



PROJECT-SET

Statistics Education for Teachers

Gas Chromatography

Task adopted from: <http://lib.stat.cmu.edu/DASL/Datafiles/Chromatography.html>

Written task aligned with Reg_Loop 2

Gas chromatography is a technique used to detect very small amounts of a substance. Lab technicians are interested in investigating whether a specific chromatograph was measuring accurately. To study the calibration of the gas chromatograph, five measurements were taken for each of four specimens containing different but known amounts of the substance being studied. The purpose of the study is to calibrate the chromatograph by relating the actual amount of the substance to the chromatograph reading. Is the amount of the substance related to the chromatograph reading? If so, what is an appropriate model for the relationship?

The following table presents the measurement data:

Amount	Response
0.25	6.55
0.25	7.98
0.25	6.54
0.25	6.37
0.25	7.96
1	29.7
1	30
1	30.1
1	29.5
1	29.1
5	211
5	204
5	212
5	213
5	205
20	929
20	905
20	922
20	928
20	919

1. Find the sample linear regression equation using technology that models the relationship between gas amount and reading.

2.
 - (a) Using technology, show the residual plot.
 - (b) Upon studying the residual plot, do you have any concerns about the simple linear regression line as a model for the performance of the chromatograph?
 - (c) What is the sum of the residuals? Is this always the case? Why or why not?

3.
 - (a) Compute the average amount of gas (\bar{x}) and compute the average amount of reading (\bar{y}). Plot this point on the scatterplot. Where does this value lie in relation to the regression line?
 - (b) Describe how the technology estimates the regression line for these data. What does least-squares regression do in order to estimate the model?

4. Based on just the scatterplot, the estimated regression line, and the answers you gave above, does the linear model appear to provide a good description of the performance of the chromatograph?