Practical Management Science (3rd and Revised 3rd Edition)
Test Bank for Chapter 2: Introductory Spreadsheet Modeling

New problem in red text

Revised problem in blue text

2.1 (Version A) The owner of a relatively small business is trying to determine the breakeven level of sales of the company's single product. The fixed cost of manufacturing this product each month is $25,000. The unit cost of producing and selling this product is $50. The current selling price is $75 and the current demand for the product is 5000 units per month. In general, the owner believes that the unit selling price is best described by the expression $125 - 0.01D$, where D is the monthly demand for the product. Assume that this business can meet the demand for its product each month. Formulate a spreadsheet model in the file **Problem02_01A.xls** to find the breakeven level of monthly sales in this case.

(Version B) The owner of a relatively small business is trying to determine the breakeven level of sales of the company's single product. The fixed cost of manufacturing this product each month is $25,000. The unit cost of producing and selling this product is $50. The current selling price is $75 and the current demand for the product is 5000 units per month. In general, the owner believes that the unit selling price is best described by the expression $125 - 0.01D$, where D is the monthly demand for the product. Assume that this business can meet the demand for its product each month. The file **Problem02_01B.xls** contains a spreadsheet model that was developed to find the breakeven level of monthly sales in this case. Is this model formulated correctly? If not, correct the formulation. In any case, use the correct model to find the breakeven sales level.

2.2 (Version A) A recent college graduate is trying to save for his retirement. He believes that he will most likely be able to place $1800 in his retirement account at the beginning of each of the next 40 years. His goal is to retire after 40 years of work with a total of $1,000,000 in his account. What is the lowest expected annual interest rate that will ensure that this individual reaches his financial goal after 40 years of saving? Answer this question by formulating and analyzing an appropriate model in the file **Problem02_02A.xls**.

(Version B) A recent college graduate is trying to save for his retirement. He believes that he will most likely be able to place $1800 in his retirement account at the beginning of each of the next 40 years. His goal is to retire

after 40 years of work with a total of $1,000,000 in his account. What is the lowest expected annual interest rate that will ensure that this individual reaches his financial goal after 40 years of saving? The file **Problem02_02B.xls** contains a model that can be analyzed to answer this question. Is this model formulated correctly? If not, correct the formulation. In any case, use the correct model to find the minimum average annual interest rate needed by the investor in this case.

2.3 (Version A) The file **Problem02_03A.xls** contains data on the price and demand of a particular product for each month of the previous year. The product manager would like to estimate the relationship between price and demand of this product. Which of the following functional relationships yields the lowest MAPE: linear function, power function, or exponential function? Show all of your work and state your conclusion in **Problem02_03A.xls**.

(Version B) The file **Problem02_03B.xls** contains data on the price and demand of a particular product for each month of the previous year. The product manager would like to estimate the relationship between price and demand of this product. Which of the following functional relationships yields the lowest MAPE: linear function, power function, or exponential function? A model has been formulated in **Problem02_03B.xls** to answer this question. Is this model formulated correctly? If not, correct the formulation. In any case, use the correct model to find the answer to this question.

2.4 (Version A) Assume that the number of units sold of a product is given by $100 - P + 40A^{0.5}$, where P is the price (in dollars) charged for one unit of the product and A is the amount spent on advertising (in thousands of dollars). Each unit of the product costs $10 to manufacture. What combination of price and advertising will maximize profit in this case? Formulate and analyze a model in the file **Problem02_04A.xls** to answer this question.

(Version B) Assume that the number of units sold of a product is given by $100 - P + 40A^{0.5}$, where P is the price (in dollars) charged for one unit of the product and A is the amount spent on advertising (in thousands of dollars). Each unit of the product costs $10 to manufacture. What combination of price and advertising will maximize profit in this case? A model has been formulated and analyzed in **Problem02_04B.xls** to answer this question. Is this model formulated correctly? If not, correct the formulation. In any case, use the correct model to find the answer to this question.

2.5 (Version A) Financial theory defines the yield of a bond as the interest rate that would make the net present value (NPV) of the bond's payments equal to the bond's selling price. Consider a bond with a yield of 4.5%. Suppose that

this bond pays the amounts listed in the file **Problem02_05A.xls** at the end of the next 20 years. Formulate and analyze a model in **Problem02_05A.xls** to find the price at which this bond is currently selling.

(Version B) Financial theory defines the yield of a bond as the interest rate that would make the net present value (NPV) of the bond's payments equal to the bond's selling price. Consider a bond with a yield of 4.5%. Suppose that this bond pays the amounts listed in the file **Problem02_05B.xls** at the end of the next 20 years. The file **Problem02_05B.xls** contains a model that one can use to determine the bond's current selling price. Is this model formulated correctly? If not, correct the formulation. In any case, use the correct model to find the bond's selling price.

2.6 (Version A) The annual demand for a particular product during the current year is 100,000. Demand is expected to grow at a rate of 4% each year. If the manufacturer of this product builds a plant that can produce x units of the product each year, it will incur a cost of 22.50x$ at the end of the current year. Each unit of this product sells for $25. Each unit of the product manufactured incurs a variable production cost of $12.50. Also, the manufacturer incurs a cost of $2.50 per year to operate each unit of capacity. Finally, assume that the discount rate in this case is 10%. What capacity level maximizes this producer's expected net present value of total profit over the upcoming six years? Formulate a model and corresponding data table in the file **Problem02_06A.xls** to answer this question.

(Version B) The annual demand for a particular product during the current year is 100,000. Demand is expected to grow at a rate of 4% each year. If the manufacturer of this product builds a plant that can produce x units of the product each year, it will incur a cost of 22.50x$ at the end of the current year. Each unit of this product sells for $25. Each unit of the product manufactured incurs a variable production cost of $12.50. Also, the manufacturer incurs a cost of $2.50 per year to operate each unit of capacity. Finally, assume that the discount rate in this case is 10%. What capacity level maximizes this producer's expected net present value of total profit over the upcoming six years? The file **Problem02_06B.xls** contains a model and corresponding data table that can be analyzed to answer this question. Is this model formulated correctly? If not, correct the formulation. In any case, use the correct model to find the best capacity level for the upcoming six-year period.

2.7 (Version A) Suppose that a couple is borrowing $190,000 to purchase a new home. The current annual interest rate for a 30-year fixed mortgage is 8.4%. Assuming that they want to pay off the loan principal and all interest by the end of 30 years from now, what will the couple's monthly payment be?

Formulate and analyze a model in the file **Problem02_07A.xls** to answer this question.

(Version B) Suppose that a couple is borrowing $190,000 to purchase a new home. The current annual interest rate for a 30-year fixed mortgage is 8.4%. Assuming that they want to pay off the loan principal and all interest by the end of 30 years from now, what will the couple's monthly payment be? A model has been formulated and analyzed in **Problem02_07B.xls** to answer this question. Is this model formulated correctly? If not, correct the formulation. In any case, use the correct model to find the monthly mortgage payment in this case.

2.8 (Version A) The owners of *Good Taste*, a bakery in Lewisburg, PA are attempting to determine how many loaves of their famous raisin bread to bake for the first day of the upcoming county fair. Company accounting records show that each loaf of raisin bread costs $1.30 to make. *Good Taste* plans to sell each loaf for $2.75. Unsold loaves can be sold on the county fair's second day as "day-old" products. The owners plan to sell such loaves for $1.00 each. Furthermore, they feel that county fair patrons are likely to buy 1,250 loaves on the first day. Their goal is to decide how many loaves to bake in order to maximize expected profit from these sales. Develop a spreadsheet model in the file **Problem02_08A.xls** and a corresponding data table to find the best order quantity among the given alternatives.

(Version B) The owners of *Good Taste*, a bakery in Lewisburg, PA are attempting to determine how many loaves of their famous raisin bread to bake for the first day of the upcoming county fair. Company accounting records show that each loaf of raisin bread costs $1.30 to make. *Good Taste* plans to sell each loaf for $2.75. Unsold loaves can be sold on the county fair's second day as "day-old" products. The owners plan to sell such loaves for $1.00 each. Furthermore, they feel that county fair patrons are likely to buy 1,250 loaves on the first day. Their goal is to decide how many loaves to bake in order to maximize expected profit from these sales. The file **Problem02_08B.xls** contains a spreadsheet model and a corresponding data table that ought to enable the manager to find the best order quantity among the given alternatives. Is this formulation correct? If not, correct the given formulation and find the actual optimal number of loaves to bake.

2.9 (Version A) The circulation manager of *The New York Times* in State College, PA is trying to decide how many copies of the upcoming Sunday edition of the paper to order so as to meet the demand of local customers. Each copy of the newspaper costs $2.00 and is sold for $3.00. On Tuesday (following the weekend the newspapers are printed), all unsold copies will be returned to the distributor for a refund of $1.80 per copy. The owner believes that the

number of papers she can sell on a typical Sunday is 21,100. She wants to decide how many copies of *The New York Times* to order so as to maximize expected profit from the sale of this particular newspaper. Develop a spreadsheet model in the file **Problem02_09A.xls** and a corresponding data table to find the best order quantity among the given alternatives.

(Version B) The circulation manager of *The New York Times* in State College, PA is trying to decide how many copies of the upcoming Sunday edition of the paper to order so as to meet the demand of local customers. Each copy of the newspaper costs $2.00 and is sold for $3.00. On Tuesday (following the weekend the newspapers are printed), all unsold copies will be returned to the distributor for a refund of $1.80 per copy. The owner believes that the number of papers she can sell on a typical Sunday is 21,100. She wants to decide how many copies of *The New York Times* to order so as to maximize expected profit from the sale of this particular newspaper. The file **Problem02_09B.xls** contains a spreadsheet model and a corresponding data table that should enable the manager to find the best order quantity among the given alternatives. Is this formulation correct? If not, correct the given formulation and find the actual optimal conclusion.