Solved Problem

Virtual Office Hours help is available at www.myomlab.com.

SOLVED PROBLEM 5.1

Sarah King, president of King Electronics, Inc., has two design options for her new line of high-resolution cathode-ray tubes (CRTs) for CAD workstations. The life cycle sales forecast for the CRT is 100,000 units.

Design option A has a .90 probability of yielding 59 good CRTs per 100 and a .10 probability of yielding 64 good CRTs per 100. This design will cost $1,000,000.

Design option B has a .80 probability of yielding 64 good units per 100 and a .20 probability of yielding 59 good units per 100. This design will cost $1,350,000.

Good or bad, each CRT will cost $75. Each good CRT will sell for $150. Bad CRTs are destroyed and have no salvage value. We ignore any disposal costs in this problem.

SOLUTION

We draw the decision tree to reflect the two decisions and the probabilities associated with each decision. We then determine the payoff associated with each branch. The resulting tree is shown in Figure 5.14.

For design A:

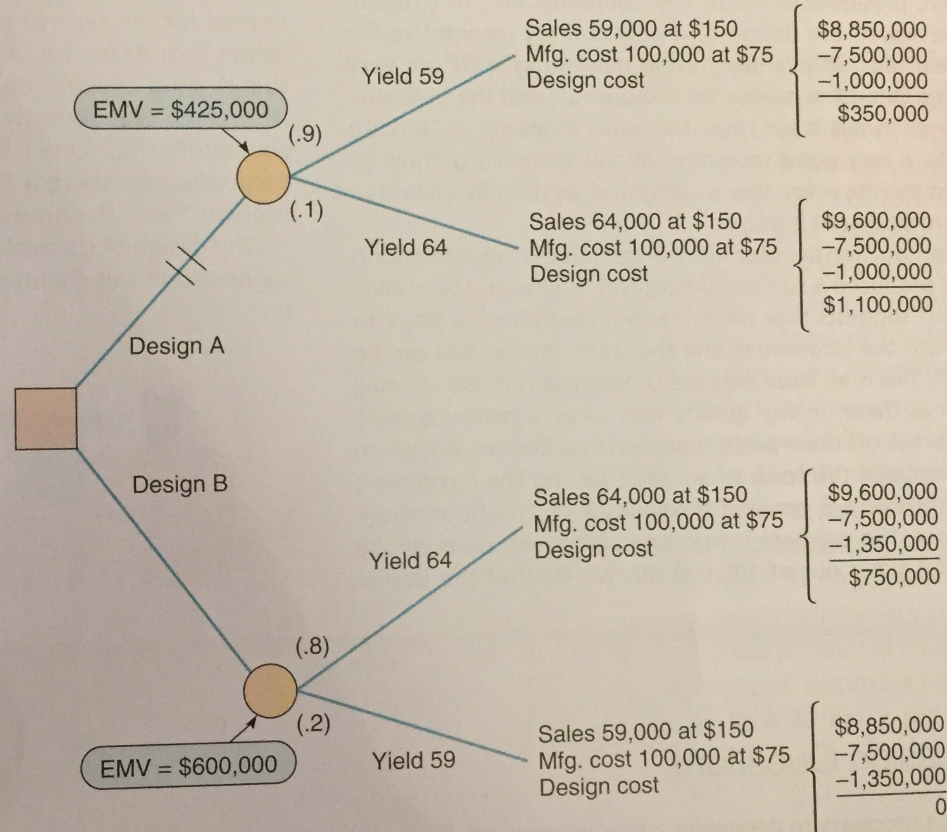
$$\text{EMV(design A)} = (.9)(\$350{,}000) + (.1)(\$1{,}100{,}000) = \$425{,}000$$

For design B:

$$\text{EMV(design B)} = (.8)(\$750{,}000) + (.2)(\$0) = \$600{,}000$$

The highest payoff is design option B, at $600,000.

Figure **5.14**
Decision Tree for Solved Problem 5.1



Problems

Note: **PX** means the problem may be solved with POM for Windows and/or Excel OM.

•• **5.1** Construct a house of quality matrix for a wristwatch. Be sure to indicate specific customer wants that you think the general public desires. Then complete the matrix to show how an operations manager might identify specific attributes that can be measured and controlled to meet those customer desires.

•• **5.2** Using the house of quality, pick a real product (a good or service) and analyze how an existing organization satisfies customer requirements.

•• **5.4** Conduct an interview with a prospective purchaser of a new bicycle and translate the customer's *wants* into the specific *hows* of the firm.

•• **5.5** Prepare a bill of material for (a) a pair of eyeglasses and its case or (b) a fast-food sandwich (visit a local sandwich shop like Subway, McDonald's, Blimpie, Quizno's; perhaps a clerk or the manager will provide you with details on the quantity or weight of various ingredients—otherwise, estimate the quantities).

Example 3

DECISION TREE APPLIED TO PRODUCT DESIGN

Silicon, Inc., a semiconductor manufacturer, is investigating the possibility of producing and marketing a microprocessor. Undertaking this project will require either purchasing a sophisticated CAD system or hiring and training several additional engineers. The market for the product could be either favorable or unfavorable. Silicon, Inc., of course, has the option of not developing the new product at all.

With favorable acceptance by the market, sales would be 25,000 processors selling for $100 each. With unfavorable acceptance, sales would be only 8,000 processors selling for $100 each. The cost of CAD equipment is $500,000, but that of hiring and training three new engineers is only $375,000. However, manufacturing costs should drop from $50 each when manufacturing without CAD to $40 each when manufacturing with CAD.

The probability of favorable acceptance of the new microprocessor is .40; the probability of unfavorable acceptance is .60.

APPROACH ▶ Use of a decision tree seems appropriate as Silicon, Inc., has the basic ingredients: a choice of decisions, probabilities, and payoffs.

SOLUTION ▶ In Figure 5.13 we draw a decision tree with a branch for each of the three decisions, assign the respective probabilities and payoff for each branch, and then compute the respective EMVs. The expected monetary values (EMVs) have been circled at each step of the decision tree. For the top branch:

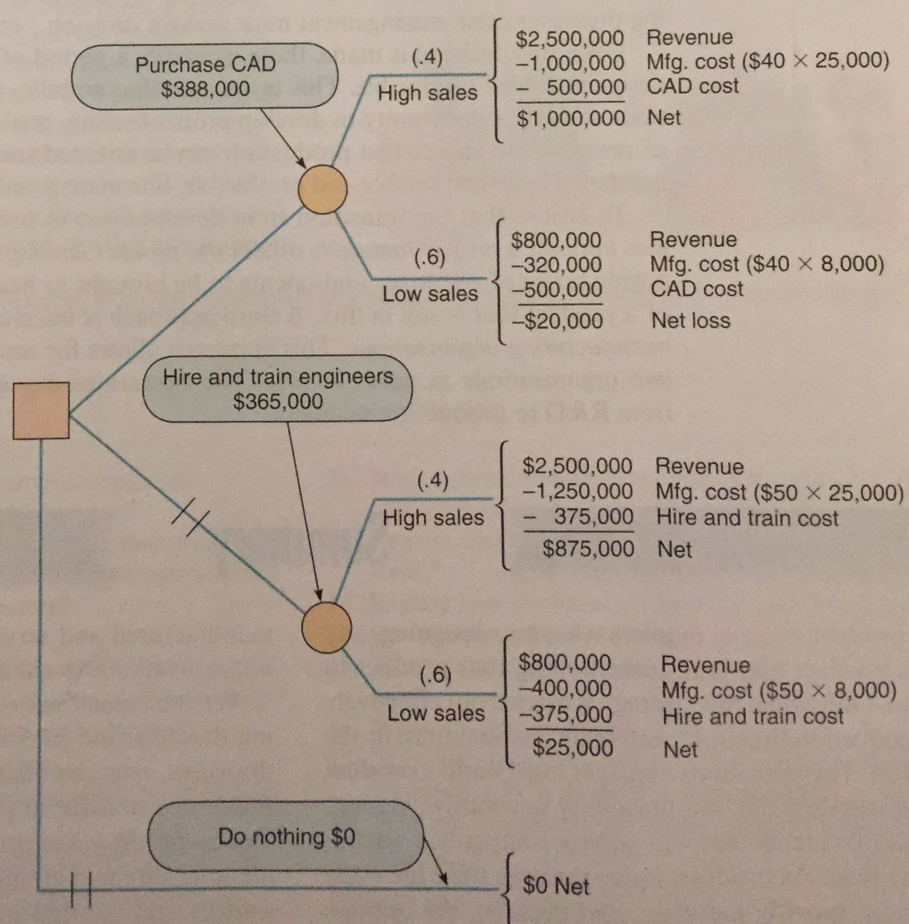
$$\text{EMV (Purchase CAD system)} = (.4)(\$1{,}000{,}000) + (.6)(-\$20{,}000) = \$388{,}000$$

This figure represents the results that will occur if Silicon, Inc., purchases CAD.

The expected value of hiring and training engineers is the second series of branches:

$$\text{EMV (Hire/train engineers)} = (.4)(\$875{,}000) + (.6)(\$25{,}000) = \$365{,}000$$

Figure **5.13**
Decision Tree for Development of a New Product



STUDENT TIP ☆
The manager's options are to purchase CAD, hire/train engineers, or do nothing. Purchasing CAD has the highest EMV.

The EMV of doing nothing is $0.

Because the top branch has the highest expected monetary value (an EMV of $388,000 vs. $365,000 vs. $0), it represents the best decision. Management should purchase the CAD system.

INSIGHT ▶ Use of the decision tree provides both objectivity and structure to our analysis of the Silicon, Inc., decision.

LEARNING EXERCISE ▶ If Silicon, Inc., thinks the probabilities of high sales and low sales may be equal, at .5 each, what is the best decision? [Answer: Purchase CAD remains the best decision, but with an EMV of $490,000.]

RELATED PROBLEMS ▶ 5.10, 5.11, 5.12, 5.13, 5.14, 5.15, 5.16, 5.18

ACTIVE MODEL 5.1 This example is further illustrated in Active Model 5.1 at **www.pearsonhighered.com/heizer**.

STUDENT TIP ☆ One of the arts of management is knowing when a product should move from development to production.

Transition to Production

Eventually, a product, whether a good or service, has been selected, designed, and defined. It has progressed from an idea to a functional definition, and then perhaps to a design. Now, management must make a decision as to further development and production or termination of the product idea. One of the arts of management is knowing when to move a product from development to production; this move is known as *transition to production*. The product development staff is always interested in making improvements in a product. Because this staff tends to see product development as evolutionary, they may never have a completed product, but as we noted earlier, the cost of late product introduction is high. Although these conflicting pressures exist, management must make a decision—more development or production.

Once this decision is made, there is usually a period of trial production to ensure that the design is indeed producible. This is the