Practice Problems

Problem 11.5:

An equal number of families from eight different cities of various sizes were asked how much money they spend for food, clothing, and housing per year. The city sizes and average family responses are summarized below. (City size in 1000s, expenditure in $1000s.)

City Size (x)	30	50	75	100	150	200	175	120
Expenditure (y)	65	77	79	80	82	90	84	81

(a) We know that $SS_{xx} = 25300,\ SS_{yy} = 355.50,\ SS_{xy} = 2670.04,\ \bar{x} = 112.5,\ \bar{y} = 79.75.$

Compute SSE, s^2, $\hat{\beta}_1$, $\hat{\beta}_0$, and $s_{\hat{\beta}_1}$.

(b) Plot the sample data. Does the plot suggest that the city size and expenditure have a straight-line relationship?

(c) Does the city size contribute enough information for the prediction of expenditure using the straight-line model? ($\alpha = 0.05$)

(d) Find the 99% confidence interval for β_1.

Problem 11.6:

Rathbun (1988) reported on experiments in surveying manatees along Florida's Crystal and Indian Rivers by observation from airplanes and helicopters. He initially suspected that helicopters, due to their slower speed, would provide higher and more accurate counts. Helicopter counts were intended to provide a "truth" count for judging the airplane counts. Data failed to support this expectation, however, partly because helicopters frighten manatees. Rathbun concluded that "there is no significant advantage" in using helicopters, which are much more expensive.

	Manatee Count	
Day	**From Airplane**	**From Helicopter**
1	24	30
2	31	30
3	32	33
4	39	38
5	47	58
6	47	58
7	35	48
8	76	75
9	95	85
10	85	55

(a) Plot the sample data with the straight-line. Do you think that the straight-line model is reasonable to explain the relationship between airplane count and helicopter count?

(b) Complete the following SAS printout.

Model: MODEL1
Dependent Variable: Y

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	2439.60365	2439.60365	24.692	0.0011
Error	(1)	790.39635	(2)		
C Total	9	3230.00000			

Root MSE	9.93980	R-square	0.7553
Dep Mean	51.00000	Adj R-sq	0.7247
C.V.	19.48980		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0
INTERCEP	1	17.388852	7.45862853	2.331
X	1	0.657752	0.13236717	(3)

(c) Test H_0: $\beta_1 = 0$ against H_a: $\beta_1 \neq 0$. ($\alpha = 0.05$)

(d) A bright student suggests that we should test H_0: $\beta_1 = 1$ against H_a: $\beta_1 \neq 1$. Do you believe that he is right?