

Chapter 12 Review Sheet Solutions

UNsheet
Linear Regression

Key

1. The data in the above table gives the top 15 states for per pupil expenditure in 1985 and the average teacher salary in the state for that year.

State	MN	CO	OR	PA	WI	MD	DE	MA	RI	CT	DC	WY	NJ	NY	AK
Salary	27360	25892	25788	25853	26525	27186	24624	26800	29470	26610	33990	27224	27170	30678	41480
Pupil Exp	3982	4042	4123	4168	4247	4349	4517	4642	4669	4888	5020	5440	5536	5710	8349

a. Find a model that allows us to predict teacher salary from per pupil expenditure and justify that it is appropriate. Interpret the slope of the regression line in the context of the problem.
 $\hat{y} = 12027.07 + 3.34x$ where x = pupil exp. and $\hat{y}$ = predicted salary.
 For each one \$ increase, salary increases by \$3.34/year.

b. Predict the teacher salary if the pupil spending is \$4600.
 $\hat{y} = 12027.07 + 3.34(4600) = \27391.07

c. For the model, identify the standard error of the residuals and the error of the slope of the regression line.
 $S = 2280.96$ $SE_b = \frac{s}{\sqrt{\sum x^2}} = \frac{3.34}{6.04} = .55$

d. Construct a 95% confidence interval for the slope of the population regression line.
 $b \pm t^* SE_b$ I am 95% confident that the true slope of exp. and salary lies between 2.152 and 4.528. Since my interval is all pos. there is a positive correlation.

e. Perform a significance test of the hypotheses that there is a slope.
 $H_0: \beta = 0$ There is no corr. between pupil exp. and salary.
 $H_a: \beta > 0$ There is a pos. corr. between exp. and salary.
 $p\text{-value} = 2.09 \times 10^{-5}$
 $df = 13$ $r^2 = .74$ $r = .86$

2. The following data relates the number of times a dog chases its tail (x) with average hours of sleep per week (y).

x	4.3	4.55	5.55	5.65	5.95	6.3	6.45	6.45
y	8.0	8.3	7.8	7.25	7.7	7.5	7.6	7.2

a. Is there significant evidence at the 10% level to show there is a linear relationship between tail chasing and sleep?
 $H_0: \beta = 0$ there is no linear relationship between tail chasing and sleep.
 $H_a: \beta \neq 0$ there is a linear relationship between tail chasing and sleep.
 $t = -3.10$ $a = 9.64$ $r^2 = .62$ since my p-value (.02) is less than $\alpha = .10$, I have statis. sig. evidence to reject H_0 and say that there is a linear relationship between tail chasing and sleep.
 $p\text{-value} = .02$ $b = -.35$ $r = -.78$
 $df = 6$ $s = .25$ $SE_b = \frac{s}{\sqrt{\sum x^2}} = \frac{.35}{.11} = 3.10$

b. The researchers believe that there is a decrease in the average hours slept per tail chase to be 0.25 hours per tail chase. Is there enough evidence at the 5% to support the researchers claim?
 $H_0: \beta \geq 0$ there is a neg. corr. between tail chasing and sleep.
 $H_a: \beta < 0$ there is a neg. corr. between tail chasing and sleep.
 $p\text{-value} = .01$ yes, since my p-value (.01) is less than $\alpha = .05$, I have statistically significant evidence to reject H_0 and say there is a negative relationship between tail chasing and sleep.

c. Construct a 98% confidence interval for the slope of the population regression line.
 $b \pm t^* SE_b$ I am 98% confident that the true slope lies between -.69573 and -.00427. Since my interval is all negative, there is a negative correlation between dog tail chases and sleep.
 $-.35 \pm (3.143)(.11)$
 $(-.69573, -.00427)$