

Please use the R Markdown template – Homework 2 – on Posit Cloud.

**Question 1. Sweetness of Orange Juice**

(Refer to Page 105 Question 3.13, Data set: OJUICE)

- (a) Fit the model and find a 90% confidence interval for the true slope of the line. Interpret the result. (Hint: You need to decide which R code to use. `confint()`? or `predict()`?)
- (b) Fit the model and determine whether there is a positive or negative linear relationship between the amount of pectin  $x$  and the sweetness  $y$ . That is, determine if there is sufficient evidence (at  $\alpha=0.05$ ) to indicate that  $\beta_1$ , the slope of the straight-line model, is significantly different from zero. Hints:
  - You'll need to use `summary()` in R to find the  $t$ -statistic or  $p$ -value.
  - You could use either the critical value method or the  $p$ -value method.
  - Feel free to write your answer to this question on a piece of paper, if needed. Then take a picture and upload to Blackboard.

**Question 2. Joint Strike Fighter program**

(Refer to Page 105 Question 3.12, Data set: F35)

- (a) Fit the simple linear regression model,  $E(y) = \beta_0 + \beta_1$ , to the data.
- (b) List assumptions required for the regression analysis.
- (c) Find the value of SSE.
- (d) Find the estimated standard error of the regression model,  $s$ .
- (e) Give a practical interpretation of  $s$ .
- (f) Find a 95% confidence interval for the true slope of the line. (Hint: You need to decide which R code to use. `confint()`? or `predict()`?)
- (g) Interpret the confidence interval in (f).
- (h) Find the  $p$ -value for testing  $H_0 : \beta_1 = 0$  versus  $H_a : \beta_1 \neq 0$ . Use this result to test the simple linear regression model is statistically useful for predicting the annual cost using the year of initial operation. (Test using  $\alpha = 0.05$ )
- (i) Find and interpret the coefficient of determination,  $r^2$ .
- (j) A researcher wants to estimate of the average annual cost of all the military aircraft with the year of initial operation in 1980. Which interval is desired by the researcher, a 95% prediction interval for  $y$  or a 95% confidence interval for  $E(y)$ ? Use R to calculate the desired interval. (Hint: You need to decide which R code to use. `confint()`? or `predict()`?)
- (k) Give a practical interpretation of the interval in part (j).

### Question 3. Fill in the blanks in the table and answer questions

For future planning and budgeting, the researchers want to analyze the relationship between the total area of structurally deficient bridges in a state and the number of deficient bridges. A simple linear regression model was fitted. In this analysis,

$x$  = number of structurally deficient bridges,

$y$  = the total area (thousands of square feet) of the deficient bridges.

The MINITAB output is as follows:

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#### Regression Analysis: SDArea versus NumberSD

The regression equation is  
SDArea = 120 + 0.346 NumberSD

Predictor	Coef	SE Coef	T	P
Constant	119.9	123.0	0.97	0.335
NumberSD	0.34560	0.06158	(1)	(2)

S = (3)      R-Sq = 38.7%      R-Sq(adj) = 37.4%

#### Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	12710141	(4)	31.50	0.000
Residual Error	50	20173111	(5)		
Total	51	32883252			

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(a) Please fill in the five blanks in the table.

(1)

(2)

(3)

(4)

(5)

(b) Find and interpret the coefficient of determination,  $r^2$ .

(c) Calculate the coefficient of correlation,  $r$ .

### Question 4. Recalling student names

(Refer to Page 106 Question 3.15, Data set: NAMEGAME2)

(a) Find a 99% confidence interval for the mean recall proportion for students in the fifth position during the "name game." Interpret the result.

- (b) Find a 99% prediction interval for the recall proportion of a particular student in the fifth position during the "name game." Interpret the result.
- (c) Compare the two intervals, part (a) and part (b). Which interval is wider? Will this always be the case? Explain.

**Due date:** Sep. 19th at 11:59 PM

In Posit Cloud, please use R Markdown to complete the homework. Then knit it into a pdf file.

Please upload the pdf created to Blackboard → Work Submission → Homework 2.