

which contains 0, as expected.

12.1 Exercises

♥ = answers are provided beginning on page 229.

- 12.1 ♥ A new speech processor for existing cochlear implants has been developed. A clinical trial involving 23 subjects compared the new processor to the old processor. The following multiple regression model was used: $\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x_1 + \hat{\beta}_2 x_2$ where y denotes the speech recognition score (i.e. y is simply the percentage of spoken words correctly understood), x_1 denotes the subjects age, and x_2 equals 0 if the subject is using the old processor, and 1 if using the new processor. The population regression equation is $\mu_{y|x_1, x_2} = \beta_0 + \beta_1 x_1 + \beta_2 x_2$. The analysis yielded the following results in Minitab:

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The regression equation is
y = 43.1376 - 0.1034 x1 + 22.3329 x2
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Predictor	Coef	SE Coef	T	P
Intercept	43.1376	12.6781	3.403	0.0028
age	-0.1034	0.8763	-0.118	0.9072
processor	22.3329	8.1293	2.747	0.0124

Note that $\hat{\beta}_0 = 43.1376$, $\widehat{se}(\hat{\beta}_0) = 12.6781$, $\hat{\beta}_1 = -0.1034$, $\widehat{se}(\hat{\beta}_1) = 0.8763$, $\hat{\beta}_2 = 22.3329$, and $\widehat{se}(\hat{\beta}_2) = 8.1293$.

- Does age significantly influence the speech recognition score? To answer this, test $H_0 : \beta_1 = 0$ vs $H_a : \beta_1 \neq 0$ at the $\alpha = 0.05$ significance level (find the test statistic and critical value, plot the rejection region, and state your decision and final conclusion).
- Find the p -value for the test in part (a). Does age significantly affect speech recognition score? Why?
- Find a 95% confidence interval for β_1 . Is age significant? Why?
- Find a 95% confidence interval for β_2 . Is there a significant difference between the old and new processors? Why?
- If we were to test $H_0 : \beta_2 = 0$ vs $H_a : \beta_2 \neq 0$ at the $\alpha = 0.05$ significance level, would the p -value be less than 0.05 or more than 0.05? Why? Base your answer on the CI in part (d).
- Find the p -value for the test in part (e). Is there a significant difference between the old and new processors? Why?
- Approximate the mean speech recognition score for 33 year olds with the new processor, i.e. approximate $\mu_{y|x_1=33, x_2=1}$.
- In part (g), Minitab determined that $\widehat{se}(\hat{y}) = 5.77$. Compute a 95% confidence interval for $\mu_{y|x_1=33, x_2=1}$.
- Is the mean speech recognition score for 33 year olds with the new processor significantly higher than 50? Why?