

# Loan and Bond Amortization

# 5

## *In this chapter you will learn:*

- How to use the payment function to calculate payments to retire a loan
- How to create a loan amortization schedule
- How to use a what-if analysis with the payment function
- How to use names in a worksheet
- How to use the present value function to calculate the proceeds of a bond
- How to create a bond amortization schedule
- How to use Excel's what-if analysis and goal-seeking capabilities with the present value function
- How to use Excel's Scenario Manager
- How to integrate monthly periods into loan or bond amortization analyses

## **Case: What SUP, Inc.**

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Nathan and Meagan have been contemplating the prospect of opening several new locations. They are somewhat strapped for cash and are interested in looking into their financing alternatives. On the one hand, they could borrow funds from their local banker. Alternatively, they could borrow money by issuing bonds to local investors. They are curious whether Excel could help them analyze the alternatives or at least help them determine the payments required to pay back a loan or bond.

“Can Excel perform these types of loan calculations?” Meagan asks.

“Yes,” Kyle responds, “not only can Excel help you with the calculations, it can also help you with what-if sensitivity analyses to determine interest costs, loan payments, and balances.”

## **Loan Calculations**

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Kyle explains that loans usually involve some constant periodic payment that pays both interest and principal over a specified period of time. Banks usually want to see some principal payment rather than the interest-only payments often associated with bonds. Excel has a built-in function that calculates the payment on a loan given three variables: interest rate, period, and loan amount. The PMT function takes three arguments and is written `=PMT (rate, nper, pv)`, where *rate* is the periodic interest rate, *nper* is the number of periods, and *pv* is the present value (usually the loan amount). Kyle suggests that you create a

worksheet to calculate the annual payment necessary on a 3-year, \$100,000 loan at an interest rate of 10 percent.

### To calculate a loan payment using Excel's built-in function:

- 1 Start Excel and open file ch5-01. The worksheet should look like Figure 5.1.

**Figure 5.1**  
Loan Worksheet

	A	B	C	D	E	F
1	What SUP, Inc.					
2	Loan Amortization Schedule					
3						
4	Amount					
5	Rate					
6	Term					
7	Payment					
8						
9						
10	Payment #	Payment	Interest	Principal	Balance	
11						
12	1					
13	2					
14	3					

- 2 Type **100000** in cell B4, **10** in cell B5, and **3** in cell B6.
- 3 Type **=PMT(B5,B6,B4)** in cell B7, and then press **[Enter]**. Note that the resulting amount is a negative number. This is Excel's way of indicating that cash must be paid out to repay the loan proceeds received.
- 4 Place a negative sign in front of the function PMT so that the formula reads as follows: **=-PMT(B5,B6,B4)**. This has the effect of making the payment a positive number.
- 5 Save your work to ch5-01\_student\_name (replacing student\_name with your name).

Thus, a payment of \$40,211.48, when made at the end of each year for 3 years, will repay the loan and interest charges.

“How much of those payments is interest and how much principal?” Nathan asks.

“Good question.” Kyle responds. “That’s why it is helpful to create a loan amortization schedule with each worksheet.”

## Loan Amortization Schedule

Kyle explains how a loan amortization schedule answers Nathan’s question. The schedule breaks down each payment into the components of interest and principal. You remind Kyle that interest expense, based on the accrual accounting principal, is calculated as the balance owed multiplied by the periodic

interest rate. The amount of payment that exceeds the interest owed is applied to the principal and so reduces the loan amount.

“I can do that,” you say.

**To add a loan amortization schedule to your worksheet:**

- 1 Type **=B4** in cell E11. This places the loan amount at the beginning of the schedule.
- 2 Type **=\$B\$7** in cell B12. This places the loan payment in the schedule. (This reference is absolute so that it can be replicated later.)
- 3 Type **=E11\*\$B\$5** in cell C12. This formula calculates interest expense as the loan amount multiplied by the interest rate. (The reference to the interest rate is absolute so that it can be replicated later.)
- 4 Type **=B12-C12** in cell D12. This formula calculates the amount of the payment that reduces the loan amount, otherwise known as principal.
- 5 Type **=E11-D12** in cell E12. This formula calculates the new loan balance after the loan payment as the previous loan balance less principal reduction.
- 6 Replicate formulas located at cells B12 through E12 down through row 14.
- 7 The resulting worksheet should look like Figure 5.2.

	A	B	C	D	E
1	What SUP, Inc.				
2	Loan Amortization Schedule				
3					
4	Amount	\$ 100,000.00			
5	Rate	10%			
6	Term	3			
7	Payment	\$40,211.48			
8					
9					
10	Payment #	Payment	Interest	Principal	Balance
11					\$100,000.00
12	1	\$40,211.48	\$10,000.00	\$30,211.48	\$ 69,788.52
13	2	\$40,211.48	\$ 6,978.85	\$33,232.63	\$ 36,555.89
14	3	\$40,211.48	\$ 3,655.59	\$36,555.89	\$ -
15					

**Figure 5.2**

Loan Amortization Schedule for a \$100,000 Loan at 10%

- 8 Save your work.

Kyle points out that, at the end of the loan period, the balance should (of course) be zero, which it is in the worksheet.

“What is the payment if the interest rate is higher or lower?” Meagan asks.

“Another good question,” Kyle comments. “That leads us into the sensitivity features of Excel that we’ve worked on previously.”

## What-If Analysis and the Payment Function

Kyle explains that, because you built the loan amortization worksheet with cell references, a what-if analysis is easy. To investigate the effects of changing interest rates or different loan balances, Kyle suggests he determine the effect on the loan payment of interest rates of 11 percent and 9 percent as well as loan balances of \$150,000 or \$75,000.

Using Excel, Kyle demonstrates how these variable changes affect the loan payment.

### To perform a what-if analysis using the payment function:

- 1 Type **11** in cell B5, and then press [Enter]. Note the change in payment.
- 2 Type **9** in cell B5, and then press [Enter]. Again, note the change in payment. Your worksheet should look like Figure 5.3.

**Figure 5.3**

Loan Amortization  
Schedule for a \$100,000  
Loan at 9%

	A	B	C	D	E
1	What SUP, Inc.				
2	Loan Amortization Schedule				
3					
4	Amount	\$ 100,000.00			
5	Rate	9%			
6	Term	3			
7	Payment	\$39,505.48			
8					
9					
10	Payment #	Payment	Interest	Principal	Balance
11					\$100,000.00
12	1	\$39,505.48	\$ 9,000.00	\$30,505.48	\$ 69,494.52
13	2	\$39,505.48	\$ 6,254.51	\$33,250.97	\$ 36,243.56
14	3	\$39,505.48	\$ 3,261.92	\$36,243.56	\$ -
15					

- 3 Type **10** in cell B5, and then press [Enter].
- 4 Type **150000** in cell B4, then press [Enter]. Note the change in payment.
- 5 Type **75000** in cell B4, then press [Enter]. Note the change in payment. Your worksheet should look like Figure 5.4.

**Figure 5.4**

Loan Amortization  
Schedule for a \$75,000  
Loan at 10%

	A	B	C	D	E
1	What SUP, Inc.				
2	Loan Amortization Schedule				
3					
4	Amount	\$ 75,000.00			
5	Rate	10%			
6	Term	3			
7	Payment	\$30,158.61			
8					
9					
10	Payment #	Payment	Interest	Principal	Balance
11					\$ 75,000.00
12	1	\$30,158.61	\$ 7,500.00	\$22,658.61	\$ 52,341.39
13	2	\$30,158.61	\$ 5,234.14	\$24,924.47	\$ 27,416.92
14	3	\$30,158.61	\$ 2,741.69	\$27,416.92	\$ (0.00)
15					

- 6 Type **100000** in cell B4.

“Fascinating!” Meagan exclaims. “This is a great tool!”

“Yes, but these formulas get a bit confusing,” Nathan comments. “I have trouble understanding what the payment function is doing with B5, B6, and B4. Isn’t there a better way of describing the arguments to functions or what these cell references mean?”

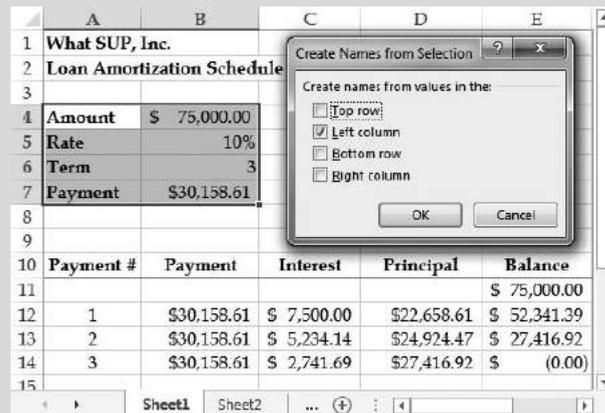
Kyle decides to introduce the concept of named ranges to you, Nathan, and Meagan. He explains that cell references can also be named for clearer analysis.

## Names in a Worksheet

Excel provides a naming feature in every worksheet that allows you to define a cell or cells with a name that can then be used elsewhere in the worksheet. There are two steps involved in changing an existing worksheet from cell references to named references. Step 1 is defining cell names; Step 2 is applying those names throughout the worksheet. Kyle suggests that you first name the variables Amount, Rate, Term, and Payment and then apply those names throughout the loan amortization worksheet.

### To use names in the loan amortization worksheet:

- 1 Select the cell range **A4** through **B7**.
- 2 Click **Create from Selection** from the Defined Names group of the Formulas tab.
- 3 Click in the check box next to **Left column** as shown in Figure 5.5. (Note: This will name the cells in B4 through B7 with the corresponding name in the left column.)



**Figure 5.5**  
Creating Names

- 4 Click **OK**.
- 5 Click in cell **E11**.
- 6 Click **Use in Formula** from the Defined Names group on the Formulas tab.
- 7 Click **Amount** and then press **[Enter]**. (Note: This action only replaces the reference to B4 in cell E11 with the newly defined name Amount.)

- 8** Click in cell **B12**. Click **Use in Formula** like you did before and this time click **Payment** and then press **[Enter]**. Then fill this new formula down to cell B14.
- 9** Click in any blank cell and then click the down arrow next to Define Name and then click **Apply Names** and then click **OK** from the Apply Names window. (*Note:* This action replaces all references to B4, B5, B6, and B7 with the respective new names of Amount, Rate, Term, and Payment.)
- 10** Click in cell **B7**. Observe that the new argument references the payment function:  $=-PMT(\text{Rate}, \text{Term}, \text{Amount})$ .
- 11** Save your work.

Kyle explains that not all cell references will be replaced, since you defined only four cells. However, all references to those cells will now refer to the names instead of specific cells such as B4 and B5.

“This looks much better,” Nathan says. “Now I can clearly see that the payment function takes three arguments: Rate, Term, and Amount.”

Kyle further explains that these named cells can be used in other ways as well. For example, Excel provides you with a Name Box that lists all the named cells and ranges on the worksheet. He suggests that you explore the use of names further.

### To explore the use of named cells and ranges:

- 1** Click on the drop-down arrow of the Name box located next to the formula text box to reveal the named cells on the worksheet. Then highlight Rate but don't click; see Figure 5.6.

**Figure 5.6**  
Name Box

	B	C	D	E
	Inc.			
	<b>Amortization Schedule</b>			
4	<b>Amount</b>	\$ 75,000.00		
5	<b>Rate</b>	10%		
6	<b>Term</b>	3		
7	<b>Payment</b>	\$30,158.61		
8				
9				
10	<b>Payment #</b>	<b>Payment</b>	<b>Interest</b>	<b>Principal</b>
11				\$ 75,000.00
12	1	\$30,158.61	\$ 7,500.00	\$22,658.61
13	2	\$30,158.61	\$ 5,234.14	\$24,924.47
14	3	\$30,158.61	\$ 2,741.69	\$27,416.92
				\$ (0.00)

- 2** Now click **Rate**. (Note how Excel now positions the active cell as B5, the location of the name Rate.)
- 3** Save and close this file.

Once names have been created, they can be used throughout the worksheet as you'll see in the next section. Kyle suggests that you now explore the use of worksheets as tools for bond calculations.

## Present Value and Bonds

You recall having lots of trouble with present value and bonds while in school and are leery of using them in a worksheet. However, Kyle calms your fears by explaining how the use of a worksheet actually helped him better understand bonds and the concept of present value.

“Whoa now!” Meagan comments. “Why should I learn about present values?”

“Present values are very helpful to an accountant and businessperson,” Kyle explains. “In fact, you were using present value concepts when you computed the loan payment above!”

Kyle reminds you that bonds are financial instruments that usually require constant interest payments to the bondholder and then a lump-sum payment equal to the bond's face value at the end of a specified term. The proceeds from a bond's sale, however, depend on the market interest rate at the time of sale.

Kyle explains that Excel's present value function can compute those proceeds based on the following variables: market interest rate, term, periodic interest payment, and lump-sum face value payment. The present value function is written:  $PV(\text{rate}, \text{nper}, \text{pmt}, \text{fv})$ , where *rate* is the market rate of interest, *nper* is the number of periods, *pmt* is the periodic interest payment, and *fv* is the future value that is paid at the end of the bond term.

You recall that, if the stated rate of interest on a bond differs from the market rate of interest, then the bond's proceeds won't match its face value. If the stated rate is lower than the market rate, then buyers will pay less than the face value, resulting in a discount; if the stated rate is higher than the market rate, then buyers will pay more than the face value, resulting in a premium.

Kyle suggests you use Excel to calculate proceeds of a \$100,000 bond paying 10 percent per year for 5 years, given an 11 percent market interest rate at the time of the bond's issuance.

### To calculate bond proceeds:

- 1** Open file ch5-02. The worksheet should look like Figure 5.7.
- 2** Type **100000** in cell B4 to identify the bond face value.
- 3** Type **10** in cell B5 to identify the bond's stated interest rate.
- 4** Type **11** in cell B6 to identify the market interest rate.

**Figure 5.7**  
Bond Worksheet

	A	B	C	D	E	F
1	What SUP, Inc.					
2	<b>Bond Amortization Schedule</b>					
3						
4	<b>Amount</b>					
5	<b>Stated Rate</b>					
6	<b>Market Rate</b>					
7	<b>Term</b>					
8	<b>Interest Payment</b>					
9	<b>Proceeds</b>					
10	<b>(Discount)/ Premium</b>					
11						
12	<b>Payment #</b>	<b>Interest Payment</b>	<b>Interest Expense</b>	<b>Amortization</b>	<b>(Discount) Premium</b>	<b>Carrying Value</b>
13						
14	1					
15	2					
16	3					
17	4					
18	5					

- 5** Type **5** in cell B7 to identify the bond term.
- 6** Type  $=B4*B5$  in cell B8 to calculate annual interest payment.
- 7** Type  $=-PV(B6,B7,B8,B4)$  in cell B9 to calculate bond proceeds. (Don't forget the minus sign in front of PV to make the proceeds positive.)
- 8** Type  $=B9-B4$  in cell B10 to calculate the bond discount or premium. Your worksheet should look like Figure 5.8.

**Figure 5.8**  
Calculating Bond Proceeds

	A	B
1	What SUP, Inc.	
2	<b>Bond Amortization Schedule</b>	
3		
4	<b>Amount</b>	\$ 100,000.00
5	<b>Stated Rate</b>	10.00%
6	<b>Market Rate</b>	11.00%
7	<b>Term</b>	5
8	<b>Interest Payment</b>	\$10,000.00
9	<b>Proceeds</b>	\$96,304.10
10	<b>(Discount)/ Premium</b>	(\$3,695.90)

- 9** Name the cells located at B4 through B10.
- 10** Apply the names you just defined. (*Hint*: If you need help doing this, review the Names in a Worksheet section of this chapter.)
- 11** Click on cell **B9**. The new formula should read as follows:  
 $=-PV(\text{Market\_Rate},\text{Term},\text{Interest\_Payment},\text{Amount})$ .
- 12** Save the file as ch5-02\_student\_name (replacing student\_name with your name).

Next you need to create a bond amortization schedule to summarize interest payments, interest expense, bond amortization, and remaining carrying value.

## Bond Amortization Schedule

A bond amortization schedule is, in essence, a reconciliation of interest payments and bond accounting. Interest expense, usually recorded using the “effective interest” method, is based on the market rate of interest and the carrying value of the debt.

Kyle suggests that you complete the bond amortization table using the named cell ranges that you’ve already created. In addition to the effective interest formula described previously, you’ll need to compute the bond discount/premium amortization as the difference between the interest expense recorded and the interest payment. The ending carrying value for each period will then be the previous period carrying value plus or minus the remaining discount or premium amortization.

### To create the bond amortization schedule:

- 1 Select cell **E13**.
- 2 Click **Use in Formula** from the Defined Names group of the Formulas tab.
- 3 Click **Discount\_Premium** from the drop-down list of names and then press [**Enter**]. (*Note:* This is one way to use previously defined names.)
- 4 Type **=Amount+E13** in cell F13. Then replicate this formula down to cell F18. This calculation represents the sum of the discount or premium left to be amortized plus the face value of the note. (*Note:* Typing a name is another way of using previously defined names.)
- 5 Type **=Interest\_Payment** in cell B14. Replicate this formula down to cell B18.
- 6 Type **=F13\*Market\_Rate** in cell C14. Replicate this formula down to cell C18. These cells will calculate interest expense as the previous period carrying value multiplied by the market rate of interest.
- 7 Type **=B14-C14** in cell D14. Replicate this formula down to cell D18. These cells will calculate the amortization for the period as the amount by which interest expense differs from the interest payment.
- 8 Type **=E13-D14** in cell E14. Replicate this formula down to cell E18. These cells will calculate the remaining amount of bond discount or premium to be amortized in future periods.

- 9 Type `=SUM(B14:B18)` in cell B19 to sum interest payments.
- 10 Format the cell with a top and double bottom border.
- 11 Replicate the formula to cell D19 to sum interest expense and amortization.
- 12 Select cell B19, then click **Define Name** from the Defined Names group on the Formulas tab of the Ribbon.
- 13 Type **Total\_Interest\_Payments** in the Name: text box and then click **OK**.
- 14 Select cell C19, then click **Define Name** from the Defined Names group on the Formulas tab of the Ribbon.
- 15 Type **Total\_Interest\_Expense** in the Name: text box and then click **OK**. (Note: You'll use this name later.)
- 16 The resulting amortization table should look like Figure 5.9.

**Figure 5.9**  
Bond Amortization at a  
Market Rate of 11%

	A	B	C	D	E	F
1	What SUP, Inc.					
2	<b>Bond Amortization Schedule</b>					
3						
4	<b>Amount</b>	\$ 100,000.00				
5	<b>Stated Rate</b>	10.00%				
6	<b>Market Rate</b>	11.00%				
7	<b>Term</b>	5				
8	<b>Interest Payment</b>	\$10,000.00				
9	<b>Proceeds</b>	\$96,304.10				
10	<b>(Discount) / Premium</b>	(\$3,695.90)				
11						
12	<b>Payment #</b>	<b>Interest Payment</b>	<b>Interest Expense</b>	<b>Amortization</b>	<b>(Discount) Premium</b>	<b>Carrying Value</b>
13					(\$3,695.90)	\$96,304.10
14	1	\$10,000.00	\$10,593.45	(\$593.45)	(\$3,102.45)	\$96,897.55
15	2	\$10,000.00	\$10,658.73	(\$658.73)	(\$2,443.71)	\$97,556.29
16	3	\$10,000.00	\$10,731.19	(\$731.19)	(\$1,712.52)	\$98,287.48
17	4	\$10,000.00	\$10,811.62	(\$811.62)	(\$900.90)	\$99,099.10
18	5	\$10,000.00	\$10,900.90	(\$900.90)	\$0.00	\$100,000.00
19		\$50,000.00	\$53,695.90	(\$3,695.90)		

- 17 Save the file.

“I’ll bet we can use this schedule to do some what-if analyses like we did with the loan amortization schedule,” you suggest.

“Exactly!” Kyle responds. “Let’s see the impact of changing the effective interest rate on bond proceeds and interest expense.”

## What-If Analysis and Goal Seeking

Nathan is curious about the impact that different market interest rates will have on the proceeds from a bond issuance and on the company’s interest expense. He suggests you try interest rates of 9 percent and 12 percent.

### To assess the effect of different market rates:

- 1 Type **9** into cell B6. Note the effect on bond proceeds and total interest expenses, as shown in Figure 5.10.

	A	B	C	D	E	F
1	What SUP, Inc.					
2	Bond Amortization Schedule					
3						
4	Amount	\$ 100,000.00				
5	Stated Rate	10.00%				
6	Market Rate	9.00%				
7	Term	5				
8	Interest Payment	\$10,000.00				
9	Proceeds	\$103,889.65				
10	(Discount) / Premium	\$3,889.65				
11						
12	Payment #	Interest Payment	Interest Expense	Amortization	(Discount) Premium	Carrying Value
13					\$3,889.65	\$103,889.65
14	1	\$10,000.00	\$9,350.07	\$649.93	\$3,239.72	\$103,239.72
15	2	\$10,000.00	\$9,291.57	\$708.43	\$2,531.29	\$102,531.29
16	3	\$10,000.00	\$9,227.82	\$772.18	\$1,759.11	\$101,759.11
17	4	\$10,000.00	\$9,158.32	\$841.68	\$917.43	\$100,917.43
18	5	\$10,000.00	\$9,082.57	\$917.43	\$0.00	\$100,000.00
19		\$50,000.00	\$46,110.35	\$3,889.65		

**Figure 5.10**

Bond Amortization at a Market Rate of 9%

- 2 Type **12** into cell B6. Note the effect on bond proceeds and total interest expenses.

“Wow, that sure is useful.” Nathan says. “We can use this information for our accounting record keeping as well as for financial planning.”

“Quite true,” Kyle responds. “Excel also has a goal seek feature to help determine a stated rate given needed bond proceeds. Let’s assume the company wants to issue a 5-year, \$100,000 bond when the market interest rate is 8 percent. If the company needs at least \$95,000 from the proceeds, what must be the bond’s stated rate of interest?”

“I’ll use the existing worksheet and try different stated rates to see how close I can get to \$95,000,” you comment.

“Not necessary,” Kyle explains. “We can use the existing worksheet formulas and simply use Excel’s goal seek feature. First you change the variable information, such as the market rate of interest. Then you invoke the goal seek command, set the location of the desired value (B9), specify the desired value (95,000), and identify the location of the variable that should be changed to achieve the desired value (B5). In this case, that location is the cell containing the stated interest rate.”

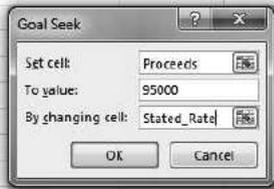
“I’ll try that,” Meagan says.

### To use the goal seek feature:

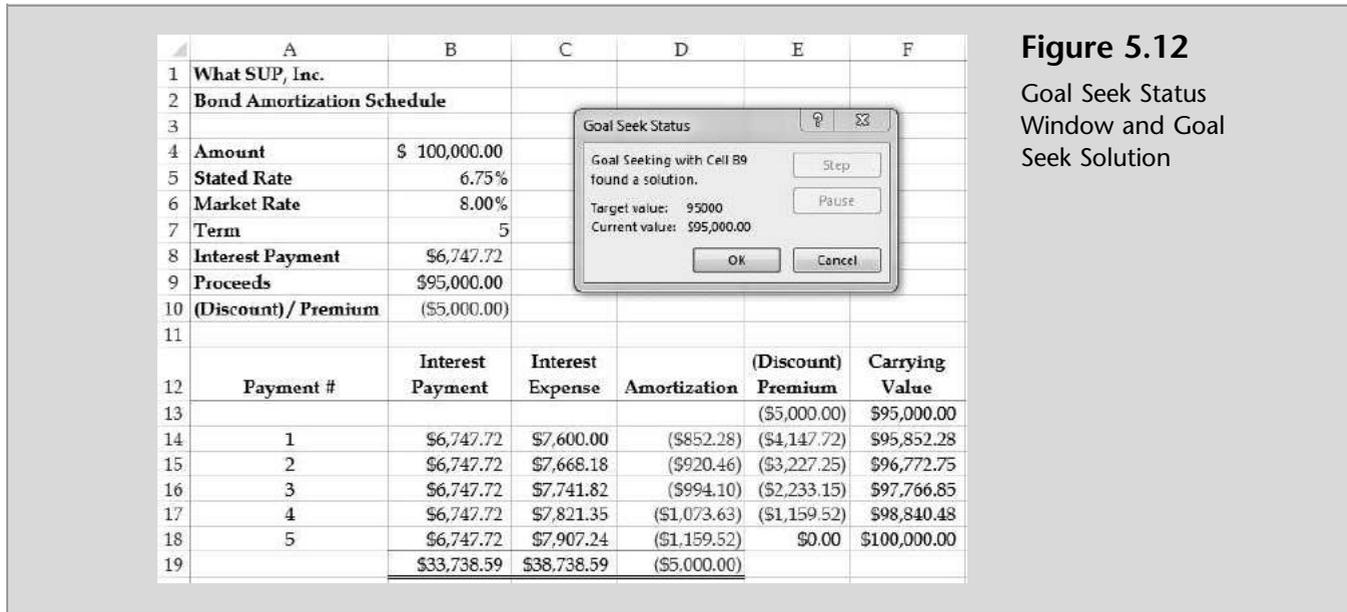
- 1 Type **8** into cell B6. Observe the effect on bond proceeds (the old stated rate of 10% implied payment of a bond premium).
- 2 Now click **What-If Analysis** from the Data Tools group of the Data tab of the Ribbon.
- 3 Select **Goal Seek** from the drop-down menu.
- 4 Type **Proceeds** in the Set cell: edit box. (Alternatively, you could click in the **Set cell: edit** box and then click cell **B9**.)
- 5 Type **95000** in the To value: edit box.
- 6 Type **Stated\_Rate** in the By changing cell: edit box, as shown in Figure 5.11.

**Figure 5.11**  
Goal Seek Window

	A	B	C	D	E	F
1	What SUP, Inc.					
2	Bond Amortization Schedule					
3						
4	Amount	\$ 100,000.00				
5	Stated Rate	10.00%				
6	Market Rate	8.00%				
7	Term	5				
8	Interest Payment	\$10,000.00				
9	Proceeds	\$107,985.42				
10	(Discount) / Premium	\$7,985.42				
11						
12		Interest Payment	Interest Expense	Amortization	(Discount) Premium	Carrying Value
13					\$7,985.42	\$107,985.42
14	1	\$10,000.00	\$8,638.83	\$1,361.17	\$6,624.25	\$106,624.25
15	2	\$10,000.00	\$8,529.94	\$1,470.06	\$5,154.19	\$105,154.19
16	3	\$10,000.00	\$8,412.34	\$1,587.66	\$3,566.53	\$103,566.53
17	4	\$10,000.00	\$8,285.32	\$1,714.68	\$1,851.85	\$101,851.85
18	5	\$10,000.00	\$8,148.15	\$1,851.85	\$0.00	\$100,000.00
19		\$50,000.00	\$42,014.58	\$7,985.42		



- 7 Click **OK**. The Goal Seek Status window should appear as shown in Figure 5.12, indicating that a solution has been found.
- 8 Click **OK** in the Goal Seek Status window.
- 9 Save your work.



Kyle remarks that the goal seek solution indicates that a stated rate of 6.75 percent yields the \$95,000 proceeds needed, given an 8 percent market rate for a 5-year, \$100,000 bond. In reality, the stated rate necessary to produce exactly \$95,000 in proceeds is slightly smaller than 6.75. The B5 cell is formatted to show only two decimal places. If you formatted the cell to read additional decimal places it would have shown 6.74771772716582%. However, Kyle contends that 6.75 percent is close enough!

“This is very cool,” Nathan comments, “but I wish I could see the effects of the different market rates on the bond proceeds in one worksheet at one time.”

Kyle responds: “Sounds like I need to demonstrate the Scenario Manager to you.”

## Scenario Manager

Scenarios are part of a suite of commands called *what-if analysis tools*. When you use scenarios, you are performing what-if analysis. As we’ve seen, what-if analysis is the process of changing the values in cells to see how those changes will affect the outcome of formulas on the worksheet. The values in cells are independent variables but formulas, by their very nature, yield dependent variables. That is, the value generated by a formula is dependent on the values in the worksheet’s cells that are specified in that formula. You can use scenarios to create and save different sets of independent variable values and switch between them. You can also create a scenario summary report, which combines all the scenarios into one worksheet.

Kyle suggests you use the Scenario Manager to create a scenario describing the effects a change in the market interest rate (an independent variable) on the proceeds from issuing a bond (a dependent variable) and the related total interest expense (another dependent variable) over the term of the bond.

### To use the Scenario Manager:

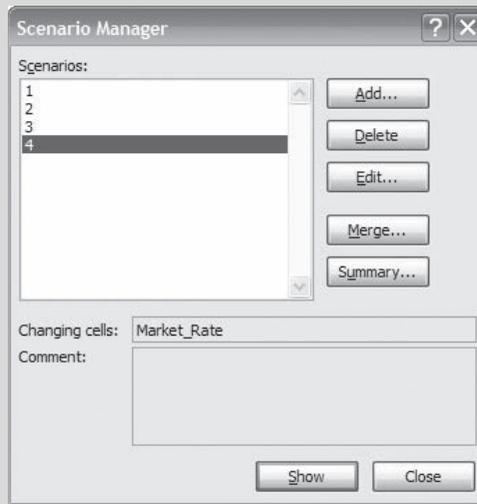
- 1 Type **100000** in cell B4, **10%** in cell B5, and **11%** in cell B6 to return to the original bond proposal.
- 2 Click **What-If-Analysis** from the Data Tools group of the Data tab on the Ribbon.
- 3 Click **Scenario Manager**.
- 4 Click **Add** to add a new scenario.
- 5 Type **1** in the Scenario name: text box.
- 6 Type **Market\_Rate** in the Changing cells: text box. Your window should look like Figure 5.13.

**Figure 5.13**  
Adding a Scenario

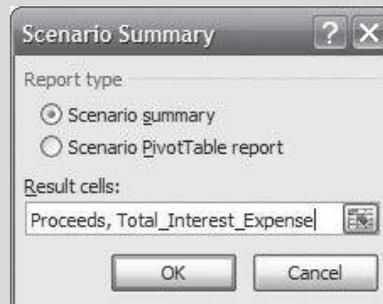
- 7 Click **OK**.
- 8 Type **0.12** for the Market\_Rate, as shown in Figure 5.14. (*Note:* 0.12 represents interest at 12 percent.)

**Figure 5.14**  
Entering Scenario Values

- 9 Click **OK**.
- 10 Continue the same process by adding scenarios 2, 3, and 4, which change the Market\_Rate cell to 0.10, 0.09, and 0.08 respectively. Your window should now look like Figure 5.15.
- 11 Click **Summary**.
- 12 Select the Scenario summary option button and then type **Proceeds, Total\_Interest\_Expense** in the Result cells text box. (*Note:* This action specifies the target variables affected by the change in interest rate—namely, bond proceeds, located in cell B9, and total interest expense, located in cell C19.) See Figure 5.16.



**Figure 5.15**  
Scenario Manager with Four Scenarios



**Figure 5.16**  
Scenario Summary Options

- 13** Click **OK**.
- 14** A new worksheet should appear, entitled Scenario Summary, that looks like Figure 5.17.

Scenario Summary		Current Values:			
		1	2	3	4
<b>Changing Cells:</b>					
Market_Rate		11.00%	12.00%	10.00%	9.00%
<b>Result Cells:</b>					
Proceeds		\$96,304.10	\$92,790.45	\$100,000.00	\$103,889.65
Total_Interest_Expense		\$53,695.90	\$57,209.55	\$50,000.00	\$46,110.35

Notes: Current Values column represents values of changing cells at time Scenario Summary Report was created. Changing cells for each scenario are highlighted in gray.

**Figure 5.17**  
Scenario Summary

- 15** Save your work.

You explain to Nathan and Meagan how the Scenario Manager is just an extension of the what-if analysis capabilities of Excel. The ability to compare alternative outcomes based on variations in market rates should prove most helpful in planning and future decision making.

## Monthly Periods

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So far you have created annual loan and bond amortization schedules and have determined loan payments and bond proceeds based on annual payments. Nathan is curious how this analysis would change if you were confronted with a monthly payment situation.

Kyle offers to help you modify your worksheets for monthly payments. He suggests you take the previous loan workbook you created—a 3-year loan of \$75,000 with interest at 10 percent and payments due every year—and convert it to a 3-year loan at 10 percent with 36 monthly payments. Kyle explains that the PMT function was used to determine annual payments; converting to monthly payments requires that the arguments in the payment function be changed from annual to monthly. The first argument is the periodic interest rate. The annual rate is 10 percent, so we need only divide by 12 to obtain the monthly interest rate. The second argument is the term. Since the term is 3 years, we simply multiply 3 by 12 to obtain the number of monthly periods: 36.

### To modify your worksheets from annual to monthly:

- 1 Open your previously saved workbook, ch5-01\_student\_name.
- 2 Change the name of Sheet1 to **Annual**.
- 3 Right-click the **Annual** sheet tab and then click **Move or Copy**.
- 4 Select the **Create a copy** check box and then select **Sheet2** to insert a copy of your worksheet before Sheet2; then click **OK**.
- 5 Change the name of Annual (2) to **Monthly**.
- 6 Type  $=\text{PMT}(\text{Rate}/12, \text{Term} * 12, \text{Amount})$  as the formula for cell B7.
- 7 Select cells A13 and A14, then fill down the column so that payment numbers 1 through 36 show.
- 8 Type  $=\text{E11} * \text{Rate} / 12$  as the new formula in cell C12
- 9 Fill that formula down to cell C14.
- 10 Select cells B14 through E14.
- 11 Fill the formulas in those cells down through B47 through E47.
- 12 Click **File** and then click **Print** to view a print preview.
- 13 Click **Page Setup** and click the **Page** tab (if it is not already selected) then choose the **Fit to:** option to scale the worksheet to 1 page wide by 1 page tall.
- 14 Click **OK** and then click **Print**. Your printout should look like Figure 5.18.
- 15 Save your work.

**What SUP, Inc.  
Loan Amortization Schedule**

**Amount**     \$ 75,000.00  
**Rate**             10%  
**Term**                3  
**Payment**        \$2,420.04

Payment #	Payment	Interest	Principal	Balance
				\$ 75,000.00
1	\$2,420.04	\$ 625.00	\$1,795.04	\$ 73,204.96
2	\$2,420.04	\$ 610.04	\$1,810.00	\$ 71,394.96
3	\$2,420.04	\$ 594.96	\$1,825.08	\$ 69,569.88
4	\$2,420.04	\$ 579.75	\$1,840.29	\$ 67,729.59
5	\$2,420.04	\$ 564.41	\$1,855.63	\$ 65,873.97
6	\$2,420.04	\$ 548.95	\$1,871.09	\$ 64,002.88
7	\$2,420.04	\$ 533.36	\$1,886.68	\$ 62,116.20
8	\$2,420.04	\$ 517.63	\$1,902.40	\$ 60,213.79
9	\$2,420.04	\$ 501.78	\$1,918.26	\$ 58,295.53
10	\$2,420.04	\$ 485.80	\$1,934.24	\$ 56,361.29
11	\$2,420.04	\$ 469.68	\$1,950.36	\$ 54,410.93
12	\$2,420.04	\$ 453.42	\$1,966.61	\$ 52,444.31
13	\$2,420.04	\$ 437.04	\$1,983.00	\$ 50,461.31
14	\$2,420.04	\$ 420.51	\$1,999.53	\$ 48,461.78
15	\$2,420.04	\$ 403.85	\$2,016.19	\$ 46,445.59
16	\$2,420.04	\$ 387.05	\$2,032.99	\$ 44,412.60
17	\$2,420.04	\$ 370.11	\$2,049.93	\$ 42,362.67
18	\$2,420.04	\$ 353.02	\$2,067.02	\$ 40,295.65
19	\$2,420.04	\$ 335.80	\$2,084.24	\$ 38,211.41
20	\$2,420.04	\$ 318.43	\$2,101.61	\$ 36,109.80
21	\$2,420.04	\$ 300.91	\$2,119.12	\$ 33,990.67
22	\$2,420.04	\$ 283.26	\$2,136.78	\$ 31,853.89
23	\$2,420.04	\$ 265.45	\$2,154.59	\$ 29,699.30
24	\$2,420.04	\$ 247.49	\$2,172.54	\$ 27,526.75
25	\$2,420.04	\$ 229.39	\$2,190.65	\$ 25,336.11
26	\$2,420.04	\$ 211.13	\$2,208.90	\$ 23,127.20
27	\$2,420.04	\$ 192.73	\$2,227.31	\$ 20,899.89
28	\$2,420.04	\$ 174.17	\$2,245.87	\$ 18,654.01
29	\$2,420.04	\$ 155.45	\$2,264.59	\$ 16,389.43
30	\$2,420.04	\$ 136.58	\$2,283.46	\$ 14,105.97
31	\$2,420.04	\$ 117.55	\$2,302.49	\$ 11,803.48
32	\$2,420.04	\$ 98.36	\$2,321.68	\$ 9,481.80
33	\$2,420.04	\$ 79.01	\$2,341.02	\$ 7,140.77
34	\$2,420.04	\$ 59.51	\$2,360.53	\$ 4,780.24
35	\$2,420.04	\$ 39.84	\$2,380.20	\$ 2,400.04
36	\$2,420.04	\$ 20.00	\$2,400.04	\$ 0.00

**Figure 5.18**

Printed Monthly Loan Amortization Worksheet

“I see,” Nathan says. “Not only is the payment reduced, but the loan is fully amortized after the 36th payment.”

“Exactly,” responds Kyle. “Note how the interest portion of each payment diminishes with each payment while the principal portion increases.”

Meagan and Nathan are impressed with Excel’s robust features and functionality. You and Kyle point out that you’ve barely scratched the surface and that more is to come.

## **End Note**

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You’ve applied some of what you learned in the first four chapters to better understand how Excel can be used to analyze loans and bonds. In addition, you’ve learned some new functions—conditional (IF), payment (PMT) and present value (PV)—as well as two new features, goal seeking and Scenario Manager. In the next chapter, you’ll explore cash flow budgets.

## Chapter 5 Questions

- 1 Explain the difference between a loan and a bond.
- 2 What function is used to calculate a loan payment?
- 3 What arguments does the loan payment function take?
- 4 Why does the payment function result in a negative number?
- 5 What does a loan amortization schedule do?
- 6 Describe the formula for computing interest expense each period for a loan.
- 7 What function is used to calculate bond proceeds, and what arguments does that function take?
- 8 Describe the formula computing interest expense each period for a bond.
- 9 Describe the goal seek process.
- 10 Describe the Scenario Manager.

## Chapter 5 Assignments

- 1 Create a new What SUP Loan Amortization Schedule

Using the ch5-03 file to start your work, create a worksheet (similar to the one created in this chapter) that calculates the required annual payment for a \$945,500, 7-year loan at 4 percent and includes a loan amortization schedule. (Be sure to use names in the worksheet, as illustrated in the chapter. You will also need to format the cells.) Save your file as ch5-03\_student\_name (replacing student\_name with your name).

- a. Print the newly completed worksheet in Value view, with your name and date printed in the lower left footer and the file name in the lower right footer.
- b. Print the worksheet from part a (above) in Formula view, with your name and date printed in the lower left footer and the file name in the lower right footer.
- c. Use the Scenario Manager to create a scenario using rates of 10, 9, 7, and 6 percent to calculate alternative payments. Print the resulting summary worksheet.
- d. Use Excel's goal seek feature to calculate the amount the company could borrow if it could afford a payment of \$100,000 per year assuming the original loan assumptions. Print the resulting worksheet in Value view, with your name and date printed in the lower left footer and the file name in the lower right footer.

## 2 Create a new What SUP Bond Amortization Schedule

Using the ch5-04 file to start your work, create a worksheet (similar to the one created in this chapter) that calculates the bond proceeds for a \$1,500,000, 10-year, 3 percent stated interest bond issued when the market interest rate is 2.8 percent. Include a bond amortization schedule and use names in the worksheet, as illustrated in the chapter (You will also need to format the cells.) Save your file as ch5-04\_student\_name (replacing student\_name with your name).

- a. Print the newly completed worksheet in Value view, with your name and date printed in the lower left footer and the file name in the lower right footer.
- b. Print the worksheet from part a (above) in Formula view, with your name and date printed in the lower left footer and the file name in the lower right footer.
- c. Use the Scenario Manager to create a scenario using stated rates of 2, 2.5, 3.1, and 3.5 percent to calculate alternative annual interest payments and bond proceeds. Print the resulting summary worksheet.
- d. Use Excel's goal seek feature to calculate the stated interest rate it would have to pay under the original bond analysis (in part a) to achieve bond proceeds of \$1,450,000. Print the resulting worksheet in Value view, with your name and date printed in the lower left footer and the file name in the lower right footer.

### **Chapter 5 Case Problem 1:**

#### **KELLY'S BOUTIQUE**

Kelly's Boutique is contemplating several alternative means of financing an expansion. One alternative is to borrow \$300,000 from a local bank; another alternative is to borrow this amount from investors by issuing bonds. Both alternatives involve a 5-year debt period. Modify the workbook file ch5-05 to compute a loan and bond analysis. Name and format cell ranges as appropriate. Assume an initial loan rate of 3 percent, an initial bond stated rate of 3 percent, and a market interest rate of 2.9 percent.

- a. Print the newly completed loan and bond worksheets in Value view, with your name and date printed in the lower left footer and the file name in the lower right footer.
- b. Print the worksheets from part a (above) in Formula view, with your name and date printed in the lower left footer and the file name in the lower right footer.
- c. Use the Scenario Manager to create two loan scenarios called Best Case and Worst Case. In the Best Case, the rate would be 2.8 percent and the loan amount would be \$325,000; in the Worst Case, the rate would be 3.2 percent and the loan amount would be \$280,000.

(*Hint:* You'll need to place two cell references, separated by a comma, in the Changing cells: text box.) The resulting comparison values you're trying to predict are Payment, Total Payments, and Total Interest. Print the resulting summary worksheet.

- d. Use the Scenario Manager to create two bond scenarios called Best Case and Worst Case. In the Best Case, the market rate would be 2.5 percent and the stated rate would be 2 percent; in the Worst Case, the market rate would be 3.2 percent and the stated rate would be 3.1 percent. (Again, you'll need to place two cell references, separated by a comma, in the Changing cells: text box.) The resulting comparison values you're trying to predict are Proceeds, Total Interest Payments, and Total Interest Expense. Print the resulting summary worksheet.
- e. Use Excel's goal seek feature to calculate the interest rate that the company would have to negotiate under the original loan analysis (in part a) to achieve a payment of \$63,000. Round the interest rate to two decimal places. Print the resulting worksheet in Value view, with your name and date printed in the lower left footer and the file name in the lower right footer.
- f. Use Excel's goal seek feature to calculate the market rate necessary to achieve bond proceeds of \$310,000. Round the interest rate to two decimal places. Print the resulting worksheet in Value view, with your name and date printed in the lower left footer and the file name in the lower right footer.

### **Chapter 5 Case Problem 2:**

#### **WINE DEPOT**

Wine Depot is considering several alternative means of financing an expansion. One alternative is to borrow \$300,000 from a local bank, but another alternative is to borrow this amount from investors by issuing bonds. Both alternatives involve a 3-year debt period with quarterly payments. Modify the workbook ch5-06 to compute a loan and bond analysis, naming and formatting cell ranges as appropriate. Assume an annual loan rate of 4 percent, an annual bond stated rate of 4 percent, and a market annual interest rate of 3.5 percent.

- a. Print the newly completed loan and bond worksheets in Value view, with your name and date printed in the lower left footer and the file name in the lower right footer.
- b. Print the worksheets from part a, above, in Formula view, with your name and date printed in the lower left footer and the file name in the lower right footer.
- c. Use the Scenario Manager to create two loan scenarios called Best Case and Worst Case. In the Best Case, the rate would be 3 percent and the loan amount would be \$350,000; in the Worst Case, the rate would be 5 percent and the loan amount would be \$200,000.

(*Hint:* You'll need to place two cell references, separated by a comma, in the Changing cells: text box.) The resulting comparison values you're trying to predict are Payment, Total Payments, and Total Interest. Print the resulting summary worksheet.

- d. Use the Scenario Manager to create two bond scenarios called Best Case and Worst Case. In the Best Case, the market rate would be 3.75 percent and the stated rate would be 5 percent. In the Worst Case, the market rate would be 4.5 percent and the stated rate would be 3.25 percent. (Again, you'll need to place two cell references, separated by a comma, in the Changing cells: text box.) The resulting comparison values you're trying to predict are Proceeds, Total Interest Payments, and Total Interest Expense. Print the resulting summary worksheet.
- e. Use Excel's goal seek feature to calculate the interest rate the company would have to negotiate under the original loan analysis (in part a) to achieve a quarterly payment of \$26,000. Round the interest rate to two decimal places. Print the resulting worksheet in Value view, with your name and date printed in the lower left footer and the file name in the lower right footer.
- f. Use Excel's goal seek feature to calculate the market rate necessary to achieve bond proceeds of \$315,000. Round the interest rate to two decimal places. Print the resulting worksheet in Value view, with your name and date printed in the lower left footer and the file name in the lower right footer.

### **Chapter 5 Case Problem 3:**

#### **SNICK'S BOARD SHOP**

Snick's Board Shop is considering several alternative means of financing an expansion. One alternative is to borrow \$400,000 from a local bank, but another alternative is to borrow this amount from investors by issuing bonds. Both alternatives involve a 2-year debt period with monthly payments. Modify the workbook ch5-07 to compute a loan and bond analysis, naming and formatting cell ranges as appropriate. Assume an initial loan rate of 8 percent, an initial bond stated rate of 8 percent, and a market interest rate of 8.5 percent.

- a. Print the newly completed loan and bond worksheets in Value view, with your name and date printed in the lower left footer and the file name in the lower right footer.
- b. Print the worksheets from part a, above, in Formula view, with your name and date printed in the lower left footer and the file name in the lower right footer.
- c. Use the Scenario Manager to create two loan scenarios called Best Case and Worst Case. In the Best Case, the rate would be 7 percent and the loan amount would be \$350,000; in the Worst Case, the rate

would be 9 percent and the loan amount would be \$450,000. (*Hint:* You'll need to place two cell references, separated by a comma, in the Changing cells: text box.) The resulting comparison values you're trying to predict are Payment, Total Payments, and Total Interest. Print the resulting summary worksheet.

- d. Use the Scenario Manager to create two bond scenarios called Best Case and Worst Case. In the Best Case, the market rate would be 7.75 percent and the stated rate would be 7 percent. In the Worst Case, the market rate would be 8.75 percent and the stated rate would be 8.25 percent. (Again, you'll need to place two cell references, separated by a comma, in the Changing cells: text box.) The resulting comparison values you're trying to predict are Proceeds, Total Interest Payments, and Total Interest Expense. Print the resulting summary worksheet.
- e. Use Excel's goal seek feature to calculate the interest rate that the company would have to negotiate under the original loan analysis (in part a) to achieve a monthly payment of \$17,000. Round the interest rate to two decimal places. Print the resulting worksheet in Value view, with your name and date printed in the lower left footer and the file name in the lower right footer.
- f. Use Excel's goal seek feature to calculate the market rate necessary to achieve bond proceeds of \$410,000. Round the interest rate to two decimal places. Print the resulting worksheet in Value view, with your name and date printed in the lower left footer and the file name in the lower right footer.

### **Chapter 5 Case Problem 4:**

#### **ROSEY'S ROSES**

Rosey's Roses is considering several alternative means of financing an expansion. One alternative is to borrow \$600,000 from a local bank, but another alternative is to borrow this amount from investors by issuing bonds. Both alternatives involve a 10-year debt period with annual payments. Modify the workbook ch5-08 to compute a loan and bond analysis, naming and formatting cell ranges as appropriate. Assume an initial loan rate of 7 percent, an initial bond stated rate of 7 percent, and a market interest rate of 6.5 percent.

- a. Print the newly completed loan and bond worksheets in Value view, with your name and date printed in the lower left footer and the file name in the lower right footer.
- b. Use the Scenario Manager to create two loan scenarios called Best Case and Worst Case. In the Best Case, the rate would be 6 percent and the loan amount would be \$550,000; in the Worst Case, the rate would be 8 percent and the loan amount would be \$650,000. The resulting comparison values you're trying to predict are Payment, Total Payments, and Total Interest. Print the resulting summary worksheet.

- c. Use the Scenario Manager to create two bond scenarios called Best Case and Worst Case. In the Best Case, the market rate would be 6 percent and the stated rate would be 6.5 percent. In the Worst Case, the market rate would be 8.25 percent and the stated rate would be 8 percent. The resulting comparison values you're trying to predict are Proceeds, Total Interest Payments, and Total Interest Expense. Print the resulting summary worksheet.
- d. Use Excel's goal seek feature to calculate the interest rate that the company would have to negotiate under the original loan analysis (in part a) to achieve a monthly payment of \$80,000. Round the interest rate to two decimal places. Print the resulting worksheet in Value view, with your name and date printed in the lower left footer and the file name in the lower right footer.
- e. Use Excel's goal seek feature to calculate the market rate necessary to achieve bond proceeds of \$650,000. Round the interest rate to two decimal places. Print the resulting worksheet in Value view, with your name and date printed in the lower left footer and the file name in the lower right footer.