CHAPTER 13 EXERCISE 6

|  |
| --- |
| The owner of Maumee Ford-Mercury-Volvo wants to study the relationship between the age of a car and its selling price. Listed below is a random sample of 12 used cars sold at the dealership during the last year. |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Car | Age (years) | Selling Price ($000) | Car | Age (years) | Selling Price ($000) |
| 1 | 9 | 8.1 | 7 | 8 | 7.6 |
| 2 | 7 | 6.0 | 8 | 11 | 8.0 |
| 3 | 11 | 3.6 | 9 | 10 | 8.0 |
| 4 | 12 | 4.0 | 10 | 12 | 6.0 |
| 5 | 8 | 5.0 | 11 | 6 | 8.6 |
| 6 | 7 | 10.0 | 12 | 6 | 8.0 |
|  |

[ Click here for the Excel Data File](http://lectures.mhhe.com/connect/0078020522/data_files/chapter13/Ex13_6_e16.xls)

|  |  |
| --- | --- |
| **a.** | If we want to estimate selling price on the basis of the age of the car, which variable is the dependent variable and which is the independent variable? |
|   |   |
|   |    is the independent variable and  is the dependent variable. |

|  |  |
| --- | --- |
| **b-1.** | Determine the correlation coefficient.**(Negative amounts should be indicated by a minus sign. Round your answers to 3 decimal places.)** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *X* | *Y* | Picture | Picture | (Picture )2 | (Picture )2 | (Picture )(Picture ) |
| 9.0   | 8.1   |    | 1.192   | 0.007   | 1.420   | 0.099   |
| 7.0   | 6.0   |    | -0.908   | 3.674   | 0.825   | 1.741   |
| 11.0   | 3.6   | 2.083   |    | 4.340   | 10.945   | -6.892   |
| 12.0   | 4.0   | 3.083   |    | 9.507   | 8.458   | -8.967   |
| 8.0   | 5.0   | -0.917   | -1.908   |    | 3.642   | 1.749   |
| 7.0   | 10.0   | -1.917   | 3.092   |    | 9.558   | -5.926   |
| 8.0   | 7.6   | -0.917   | 0.692   | 0.840   |    | -0.634   |
| 11.0   | 8.0   | 2.083   | 1.092   | 4.340   |    | 2.274   |
| 10.0   | 8.0   | 1.083   | 1.092   | 1.174   | 1.192   |    |
| 12.0   | 6.0   | 3.083   | -0.908   | 9.507   | 0.825   |    |
| 6.0   | 8.6   | -2.917   | 1.692   | 8.507   | 2.862   | -4.934   |
| 6.0   | 8.0   | -2.917   | 1.092   | 8.507   | 1.192   | -3.184   |
| 107.000   | 82.900   |   |   |    |    |    |
|  |

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Picture | = |  | Picture | = |  | *s*x | = |  | *s*y | = |  |

|  |  |  |
| --- | --- | --- |
| *r* | = |  |

|  |  |
| --- | --- |
| **b-2.** | Determine the coefficient of determination.**(Round your answer to 3 decimal places.)** |
|   |   |
|   |  |

|  |  |
| --- | --- |
| **c.** | Interpret the correlation coefficient. Does it surprise you that the correlation coefficient is negative?**(Round your answer to nearest whole number.)** |
|   |   |
|   |    correlation between age of car and selling price. So,  % of the variation in the selling price is explained by the variation in the age of the car. |

CHAPTER 13 EXERCISE 12

|  |
| --- |
| The Student Government Association at Middle Carolina University wanted to demonstrate the relationship between the number of beers a student drinks and his or her blood alcohol content (BAC). A random sample of 18 students participated in a study in which each participating student was randomly assigned a number of 12-ounce cans of beer to drink. Thirty minutes after they consumed their assigned number of beers, a member of the local sheriff’s office measured their blood alcohol content. The sample information is reported below. |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Student | Beers | BAC | Student | Beers | BAC |
| 1 | 6 | 0.10 | 10 | 3 | 0.07 |
| 2 | 7 | 0.09 | 11 | 3 | 0.05 |
| 3 | 7 | 0.09 | 12 | 7 | 0.08 |
| 4 | 4 | 0.10 | 13 | 1 | 0.04 |
| 5 | 5 | 0.10 | 14 | 4 | 0.07 |
| 6 | 3 | 0.07 | 15 | 2 | 0.06 |
| 7 | 3 | 0.10 | 16 | 7 | 0.12 |
| 8 | 6 | 0.12 | 17 | 2 | 0.05 |
| 9 | 6 | 0.09 | 18 | 1 | 0.02 |
|  |

|  |
| --- |
| Use a statistical software package to answer the following questions. |

|  |
| --- |
| [PictureClick here for the Excel Data File](http://lectures.mhhe.com/connect/0078020522/data_files/chapter13/EX13_12_e16.xls) |

 1.

value:
**10.00 points**

**Required information**

|  |  |
| --- | --- |
| **a-1.** | Choose a scatter diagram that best fits the data. |







CHAPTER 13 EXERCISE 14

|  |
| --- |
| The following sample observations were randomly selected. |

|  |
| --- |
| [PictureClick here for the Excel Data File](http://lectures.mhhe.com/connect/0078020522/data_files/chapter13/Ex13_14_e16.xls) |

|  |
| --- |
|   |
| *X*: |  5 |  3 | 6 |  3 |  4 |  4 | 6 | 8 |
| *Y*: | 13 | 15 | 7 | 12 | 13 | 11 | 9 | 5 |
|  |

|  |  |
| --- | --- |
| **a.** | Determine the regression equation.**(Negative amounts should be indicated by a minus sign. Round your answers to 3 decimal places.)** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *X* | *Y* | Picture | Picture | (Picture )2 | (Picture )2 | (Picture )(Picture ) |
| 5   | 13    |    | 2.375   |    | 5.641   |      |
| 3   | 15    | −1.875   |    | 3.516   |    | −8.203     |
| 6   | 7    |    |    |    | 13.141   | −4.078     |
| 3   | 12    | −1.875   | 1.375   |    |    |      |
| 4   | 13    | −0.875   |    | 0.766   |    | −2.078     |
| 4   | 11    |    | 0.375   |    | 0.141   |      |
| 6   | 9    | 1.125   | −1.625   |    |    |      |
| 8   | 5    |    |    |    | 31.641   | −17.578     |
|   |    |   |   |    |    |      |
|  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|   Picture | = |  |   |   Picture | = |  |   | *sx* | = |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *sy* | = |  |   | *r* | = |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *b* | = |  |   | *a* | = |  |

|  |
| --- |
|   Y' =  +  *X* |

|  |  |
| --- | --- |
| **b.** | Determine the value of formula264.mml when *X* is 7. **(Round your answer to 3 decimal places.)** |
|   |   |
|   |  |

CHAPTER 13 EXERCISE 22

|  |
| --- |
| The owner of Maumee Ford-Mercury-Volvo wants to study the relationship between the age of a car and its selling price. Listed below is a random sample of 12 used cars sold at the dealership during the last year. |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Car | Age (years) | Selling Price ($000) | Car | Age (years) | Selling Price ($000) |
| 1 | 9 | 8.1 | 7 | 8 | 7.6 |
| 2 | 7 | 6.0 | 8 | 11 | 8.0 |
| 3 | 11 | 3.6 | 9 | 10 | 8.0 |
| 4 | 12 | 4.0 | 10 | 12 | 6.0 |
| 5 | 8 | 5.0 | 11 | 6 | 8.6 |
| 6 | 7 | 10.0 | 12 | 6 | 8.0 |
|  |

|  |
| --- |
| [PictureClick here for the Excel Data File](http://lectures.mhhe.com/connect/0078020522/data_files/chapter13/Ex13_22_e16.xls) |

|  |
| --- |
| The regression equation is formula551.mml, the sample size is 12, and the standard error of the slope is 0.23. Use the .05 significance level. Can we conclude that the slope of the regression line is less than zero? |

|  |
| --- |
|    *H0* and conclude the slope is  zero. |

CHAPTER 13 EXERCISE 26

|  |
| --- |
| The owner of Maumee Ford-Mercury-Volvo wants to study the relationship between the age of a car and its selling price. Listed below is a random sample of 12 used cars sold at the dealership during the last year. |

|  |  |  |
| --- | --- | --- |
| Car | Age (years) | Selling Price ($000) |
| 1   |   | 9   |   | 8.1   |   |
| 2   |   | 7   |   | 6.0   |   |
| 3   |   | 11   |   | 3.6   |   |
| 4   |   | 12   |   | 4.0   |   |
| 5   |   | 8   |   | 5.0   |   |
| 6   |   | 7   |   | 10.0   |   |
| 7   |   | 8   |   | 7.6   |   |
| 8   |   | 11   |   | 8.0   |   |
| 9   |   | 10   |   | 8.0   |   |
| 10   |   | 12   |   | 6.0   |   |
| 11   |   | 6   |   | 8.6   |   |
| 12   |   | 6   |   | 8.0   |   |
|  |

[ Click here for the Excel Data File](http://lectures.mhhe.com/connect/0078020522/data_files/chapter13/Ex13_6_e16.xls)

|  |  |
| --- | --- |
| **a.** | Determine the standard error of estimate. **(Round your answer to 3 decimal places.)** |
|   |   |

|  |  |
| --- | --- |
|   Standard error of estimate |    |

|  |  |
| --- | --- |
| **b.** | Determine the coefficient of determination. **(Round your answer to 3 decimal places.)** |
|   |   |
|   |  |

|  |  |
| --- | --- |
| **c.** | Interpret the coefficient of determination. **(Round your answer to the nearest whole number.)** |
|   |   |

|  |
| --- |
|    percent of the variation in the selling price is explained by the variation in the age of the car. |

CHAPTER 14 EXERCISE2

|  |
| --- |
| Thompson Photo Works purchased several new, highly sophisticated processing machines. The production department needed some guidance with respect to qualifications needed by an operator. Is age a factor? Is the length of service as an operator (in years) important? In order to explore further the factors needed to estimate performance on the new processing machines, four variables were listed: |

|  |
| --- |
| X1 = Length of time an employee was in the industry |
| X2 = Mechanical aptitude test score |
| X3 = Prior on-the-job rating |
| X4 = Age |

|  |
| --- |
| Performance on the new machine is designated y. |

|  |
| --- |
|      Thirty employees were selected at random. Data were collected for each, and their performances on the new machines were recorded. A few results are: |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Performanceon NewMachine,Y | Length ofTime inIndustry,X1 | MechanicalAptitudeScore,X2 | PriorOn-the-JobPerformance,X3 | Age,X4 |
|    Mike Miraglia | 112 |   | 12 |   | 312 |   | 121 |   | 52 |   |
|    Sue Trythall | 113 |   | 2 |   | 380 |   | 123 |   | 27 |   |
|  |

|  |
| --- |
| The equation is: |

|  |
| --- |
| formula35.mml = 11.6 + 0.4X1 + 0.286X2 + 0.112X3 + 0.002X4 |

|  |  |
| --- | --- |
| **a.** | What is this equation called? |
|   |   |
|   |

|  |  |
| --- | --- |
|  | Multiple regression equation |
|  | Multiple standard error of estimate |
|  | Coefficient of determination |

 |

|  |  |
| --- | --- |
| **b.** | How many dependent and independent variables are there? |
|   |   |
|   |  dependent,  independent |

|  |  |
| --- | --- |
| **c.** | What is the number 0.286 called? |
|   |   |
|   |

|  |  |
| --- | --- |
|  | Regression coefficient |
|  | Coefficient of determination |
|  | Homoscedasticity |
|  | Multicollinearity |

 |

|  |  |
| --- | --- |
| **d.** | As age increases by one year, how much does estimated performance on the new machine increase?**(Round your answer to 3 decimal places.)** |
|   |   |
|   |  |

|  |  |
| --- | --- |
| **e.** | Carl Knox applied for a job at Photo Works. He has been in the business for 6 years and scored 280 on the mechanical aptitude test. Carl’s prior on-the-job performance rating is 97, and he is 35 years old. Estimate Carl’s performance on the new machine. **(Round your answer to 3 decimal places.)** |
|   |   |
|   |  |

**CHAPTER 14 EXERCISE 6**

|  |
| --- |
| Consider the ANOVA table that follows. |

|  |
| --- |
|   Analysis of Variance |
|   Source | DF | SS | MS | F |  |
|   Regression | 5 |   | 3710.00 |   | 742.00 |   | 12.89 |   |  |
|   Residual Error | 46 |   | 2647.38 |   | 57.55 |   |   |   |  |
|   Total | 51 |   | 6357.38 |   |   |   |   |   |  |
|  |

|  |  |
| --- | --- |
| **a-1.** | Determine the standard error of estimate. **(Round your answer to 2 decimal places.)** |
|   |   |

|  |  |
| --- | --- |
|   Standard error of estimate |    |

|  |  |
| --- | --- |
| **a-2.** | About 95% of the residuals will be between what two values? **(Round your answers to 2 decimal places.)** |
|   |   |

|  |
| --- |
|   95% of the residuals will be between  and . |

|  |  |
| --- | --- |
| **b-1.** | Determine the coefficient of multiple determination. **(Round your answer to 3 decimal places.)** |
|   |   |

|  |
| --- |
|   Coefficient of multiple determination value is . |

|  |  |
| --- | --- |
| **b-2.** | Determine the percentage variation for the independent variables. **(Round your answer to 1 decimal place. Omit the "%" sign in your response.)** |
|   |   |

|  |
| --- |
|   The independent variables explain  % of the variation. |

|  |  |
| --- | --- |
| **c.** | Determine the coefficient of multiple determination, adjusted for the degrees of freedom. **(Round your answer to 3 decimal places.)** |
|   |   |

|  |  |
| --- | --- |
|   Coefficient of multiple determination |    |

**CHAPTER 14 EXERCISE 8**

|  |
| --- |
| The following regression output was obtained from a study of architectural firms. The dependent variable is the total amount of fees in millions of dollars. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   Predictor | Coeff | SE Coeff | t | p-value |
|   Constant | 7.987 |   | 2.967 |   | 2.690 |   | 0.010 |   |
| *X*1 | 0.122 |   | 0.031 |   | 3.920 |   | 0.000 |   |
| *X*2 | –1.120 |   | 0.053 |   | –2.270 |   | 0.028 |   |
| *X*3 | –0.063 |   | 0.039 |   | –1.610 |   | 0.114 |   |
| *X*4 | 0.523 |   | 0.142 |   | 3.690 |   | 0.001 |   |
| *X*5 | –0.065 |   | 0.040 |   | –1.620 |   | 0.112 |   |
|  |

|  |
| --- |
|   Analysis of Variance |
|   Source | DF | SS | MS | F | p-value |
|   Regression | 5 |   | 3710.00 |   | 742.00 |   | 12.89 |   | 0.000 |   |
|   Residual Error | 46 |   | 2647.38 |   | 57.55 |   |   |   |   |   |
|   Total | 51 |   | 6357.38 |   |   |   |   |   |   |   |
|  |

|  |
| --- |
| *X*1 is the number of architects employed by the company. |
| *X*2 is the number of engineers employed by the company. |
| *X*3 is the number of years involved with health care projects. |
| *X*4 is the number of states in which the firm operates. |
| *X*5is the percent of the firm’s work that is health care–related. |

|  |  |
| --- | --- |
| **a.** | Write out the regression equation. **(Round your answers to 3 decimal places. Negative answers should be indicated by a minus sign.)** |
|   |   |

|  |
| --- |
|   Ŷ =  +  *X*1 +  *X*2 +  *X*3 +  *X*4 +  *X*5. |

|  |  |
| --- | --- |
| **b.** | How large is the sample? How many independent variables are there? |
|   |   |

|  |
| --- |
|   |
|   Sample *n* |     |
|   Independent variables *k* |    |
|   |

|  |  |
| --- | --- |
| **c-1.** | State the decision rule for .05 significance level: *H*0: β1 = β2 = β3 =β4 =β5 =0; *H*1: Not all β's are 0.**(Round your answer to 2 decimal places.)** |
|   |   |

|  |  |
| --- | --- |
|   Reject *H*0 if *F* > |    |

|  |  |
| --- | --- |
| **c-2.** | Compute the value of the *F* statistic. **(Round your answer to 2 decimal places.)** |
|   |   |

|  |  |
| --- | --- |
|   Computed value of *F* is |    |

|  |  |
| --- | --- |
| **c-3.** | Can we conclude that the set of regression coefficients could be different from 0? Use the .05 significance level. |
|   |   |

|  |
| --- |
|    *H*0.  of the regression coefficients are zero. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| For *X*1 | For *X*2 | For *X*3 | For *X*4 | For *X*5 |
| *H*0: β1 = 0 | *H*0: β2 = 0 | *H*0: β3 = 0 | *H*0: β4 = 0 | *H*0: β5 = 0 |
| *H*1: β1 ≠ 0 | *H*1: β2 ≠ 0 | *H*1: β3 ≠ 0 | *H*1: β4 ≠ 0 | *H*1: β5 ≠ 0 |
|  |

|  |  |
| --- | --- |
| **d-1.** | State the decision rule for .05 significance level. **(Round your answers to 3 decimal places.)** |
|   |   |

|  |
| --- |
|   Reject *H*0 if *t* <  or *t* > . |

|  |  |
| --- | --- |
| **d-2.** | Compute the value of the test statistic. **(Round your answers to 2 decimal places. Negative answers should be indicated by a minus sign.)** |
|   |   |

|  |  |
| --- | --- |
|   | *t* − value |
| *X*1 |      |
| *X*2 |      |
| *X*3 |      |
| *X*4 |      |
| *X*5 |      |
|   |

|  |  |
| --- | --- |
| **d-3.** | Which variable would you consider eliminating? |
|   |   |

|  |
| --- |
|   Consider eliminating variables . |