

Lesson 23: Inference for Bivariate Data

Homework

Solutions

Please note that the steps show rounded numbers, but that the final answers to the problems are calculated without rounding.

Problem Part

Solution

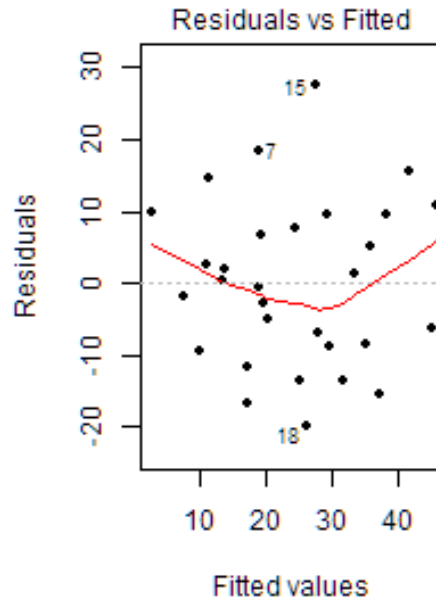
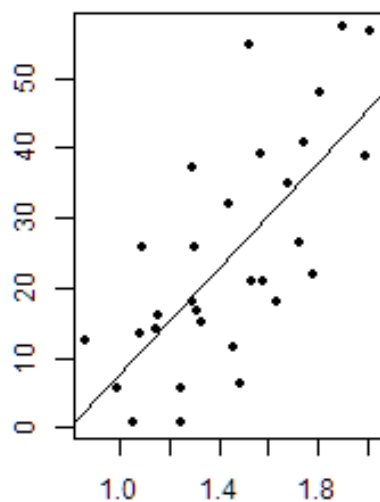
- 1 - Estimated linear regression equation:

$$\hat{Y} = b_0 + b_1X$$

True linear regression equation:

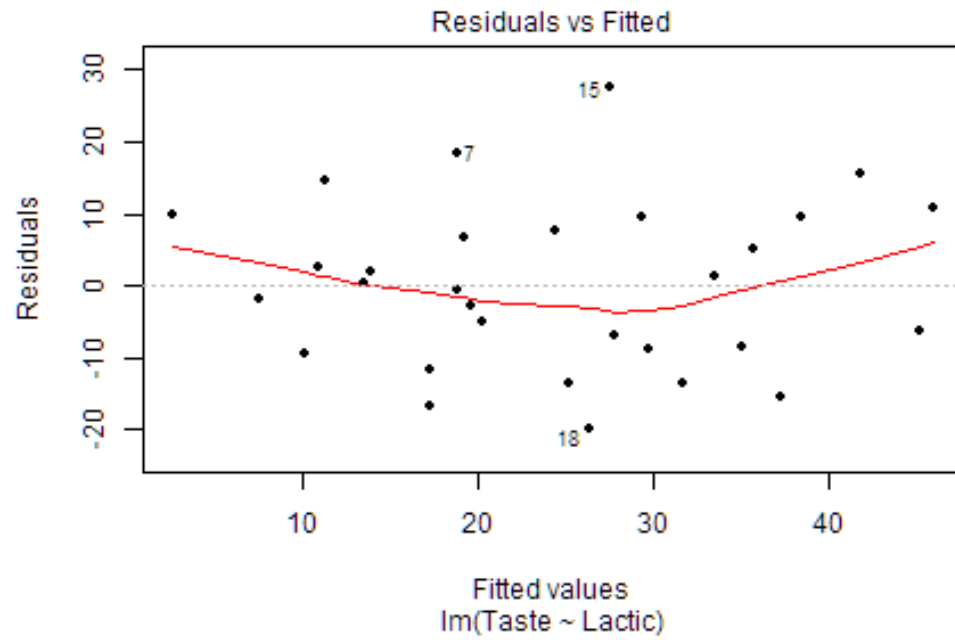
$$Y = \beta_0 + \beta_1X + \epsilon$$

- 2 - See the wiki for a review of this important concept.



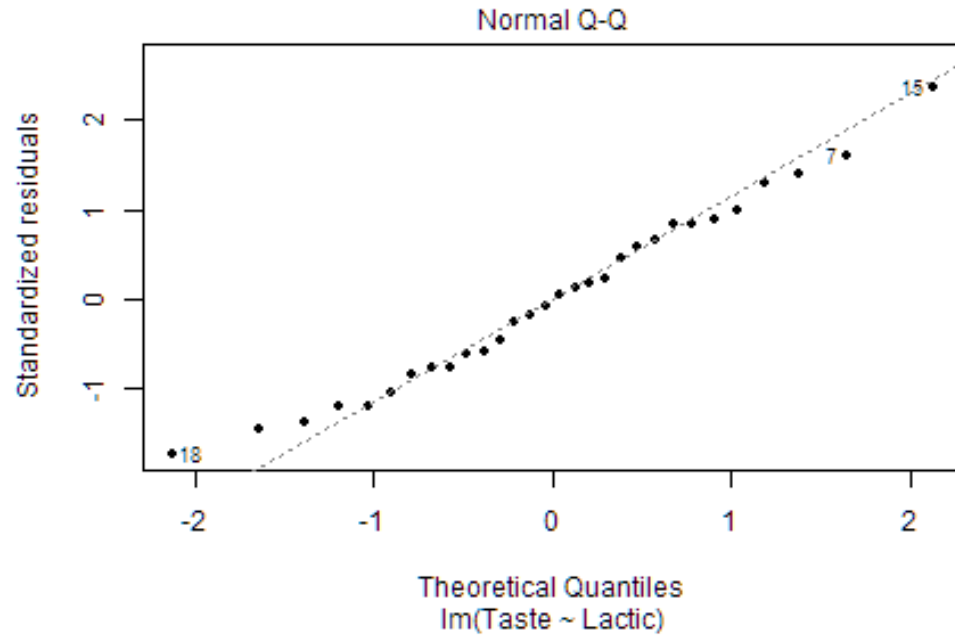
- 3 A

The appropriate graphs to check for a linear relationship are a scatterplot and a residual plot. The scatterplot seems to show a linear relationship and there is no pattern in the residual plot, so we can conclude that there is a linear relationship in the data.



3 B

The appropriate graph to check for constant variance is a residual plot. There is no pattern in the residual plot, so we can conclude that there is a constant variance in the data.



3 C

The appropriate graph to check for a normal error term is a Q-Q plot of the residuals. The points in the plot are close to the line, so we can conclude that there is a normal error term in the data.

4 - $r = 0.704$ 5 - $\hat{Y} = -29.859 + 37.72X$ 6 - $Y = 49.73$

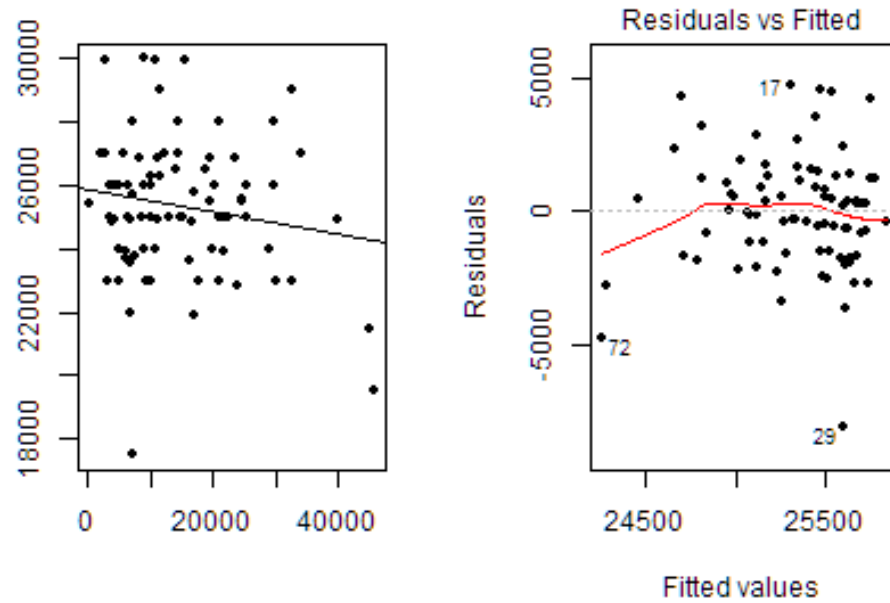
7 - (22.999, 52.441) We are 95% confident that the slope of the true true linear regression line of Lactic with Taste is between 22.999 and 52.441.

8 - $H_0 : \beta_1 = 0$ $H_a : \beta_1 \neq 0$ 9 - $t = 5.249$

10 - P-value = 0.00001405

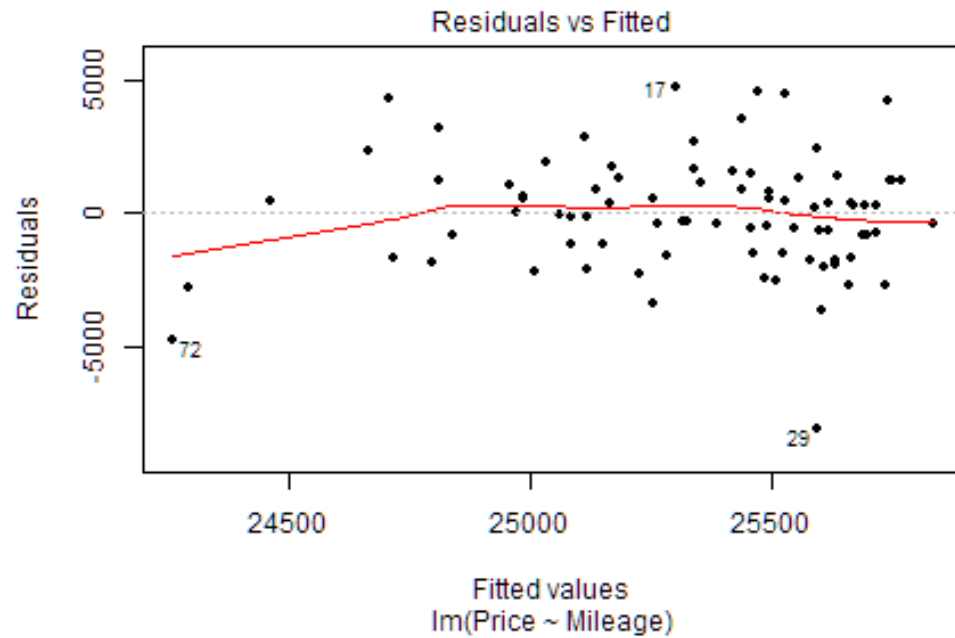
11 - reject the null hypothesis

12 - There is sufficient evidence to suggest that the slope of the true linear regression line does not equal zero. We conclude that there is a linear relationship between the concentration of lactic acid in cheese and the quality of its taste.



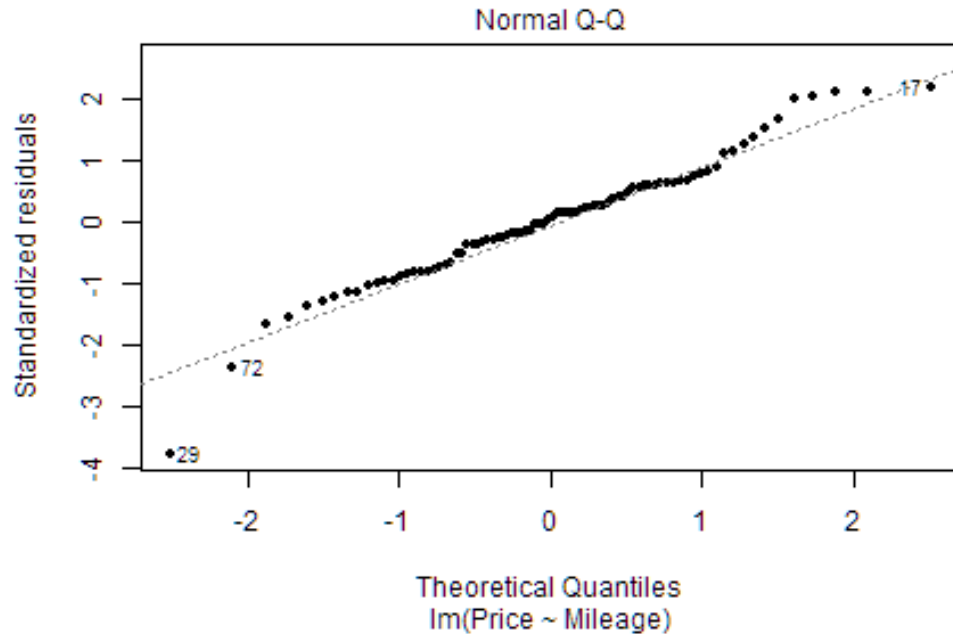
13 A

The appropriate graphs to check for a linear relationship are a scatterplot and a residual plot. The scatterplot does not seem to show a significant linear relationship, so we cannot conclude that there is a linear relationship in the data.



13 B

The appropriate graph to check for constant variance is a residual plot. There is no pattern in the residual plot, so we can conclude that there is a constant variance in the data.



13 C

The appropriate graph to check for a normal error term is a Q-Q plot of the residuals. The points in the plot are close to the line, so we can conclude that there is a normal error term in the data.

14 - $\hat{Y} = 25,838.626 + -0.034X$

15 - $Y = 22,401.192$

16 - $(-0.073, 0.004)$ We are 90% confident that the slope of the true true linear regression line of Lactic with Taste is between -0.073 and 0.004.

17 - $H_0 : \beta_1 = 0$

$H_a : \beta_1 \neq 0$

18 - $t = -1.476$

19 - $P\text{-value} = 0.144$

20 - fail to reject the null hypothesis

21 - There is insufficient evidence to suggest that the slope of the true linear regression line does not equal zero. We conclude that there is not a linear relationship between the mileage of a Prius listed for sale and its price.

22 - $r = -0.181$

23 - $\hat{Y} = 62.825 + -18.236X$

24 - $Y = 49.148$

25 - $(-41.855, 5.383)$ We are 95% confident that the slope of the true true linear regression line of Lead with BRS is between -41.855 and 5.383.

26 - $H_0 : \beta_1 = 0$

$H_a : \beta_1 \neq 0$

27 - $t = -1.54$

28 - $P\text{-value} = 0.128$

29 - fail to reject the null hypothesis

30 - There is insufficient evidence to suggest that the slope of the true linear regression line does not equal zero. We conclude that there is not a linear relationship between a child's level of lead exposure and his or her behavioral rating.

Problem Part		Solution
31	-	d. The actual Y value was 4.5 units higher than the predicted Y value