[1] A research analyst for an oil company wants to develop a model to predict miles per gallon based on highway speed. An experiment is designed in which a test car is driven at speeds ranging from 10 miles per hour to 75 miles per hour. The results are in the data set (SPEED.xls).

1. Set up a scatter diagram for speed and miles per gallon.
2. Apply simple regression analysis, and then interpret the meaning of the slope *b*1 in this problem.
3. Interpret the meaning of the regression coefficient *b*0 in this problem.
4. Determine the coefficient of determination, *r*2, and interpret its meaning.
5. How useful do you think this regression model is for predicting mileage?

[2] Refer to the data set given in [1].

1. We want to assume a quadratic relationship between speed and mileage. Is there any indication in your work in [1] where this assumption might work as the next model to the approach in [1]? Explain.
2. At the 0.05 level of significance, determine whether the quadratic model is a better fit than the linear regression model.
3. State the quadratic regression equation.
4. Predict the average mileage obtained when the car is driven at 55 miles per hour.
5. Determine the coefficient of multiple determination, *r*2.
6. Determine the adjusted *r*2.
7. Determine the adequacy of the fit of the model.

[3] An auto manufacturing company wanted to investigate how the price of one of its car models depreciates with age. The research department at the company took a sample of eight cars of this model and collected the following information on the ages (in years) and prices (in hundreds of dollars) of these cars. The data are in USEDCAR.xls.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Age (x) | 8 | 3 | 6 | 9 | 2 | 5 | 6 | 3 |
| Price (y) | 25 | 144 | 40 | 19 | 234 | 56 | 33 | 189 |

1. Set up a scatter diagram for age and price.
2. At the 0.05 level of significance, determine whether there is a significant linear relationship between age and price.
3. State the linear regression equation.
4. Determine the coefficient of determination, *r*2, and interpret its meaning.
5. Predict the average price obtained when the age of the car is 7 years old.
6. How useful do you think this regression model is for predicting price?

[4] Refer to the data set given in [3]. Now assume a quadratic relationship between age and price:

1. State the quadratic regression equation.
2. Determine the coefficient of multiple determination, *r*2.
3. Determine the adjusted *r*2.
4. Determine the adequacy of the fit of the model.
5. Predict the average price obtained when the age of the car is 7 years old.
6. At the 0.05 level of significance, determine whether the quadratic model is a better fit than the linear regression model.

[5] Refer to the data set given in [3]. Perform a natural or common logarithmic transformation of the dependent variable (price).

1. State the regression equation.
2. Predict the average price obtained when the age of the car is 7 years old.
3. Determine the coefficient of multiple determination, *r*2.
4. Determine the adjusted *r*2.
5. Determine the adequacy of the fit of the model.
6. Compare your results in [3], [4], and [5]. Which model is best? Why?