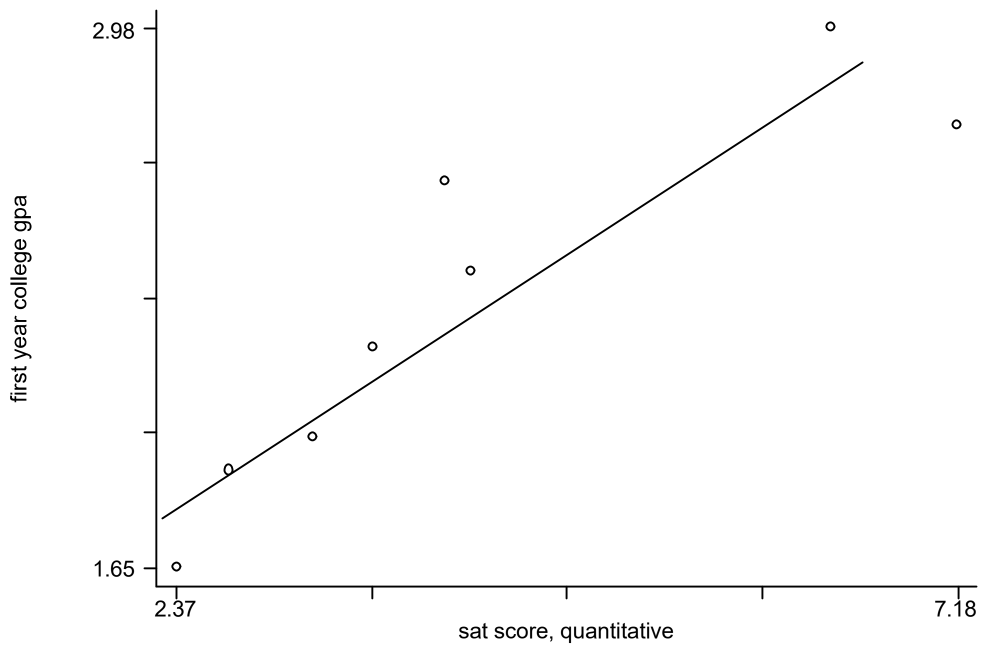
Chapter 1
A Review of the Linear Regression Model

1. a. Construct a scatterplot with GPA on the y-axis and SAT-Quant. on the x-axis. Fit by hand (and straight edge) the estimated linear regression line. Comment on the relationship between these two variables. (p.6)



There is a positive linear relationship between GPA and SAT-Quant.

b. Using the formulas for a two-variable OLS regression model, compute the slope and intercept for the following model: $GPA = " + \$_1(SAT\text{-}Quant.)$. (p.7)

Slope (1.5): $$\beta_1 = \frac{\sum_{i=1}^{n} \left(X_i - \overline{X}\right)\left(Y_i - \overline{Y}\right)}{\sum_{i=1}^{n} \left(X_i - \overline{X}\right)^2}$$

$\beta_1 =$ COV{XY}[a] ÷ SS(x)[b]

$\beta_1 =$ 4.954 ÷ 20.71279

$\boldsymbol{\beta_1 =}$ **0.239176**

Intercept (1.6): $$\alpha = \overline{Y} - \beta_1 \overline{X}$$

$\alpha =$ mean of Y − (Slope × the mean of X)

$\alpha =$ 2.3 − (0.239176 × 4.20625)

$\boldsymbol{\alpha =}$ **1.293966**

c. Compute the predicted values, the residuals, the Sum of Squared Errors (SSE), and the R^2 for the model. (pp.5-8)

As an example of the predicted and residual values we will use the data point (3.21, 1.97). See the table on page 5 for a complete list.

Predicted Value(1.3): $$\hat{Y} = \alpha + \beta_1 X$$

$\hat{Y} =$ intercept + (slope × an X value)

$\hat{Y} =$ 1.29 + (.239 × 3.21)

$\boldsymbol{\hat{Y} =}$ **2.06**

Residual:

$e = Y - \hat{Y}$

$e =$ Y value − predicted Y value

$e =$ 1.97 − 2.06

$\boldsymbol{e =}$ **−.09**

Sum of Squared Errors[c] (1.4): $$\text{SSE} = \sum_{i=1}^{n} \left(Y_i - \hat{Y}_i\right)^2$$

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[a] The covariance of X and Y.

[b] The Sum of Squares of X.

[c] Also termed the Residual Sum of Squares.