Problem Set #8
Homework • Due in 3 days

17/17 answered

Problem Set 8: Simple Linear Regression

Part A

How sensitive to changes in water temperature are coral reefs? To find out, we measured the growth of corals in aquariums where the water temperature is controlled at different levels. Growth is measured by weighing the coral before and after the experiment.

Question 1
Homework • Answered • Due Jun 7th, 11:59 PM

Of the two variables included in this question of interest, identify the explanatory and response.

Drag and drop options on the right-hand side and submit. For keyboard navigation... SHOW MORE

Explanatory	Water temperature ✓
Response	Growth of corals ✓

Your answer

Answered - Correct! • **1** attempt left

Resubmit

Question 2

Homework • Answered • Due Jun 7th, 11:59 PM

Which of the following statements is true regarding the variables water temperature and coral growth?

Select an answer and submit. For keyboard navigation, use the up/down arrow keys to select an answer.

a	Both variables are categorical.	
b	Both variables are quantitative.	✓ Your answer
c	Water temperature is a categorical variable and coral growth is a quantitative variable.	
d	Water temperature is a quantitative variable and coral growth is a categorical variable.	

Answered - Correct! • **2** attempts left

Resubmit

Part B

Florida reappraises real estate every year, so the county appraiser's Web site lists the current "fair market value" of each piece of property. Property usually sells for somewhat more than the appraised market value. Here are the appraised market values and actual selling prices (in thousands of dollars) of condominium units sold in a beachfront building in a 93-month period:

Selling Price	Appraised value	Month	Selling Price	Appraised value	Month
853	654	0	878	743	47
618	520	1	1128	1025	54
1103	958	3	1192	981	59
918	818	9	1453	950	64
873	676	13	1893	1218	64
1128	970	14	1478	638	64
743	373	15	903	834	64
1353	1060	19	1538	1269	70
728	584	21	1403	841	70
1350	907	26	588	524	73
1928	1044	26	1078	802	79
1628	1068	28	633	498	86
1008	470	34	703	573	88
968	799	37	721	718	93

Here is software output for regressing selling price on appraised value:

```
Residuals:
    Min      1Q  Median      3Q     Max
-269.22 -152.93  -84.94  173.84  589.37

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  78.4084   162.0551   0.484    0.633
appraised     1.2699     0.1938   6.553    6e-07 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 235.4 on 26 degrees of freedom
Multiple R-squared:  0.6229,    Adjusted R-squared:  0.6084
F-statistic: 42.94 on 1 and 26 DF,  p-value: 6.003e-07
```

Recall that for very small values, R using scientific notation. For example, `6e-07` is equivalent to 6×10^{-7}.

Question 3

Homework • Answered • Due Jun 7th, 11:59 PM

Is there significant evidence that that appraisal value is a good predictor of selling price? To answer this question, we need to test which of the following hypotheses?

Select an answer and submit. For keyboard navigation, use the up/down arrow keys to select an answer.

a	$H_0: \beta_1 = 0$ vs. $H_A: \beta_1 \neq 0$	✓ Your answer
b	$H_0: \alpha = 0$ vs. $H_A: \alpha > 0$	
c	$H_0: \beta_1 = 0$ vs. $H_A: \beta_1 > 0$	

Answered - Correct! • **2** attempts left

Resubmit

Question 4

Homework • Answered • Due Jun 7th, 11:59 PM

What is the conclusion based on the hypothesis test and p-value?

Select an answer and submit. For keyboard navigation, use the up/down arrow keys to select an answer.

a	There is convincing evidence that that appraisal value is a good predictor of selling price.	✓ Your answer
b	There is suggestive, but inconclusive evidence that appraisal value is a good predictor of selling price.	
c	There is moderately suggestive evidence that appraisal value is a good predictor of selling price.	
d	There is no evidence that that appraisal value is a good predictor of selling price.	

Answered - Correct! • **2** attempts left

Resubmit

Part C

Consider the following data on x = rainfall volume (m^3) and y = runoff volume (m^3) for a particular location.

x	6	12	14	18	23	30	40	45	55	67	72	83	96	112	127
y	4	10	13	14	15	25	27	45	38	46	53	72	82	99	103

Use the general software output to decide whether there is a useful linear relationship between rainfall and runoff.

```
Residuals:
    Min      1Q  Median      3Q     Max
-8.5842 -3.6667  0.8233  3.0288  8.9562

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  -1.8798     2.3372  -0.804    0.436
rainfall      0.8427     0.0360  23.410 5.17e-12 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 5.162 on 13 degrees of freedom
Multiple R-squared:  0.9768,    Adjusted R-squared:  0.975
F-statistic:   548 on 1 and 13 DF,  p-value: 5.166e-12
```

Question 5

Homework • Answered • Due Jun 7th, 11:59 PM

State the least squares regression equation.

Select an answer and submit. For keyboard navigation, use the up/down arrow keys to select an answer.

a $\hat{y} = 2.337 + 0.036x$

b $\hat{y} = -0.8 + 23.41x$

c $\hat{y} = -1.88 + 0.843x$ ✓ Your answer

d $\hat{x} = 2.337 + 0.036y$

Answered - Correct! • **2** attempts left

Resubmit

Question 6

Homework • Answered • Due Jun 7th, 11:59 PM

State the appropriate null and alternative hypotheses used to test whether there is a useful linear relationship between rainfall and runoff.

Select an answer and submit. For keyboard navigation, use the up/down arrow keys to select an answer.

a	$H_0: \beta_1 = 0$ vs. $H_A: \beta_1 \neq 0$ ✓ Your answer
b	H0: $\beta_1 = 0$ vs. HA: $\beta_1 < 0$
c	H0: $\beta_1 \neq 0$ vs. HA: $\beta_1 = 0$
d	H0: $\beta_1 = 0$ vs. HA: $\beta_1 > 0$

Answered - Correct! • **2** attempts left

Resubmit

Question 7

Homework • Answered • Due Jun 7th, 11:59 PM

Fill in the Blanks

Type your answers in all of the blanks and submit

X_a X^a Ω

From the output state the test statistic value and find the P-value. (Round your test statistic to two decimal places and your P-value to four decimal places.)

t = 23.41 ✓

You are correct

p-value = 0.0000 ✓

You are correct

Answered - Correct! • **0** attempt left

Resubmit

Question 8

Homework • Answered • Due Jun 7th, 11:59 PM

State the conclusion in the problem context. (Use α= 0.05.)

Select an answer and submit. For keyboard navigation, use the up/down arrow keys to select an answer.

a	Fail to reject *H*0. There is a significant linear relationship between runoff and rainfall at the 0.05 level.
b	Fail to reject *H*0. There is not a significant linear relationship between runoff and rainfall at the 0.05 level.
c	Reject *H*0. There is not a significant linear relationship between runoff and rainfall at the 0.05 level.
d	Reject *H*0. There is a significant linear relationship between runoff and rainfall at the 0.05 level. ✓ Your answer

Answered - Correct! • **2** attempts left

Resubmit

Question 9

Homework • Answered • Due Jun 7th, 11:59 PM

Fill in the Blanks

Type your answers in all of the blanks and submit

X_2 X^2 Ω

Calculate a 95% confidence interval for the true average change in runoff volume associated with a 1

meters cubed increase in rainfall volume. (Round your answers to three decimal places.)

(0.765 , 0.920) meters cubed.

You are correct

You are correct

Answered - Correct! • **2** attempts left

Resubmit

Part D

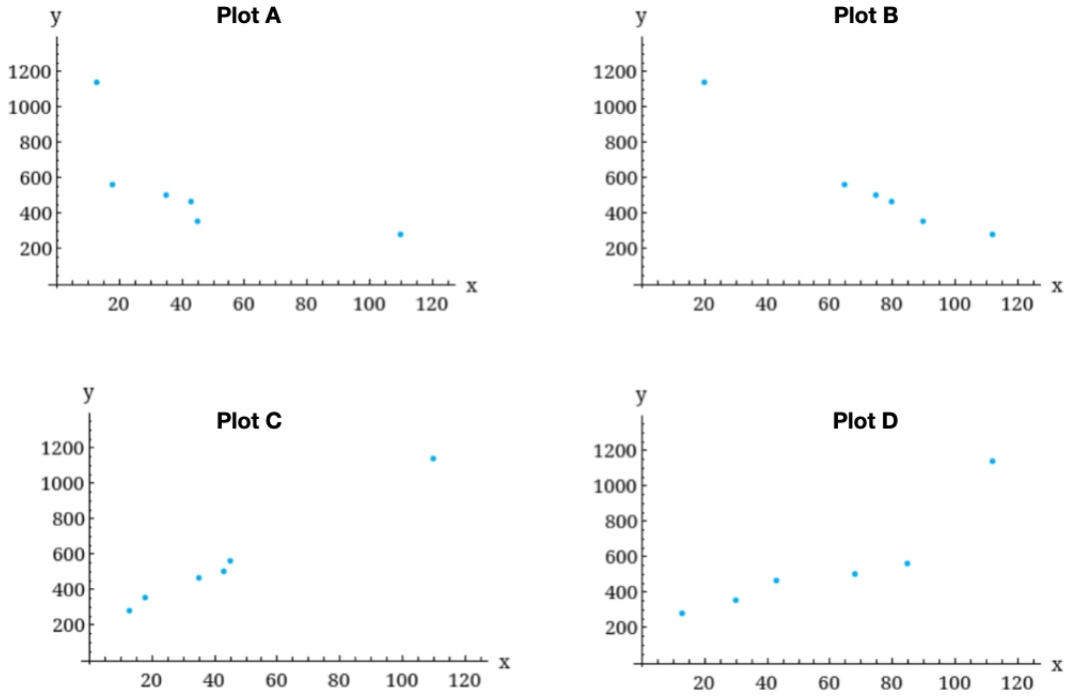
The accompanying data was read from a graph. The independent variable is SO_2 deposition rate ($mg/m^2/d$) and the dependent variable is steel weight loss (g/m^2). Use the code below to construct a scatterplot of the bivariate data, fit a simple linear regression model, and calculate the correlation coefficient between the two variables.

```
x=c(13,18,35,43,45,110)

y=c(280,350,460,500,560,1140)

# Construct a scatterplot using R.
plot(x,y)
# Calculate the least squares regression line
mod <- lm(y~x)
summary(mod)
# Correlation
cor(x,y)
```

Question 10

Homework • Answered • Due Jun 7th, 11:59 PM

Which of the following scatterplots accurately displays the bivariate data?



Select an answer and submit. For keyboard navigation, use the up/down arrow keys to select an answer.

a	Plot A
b	Plot B
c	Plot C ✓ Your answer
d	Plot D

Answered - Correct! • 2 attempts left

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Question 11

Homework • Answered • Due Jun 7th, 11:59 PM

Does the simple linear regression model appear to be reasonable in this situation?

Select an answer and submit. For keyboard navigation, use the up/down arrow keys to select an answer.

a	Yes, the scatter plot shows a reasonable linear relationship. ✓ Your answer
b	No, the scatter plot does not show a reasonable linear relationship.

Answered - Correct! • **2** attempts left

Resubmit

Question 12

Homework • Answered • Due Jun 7th, 11:59 PM

Fill in the Blanks

Type your answers in all of the blanks and submit

X_2 X^2 Ω

The estimated regression equation has the form $\hat{y} = b_0 + b_1 x$. From the R output give the parameter estimates. Round all numerical values to **two** decimal places.

$b_0 =$ 161.78 ✓

You are correct

$b_1 =$ 8.79 ✓

You are correct

Answered - Correct! • **2** attempts left

Resubmit

Question 13

Homework • Answered • Due Jun 7th, 11:59 PM

What is the correlation coefficient r? (Round your answer to three decimal places.)

Type your numeric answer and submit

0.997 ✓

You are correct

Answered - Correct! • **1** attempt left

Resubmit

Question 14

Homework • Answered • Due Jun 7th, 11:59 PM

Fill in the Blanks

Type your answers in all of the blanks and submit

X_a X^a Ω

Because the largest x value in the sample greatly exceeds the others, this observation may have been very influential in determining the equation of the line. Delete this observation and recalculate the equation. (Round all numerical values to two decimal places.)

Let the new estimated equation be denoted using the following notation.

$$\hat{y}^* = b_0^* + b_1^* x$$

$b_0^* =$ 193.41 ✓

You are correct

$b_1^* =$ 7.68 ✓

You are correct

Answered - Correct! • **2** attempts left

Resubmit

Question 15

Homework • Answered • Due Jun 7th, 11:59 PM

Does it seem the removed point was influential?

Select an answer and submit. For keyboard navigation, use the up/down arrow keys to select an answer.

a	Yes, removing the point changed the slope of the line.	✓ Your answer
b	No, removing the point did not changed the slope of the line.	

Answered - Correct! • 2 attempts left Resubmit

Part E

A number of studies have shown lichens (certain plants composed of an alga and a fungus) to be excellent bio-indicators of air pollution. An article gives the following data (read from a graph) on $x = NO_3^-$ wet deposition (g N/m^2) and y = lichen (% dry weight):

x	0.05	0.10	0.11	0.12	0.31	0.37	0.42	0.58	0.68	0.68	0.73	0.85	C
y	0.44	0.60	0.48	0.51	0.53	0.54	1.02	0.89	0.86	1.03	0.84	1.00	1.73

```
Residuals:
     Min       1Q   Median       3Q      Max
-0.23047 -0.16221  0.00779  0.02836  0.47612

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   0.3658     0.1067   3.429 0.005632 **
x             0.9653     0.1970   4.900 0.000472 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.2081 on 11 degrees of freedom
Multiple R-squared:  0.6858,    Adjusted R-squared:  0.6572
F-statistic: 24.01 on 1 and 11 DF,  p-value: 0.0004718
```

Question 16

Homework • Answered • Due Jun 7th, 11:59 PM

Fill in the Blanks

Type your answers in all of the blanks and submit

What are the least square estimates of β_0 and β_1? (Round your answers to three decimal places.)

$b_0 =$ 0.366 ✓

You are correct

$b_1 =$ 0.965 ✓

You are correct

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