**MULTIPLE CHOICE**

1. If P1 = $5, Q1 = 10,000, P2 = $6 and Q2 = 5,000, then a linear estimate of the demand curve is:

|  |  |
| --- | --- |
| a. | P = $7  $0.002Q |
| b. | P = $5 + $10,000Q |
| c. | Q = 7  0.002P |
| d. | Q = 35,000  5,000P |

2. If P1 = $5, Q1 = 10,000, P2 = $6 and Q2 = 5,000, then at point P2 an estimate of the point price elasticity P equals:

|  |  |
| --- | --- |
| a. | 6 |
| b. | 2.5 |
| c. | 4.25 |
| d. | 0.12 |

3. If P1 = $5, Q1 = 10,000, P2 = $6 and Q2 = 5,000, then at point P1 an estimate of the point price elasticity P equals:

|  |  |
| --- | --- |
| a. | 6 |
| b. | 2.5 |
| c. | 4.25 |
| d. | 0.12 |

6. In a simple regression model, the correlation coefficient is:

|  |  |
| --- | --- |
| a. | equal to one. |
| b. | greater than one. |
| c. | less than one. |
| d. | the square root of the coefficient of determination. |

8. If a decrease in price causes total revenue to increase, an estimate of the absolute value of the price elasticity of demand will be:

|  |  |
| --- | --- |
| a. | greater than zero but less than one. |
| b. | equal to one. |
| c. | greater than one. |
| d. | equal to zero. |

9. The number of observations beyond the minimum needed to calculate a given regression statistic is called:

|  |  |
| --- | --- |
| a. | a measure of the goodness of fit for a multiple regression model. |
| b. | degrees of freedom. |
| c. | the square of the coefficient of multiple correlation. |
| d. | a measure of statistical significance for the share of dependent variable variation explained by the regression model. |

10. Tests of the b = 0 hypothesis are:

|  |  |
| --- | --- |
| a. | tests for the share of dependent variable variation explained by the regression model. |
| b. | one-tail t tests. |
| c. | two-tail t tests |
| d. | tests of direction or comparative magnitude. |

**PROBLEM (Show Calculation)**

1. **Demand Curve Estimation**. Linux Servers, Inc., is a leading supplier of high-speed servers with enormous storage capacity. Average price and annual unit sales data for the VAX7500 high-speed machine are as follows:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **2001** | **2002** | **2003** | **2004** | **2005** |
| Price($) | $90,000 | $80,000 | $60,000 | $50,000 | $30,000 |
| Units sold | 250,000 | 500,000 | 1,000,000 | 1,250,000 | 1,750,000 |

|  |  |
| --- | --- |
| A. | Complete the following table, and use these data to derive intercept and slope coefficients for the linear demand curve. |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Year** | **Price** | **Quantity** | ** Price** | ** Quantity** | **Slope**  **= P/ Q** |
| 2004 | $90,000 | 250,000 | --- | --- | --- |
| 2005 | 80,000 | 500,000 |  |  |  |
| 2006 | 60,000 | 1,000,000 |  |  |  |
| 2007 | 50,000 | 1,250,000 |  |  |  |
| 2008 | 30,000 | 1,750,000 |  |  |  |

|  |  |
| --- | --- |
| B. | Assuming that demand conditions are held constant, use the preceding data to plot a linear demand curve. |

2. **The Identification Problem**. Business is booming for Complex Controls, Inc., a leading supplier of analog/digital circuits and systems used for measurement and control. The average price received by CCI for the XKE device, and the number sold (output) over the past six quarters are as follows:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Q-1** | **Q-2** | **Q-3** | **Q-4** | **Q-5** | **Q-6** |
| Price($) | $2.00 | $2.50 | $3.00 | $3.50 | $4.00 | $4.50 |
| Output(000) | 2,000 | 3,000 | 4,000 | 5,000 | 6,000 | 7,000 |

Quarterly demand and supply curves for CCI services are:

|  |  |  |  |
| --- | --- | --- | --- |
|  | QD | = 4,000  2,000P + 2,000T | (Demand) |
|  |  |  |  |
|  | QS | = 2,000 + 2,000P | (Supply) |

where Q is output (000), P is price, T is a trend factor, and T = 1 during Q**-**1 and increases by one unit per quarter.

|  |  |
| --- | --- |
| A. | Express each demand and supply curve in terms of price as a function of output. |
| B. | Plot the quarterly demand curves for the last six quarterly periods. (Hint: Let T = 1 to find the Y-intercept for Q-1, T = 2 for Q-2, and so on.) |
| C. | Plot the CCI supply curve on the same graph. |
| D. | What is this problem's relation to the identification problem? |

3. **R2 and t statistics**. Boris Yeltsin Products, Inc., has hired you to analyze demand in 30 regional markets for Product Y, a new vodka beverage. A statistical analysis of demand in these markets shows (standard errors in parentheses):

|  |  |  |
| --- | --- | --- |
|  | QY | = 500  8P + 5PX + 0.05A + 0.025I |
|  |  | (350) (2.5) (2) (0.03) (0.011) |
|  |  |  |
|  | R2 | = 93% |

Standard Error of the Estimate = 20

Here, QY is market demand for Product Y, P is the price of Y in dollars, A is dollars of advertising expenditures, PX is the average price in dollars of another (unidentified) product, and I is dollars of household income. In a typical market, the price of Y is $500, PX is $600, advertising expenditures are $10,000, and average per capita income is $40,000.

|  |  |
| --- | --- |
| A. | Does each independent X variable have a significant effect on the dependent Y variable? |
| B. | What percentage of demand variation is explained by this model? |

4. **Regression Statistics**. June Ward, controller for NAFTA, Inc., has asked you to analyze demand in 30 regional markets for Beaver's Cleavers, a new brush cutting device, dubbed Product Y. A statistical analysis of demand in these markets shows (standard errors in parentheses):

|  |  |  |
| --- | --- | --- |
|  | QY | = 2,000  25P + 10PX + 0.025I |
|  |  | (1,500) (8) (4) (0.011) |
|  |  |  |
|  | R2 | = 80% |
|  |  |  |
|  | F | = 34.7 |

Standard Error of the Estimate = 40

Here, QY is market demand for Product Y, P is the price of Y in dollars, A is dollars of advertising expenditures, PX is the average price in dollars of another (unidentified) product, and I is dollars of household income. In a typical market, the price of Y is $100, PX is $50, and disposable income per family averages $80,000.

|  |  |
| --- | --- |
| A. | Does each independent X variable have a significant effect on the dependent Y variable? |
| B. | What percentage of demand variation is explained by this model? |
| C. | Does this model explain a significant share of demand variation? |
| D. | Calculate the expected level of demand in a typical market. Also indicate the range within which actual demand is expected to fall with 95% confidence. |

5. **Elasticity Estimation**. The Lincoln National Life Insurance Company offers a wide variety of insurance products, including whole-life and term policies. The company has compiled the following data concerning policy sales during recent years:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Year** | **Whole-life** | | **Term** | |
| **Price\*** | **Quantity** | **Price\*** | **Quantity** |
| 2004 | $2.00 | 240,000 | $1.50 | 100,000 |
| 2005 | 2.00 | 200,000 | 1.45 | 130,000 |
| 2006 | 1.90 | 230,000 | 1.45 | 150,000 |
| 2007 | 1.80 | 280,000 | 1.40 | 200,000 |
| 2008 | 1.80 | 238,000 | 1.33 | 270,000 |

\*Price is quoted in terms of cost per $1,000 of coverage.

|  |  |
| --- | --- |
| A. | What is the point price elasticity of demand for whole-life insurance? |
| B. | What is the point price elasticity of demand for term insurance? |
| C. | Evaluate the percentage change in whole-life demand given a 1% change in the price of term insurance. Is term insurance a substitute for whole-life? |

6. **Standard Error of the Estimate**. Body Fit, Inc., runs a California-based chain of health clubs featuring aerobic exercise, racket sports, swimming and weight training facilities. An in-house study of monthly sales by three outlets during the past year (a total of 36 observations) revealed the following (standard errors in parentheses):

|  |  |  |
| --- | --- | --- |
|  | QY | = 450  4P + 2PX + 8A + 50T  5W |
|  |  | (200) (1.3) (0.9) (3) (18) (3) |
|  |  |  |
|  | R2 | = 96% |

Standard Error of the Estimate = 10

Here QY = membership sales (in units), PY = average membership price (in dollars), PX = average membership price charged by competitors (in dollars), A = advertising expenditures (in hundreds of dollars), T = time (in months of continuous operation), W = weather (in average monthly temperature).

|  |  |
| --- | --- |
| A. | What share of overall variation in membership sales is explained by the regression equation? What share is left unexplained? |
| B. | Using a 95% confidence level criterion, which independent factors have an influence on membership sales? |
| C. | During a recent month, the San Diego outlet's average price was $700, the average competitor price was $600, advertising was $5,000, the outlet had been in operation for 3 years, and the average monthly temperature was 70º. Assuming this was a typical observation included in the study, derive the relevant demand curve for Body Fit memberships. |
| D. | Assume the model and data given above are relevant for the coming period. Calculate the range within which you would expect to find actual monthly sales revenue with 95% confidence. |

7. **Demand Curve Estimation**. The Real Kool Toys Company manufactures and sells educational toys. An empirical demand function for one of the firm's products has been estimated over the last 21 quarters using regression analysis. The estimated demand function is:

|  |  |  |
| --- | --- | --- |
|  | QY | = 8,000  5,000PY + 192A + 120I + 2,000PX |
|  |  | (6,000) (1,000) (120) (80) (800) |
|  |  |  |
|  | R2 | = 91% |

Standard Error of the Estimate = 1,000

Here QY is quantity (measured in units) of Product Y demanded in the current period, A is hundreds of dollars of advertising ($00), I is thousands of dollars of disposable income per capita ($000), and PX is the price ($) of another toy manufactured by a competitor, ABC Toys. The terms in parentheses are the standard errors of the coefficients.

|  |  |
| --- | --- |
| A. | How would you characterize the ability of this empirical demand function to explain demand for product Y? |
| B. | Currently, PY is $8, advertising is $25,000, disposable income per capita is $50,000 and PX is $7. What are expected sales of Y in this period, and what range of sales would you specify for the current period if you wanted to establish a 99% confidence interval? |
| C. | What is the demand curve currently facing Real Kool for Product Y? (*Note*: Be careful to properly account for the units in which advertising and income appear in the estimated demand function.) |
| D. | What is the point price elasticity of demand for Y at the current price? |
| E. | Given the current price elasticity of demand, would a price reduction increase Real Kool profits? Explain. |
| F. | What demand curve would Real Kool face for Product Y if it raised advertising expenditures to $37,500? |

8. **One-Tail t-tests**. Martin's Footwear, Inc., of Boston, Massachusetts has retained you to aid the firm in an evaluation of its marketing strategy. Martin's "Happy Feet" running shoes are marketed through local retail outlets in the eastern United States. A move to extend Martin's market to Midwestern and western states is currently being contemplated.

A marketing research group conducted an empirical analysis of demand for Martin's "Happy Feet" during 2008 in thirty-six regional markets and found the following (standard errors in parentheses):

|  |  |  |
| --- | --- | --- |
|  | Q | = 518  10P + 12.5I + 5W  0.5CA + 5A |
|  |  | (240) (1.3) (8.6) (2.8) (0.4) (2.5) |
|  |  |  |
|  | R2 | = 85% |

Standard error of the estimate = 200

|  |  |  |
| --- | --- | --- |
|  | cov(I,W) | = 3.5, cov(I,CA) = 8.6, cov(I,A) = 2.8 |

where Q = quantity sold (in pairs of shoes), P = price (in dollars), I = disposable income in relevant market (in millions of dollars), W = weather measured by average temperature (in degrees), CA = competitor advertising (in thousands of dollars), A = Martin's "own" advertising (in thousands of dollars).

|  |  |  |
| --- | --- | --- |
| A. | Fully evaluate and interpret the empirical results reported above on an overall basis. Include in your analysis a discussion of: | |
|  | (i) | R2 |
|  | (ii) |  |
|  | (iii) | F-statistic |
|  | (iv) | Standard error of the estimate |
| B. | Will a recession hurt sales? | |
| C. | Is demand more dependent on local income than on weather conditions? | |

9. **Multiple Regression**. Kitchen Products, Ltd., is a regional distributor of Regal Bread Making Machine. The company wishes to assess the relative importance of price reductions versus an increase in personal selling efforts as means for enhancing product promotion. To this end, the company recently used a regression analysis approach to study the following monthly unit sales, price, and personal selling expense information for the Bozeman, Montana market:

|  |  |  |
| --- | --- | --- |
| **Unit Sales** | **Price** | **Personal Selling Expenses** |
| 132 | $74 | $1,140 |
| 203 | 74 | 1,400 |
| 217 | 55 | 1,160 |
| 255 | 53 | 1,210 |
| 252 | 64 | 1,490 |
| 239 | 70 | 1,460 |
| 152 | 75 | 1,200 |
| 197 | 58 | 1,020 |
| 230 | 65 | 1,390 |
| 154 | 61 | 1,040 |

As a first step in the analysis, the company ran simple regressions of unit sales on each of the potentially important independent variables of price and personal selling expenses:

The first simple regression equation is:

SALES = 371  2.59 PRICE

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Predictor | Coef | Stdev | t ratio | p |
| Constant | 371.0 | 109.5 | 3.39 | 0.010 |
| PRICE | 2.587 | 1.676 | 1.54 | 0.161 |
|  |  |  |  |  |
| SEE = 40.94 | R2 = 22.9% | | = 13.3% | |

The second simple regression equation is:

SALES = 5.9 + 0.158 SELLEXP

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Predictor | Coef | Stdev | t ratio | p |
| Constant | 5.89 | 90.10 | 0.07 | 0.949 |
| SELLEXP | 0.15764 | 0.07142 | 2.21 | 0.058 |
|  |  |  |  |  |
| SEE = 36.77 | R2 = 37.8% | | = 30.1% | |

|  |  |
| --- | --- |
| A. | Based on these simple regression model results, do either of the potentially important independent variables affect unit sales? |
| B. | Characterize the differences between each simple regression model coefficient estimate from part A with those estimated using the following multiple regression: |

The multiple regression equation is:

SALES = 195  4.33 PRICE + 0.231 SELLEXP

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Predictor | Coef | Stdev | t ratio | p |
| Constant | 194.92 | 38.27 | 5.09 | 0.000 |
| PRICE | 4.3296 | 0.5396 | 8.02 | 0.000 |
| SELLEXP | 0.23115 | 0.02560 | 9.03 | 0.000 |
|  |  |  |  |  |
| SEE = 12.31 | R2 = 93.9% | | = 92.2% | |

10. **Profit Probability Estimation**. Intimate Lighting, Inc., is a rapidly growing lighting accessory outlets that caters to the do-it-yourself home remodeling market. During the past year, 18 stores were operated in small to medium-size metropolitan markets. An in-house study of sales by these outlets revealed the following (standard errors in parentheses):

|  |  |  |
| --- | --- | --- |
|  | Q | = 2,500  40P + 20PX + 2A + 0.25I |
|  |  | (1,500) (20) (15) (1.3) (0.01) |
|  |  |  |
|  | R2 | = 86% |

Standard Error of the Estimate = 500.

Here, Q is unit sales, P is unit price, PX is the average unit price at competitor stores, A is advertising expenditures, and I is income per capita.

|  |  |
| --- | --- |
| A. | Tucson, Arizona was a typical market covered by this analysis. In the Tucson market, "own" price was $60, competitor price was $45, advertising was $13,500, and income was an average $80,000. Calculate and interpret the expected level of unit sales, as well as the 95% and 99% confidence regions for actual sales. |
| B. | Calculate the 95% and 99% confidence regions for actual revenues in the Tucson market. |
| C. | Estimate the probability that the Tucson store made a profit during this period if total costs were $1,735,200. |