment ($12,000 – $10,000) to avoid dropping below the Minimum Cash Required.
- In Example 2, only $3,000 is available for debt repayment.
- In Example 3, the Beginning-of-Year Debt was zero, so the Ending Cash is the same as the Net Cash Position.
- In Example 4, there was enough cash to repay the entire $40,000 debt, leaving $20,000 in Ending Cash.
- In Example 5, the company has cash problems—it cannot repay any of the Beginning-of-Year Debt of $30,000, and it will have to borrow an additional $30,000 to reach the Minimum Cash Required target of $10,000.

You should now have all the basic tools you need to tackle Scenario Manager in Cases 6 and 7. Good luck!
Crystal Lake Park is a family-owned amusement park in Pennsylvania’s Pocono Mountains. The park has been in business for more than 50 years and has grown to become the leading tourist attraction in the area. The owners, the Patterson family, have earned more than $50 million from the park over the past decade.

Sheila Patterson, the president and CEO of Crystal Lake Park, has proposed that the family invest its earnings in a park expansion. The park is adjacent to Crystal Lake and covers several hundred acres, 50 acres of which are undeveloped property. Sheila wants to build a water park on the additional land.

Sheila’s brother George, vice-president of marketing, has a different proposal. Almost 1000 acres of land have been listed for sale next to the park; the land is currently zoned for commercial use. George believes that the park should purchase the property and build a drive-through safari park and zoo. George thinks that a safari park would produce more profits in the long run. He has argued that the cooler weather in the mountains does not help ticket sales to the water park.

Sheila doesn’t agree. She thinks that the low cost of running a water park makes it a much safer investment alternative, even when ticket sales decrease because of cooler weather. Running a safari park and zoo requires high recurring costs, Sheila contends, and will not attract as many repeat customers as a water park.

Another factor that will affect the investment decision is the state of the economy. The economic recovery has boosted both attendance and spending per visitor at the amusement park for the past two years. The last recession affected attendance and revenues significantly, which will be important when analyzing each alternative.

**PREPARATION**

- Review the spreadsheet concepts discussed in class and in your textbook.
- Your instructor may assign Excel exercises to help prepare you for this case.
- Tutorial C has an excellent review of IF, nested IF, and AND statements that will help you with this case.
- Review the file-saving instructions in Tutorial C—it is always a good idea to save an extra copy of your work on a USB thumb drive.
- Review Tutorial F to brush up on your presentation skills.
- Because Crystal Lake Park is a strategic investment decision model, you will calculate the internal rate of return (IRR) in the decision model. If you are unfamiliar with the IRR function in Excel, the case includes a section that explains how to set it up.

**BACKGROUND**

You are an information analyst working for Crystal Lake Park. Sheila has asked you to prepare a quantitative analysis of financial, sales, and operations data to help determine which expansion path would offer the best...
strategic opportunity for the park. The park’s managers have been asked to provide the following data from their functional areas:

- **Accounting**—The current cash position of the company, the cash outlays for the two investment choices, and the corporate income tax rates
- **Sales**—Forecasts for park attendance and concessions sales based on the current economy and projections of attendance and income for a water park and a safari park/zoo
- **Operations**—Materials, labor, and overhead costs for a water park and a safari park/zoo; for the latter option, these costs would include expenses for animal keepers, feed consumption, and veterinary care

The departments have given you the following data for 2014 through 2016:

- The cost to purchase the 1000 acres, convert it to a safari park, build a zoo on the existing land, and purchase the animals
- The cost to build a water park on Crystal Lake’s undeveloped 50 acres
- Direct materials and labor costs per day for the water park’s operating expenses and maintenance employees
- Overhead expenses per day for the water park
- Direct materials and feed costs per day for the safari park and zoo
- Direct labor costs per day for the safari park and zoo’s animal keepers and maintenance employees
- Overhead expenses per day for the safari park and zoo
- Expected inflation rate
- Total operating days per year at either park
- Expected average water park attendance per day, price per ticket, and expected concession sales per ticket
- Expected average attendance per day at the safari park and zoo, price per ticket, and expected concession sales per ticket
- Corporate income tax rates

Assignment 1 also contains information you need to write the formulas for the Calculations section, Income and Cash Flow Statements section, and IRR Calculation section.

You will use Excel to see how much profit and positive cash flow each expansion alternative will generate for Crystal Lake Park for the next three years, and then you will use Excel to calculate an internal rate of return for each alternative. You will also examine the effects of the economy (Recession or Stable) and the effects of seasonal temperature (Cool or Hot) on your projected sales and profits for each alternative. In summary, your DSS will include the following inputs:

- Your decision to invest in the water park or safari park/zoo expansion
- Whether the economic outlook is for a recession or stable cycle
- Whether the seasonal temperatures are cool or hot

In a stable economy, attendance at each park would be higher than in a recession. Cool seasonal temperatures will hurt sales at the water park.

Your DSS model must account for the effects of the preceding three inputs on costs, selling prices, and other variables. If you design the model well, it will let you develop “what-if” scenarios with all the inputs, see the results, and select the expansion plan that Crystal Lake Park should adopt.

**ASSIGNMENT 1: CREATING A SPREADSHEET FOR DECISION SUPPORT**

In this assignment, you create a spreadsheet that models the business decision Crystal Lake Park is seeking. In Assignment 2, you write a report to the park’s management team. In Assignment 3, you prepare and give a presentation of your analysis and recommendations.

To begin, you create the spreadsheet model of the company’s financial and operating data. The model will cover three years of park operations and sales (2014 through 2016) for the alternative expansions considered. Assume that the park’s accountants have completed preliminary research for 2013, and that the new acreage, associated buildings, and equipment are in place to begin operations and sales in 2014.
This section helps you set up each of the following spreadsheet components before entering the cell formulas:

- Constants
- Inputs
- Summary of Key Results
- Calculations
- Income and Cash Flow Statements
- Internal Rate of Return Calculation

The Internal Rate of Return Calculation section was added because Excel financial formulas such as IRR work better if the cash outflow and inflow data are arranged in a vertical column with the years in ascending order, as opposed to taking the cash flows from across the page or from nonadjacent cells.

The spreadsheet skeleton is available for you to use. To access this skeleton, go to your data files, select Case 6, and then select Case 6—Crystal Lake Park Skeleton.xlsx.

**Constants Section**
First, build the skeleton of your spreadsheet. Set up your Constants section as shown in Figure 6-1. An explanation of the line items follows the figure.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Crystal Lake Park—Expansion Analysis</strong></td>
<td>2013</td>
<td>2014</td>
<td>2015</td>
</tr>
<tr>
<td>2</td>
<td><strong>Constants</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Direct Materials cost per day—Water Park</td>
<td>NA</td>
<td>$1,500</td>
<td>$1,575</td>
</tr>
<tr>
<td>5</td>
<td>Direct Labor cost per day—Water Park</td>
<td>NA</td>
<td>$3,000</td>
<td>$3,675</td>
</tr>
<tr>
<td>6</td>
<td>Overhead cost per day—Water Park</td>
<td>NA</td>
<td>$1,500</td>
<td>$1,648</td>
</tr>
<tr>
<td>7</td>
<td>Direct Materials/Feed cost per day—Safari Park/Zoo</td>
<td>NA</td>
<td>$3,000</td>
<td>$3,675</td>
</tr>
<tr>
<td>8</td>
<td>Direct Labor cost per day—Safari Park/Zoo</td>
<td>NA</td>
<td>$4,000</td>
<td>$4,520</td>
</tr>
<tr>
<td>9</td>
<td>Overhead cost per day—Safari Park/Zoo</td>
<td>NA</td>
<td>$3,000</td>
<td>$3,675</td>
</tr>
<tr>
<td>10</td>
<td>Expected Park Attendance per day—Water Park</td>
<td>NA</td>
<td>0,000</td>
<td>0,000</td>
</tr>
<tr>
<td>11</td>
<td>Expected Park Attendance per day—Safari Park/Zoo</td>
<td>NA</td>
<td>5,000</td>
<td>5,000</td>
</tr>
<tr>
<td>12</td>
<td>Average Ticket and Concession Sales per Customer—Water Park</td>
<td>NA</td>
<td>$14.00</td>
<td>$15.00</td>
</tr>
<tr>
<td>13</td>
<td>Average Ticket and Concession Sales per Customer—Safari Park</td>
<td>NA</td>
<td>$25.00</td>
<td>$27.00</td>
</tr>
<tr>
<td>14</td>
<td>Capital Investment for Water Park</td>
<td>$20,000,000</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>15</td>
<td>Capital Investment for Safari Park/Zoo</td>
<td>$40,000,000</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>16</td>
<td>Expected Inflation Rate</td>
<td>3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Total Park Operating Days per year</td>
<td>190</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Corporate Income Tax Rate</td>
<td>25%</td>
<td>25%</td>
<td>25%</td>
</tr>
</tbody>
</table>

Source: Used with permission from Microsoft Corporation

**FIGURE 6-1  Constants section**

**NOTE**
The direct materials and overhead costs for 2015 and 2016 are formulas created by increasing the previous year’s costs by the expected inflation rate. The direct labor costs for 2015 and 2016 were created by increasing the previous year’s costs by 5 percent. Accountants frequently use such formulas in spreadsheets. However, you do not have to write any formulas in the Constants section—just enter the values shown in Figure 6-1.

- Direct Materials cost per day—Water Park—This value is the daily cost of direct materials to run the water park. Most of these materials are potable water and water treatment chemicals. If the weather is hot, these costs will increase by 5 percent due to evaporation.
- Direct Labor cost per day—Water Park—This value is the daily labor cost for water park employees and concessions employees.
- Overhead cost per day—Water Park—This value is the cost per day for maintenance employees, utilities, and repair materials.
- Direct Materials/Feed cost per day—Safari Park/Zoo—This value is the cost per day for direct materials and feed for the animals. Animals must be kept and fed all year. However, if the weather is hot during the park season, the animals will eat less, which will reduce the Direct Materials/Feed cost by 3 percent during the park season only.
• Direct Labor cost per day—Safari Park/Zoo—This value is the daily cost of animal keepers, trainers, and store employees. The full cost will be applied during park operating season (150 days). The cost will be reduced by half when the park is closed (215 days).

• Overhead cost per day—Safari Park/Zoo—This value is the cost per day for maintenance employees, utilities, and veterinary services. The full cost will be applied during park operating season (150 days). This cost will be reduced by half when the park is closed (215 days).

• Expected Base Attendance per day—Water Park—This value is a marketing estimate of the average water park attendance per day. The actual attendance will depend on the Seasonal Temperature and Economic Outlook values from the Inputs section.

• Expected Base Attendance per day—Safari Park/Zoo—This value is a marketing estimate of the average safari park attendance per day. The actual attendance will depend on the Seasonal Temperature and Economic Outlook values from the Inputs section.

• Average Ticket and Concession Sales per Customer—Water Park—This value is the average ticket and concessions sales per customer in the water park.

• Average Ticket and Concession Sales per Customer—Safari Park—This value is the average ticket and concessions sales per customer in the safari park/zoo.

• Capital Investment for Water Park—This value is the total amount of capital needed to convert the 50 undeveloped acres to a water park, including water slides, pools, and water rides.

• Capital Investment for Safari Park/Zoo—This value is the total amount of capital needed to purchase the adjoining acreage; convert it and the 50 undeveloped acres to a wildlife preserve and zoo, including all buildings, animal habitats, and equipment, and purchase the animals.

• Expected Inflation Rate—This value is the estimate of the annual inflation rate for 2015 and 2016.

• Total Park Operating Days per year—This value is an estimate of the number of days per year that either park will be open for business.

• Corporate Income Tax Rate—This value is an estimate of the corporate income tax rates that the park must pay after the expansion.

Inputs Section
Your spreadsheet model must include the following inputs that will apply for all three years, as shown in Figure 6-2.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>Expansion Selection (W: Water Park, Z: Safari Park/Zoo)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>22</td>
<td>Economic Outlook (S: Stable, R: Recession)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>23</td>
<td>Seasonal Temperature (C: Cool, H: Hot)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

Source: Used with permission from Microsoft Corporation

FIGURE 6-2 Inputs section

• Expansion Selection—This value is the basic input for the strategic decision to expand the park. Add W for Water Park or Z for Safari Park/Zoo.

• Economic Outlook—This value is Stable (S) or Recession (R). Whether the economy is stable or in a recession affects the expected daily park attendance. Tourism is discretionary consumer spending and is affected significantly by a recession.

• Seasonal Temperature—This value is Cool (C) or Hot (H). Cool weather will decrease water park attendance, while hot weather will have a similar adverse effect on safari park/zoo attendance because of customer discomfort, animal inactivity, and customers switching to the water park attractions.

Summary of Key Results Section
This section (see Figure 6-3) contains the results data, which is of primary interest to the owners of Crystal Lake Park. This data includes income and end-of-year cash on hand information, as well as the annualized internal rate of return for a particular set of business inputs. This section summarizes the values from the Calculations, Income and Cash Flow Statements, and Internal Rate of Return Calculation sections.
For each year from 2014 to 2016, your spreadsheet should show net income after taxes and end-of-year cash on hand. The net income after taxes is also the net cash inflow for the IRR calculation. Because Crystal Lake Park is funding the capital investment from its cash on hand at the end of 2013, there is no debt to repay. However, Sheila and her management team want to know the internal rate of return for the expansion investment by the end of 2016.

Calculations Section

The Calculations section includes the calculations you need to perform to determine the operating costs and revenues for the park expansion. See Figure 6-4.

- New Product Capital Investment—This value is the amount of investment money spent by Crystal Lake Park at the end of 2013, depending on the Expansion Selection from the Inputs section. If the selected expansion is Water Park (W), this cell should display the capital investment amount from the Constants section for the water park (the value in cell B14). If the selected expansion is Safari Park/Zoo (Z), the cell should display the capital investment amount from the Constants section for the safari park/zoo (the value in cell B15). Note that when you see the word if in the text, you need to write a formula that uses the IF function in the target cell.

- Annual Direct Materials cost—The Direct Materials cost per day for both expansions are included in rows 4 and 7 of the Constants section. You must write formulas to calculate the Annual Direct Materials cost for 2014, 2015, and 2016. This cost equals the Direct Materials cost per day multiplied by the number of days in the year. For the water park, calculate a 5 percent increase in the Annual Direct Materials cost if the Seasonal Temperature is Hot, but note that the cost is incurred only during the Total Park Operating Days per year (cell B17). For the safari park/zoo, the calculation is more complex. The animals must be kept and fed all year, but if the Seasonal Temperature is Hot, the animals eat less, reducing the Annual Direct Materials cost by 3 percent. Therefore, four conditions require you to write a nested IF(AND) formula:
  - Water Park and Cool: The Annual Direct Materials cost will be calculated using the basic formula described earlier, with no modifications.
  - Water Park and Hot: The Annual Direct Materials cost will be calculated using the basic formula multiplied by 1.05 to reflect the use of additional water and chemicals due to evaporation.
  - Safari Park/Zoo and Cool: The Annual Direct Materials cost will be calculated using the basic formula described earlier, with no modifications.
  - Safari Park/Zoo and Hot: The Annual Direct Materials cost will be calculated using the basic formula multiplied by 0.97 to reflect the use of additional water and chemicals due to the animals eating less.
- **Safari Park/Zoo and Cool:** The Annual Direct Materials cost will be calculated using the basic formula described earlier, except that you must calculate the cost for the entire year (365 days) instead of the park's operating days.
- **Safari Park/Zoo and Hot:** The Annual Direct Materials cost will be calculated using the basic formula multiplied by 0.97 to reflect reduced animal activity for hotter operating days (the value in cell B17—150 days). The full daily cost is then multiplied by the number of days per year the park is closed (365 minus the value in cell B17, or 215 days).
- **Annual Direct Labor cost—**The Direct Labor cost per day for both expansions is included in rows 5 and 8 of the Constants section. You must write formulas to calculate the Annual Direct Labor cost for 2014, 2015, and 2016. This cost equals the Direct Labor cost per day multiplied by the applicable number of days in the year for either alternative. You must write the formula as an IF statement to calculate the Annual Direct Labor cost for either the water park or safari park/zoo expansion. Two conditions require you to create the following formulas:
  - Water Park: The Annual Direct Labor cost is the daily cost multiplied by the number of park operating days (the value in cell B17).
  - Safari Park/Zoo: The animals must be kept and fed, but the off-season labor requirement is only half that of the operating season. Therefore, the Annual Direct Labor cost is the daily labor cost multiplied by the number of park operating days (the value in cell B17), plus the daily labor cost, multiplied by the remaining days in the year (365 days minus the value in cell B17, or 215 days), multiplied by 0.5.
- **Annual Overhead cost—**The daily Overhead cost per day for both expansions is included in rows 6 and 9 of the Constants section. You must write formulas to calculate the Annual Overhead cost for 2014, 2015, and 2016. This cost equals the Overhead cost per day multiplied by the applicable number of days in the year for either alternative. You must write the formula as an IF statement to calculate the Annual Overhead cost for either the water park or safari park/zoo expansion. Two conditions require you to create the following formulas:
  - Water Park: The Annual Overhead cost is the daily overhead cost multiplied by the number of park operating days (the value in cell B17).
  - Safari Park/Zoo: The off-season overhead cost of keeping the animals is expected to be half that of the operating season. Therefore, the Annual Overhead cost is the daily overhead cost multiplied by the number of park operating days (the value in cell B17), plus the daily overhead cost, multiplied by the remaining days in the year (365 days minus the value in cell B17, or 215 days), multiplied by 0.5.
- **Annual Cost of Sales**—This value is the sum of the Annual Direct Materials, Annual Direct Labor, and Annual Overhead costs (rows 32 through 34).
- **Annual Sales Revenues**—The base formula for this calculation is the Expected Base Attendance per day for either alternative, multiplied by the Average Ticket and Concessions Sales per Customer, multiplied by the Total Park Operating Days per year. However, you must construct a complex nested IF(AND) formula that reflects the following eight combinations from the Inputs section (cells SC21, SC22, and SC23):
  - Water/Stable/Cool—Multiply the base formula by 0.95 to reflect reduced water park ticket sales due to cooler weather.
  - Water/Recession/Cool—Multiply the base formula by 0.80 to reflect the effects of cooler weather and reduced business in a recession economy.
  - Water/Stable/Hot—Make no modifications to the base formula; this is the best combination of inputs for the water park.
  - Water/Recession/Hot—Multiply the base formula by 0.90 to reflect the effects of reduced business in a recession economy.
  - Zoo/Stable/Cool—Make no modifications to the base formula; this is the best combination of inputs for the safari park/zoo.
  - Zoo/Recession/Cool—Multiply the base formula by 0.90 to reflect the effects of reduced business in a recession economy.
  - Zoo/Stable/Hot—Multiply the base formula by 0.95 to reflect the effects of hot weather diverting customers to the water park instead.
  - Zoo/Recession/Hot—Multiply the base formula by 0.85 to reflect the effects of hot weather and a recession on the safari park/zoo’s attendance.
The Calculations section includes several complicated formulas, and the Annual Sales Revenues calculation is the most complex—it contains seven nested IF(AND)s. You might want to write the formulas on a piece of paper and check your logic before trying to enter the formulas into the spreadsheet. Also, when you are constructing a complex nested IF(AND) formula, it is sometimes difficult to count the correct number of parentheses needed at the end of the formula. If you do not enter the correct number, Excel displays an error message and suggests the correct number of parentheses. Click OK to have Excel finish the formula for you. If you get lost while trying to write the nested IF and AND formulas, refer to Tutorial C or ask your instructor for help.

**Income and Cash Flow Statements Section**

The statements for income and cash flow start with the cash on hand at the beginning of the year. Because Crystal Lake Park is funding the capital investment *internally*—that is, with its own cash on hand—you must deduct the invested funds from the cash on hand at the end of 2013. Figure 6-5 and the following list show how you should structure the Income and Cash Flow Statements section.

| Source: Used with permission from Microsoft Corporation |
| FIGURE 6-5 Income and Cash Flow Statements section |

- **Beginning-of-year Cash on Hand**—For 2014, this value is the End-of-year Cash on Hand from 2013 minus the capital investment, depending on the expansion selection. If you choose the water park expansion, the capital investment will be $20 million (cell B14 in the Constants section). If you choose the safari park/zoo expansion, the capital investment will be $40 million (cell B15 in the Constants section). For 2015 and 2016, the Beginning-of-year Cash on Hand is the End-of-year Cash on Hand from the previous year.
- **Annual Sales Revenues**—This value is taken from the Annual Sales Revenues in the Calculations section for each year (cells C36, D36, and E36).
- **Less: Annual Cost of Sales**—This value is taken from the Annual Cost of Sales in the Calculations section for each year (cells C35, D35, and E35).
- **Expansion Profit before Income Tax**—This value is the Annual Sales Revenues minus the Annual Cost of Sales.
- **Less: Income Tax Expense**—If you make a profit (in other words, if the Expansion Profit before Income Tax is greater than zero), this value is the Expansion Profit before Income Tax multiplied by the Corporate Income Tax Rate for that year from the Constants section. If you make nothing or have a net loss, the Income Tax Expense is zero.
- **Expansion Income after Taxes (Net Cash Inflow)**—This value is the Expansion Profit before Income Tax minus the Income Tax Expense. From a strict accounting standpoint, the net income after taxes is not the net cash inflow because you would have to add back all noncash expenses such as depreciation or depletion to determine the true cash inflow. However, for the purposes of this case, assume that net income after taxes is equal to net cash inflow.
- **End-of-year Cash/Securities on Hand**—This value is the Beginning-of-year Cash on Hand plus the Expansion Income after Taxes.

**Internal Rate of Return Calculation Section**

This section, as shown in Figure 6-6, is set up to facilitate using the Excel built-in Internal Rate of Return function.
Internal Rate of Return Calculation section

- Investment (Cash Outflow)—This value is the Capital Investment amount from cell B31 of the Calculations section, multiplied by -1. The investment value must be a negative number to represent it as a Cash Outflow. (Think of it as money out of your pocket.)
- Net Cash Inflow 2014—This value is the net income after tax for 2014.
- Net Cash Inflow 2015—This value is the net income after tax for 2015.
- Net Cash Inflow 2016—This value is the net income after tax for 2016.
- Internal Rate of Return (IRR)—This value is the annual rate of return that the park expansion will generate for Crystal Lake Park. To calculate the IRR, click cell B52, which is where you want to record the IRR result. Next, click the $f_x$ symbol next to the cell-editing window below the Ribbon. The Insert Function window appears (see Figure 6-7). Type IRR in the “Search for a function” text box, and then click Go.

The Function Arguments window appears to help you build the formula (see Figure 6-8). In the Values text box, enter the cells that contain all your cash outflows and inflows (B48:B51), or click and drag the mouse to select cells B48 through B51. Notice that Excel enters the formula for you in cell B52: =IRR(B48:B51). You do not have to enter a value in the Guess text box. When you click OK, Excel calculates the IRR and places the result in cell B52.
After you complete all the formulas, try testing your spreadsheet with various combinations of the three inputs. (There are eight possible combinations, as listed in the next section.) If you receive any error messages or see strange values in the cells, go back and check your formulas.

This DSS spreadsheet contains some values that represent millions of dollars. Accountants often simplify their spreadsheets by listing the outputs in multiples of thousands or millions of dollars. It is not hard to do—you simply divide the cell values by a thousand or a million, depending on the scale—but for the purposes of this case, you should keep the large numbers in the spreadsheet. If you see cell results listed as a group of “#” signs when working with large numbers (see Figure 6-9), the cell is not wide enough to display the number. Simply widen the column until the number is displayed.

ASSIGNMENT 2: USING THE SPREADSHEET FOR DECISION SUPPORT

Next, you use the spreadsheet to gather data needed to determine the best expansion decision and to document your recommendations in a report to Sheila Patterson and the Crystal Lake Park directors.

This DSS model has eight possible financial outcomes:

1. Water Park Expansion (W)
   a. Stable Economy and Cool (W/S/C)
   b. Recession and Cool (W/R/C)
   c. Stable Economy and Hot (W/S/H)
   d. Recession and Hot (W/R/H)

2. Safari Park/Zoo Expansion (Z)
   a. Stable Economy and Cool (Z/S/C)
   b. Recession and Cool (Z/R/C)
   c. Stable Economy and Hot (Z/S/H)
   d. Recession and Hot (Z/R/H)
You are primarily interested in the park’s financial position based on each of these possible outcomes. The Summary of Key Results section lets you see the Net Expansion Income after Taxes for each of the first three years of the expansion, the End-of-year Cash on Hand at the end of each of the three years, and the Internal Rate of Return for Investment. The Crystal Lake Park management team wants to make sure that the selected expansion restores the company’s cash on hand to a better position by the end of the third year of operation (2016) than the cash on hand in 2013. In addition, the team prefers the expansion selection that provides a 12 percent or higher annual rate of return averaged across the four possible combinations of inputs.

Because there are eight \(2^3\) possible combinations of inputs when considering economic outlook, seasonal temperature, and expansion selection, you might want to run the spreadsheet model eight times, changing the inputs according to the preceding list. You should do this for two reasons:

- To ensure that no single year from 2014 through 2016 has negative income or negative end-of-year cash on hand (in other words, to make sure the park does not suffer a loss or run out of money)
- To print each spreadsheet to meet the requirements of Assignment 2A

You could then transcribe the results to a summary sheet. Next, you know that the management team is very interested in the financial data from the end of the third year of the model (2016). You can summarize the data easily using Scenario Manager.

### Assignment 2A: Using Scenario Manager to Gather Data

For each of the eight situations listed earlier, you want to know the end-of-year cash on hand for the third year (2016) of the project as well as the internal rate of return generated by the three years’ cash inflows. You will run “what-if” scenarios with the eight sets of input values using Excel Scenario Manager. If necessary, review Tutorial C for tips on using Scenario Manager. In this case, the input values are stored together in one vertical group of cells (C21 through C23) in the inputs section, as are the output cells (E27 and E28) in the Summary of Key Results section, so selecting the cells is easy. Run Scenario Manager to gather your data in a report called the Scenario Summary. Format the Scenario Summary to make it presentable, and then print it for your instructor.

If you haven’t done so already, you should run the spreadsheet model for each of the eight input combinations. Save each spreadsheet in your Excel workbook with a different sheet name. Keep these names as short (but descriptive) as possible; for example, you can name the sheets WSC, WRC, WSH, WRH, ZSC, ZRC, ZSH, and ZRH. Print the spreadsheets if your instructor requires it. Make sure to save your completed Excel workbook before closing it.

### Assignment 2B: Documenting Your Recommendations in a Report

Use Microsoft Word to write a brief report to the Crystal Lake Park management team. State the results of your analysis and recommend which expansion choice to make (water park or safari park/zoo). Your report must meet the following requirements:

- The first paragraph must summarize the expansion choices facing Crystal Lake Park and must state the purpose of the analysis.
- Summarize the results of your analysis and state your recommended action.
- Support your recommendation with a table outlining the Scenario Summary results. Figure 6-10 shows a recommended table format in Microsoft Word.
- If your report is well formatted, you might choose to embed an Excel object of the Scenario Summary in the body of the report. Tutorial C includes a brief description of how to copy and paste Excel objects.
- Your instructor might also ask you to provide a graph of the internal rates of return for the eight possible combinations of inputs.
ASSIGNMENT 3: GIVING AN ORAL AND SLIDE PRESENTATION

Your instructor may ask you to summarize your analysis in an oral presentation. Also, assume that the management team at Crystal Lake Park wants you to explain your analysis and recommendations in 10 minutes or less. A well-designed PowerPoint presentation, with or without handouts, is considered appropriate in a business setting. Tutorial F provides excellent tips for preparing and delivering a presentation.

DELIVERABLES

Your completed case should include the following deliverables for the instructor:

- A printed copy of your report to management
- Printouts of your spreadsheets
- Electronic copies of all your work, including your report, PowerPoint presentation, and Excel DSS model. Ask your instructor for specific guidance on which items you should submit for grading.