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HW3: Chapter 11: 45, 46, 61, 65 and Chapter 12: 5, 10

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11.45 With reference to Exercise 11.13 on page 400,

assume a bivariate normal distribution for x and y.

(a) Calculate r.

(b) Test the null hypothesis that ρ = −0.5 against the

alternative that ρ < −0.5 at the 0.025 level of significance.

(c) Determine the percentage of the variation in the

amount of particulate removed that is due to

changes in the daily amount of rainfall.

STARTING R SOLUTION BELOW FOR PART A:--------------------------------------

Data is

x = Daily Rainfall

y = Particulate Removed

x^2 =

[1] 18.49 20.25 34.81 31.36 37.21 27.04 14.44 4.41 56.25

xy =

[1] 541.8 544.5 684.4 660.8 695.4 613.6 501.6 296.1 810.0

y^2 =

[1] 15876 14641 13456 13924 12996 13924 17424 19881 11664

Sum(x) =

45

Sum(y) =

1094

Sum(xy) =

5348.2

Sum(y^2) =

133786

Sum(x^2) =

244.26

Correlation coefficient is r = Sxy/sqrt(Sxx\*Syy) where Sxx, Syy, and Sxy are

Sxx =

19.26

Syy =

804.2222

Sxy =

-121.8

So r is

[1] -0.9786584

STARTING R SOLUTION BELOW FOR PART B:--------------------------------------

The test statistic is t = (r\*sqrt(n-2))/sqrt(1-r^2)

[1] -12.6003

since calculated t is < -2.365 we reject the null hypothesis and conclude that ρ < −0.5

STARTING R SOLUTION BELOW FOR PART C:--------------------------------------

Sample coefficient of determination is r^2, which is

[1] 0.9577722

END OF PROBLEM 45----------------------------------------------------------

11.46 Test the hypothesis that ρ = 0 in Exercise

11.43 against the alternative that ρ  
= 0. Use a 0.05

level of significance.

Data is

x = Mathematics Grade

y = English Grade

x^2 =

[1] 4900 8464 6400 5476 4225 6889

xy =

[1] 5180 7728 5040 6438 5070 7470

y^2 =

[1] 5476 7056 3969 7569 6084 8100

Sum(x) =

464

Sum(y) =

476

Sum(xy) =

36926

Sum(y^2) =

38254

Sum(x^2) =

36354

Correlation coefficient is r = Sxy/sqrt(Sxx\*Syy) where Sxx, Syy, and Sxy are

Sxx =

471.3333

Syy =

491.3333

Sxy =

115.3333

So r is

[1] 0.2396639

The test statistic is t = (r\*sqrt(n-2))/sqrt(1-r^2)

[1] 0.4937168

since calculated t is < 2.776 we reject the null hypothesis and conclude that ρ < −0

END OF PROBLEM 46----------------------------------------------------------

11.61 For a simple linear regression model

Yi = β0 + β1xi +

i, i= 1, 2, . . . , n,

where the

i are independent and normally distributed

with zero means and equal variances σ2, show that ¯ Y

and

B1 =

n

i=1

(xi − ¯x)Yi

n

i=1

(xi − ¯x)2

have zero covariance.

Done by hand

END OF PROBLEM 61----------------------------------------------------------

11.65 Suppose that an experimenter postulates a

model of the type

Yi = β0 + β1x1i +

i, i= 1, 2, . . . , n,

when in fact an additional variable, say x2, also contributes

linearly to the response. The true model is

then given by

Yi = β0 + β1x1i + β2x2i +

i, i= 1, 2, . . . , n.

Compute the expected value of the estimator

B1 =

n

i=1

(x1i − ¯x1)Yi

n

i=1

(x1i − ¯x1)2

.

Done by hand

END OF PROBLEM 61----------------------------------------------------------