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STA 3032
Section 7370
Quiz #4
Spring, 2009

1. Horizontal (x) and vertical (y) expansion were measured on 9 bridges in the area of Quebec City:

Bridge	1	2	3	4	5	6	7	8	9
x	20	15	43	5	18	24	32	10	21
y	68	58	55	75	58	68	55	69	63

Summary statistics are:

$\bar{x} = 20.9$ $\bar{y} = 60.9$

$S_{xx} = \sum (x-\bar{x})^2 = 1036.9$ $S_{yy} = \sum (y-\bar{y})^2 = 524.9$

$S_{xy} = \sum (x-\bar{x})(y-\bar{y}) = -515.1$

a. (5) The equation for the least squares line is $\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x = 71.4 - 0.50x$. Use the **summary statistics** to illustrate computation of $\hat{\beta}_0$ and $\hat{\beta}_1$:

$\hat{\beta}_1 = S_{xy} / S_{xx}$ = -515.1/1036.9 = -0.497 $\hat{\beta}_0 = \bar{y} - \hat{\beta}_1(\bar{x})$ = 60.0 + 0.497(20.9) = 70.382

b. (5) Complete the following analysis of variance (ANOVA) table:

Source	df	SS	MS
Regression	**1**	255.9	**255.9**
Error	**7**	**269.0**	38.43
Total	**8**	**524.9**	

c. (3) R^2=.49. Use results in the ANOVA table to show how R^2 was computed:

R^2=.49 **= 255.9/524.9**

d. (5) Construct a 95% confidence interval for β_1:

$$\hat{\beta}_1 \pm t_{.025,7}\sqrt{MSE / S_{xx}} = -0.497 \pm 2.36\sqrt{38.43/1036.9} = -0.497 \pm 0.454$$

e. (2) Compute the correlation coefficient between horizontal and vertical expansion:

$$r = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}} = \frac{-515.1}{\sqrt{(1036.9)(524.9)}}$$ Also, r = negative square root of R^2, -.70

f. (3) The method least squares is used to **obtain parameter estimates,** $\hat{\beta}_0$ and $\hat{\beta}_1$.

g. (2) The least squares estimates are obtained by minimizing

$\sum_i (y_i - (b_0 + b_1 x_i))^2$ with respect to b_0 and b_1.