Some depositions and a series of discussions took place between both sides. As a result, John Campbell offered to accept a settlement of $750,000. Thus, one option is for Allied to pay John $750,000 to settle the claim. Allied is also considering making John a counteroffer of $400,000 in the hope that he will accept a lesser amount to avoid the time and cost of going to trial. Allied's preliminary investigation shows that John's case is strong; Allied is concerned that John may reject their counteroffer and request a jury trial. Allied's lawyers spent some time exploring John's likely reaction if they make a counteroffer of $400,000.

The lawyers concluded that it is adequate to consider three possible outcomes to represent John's possible reaction to a counteroffer of $400,000: (1) John will accept the counteroffer and the case will be closed; (2) John will reject the counteroffer and elect to have a jury decide the settlement amount; or (3) John will make a counteroffer to Allied of $600,000. If John does make a counteroffer, Allied has decided that they will not make additional counteroffers. They will either accept John's counteroffer of $600,000 or go to trial.

If the case goes to a jury trial, Allied considers three outcomes possible: (1) the jury may reject John's claim and Allied will not be required to pay any damages; (2) the jury will find in favor of John and award him $750,000 in damages; or (3) the jury will conclude that John has a strong case and award him the full amount of $1,500,000.

Key considerations as Allied develops its strategy for disposing of the case are the probabilities associated with John's response to an Allied counteroffer of $400,000 and the probabilities associated with the three possible trial outcomes. Allied's lawyers believe the probability that John will accept a counteroffer of $400,000 is 0.10, the probability that John will reject a counteroffer of $400,000 is 0.40, and the probability that John will, himself, make a counteroffer to Allied of $600,000 is 0.50. If the case goes to court, they believe that the probability the jury will award John damages of $1,500,000 is 0.30, the probability that the jury will award John damages of $750,000 is 0.50, and the probability that the jury will award John nothing is 0.20.

Managerial Report

Perform an analysis of the problem facing Allied Insurance and prepare a report that summarizes your findings and recommendations. Be sure to include the following items:

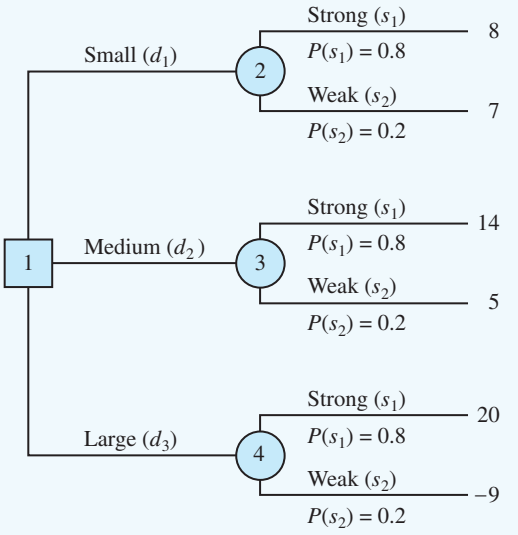
1. A decision tree
2. A recommendation regarding whether Allied should accept John's initial offer to settle the claim for $750,000
3. A decision strategy that Allied should follow if they decide to make John a counteroffer of $400,000
4. A risk profile for your recommended strategy

Appendix 13.1 DECISION ANALYSIS WITH TREEPLAN

TreePlan* is an Excel add-in that can be used to develop decision trees for decision analysis problems. The software package is provided at the website that accompanies this text. Instructions for installing TreePlan are included with the software. A manual containing additional information on starting and using TreePlan is also at the website. In this

*TreePlan was developed by Professor Michael R. Middleton at the University of San Francisco and modified for use by Professor James E. Smith at Duke University. The TreePlan website is www.treeplan.com.

FIGURE 13.18 PDC DECISION TREE



appendix we show how to use TreePlan to build a decision tree and solve the PDC problem presented in Section 13.3. The decision tree for the PDC problem is shown in Figure 13.18.

Getting Started: An Initial Decision Tree

We begin by assuming that TreePlan has been installed and an Excel worksheet is open. To build a TreePlan version of the PDC decision tree, proceed as follows:

Step 1. Select cell A1
Step 2. Select the **Add-Ins** tab and choose **Decision Tree** from the **Menu Commands** group
Step 3. When the **TreePlan Acad. - New Tree** dialog box appears:
Click **New Tree**

A decision tree with one decision node and two branches appears as follows:

	A	B	C	D	E	F	G
1	**TreePlan Academic Version Only For Academic Use**						
2				Alternative 1			
3							0
4				0	0		
5		1					
6	0						
7				Alternative 2			
8							0
9				0	0		

Adding a Branch

The PDC problem has three decision alternatives (small, medium, and large condominium complexes), so we must add another decision branch to the tree.

Step 1. Select cell B5
Step 2. Select **Decision Tree** from the **Menu Commands** group
Step 3. When the **TreePlan Acad. - Decision Node** dialog box appears:
Select **Add branch**
Click **OK**

A revised tree with three decision branches now appears in the Excel worksheet.

Naming the Decision Alternatives

The decision alternatives can be named by selecting the cells containing the labels Alternative 1, Alternative 2, and Alternative 3, and then entering the corresponding PDC names Small, Medium, and Large. After naming the alternatives, the PDC tree with three decision branches appears as follows:

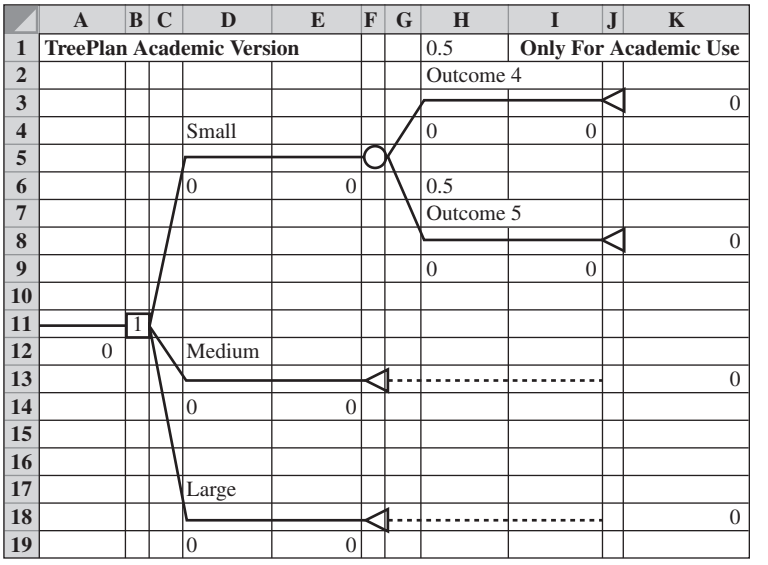
	A	B	C	D	E	F	G
1	**TreePlan Academic Version Only For Academic Use**						
2				Small			
3							0
4				0	0		
5							
6							
7				Medium			
8		1					0
9	0			0	0		
10							
11							
12				Large			
13							0
14				0	0		

Adding Chance Nodes

The chance event for the PDC problem is the demand for the condominiums, which may be either strong or weak. Thus, a chance node with two branches must be added at the end of each decision alternative branch.

Step 1. Select cell F3
Step 2. Select **Decision Tree** from the **Menu Commands** group
Step 3. When the **TreePlan Acad. - Terminal Node** dialog box appears:
Select **Change to event node**
Select **Two** in the **Branches** section
Click **OK**

The tree now appears as follows:



We next select the cells containing Outcome 4 and Outcome 5 and rename them Strong and Weak to provide the proper names for the PDC states of nature. After doing so we can copy the subtree for the chance node in cell F5 to the other two decision branches to complete the structure of the PDC decision tree.

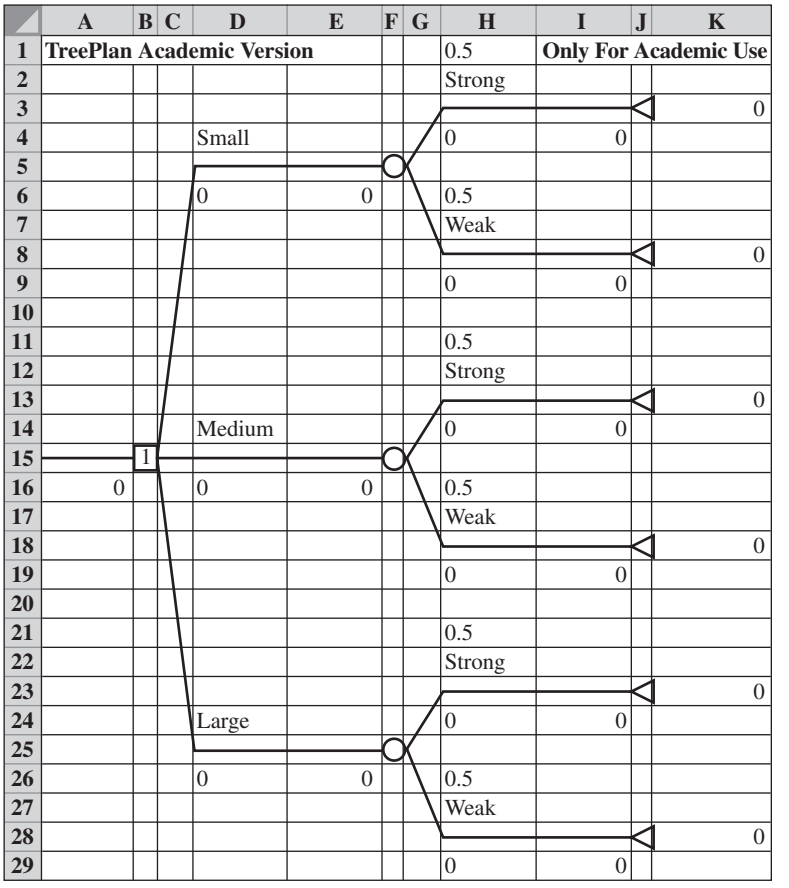
Step 1. Select cell F5
Step 2. Select **Decision Tree** from the **Menu Commands** group
Step 3. When the **TreePlan Acad. - Event Node** dialog box appears:
Select **Copy subtree**
Click **OK**
Step 4. Select cell F13
Step 5. Select **Decision Tree** from the **Menu Commands** group
Step 6. When the **TreePlan Acad. - Terminal Node** dialog box appears:
Select **Paste subtree**
Click **OK**

This copy/paste procedure places a chance node at the end of the Medium decision branch. Repeating the same copy/paste procedure for the Large decision branch completes the structure of the PDC decision tree as shown in Figure 13.19.

Inserting Probabilities and Payoffs

TreePlan provides the capability of inserting probabilities and payoffs into the decision tree. In Figure 13.19 we see that TreePlan automatically assigned an equal probability 0.5 to each of the chance outcomes. For PDC, the probability of strong demand is 0.8 and the probability of weak demand is 0.2. We can select cells H1, H6, H11, H16, H21, and H26 and insert the appropriate probabilities. The payoffs for the chance outcomes are inserted in cells H4, H9, H14, H19, H24, and H29. After inserting the PDC probabilities and payoffs, the PDC decision tree appears as shown in Figure 13.20.

FIGURE 13.19 THE PDC DECISION TREE DEVELOPED BY TREEPLAN

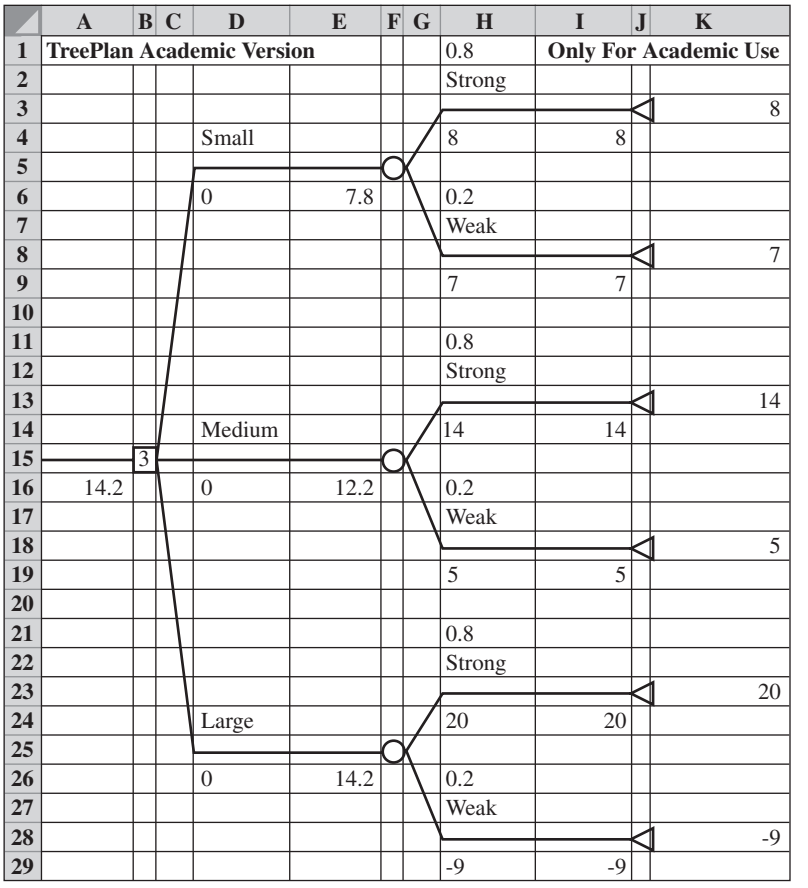


Note that the payoffs also appear in the right-hand margin of the decision tree. The payoffs in the right margin are computed by a formula that adds the payoffs on all of the branches leading to the associated terminal node. For the PDC problem, no payoffs are associated with the decision alternatives branches so we leave the default values of zero in cells D6, D16, and D24. The PDC decision tree is now complete.

Interpreting the Result

When probabilities and payoffs are inserted, TreePlan automatically makes the backward pass computations necessary to determine the optimal solution. Optimal decisions are identified by the number in the corresponding decision node. In the PDC decision tree in Figure 13.20, cell B15 contains the decision node. Note that a 3 appears in this node, which tells us that decision alternative branch 3 provides the optimal decision. Thus, decision analysis recommends PDC construct the Large condominium complex. The expected value of this decision appears at the beginning of the tree in cell A16. Thus, we see the optimal expected value is $14.2 million. The expected values of the other decision alternatives are displayed at the end of the corresponding decision branch. Thus, referring to cells E6 and E16, we see that the expected value of the Small complex is $7.8 million and the expected value of the Medium complex is $12.2 million.

FIGURE 13.20 THE PDC DECISION TREE WITH BRANCH PROBABILITIES AND PAYOFFS



	A	B	C	D	E	F	G	H	I	J	K
1	**TreePlan Academic Version**							0.8	**Only For Academic Use**		
2								Strong			
3											8
4				Small				8	8		
5											
6				0	7.8			0.2			
7								Weak			
8											7
9								7	7		
10											
11								0.8			
12								Strong			
13											14
14				Medium				14	14		
15		3									
16	14.2			0	12.2			0.2			
17								Weak			
18											5
19								5	5		
20											
21								0.8			
22								Strong			
23											20
24				Large				20	20		
25											
26				0	14.2			0.2			
27								Weak			
28											-9
29								-9	-9		

WEB file
PDC Tree

Other Options

TreePlan defaults to a maximization objective. If you would like a minimization objective, follow these steps:

Step 1. Select **Decision Tree** from the **Menu Commands** group
Step 2. Select **Options**
Step 3. Choose **Minimize (costs)**
Click **OK**

In using a TreePlan decision tree, we can modify probabilities and payoffs and quickly observe the impact of the changes on the optimal solution. Using this "what-if" type of sensitivity analysis, we can identify changes in probabilities and payoffs that would change the optimal decision. Also, because TreePlan is an Excel add-in, most of Excel's capabilities are available. For instance, we could use boldface to highlight the name of the optimal decision alternative on the final decision tree solution. A variety of other options TreePlan provides are contained in the TreePlan manual at the website that accompanies this text. Computer software packages such as TreePlan make it easier to do a thorough analysis of a decision problem.