Tutorial 11: Questions

April 4, 2018

Question 10.1.5, Page 419

Consider the following summary data on the modulus of elasticity (3×106 psi) for lumber of three different grades:

Grade	J	$\overline{x}_{i\cdot}$	s_i
1	10	1.63	0.27
2	10	1.56	0.24
3	10	1.42	0.26

Use this data and a significance level of 0.01 to test the null hypothesis of no difference in mean modulus of elasticity for the three grades.

Question 10.1.6, Page 419

An article reports the following data on total Fe for four types of iron formation (1 = carbonate, 2 = silicate, 3 = magnetite, 4 = hematite).

Category	Fe Amount									
1	20.5	28.1	27.8	27.0	28.0	25.2	25.3	27.1	20.5	31.3
2	26.3	24.0	26.2	20.2	23.7	34.0	17.1	26.8	23.7	24.9
3	29.5	34.0	27.5	29.4	27.9	26.2	29.9	29.5	30.0	35.6
4	36.5	44.2	34.1	30.3	31.4	33.1	34.1	32.9	36.3	25.5

Carry out an analysis of variance F-test at significance level 0.01, and summarize the results in an ANOVA table.

Question 10.1.7, Page 419

An experiment was carried out to compare electrical resistivity for six different low-permeability concrete bridge deck mixtures. There were 26 measurements on concrete cylinders for each mixture; these were obtained 28 days after casting. Fill in the missing entries and test appropriate hypotheses.

Source	df	SS	MS	F-value
Mixture	a	d	g	F
Error	b	e	13.929	
Total	c	5664.415		

Question 12.2.17, Page 507

A least squares analysis in studying how y - porosity (%), is related to x - unit weight(pcf) in concrete specimens. Consider the following representative data (note that the x value corresponds to the y value given immediately below it):

x	99.0	101.1	102.7	103.0	105.4	107.0	108.7	110.8
y	28.8	27.9	27.0	25.2	22.8	21.5	20.9	19.6
x	112.1	112.4	113.6	113.8	115.1	115.4	120.0	
y	17.1	18.9	16.0	16.7	13.0	13.6	10.8	

Relevant summary quantities are:

$$\sum_{i=1}^{n} x_i = 1640.1, \quad \sum_{i=1}^{n} y_i = 299.8, \quad \sum_{i=1}^{n} x_i y_i = 32,308.59$$

$$\sum_{i=1}^{n} {x_i}^2 = 179,849.73, \quad \sum_{i=1}^{n} {y_i}^2 = 6430.06$$

(a) Obtain the equation of the estimated regression line. Then create a scatterplot of the data and graph the estimated line. Does it appear that the model relationship will explain a great deal of the observed variation in y?

(b) Interpret the slope of the least squares line.

(c) What happens if the estimated line is used to predict porosity when unit weight is 135? Why is this not a good idea?

(d) Calculate the residuals corresponding to the first two observations.

(e) Calculate and interpret a point estimate of σ.

(f) What proportion of observed variation in porosity can be attributed to the approximate linear relationship between unit weight and porosity?

Question 12.3.31, Page 517

During oil drilling operations, components of the drilling assembly may suffer from sulfide stress cracking. An article reported on a study in which the composition of a standard grade of steel was analyzed. The following data on y - threshold stress (% SMYS), and x - yield strength (MPa), was read from a graph in the article (which also included the equation of the least squares line).

x	635	644	711	708	836	820	810	870	856	923	878	937	948
y	100	93	88	84	77	75	74	63	57	55	47	43	38

$$\sum x_i = 10,576, \quad \sum y_i = 894, \quad \sum x_i y_i = 703,192$$

$$\sum {x_i}^2 = 8,741,264, \quad \sum {y_i}^2 = 66,224$$

(a) What proportion of observed variation in stress can be attributed to the approximate linear relationship between the two variables?

(b) Compute the estimated standard deviation $s_{\widehat{\beta}_1}$.

(c) Calculate a confidence interval using confidence level 95% for the expected change in stress associated with a 1 MPa increase in strength. Does it appear that this true average change has been precisely estimated?