

Q1: Use copier maintenance data to obtain ANOVA table. Interpret every value in the table.

Q1.19. Grade point average. The director of admissions of a small college selected 120 students at random from the new freshman class in a study to determine whether a student's grade point average (GPA) at the end of the freshman year (Y) can be predicted from the ACT test score (X). The results of the study follow. Assume that first-order regression model (1.1) is appropriate.

- Obtain the least squares estimates of β_0 and β_1 , and state the estimated regression function.
- Plot the estimated regression function and the data. Does the estimated regression function appear to fit the data well?
- Obtain a point estimate of the mean freshman GPA for students with ACT test score $X = 30$.
- What is the point estimate of the change in the mean response when the entrance test score increases by one point?

Q1.23. Refer to Grade point average Problem 1.19.

- Obtain the residuals e_j . Do they sum to zero in accord with (1.17)?
- Estimate σ^2 and σ . In what units σ is expressed?

Q2.4. Refer to Grade point average Problem 1.19.

- Obtain a 99 percent confidence interval for β_1 . Interpret your confidence interval. Does it include zero? Why might the director of admissions be interested in whether the confidence interval includes zero?
- Test, using the test statistic t^* , whether or not a linear association exists between student's ACT score (X) and GPA at the end of the freshman year (Y). Use a level of significance of 0.01. State the alternatives, decision rule, and conclusion.
- What is the P-value of your test in part (b)? How does it support the conclusion reached in part (b)?

Q2.13. Refer to Grade point average Problem 1.19.

- Obtain a 95 percent interval estimate of the mean freshman GPA for students whose ACT test score is 28. Interpret your confidence interval.
- Mary Jones obtained a score of 28 on the entrance test. Predict her freshman GPA using a 95 percent prediction interval. Interpret your prediction interval.
- Is the prediction interval in part (b) wider than the confidence interval in part (a)? Should it be?
- Determine the boundary values of the 95 percent confidence band for the regression line when $X_h = 28$. Is your confidence band wider at this point than the confidence interval in

part (a)? Should it be?

Q2.23. Refer to Grade point average Problem 1.19.

- a. Set up the ANOVA table.
- b. What is estimated by MSR in your ANOVA table? by MSE? Under what condition do MSR and MSE estimate the same quantity?
- c. Conduct an F test of whether or not $\beta_1 = 0$. Control the α risk at .01. State the alternatives, decision rule, and conclusion.
- e. Obtain r and attach the appropriate sign.
- f. Which measure, R^2 or r , has the more clear-cut operational interpretation? Explain.

Q3.3. Refer to Grade point average Problem 1.19.

- a. Prepare a box plot for the ACT scores X_i . Are there any noteworthy features in this plot?
- b. Prepare a dot plot of the residuals. What information does this plot provide?
- c. Plot the residual e_i against the fitted values \hat{Y}_i . What departures from regression model (2.1) can be studied from this plot? What are your findings?
- d. Prepare a normal probability plot of the residuals.
- e. Conduct the Brown-Forsythe test to determine whether or not the error variance varies with the level of X . Divide the data into the two groups, $X < 26$, $X \geq 26$, and use $\alpha = .01$. State the decision rule and conclusion. Does your conclusion support your preliminary findings in part (c)?